The Guidelines Manual

Final Version of 31/12/2020

Deliverable Number 3.1

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Deliverable Title	The guidelines manual
Partner in Charge	University of Camerino and All Partners
Partners involved	ALL
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Summary

List of abbreviations and terms

AR4	IPCC 4th Assessment Report
AR5	IPCC 5th Assessment Report
BMZ	German Federal Ministry for Economic Cooperation and Development
CCl	Commission for Climatology
CDD	Consecutive dry days
Cfa	Humid subtropical; temperate climate without dry season with very hot summer
Cfb	Temperate Oceanic climate; temperate climate without dry season with hot summer
Cfc	Subpolar Oceanic climate; temperate climate without dry season with fresh and short summer
CLIVAR	Climate Variability and Predictability
Csa	Temperate climate with dry and very hot summer (Mediterranean hot summer climates)
Csb	Temperate climate with dry and hot summer (Mediterranean warm/cool summer)
CSDI	Cold spell duration index. Number of days in periods with at least 6 consecutive days with minimum temperature below TN10%
DD	Dry Days
Dfb	Cold climate without dry season in hot summer
EASW	European Awareness Scenario Workshop
EEA	European Environment Agency
ETCCDI	Expert Team on Climate Change Detection and Indices

FD	Frost days (absolute threshold). Number of days with minimum temperature below 0 °C
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate change
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
R95p	Amount of Precipitation from Days (very rainy days)
R20	Very intense precipitation days
SDII	Simple Daily Precipitation Intensity Index
SMEs	Small and medium-sized enterprises
SU	Percentile threshold. Number of days with maximum temperature 25 °C
Tn10%	Cold nights (percentile threshold). Number of days with minimum temperature (TN) below the 10th percentile from the 1961-1990 baseline period
Tx10%	Cold days (percentile threshold). Number of days with maximum temperature (TX) below the 10th percentile from the 1961-1990 baseline period
TN90p	Percentage of days when TN > 90th percentile
TX90p	Percentage of days when TX > 90th percentile
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WSDI	Warm spell duration index. Number of days in periods with at least 6 consecutive days with minimum temperature above TX90%

Introduction: objectives and purposes of the Joint_SECAP project

The aim of the "Joint strategies for Climate Change Adaptation in coastal areas" (Joint_SECAP) project is the experimentation of a methodological model based on joint responses to climate change within the target areas identified in the Italian and Croatian Adriatic area, repeatable in the time and exportable in homogeneous territories. The inter-municipal scale is central to this project in order to achieve adaptation objectives in homogeneous areas primarily for climatic characteristics, but also for environmental, social and settlement characteristics, for dangers and risks, capable of marking a turning point in policies that tackle climate change.

The Joint_SECAP (Sustainable Energy and Climate Action Plan) is an emanation of the EU through the Covenant of Mayors which in 2015, after the merger with the sister initiative Mayors Adapt, promoted the implementation of mitigation objectives with the adaptation to changes climatic ones. In 2016, the European initiative joined the Compact of Mayors, giving life to the Global Covenant of Mayors for Climate & Energy, the largest movement of local authorities committed to climate change. The SECAP, that is the emanation of this implementation, obtains more effective results if done jointly between more neighbouring municipalities, since often the opportunities for high-impact actions can be more easily identified within an aggregation of neighbouring local authorities, rather than by the single municipality, especially for measures concerning for example the water resources management or the provision of advisory services to citizens, public transport, local energy production, etc. In addition, the municipalities involved in the joint implementation can benefit from economies of scale, such as in the public procurement sector, and solve the problem of the lack of human and financial resources to achieve the commitments of the Covenant of Mayors. This makes it easier for them to join forces in preparing, implementing and monitoring SECAPs.

The Joint SECAP is also a short-term implementation document of Energy and Climate policies (horizon 2030), a communication tool for stakeholders, but also a document shared at a political level. It is important to specify that the Joint_SECAP must not be considered as a rigid and binding document; as the surrounding conditions change and as the interventions carried out give results, it may be useful or even necessary to review your plan.

In the Italian and Croatian network of cities that are part of the Joint_SECAP project, each target area is committed to building a common vision, evaluating the impacts of climate change, and defining a series of actions that can be implemented both individually and jointly in the analyzed territory. The joint SECAP aims to promote institutional cooperation between these different target areas, and develop common approaches and sensitivities between local authorities operating in the same territorial area: this will allow to obtain more effective results than an isolated case. In this search for cooperation and sharing, the project identifies a key figure: the Joint coordinator who will have the task of coordinating common actions. This figure will be the technical reference point for the consortium of municipalities and will provide services in order to develop a shared strategy and objectives at the district level; he will enhance the capacity of public authorities and other stakeholders to evaluate, define, adopt, implement and monitor the joint SECAP, activate synergies between the various initiatives already active in the area, follow up on opportunities for long-term financing for the necessary investments, identify the actions and interventions to be implemented jointly. In this task the coordinator will be able to use the Joint_ SECAP SUPPORT SYSTEM PLATFORM, which can be used to implement long-term joint actions and investments, thus assuring the durability of the project output even after the project conclusion. The platform will be maintained functional after the project conclusion by the project partners serving as on line database, that will collect case studies, climate and energy measures and Joint Actions, successfully implemented through the time. Finally, at the end of the project the partners will continue to use the platform to manage climate and energy actions.

The project started on January 1, 2019 and has a duration of 30 months.

The project is structured in two phases:

The first phase develops a common methodology to share basic knowledge and promote vulnerabilities and climatic risks assessment of the different target risk areas. In this first phase, the project envisaged a context analysis for each target area through:

- the recognition of the plans and measures already planned in each territory, the financing opportunities at different levels;

- the climatic analysis of the Marche Region, Abruzzo and Croatia;

- the recognition of some case studies to have a comparison between the methodology identified for the assessment of vulnerabilities and risks by the Joint_SECAP Project at the level of each district and those implemented in other European programs and contexts.

The second phase involves the development of common scenarios and actions to be adopted in each target area and the preparation of the Joint SECAP Support System Platform. The strategic result for the project was the preparation of specially fitted cognitive tools, the adoption of shared systems of stakeholders' consultation, and the adoption of comparable methods for the definition of climate scenarios and the selection of joint actions. All of the partners who were coordinators of specific activities actively participated in the construction of these shared tools and systems.

1 Target areas introduction

The following target areas are part of the Joint SECAP network (fig. 1), coordinated by the University of Camerino:

1. Italian side

- Abruzzo Region (involves two target areas; target area 1 with 4 municipalities Penne, Elice, Castilenti e Castiglione Messer Raimondo and target area 2 with 5 municipalities Giulianova, Roseto degli Abruzzi, Pineto, Silvi and Mosciano S. Angelo)
- Pescara municipality (including Pescara and neighbouring San Giovanni Teatino, Spoltore, Montesilvano, Chieti and Francavilla al Mare)
- San Benedetto del Tronto Region (including San Benedetto del Tronto and neighbouring Cupra Marittima, Grottammare and Monteprandone)

2. Croatian side

- Korčula island in Dubrovnik-Neretva County
- Brač island in Split-Dalmatia County
- Primorje-Gorski kotar region (municipalities Kastav, Opatija, Čavle, Matulji and Viškovo)
- Dubrovnik-Neretva region (City of Dubrovnik, Župa Dubrovačka, Konavle and Dubrovačko Primorje)
- Istria region (Novigrad-Cittanova, Buje-Buie, Brtonigla-Verteneglio)

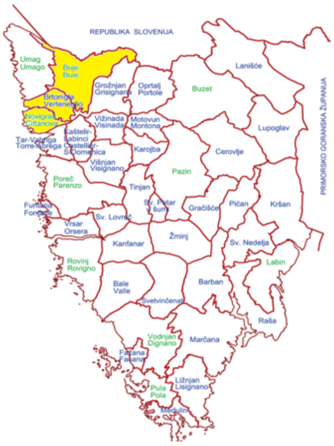
Fig.1 Target Areas

PILOT TARGET AREA N.1- PP1 IRENA

Partner name and number: IRENA - Istrian Regional Energy Agency Ltd. Croatia (PP1)

TARGET AREA

The target area for PP1 IRENA - Istrian Regional Energy Agency Ltd consists of the City of Buje-Buie, City of Novigrad-Cittanova and the municipality of Brtonigla-Verteneglio, all located in the NW part of Istrian County. The area of the Ciy of Buje-Buie is located in the northwestern part of the Istrian peninsula and the Republic of Croatia. Approximately 5.300 inhabitants live in the area of 103,40 km2. The city is located between the rivers Mirna and Dragonja. In the north are the hills of the Upper Buje region, and in the south the Adriatic Sea in Kanegra and the Piran Bay, i.e Savudrija Bay. Brtonigla is a municipality that is rich in natural resources and which is proud of its untouched nature and lays the foundations for development of agricultural production and tourist resources. It covers an area of 33 km2, the western part of the municipality is located along the Adriatic coast in the length of about 3 km. The municipality mostly stretches inland, and its southern part reaches the river Mirna. It includes the sea coast and also inland Istria with prevailing mild Mediterranean climate. The City of Novigrad-Cittanova is located on the northwest coast of the Istrian peninsula, 25 km from the border with Slovenia. It is about 15 kilometers away from the nearby city centers - Poreč, Umag and Buje. The city area covers an area of 27 km2, from Dajla in the north to the mouth of the river Mirna in the south.



City of Buje – Buie

Localization:	NW Istria
Surface area:	103,40 km2
Population:	5.340

Municipality of Brtonigla - Verteneglio

Localization:	NW Istria
Surface area:	33 km2
Population:	1.626

City of Novigrad – Cittanova

Localization:	NW Istria
Surface area:	27 km2
Population:	4.345

Surface Target area: 163,40 km2

Population: 11.311

Structure: 2 cities + 1 municipality

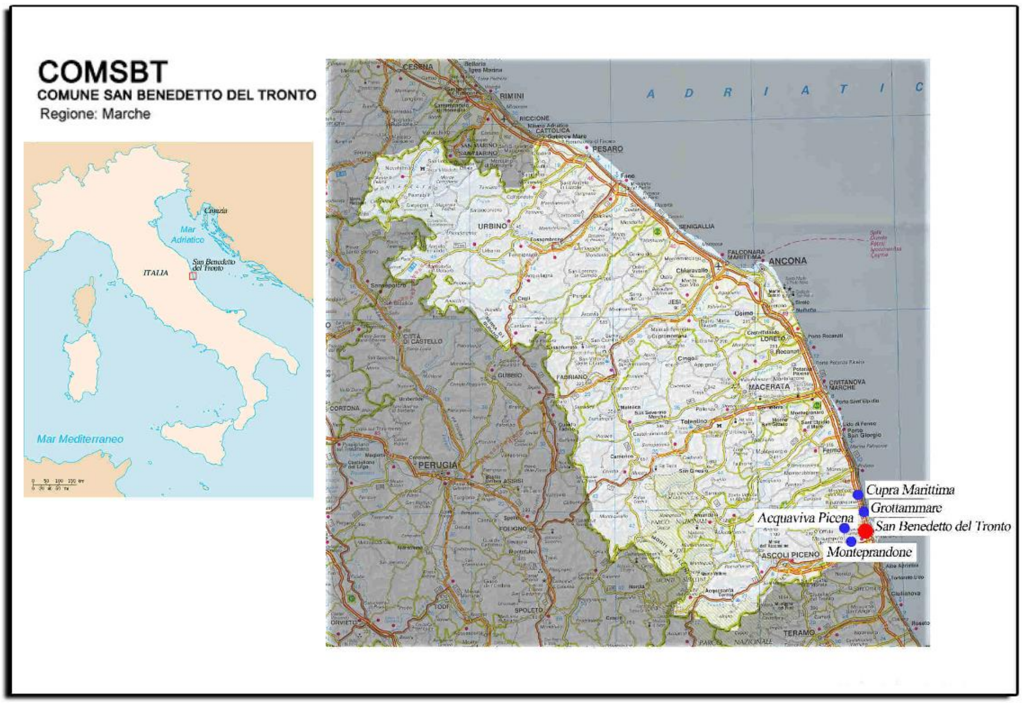
SEAP (Sustainable Energy Action Plan) / SECAP(Sustainable Energy and Climate Action Plan)

SEAP was approved by the City of Buje-Buie in 2012, and by the City of Novigrad in 2015, with a SEAP revision in 2019.

CLIMATE-RELATED RISKS AND THREATS

Main climate risks: Tourism, agricultural, water supply and drainage & health sectors (all), coastal area and fishery (Novigrad)

TARGET AREA N.2-PP2 SAN BENEDETTO DEL TRONTO



Partner name and number: PP2-Municipality of San Benedetto del Tronto. Italy
Associates Partner name: City of Monteprandone, Grottammare, Cupra Marittima

TARGET AREA

The area is located between the coast in the middle Adriatic Sea and the river line traced by the Tronto River. The prevailing morphological characteristic consists of a plain bordered to the west by a medium hill range. The relevant environmental aspects are: hydrogeological instability; coastal erosion, heavy soil consumption, disruptions of eco-systemic corridors. The target area includes the municipalities of San Benedetto del Tronto, Monteprandone, Grottammare, Cupra Marittima.

Surface Target area:	86,65 km2
Population:	81.785
Structure:	4 municipalities

SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

The City of San Benedetto del Tronto is a member of "Covenant of Mayors" since 2011, approving its SEAP on 2013.
Furthermore, the City Council approved its adhesion to "Mayors Adapt" on 2014 June 12th.
It commits to contributing to the overall aim of the EU Adaptation Strategy by either developing a comprehensive local adaptation strategy or integrating adaptation to climate change into relevant existing plans.
The City of Monteprandone is a member of "Covenant of Mayors", but it isn’t a member of “Mayor Adapt”. The cities of Grottammare, Cupra Marittima are not members of “Covenant of Mayor” and “Mayor Adapt”.

CLIMATE-RELATED RISKS AND THREATS

Hydrogeological instability, coastal erosion, heavy soil consumption, disruptions of eco-systemic corridors.

TARGET AREA N.3 (3a; 3b) -PP3 ABRUZZO REGION

Partner name and number: PP3-Abruzzo Region. Italy

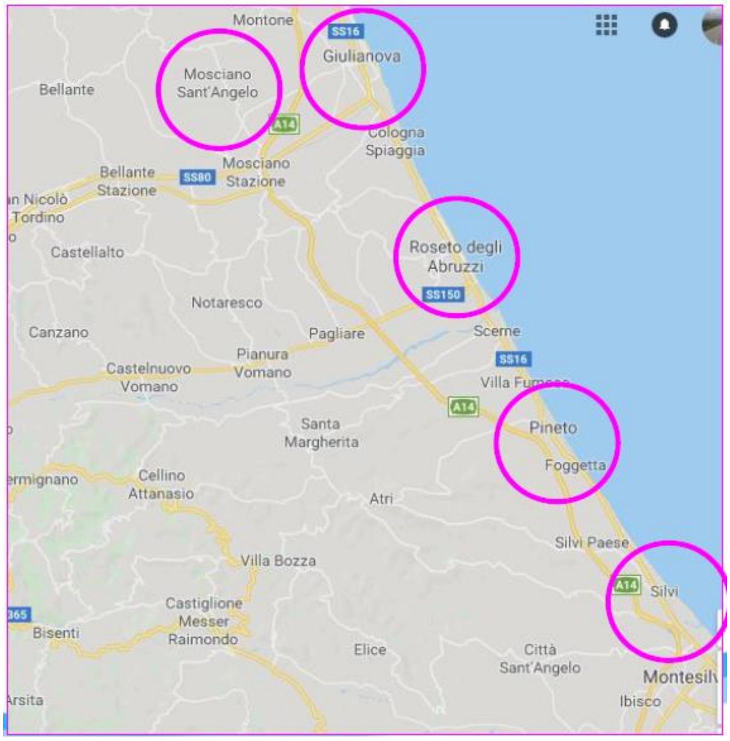
TARGET AREA

Two areas have been identified:

- a coastal area in the Province of Teramo. Abruzzo Region has 133 kilometers of coastline that alternate jagged coastline with golden beaches. In the Teramo area, the enormous building development and tourist infrastructures completely canceled the natural morphology. Indeed, the Teramo coast is entirely industrialized, subject to strong development for tourism and for the increase in population. The 4 municipalities described in the previous section are located in the northern part of the coast and are characterized by sandy and equipped beaches. Only the Marine Protected Area (MPA) of Torre di Cerrano preserves the original state. The MPA was established by the Italian Ministry of the Environment with a decree of 21-10-2009, published on the G.U. (official journal) of the Italian Republic no. 80 of 07-04-2010. It extends for 3 nautical miles from the coast and develops along the coastline for 7 km.
- a hilly area of the cliff crossed by the Fino river. The river flows southeast until it joins the Tavo river and the two rivers become theSaline River. Abruzzo is characterized by the prevalence of mountainous and hilly areas. In particular, 65.1% of the regional territory is occupied by mountain systems, while the remaining 34.9% is characterized by hills that degrade from the Apennine chains towards the Adriatic Sea.

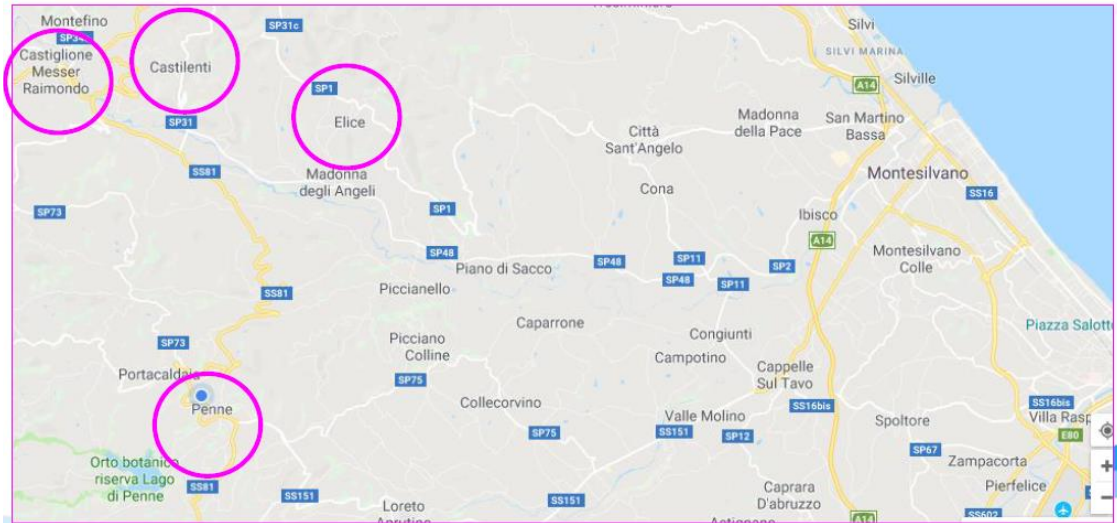
The second target area we have selected for the Joint_SECAP purpose is thus represented by municipalities in the hilly area also characterized by the presence of rivers.

FIRST TARGET AREA: COAST - PROVINCE OF TERAMO



No. 5 municipalites in the coastal area: Silvi, Pineto, Mosciano Sant'Angelo, Roseto, Giulianova

SECOND TARGET AREA – inner hilly area of the cliff crossed by the Fino river - Province of PE and TE



No. 4 municipalities in the hilly area: Castiglione Messer Raimondo, Castilenti, Elice, Penne

Surface Target area:	348,44 square km (considering both pilot areas)
Population:	106.927 (considering both pilot areas)
Structure:	5 (coastal area)+ 4 (hilly) municipalities

SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

The Service of Energy Policy is a coordinator of the Covenant of Mayors.
It has endorsed the new Com in 2015.
All municipalities (305) and provinces (4) have joined the initiative in 2010. 309 SEAPs have been realized, submitted and implemented. Monitoring activities are ongoing.
Silvi (2013); Pineto (2012); Mosciano (2012); Castiglione Messer Raimondo (2012); Penne (2012); Elice (2012); Castilenti (2013) have adopted their SEAPs.
4 municipalities have joined Mayors Adapt: Silvi, Pineto, Mosciano, Castiglione Messer Raimondo, all of them involved in the Joint_SECAP Project.

CLIMATE-RELATED RISKS AND THREATS

Flooding; coast erosion, hydrogeological risk, wildfires, insufficient energy supply, declining water availability, decreasing agricultural yeld

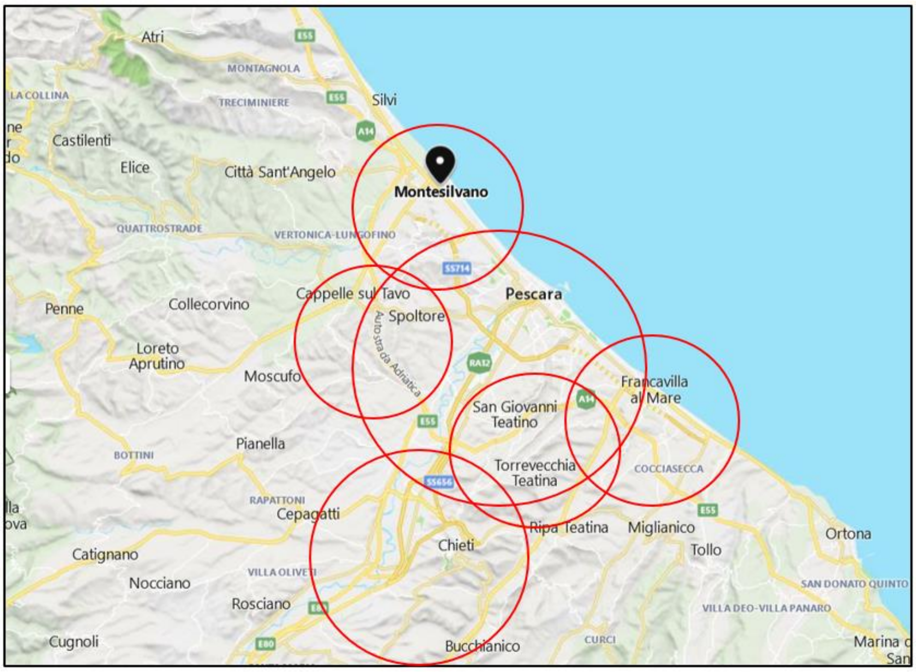
TARGET AREA N.4 -PP4 MUNICIPALITY OF PESCARA

Partner name and number: PP4- Municipality of Pescara. Italy

TARGET AREA

The pilot area, links the coastal area along Adriatic see - including the municipalities of Montesilvano, Pescara and Francavilla, with the internal lands, following the final segment of Pescara river, through the municipalities of and San Giovanni Teatino. The Municipality of Chieti is also included in the target area.

Due to the presence of a common metropolitan area, that shows common phenomena, the pilot area needs to be governed at a unitary level, higher than single municipalities level, in order to face efficaciously all the consequences of climate changes.



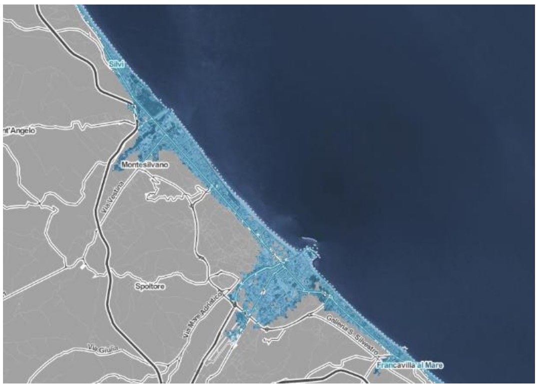
Surface area (square km): 193,8 Kmq
Country: Italy
Region: Abruzzo
Municipalities included in the area: N.6
Pescara, Montesilvano, Francavilla, Spoltore , San Giovanni Teatino, Chieti
Number of inhabitants in the area: 282.708

SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

Pescara, Montesilvano, Francavilla, Spoltore, San Giovanni Teatino, Chieti signed the Covenant of Mayors. Date of SEAPs adoption: Pescara (2011), Montesilvano (2012), Francavilla (2012), Spoltore (2012) , San Giovanni Teatino (2012), Chieti (2012).

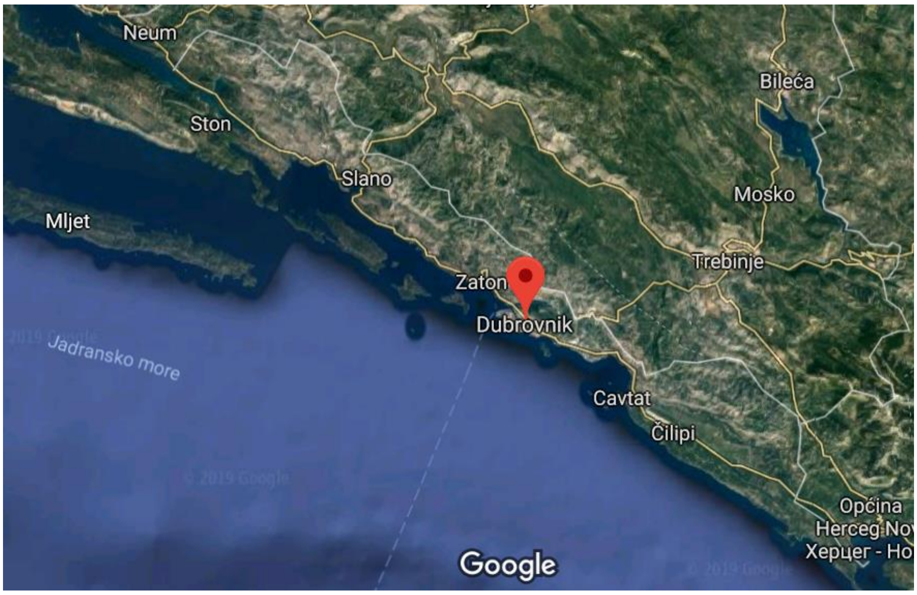
CLIMATE-RELATED RISKS AND THREATS

Flooding/inundations; coast erosion, Hydrogeological risk-landslides.



Seven Italian coastal areas, including the Abruzzo region coastal area are at risk of flooding for the rise of the Mediterranean Sea. There are also other Regions such as Puglia, Sicily, Sardinia and Tuscany. This an evaluation by ENEA that thanks to new assessments considers the possibility of losing tens of square kilometres of Italian territory by the end of the century. Thus, a total of new twenty coastal areas are in danger due to climate change and geological characteristics of the country.

TARGET AREA- N.5 PP5 SDEWES



Partner name and number: PP5- SDEWES Centre. Croatia

TARGET AREA: Wider Dubrovnik Area

The area presents the most southern part of Croatia. On the south side there is the border with Montenegro, and on the east and north side with Bosnia and Hercegovina. The Adriatic Sea is on the west. The area has typical Mediterranean climate and tourism has high influence on the whole area. Even the whole area is quite small there are big differences in the development level. The whole area is often stressed by storms and the appearance of small rivers and floods is often.

Surface area (square km): 742,03
Country: Croatia
Number of inhabitants:65327
Region: Dubrovnik-Neretva County
Municipalities included in the area: 5 municipalities/cities in total
-Municipality of Konavle
-Municipality of Zupa Dubrovacka
-City of Dubrovnik
-Municipality of Dubrovnik primorje
-Municipality of Ston

SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

Municipalities that signed the Covenant of Mayors and date of SEAPs adoption:
Municipality of Konavle - 2014-12-12
Municipality of Zupa dubrovacka - 2014-10-23
Municipality of Ston - 2014-12-08

CLIMATE-RELATED RISKS AND THREATS

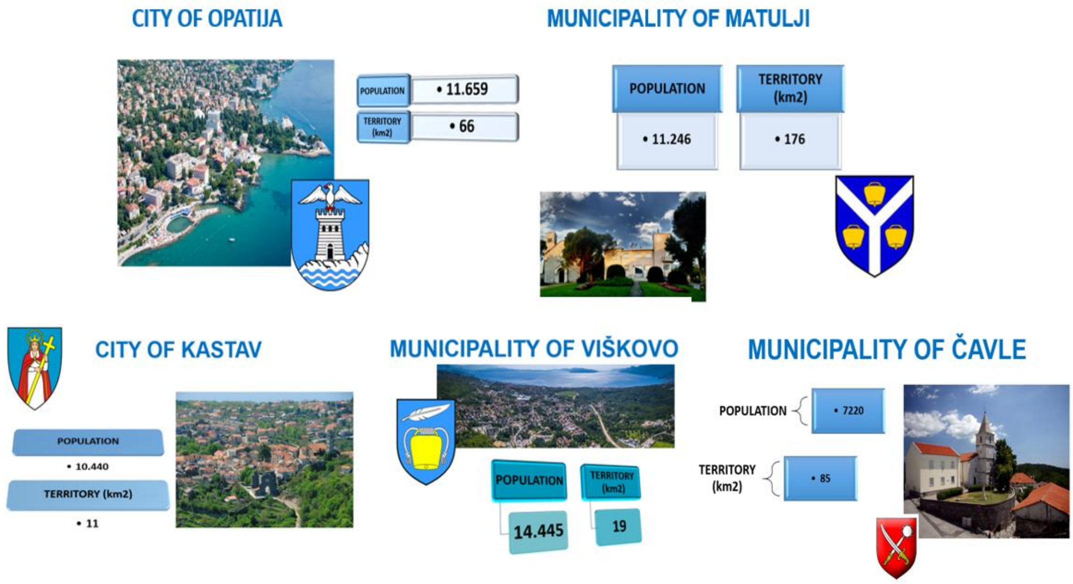
Flooding/inundations; coast erosion; declining water availability; wildfires, het island in cities, decreasing agricultural yield

TARGET AREA N.6 -PP6 PRIMORJE-GORSKI KOTAR COUNTY

Partner name and number: PP6- Primorje-Gorski Kotar County. Croatia

TARGET AREA
Surface area (square km): 357 km2
Country: Croatia
Number of inhabitants: 55.010
Region: Primorje-Gorski Kotar County
Municipalities included in the area: 5 municipalities/cities in total:

1. City of Opatija
2. Municipality of Matulji
3. City of Kastav
4. Municipality of Viškovo
5. Municipality of Čavle



SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

All municipality signed the Covenant of Mayors: 1. City of Opatija; 2. Municipality of Matulji 3. City of Kastav;4. Municipality of Viškovo; 5. Municipality of Čavle

SEAPs adopted:

Opatija: 27. 03.2012.

Matulji: 26. 07.2016.

Kastav: 26. 10.2017.

Viškovo: N/A

Čavle: 11.09.2014.

CLIMATE-RELATED RISKS AND THREATS

Flooding/inundations, hydrogeological risk, wildfires, declining water availability.

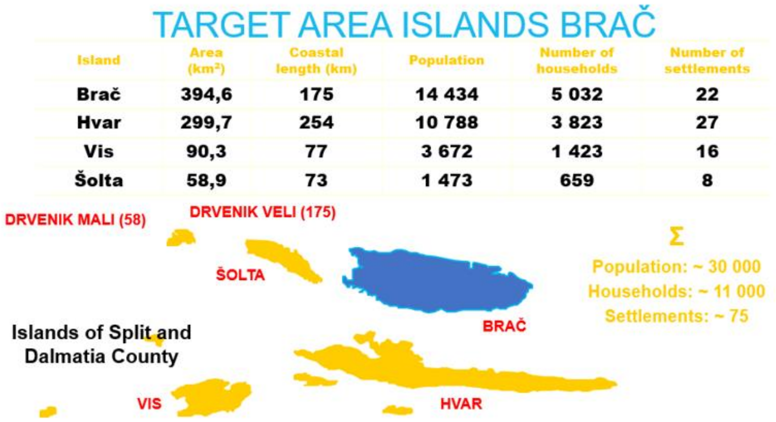
TARGET AREA- N.7 PP7 COUNTY OF SPLIT AND DALMATIA

Partner name and number: PP7- County of Split and Dalmatia. Croatia

TARGET AREA

The island of Brač is one of the 50 permanently inhabited islands of the Croatian Adriatic. It belongs to Middle Dalmatian group of islands, and the town of Supetar and island's seven municipalities (Bol, Milna, Nerežišća, Postira, Pučišća, Selca, Sutivan) make a part of Split - Dalmatia County. Area of 396 square kilometres (153 sq mi), making it the largest island in Dalmatia, and the third largest in the Adriatic.
Brač population is currently estimated at 14 343 people.
The summer on-season starts beginning of May and lasts until the end of October. In this period, Brac is visited by more than 250000 tourists. As a result of that, energy consumption is almost double compared to the average winter consumption (HEP-ODS Brac statistics).

Surface area (square km): 394,6 km2
Country: Croatia
Number of inhabitants: 14434
Municipalities included in the area: 8 municipalities/cities in total: Supetar, Bol, Milna, Nerežišća, Postira, Pučišća, Selca, Sutivan



TARGET AREA ISLANDS BRAČ

Island	Area (km²)	Coastal length (km)	Population	Number of households	Number of settlements
Brač	394,6	175	14 434	5 032	22
Hvar	299,7	254	10 788	3 823	27
Vis	90,3	77	3 672	1 423	16
Šolta	58,9	73	1 473	659	8

SEAP (Sustainable Energy Action Plan) / SECAP (Sustainable Energy and Climate Action Plan)

The Easy project adopted an energy development plan for the island of Brač financed from Intelligent Energy Europe, in November 2009

The program of transition of the island of Brač towards clean energy supported by Clean energy for EU islands secretariat, December 2020

CLIMATE-RELATED RISKS AND THREATS

Coast erosion, declining water availability, Heat island in cities, wildfires, decreasing agricultural yeld.

TARGET AREA N.8 -PP8 MUNICIPALITY OF VELA LUKA

Partner name and number: PP8- Municipality of Vela Luka . Croatia

TARGET AREA: Island of Korčula

The Island of Korcula is one of the islands in Central Dalmatia, the southern region of Croatia located along Adriatic Coast. It runs parallel with Croatian mainland as some kind of continuation of Peljesac Peninsula, located between islands of Hvar and Mljet. Korcula is also located somewhere in the middle between cities of Split and Dubrovnik, therefore its western tip (near Vela Luka) is closer to Split, and its eastern tip (near Korcula Old Town) is much closer to Dubrovnik. The island itself is separated from Peljesac Peninsula by 1.2 km wide Peljesac Channel (15 minutes by boat or ferry ride) and it covers the area of about 270 square kilometres. It is about 47 kilometres long (from tip to tip) and about 6-7 km wide and is considered one of the larger islands among Croatians thousand islands.

Morphologically, the relief of the island is characterized by interleaving of hills and fields, and indented coastline. There are a large number of soil units. The highest peak being Klupca just above the village of Pupnat (568 meters) towards west and village of Cara (pronounced “Chara”).

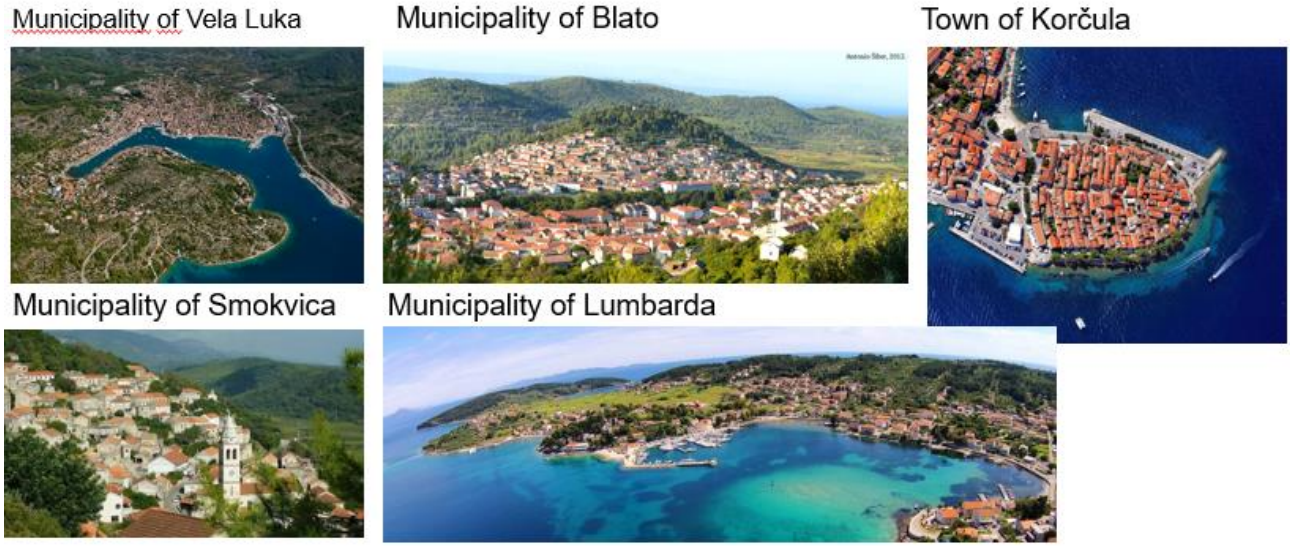
The island has a very long and dramatic shoreline, as well as three groups of islands in the near vicinity of the Island: Skoji, with its Badija and Vrnik (near Korcula Old Town), Karbuni (near Blato and bay of Prizba) and Proizd and Osjak near Vela Luka. Korcula also has numerous larger and smaller bays, some inhabited, some yet to be discovered.

Due to its relief created by weather and erosion, southern shores of the islands are steeper, un-sheltered from the southern open sea and Jugo (south) wind, while northern shores of Korcula (facing mainland and Peljesac Peninsula) are less steep, with some nice little pebble beaches. Small slopes of sand that are covering a large part of the northeastern bit of the island, near the village of Lumbarda, is where the only island's sandy beaches are located.

The coastal area of Dalmatia, including the Island of Korčula, has Mediterranean climate with long and hot summers, usually dry with minimum rainfall and mild winters that can sometimes feel cold due to cold north winds (the wind factor). The wind is as important weather and climate factor that influences the nature around the island. The island is largely covered with Mediterranean flora including extensive pine forests. In general, climatic conditions are very favourable for life and economic activity.

Natural resources such as ornamental and building stone, forest, poljes and valleys suitable for agricultural production and water are limited, and therefore their exploitation should be consistent with sustainable development. Wide panoramic views, mild Mediterranean climate, clear sea... make the island of Korcula an attractive tourist destination.

Surface area (square km): 276 km²
Country: Croatia
Number of inhabitants: 15.522 (2011)
Region: Adriatic Croatia
Municipalities included in the pilot area: 5 municipalities/Town in total
Municipality of Vela Luka, Municipality of Blato, Municipality of Smokvica, Municipality of Lumbarda and Korčula Town.



SEAP (Sustainable Energy Action Plan) / SECAP(Sustainable Energy and Climate Action Plan)

With the MESHARTILITY project, Sustainable Energy Action Plans (SEAP) were made for Municipalities of: Vela Luka, Blato, Smokvica and the Town of Korčula. All Municipalities/Town are adopted their SEAPs in 2014.

CLIMATE-RELATED RISKS AND THREATS

Coast erosion, wildfires, declining water availability, insufficient energy supply, decreasing agricultural yield.

2. Energy and climate in the Target Areas: Common Problems and Challenges

This document is a summary of the work carried out in previous European projects regarding climate change in the project regions. It focusses on the climate analysis of the past and present trends and of future projections. It is made of:

Introduction
It explains the distinction between past and current climate trends and future projections. It indicates what documents have been used reference.

Analysis of past and current climate trends
It describes methodology and sources, the chosen data and extreme indices; temperature and precipitation data, and finally temperature and precipitation indices.

Analysis of future climate projections
It describes methodology and sources, the chosen climate models and scenarios, temperature and precipitation variations and finally temperature and precipitation indices variations.

The list reports the following analysis:
-Climate Analysis – Croatia by Sdewes Centre
-Climate Analysis – Marche Region
-Climate Analysis -Abruzzo Region

3. Climate Analysis – Croatia, by Sdewes Centre

3.1 Introduction

This document shows summarizing existing climate analyses in Croatia. His focus is on the climate analysis of past and present trends and of future projections.

3.1.1 About Croatia

Croatia is a country located in the southeast of the European continent, extending to the southern part of Central Europe and the northern Mediterranean. The country is roughly divided into two sections: the coast with over 1,000 islands and islets, and the interior section with high elevation points such as the Dinaric Alps and hilly northern areas of Hrvatsko Zagorje as well as the flat plains of Slavonia in the east, part of the Pannonian Basin. The country borders Bosnia and Herzegovina to the south and the east, Hungary to the north, Serbia to the east, Montenegro to the south and Slovenia to the west. Croatia shares a maritime border with Italy. Overall, Croatia has a moderately warm and semi-rainy continental climate; the coast alongside the Adriatic Sea has a warm Mediterranean climate with hot and dry summers, while the interior has a typical continental climate with regular snowfalls in the winter months.

The country became a member of NATO in 2009 and the EU in 2013. Today, Croatia has the highest standard of living in its region (alongside Slovenia) and an economy which is led by the services sector (i.e. different economic activities connected to mass tourism), the industrial sector (e.g. food processing and chemical industry) and agriculture (from exports of blue-water fish to the production of fine wines). Manufacturing and tourism are the biggest contributors to GDP, cumulatively accounting for over 30% of the total contribution [1],[2],[3].

In the future, the country is expected to join the Schengen Area and adopt the euro. Currently, the most significant economic issue in the country is the brain drain trend that caused the outflow of roughly 200,000 qualified workforce individuals since the last population census in 2011 [4] [5].

Table 1. Main socio-economic and business statistics, 2018. [7], [8], [9]

Country map, geographical location within Europe and the national flag	
Capital	Zagreb
Official language	Croatian
Government type	Aunitaryparliamentaryconstitutionalrepublic
Area	56,594 km^2
Population	4.1 million
Ethnic composition	90.42% Croats, 4.36% Croatian Serbs, 5.22% others (e.g. Bosniaks, Italians, Albanians, Roma)
Life expectancy at birth	74 years (men), 80 years (women)
Currency	Croatian kuna(HRK)
GDP (current)	US$55.2 billion
Main industries	Chemicals and plastics, machine tools, fabricated metal, electronics, pig iron and rolled steel products, paper, shipbuilding, petroleum and petroleum refining, food and beverages, tourism
GDP bysector	70.1% services, 26.2% industry, 3.7% agriculture
Diaspora contribution to GDP	4.5%
Unemployment	9.4%
Major export commodities	Transportationequipment,machinery,textiles, chemicals, foodstuffs, fuels

Major import commodities	Machinery, transportation and electrical equipment, chemicals, fuels and lubricants, foodstuffs
Major exportmarkets	Slovenia(US$1.69billion),Italy(US$1.64billion), Germany (US$1.55 billion), Bosnia and Herzegovina (US$1 billion), Austria (US$863 million)
Major importcountries	Germany(US$3.47billion),Italy(US$2.76billion), Slovenia(US$2.37billion),Austria (US$1.73billion), Hungary (US$1.55billion)
Average FDI inflow per year (1992–2017)	US$ 1.59billion
Top five FDI investors (2000–2015)	25%Austria,15%theNetherlands,12%Germany, 9% Hungary, 6% Luxembourg
FDI inflow by sector (2000–2015)	33% financial sector, 21% manufacturing, 16% wholesaleandtrade,9%realestate,6% telecommunications, 15% other
Doing businessranking	58/190

3.2 Analysis of past and current climate trends

3.2.1 Introduction

The Republic of Croatia has been exposed to the negative effects of climate change for a long time, resulting in significant economic losses. According to the European Environment Agency (EEA) report, the Republic of Croatia belongs to a group of three countries, together with the Czech Republic and Hungary, with the highest share of the damages from extreme weather and climate events in relation to the Gross Domestic Product (GDP). It is estimated that these losses, in the period from 1980 to 2013, amounted to around EUR 2.25 billion or around EUR 68 million per year on average. These losses have increased significantly during 2014 and 2015 (to EUR 2.83 billion in 2015). Some economic sectors were significantly affected in that period. According to some estimates, between 2000 and 2007 extreme weather conditions caused a damage of EUR 173 million to the agricultural sector, while the drought in 2003 caused damage of between EUR 63 and 96 million in the energy sector. It is also estimated that in August 2003 the mortality rate was 4 % higher due to heat stroke. Republic of Croatia, due to its size and economic power, can only make a small contribution to mitigate climate change, but it is nevertheless exposed to a significant impact of the adverse effects of climate change [10].

3.2.2 Methodology

The description of observed climate changes in the Republic of Croatia was taken from the Sixth National Report of the Republic of Croatia to the United Nations Framework Convention on Climate Change in 2014, considering that both reporting entries are in the same decade climatological period. Climate change in Croatia over the period 1961-2010 has been determined by trends in annual and seasonal mean air temperature, mean minimum and mean maximum temperature; and in indices of temperature extremes; then in precipitation amounts and precipitation indices, as well as in dry and wet spells.

The analyses are based on data from 41 mean, minimum and maximum daily temperature series and 137 daily precipitation series. The indices of temperature and precipitation extremes are calculated according to the definitions given by ETCCDI (Expert Team on Climate Change Detection and Indices) (Peterson et al. 2001; WMO 2004), Commission for Climatology (WMO/CCL) and World Climate Research Programme, Climate Variability and Predictability (WCRP/CLIVAR). The non-parametric Mann-Kendall rank test (Gilbert, 1987) was applied to assess statistical significance of trends at the 95% confidence level. The field significance test is based on the Monte Carlo simulation (Zhang et al. 2004).

3.2.3 Air temperature

Temperature trends were calculated for the temperature deviations from the associated 1961- 1990 means, and expressed in °C per decade, while trends in indices of temperature extremes are expressed by number of days per decade. Trends in air temperature (mean, mean minimum and mean maximum temperature) show warming all over Croatia (Figure 6-11). Annual temperature trends are positive and significant, and the changes are higher on the mainland than at the coast and the Dalmatian hinterland. The maximum temperature values were exposed to the greatest changes (Figure 6-8) with the highest frequency of trends in the class of 0.3 - 0.4 °C per decade, while trends in the mean and the mean minimum air temperatures mostly range between 0.2 °C and 0.3°C per decade. The overall positive trend in the annual air temperatures comes are mainly caused by the significant positive summer trends, while the trends for the winter and spring gave almost equal contribution to the increasing trends of mean maximum temperature. Autumn temperatures are subjected to small changes and they are mostly positive, though mainly insignificant.

Observed warming can be seen in all indices of temperature extremes, with positive trends of warm temperature indices (warm days and nights as well as warm spell duration index) and with the negative trends of cold temperature indices (cold days and nights and cold spell duration index).

All trends of indices of warm temperature extremes are statistically significant which is confirmed with the field significance trend (Figure 3). The most prominent increases are found in the number of warm days (Tx90) and warm nights (Tn90), and slightly lower trends are found in summer days (SU, absolute thresholds) and warm spell duration (WSDI). At most stations, the increase of the number of SU ranges between 2 and 8 days per decade (Table 3). Increase in the number of warm days (Tx90) most often accounted 6-10 days and warm nights (Tn90) even 8-12 days per decade. The duration of warm spells at most stations has increased for 4-6 days.

Warming is also evident in the observed negative trend in the indices of cold temperature extremes, but they are less expressed than the trends of warm indices. Cold days and cold nights (Tx10 and Tn10) have the most significant trends, and their number at most stations is reduced for up to 4 days per decade, while the trends in the number of cold days (FD, absolute thresholds) are smaller and are mostly reduced for up to 2 days per decade (Table 2.). The smallest changes are observed in the cold spell duration index (CSDI) which show a decrease by 2 days per decade at the majority of stations (more than 90 % of stations). Nevertheless, the trend is not statistically significant [10].

Table 2. List of the indices of temperature extremes and their definition. The abbreviations and definitions are according to standardisation of WMO-CCL/CLIVAR working group for climate change [10]

Indices of cold temperature extremes		
FD	Frost days (absolute threshold	Number of days with minimum temperature below 0 °C
Tn10%	Cold nights (percentile threshold)	Number of days with minimum temperature (TN) below the 10th percentile from the 1961-1990 baseline period.
Tx10%	Cold days (percentile threshold)	Number of days with maximum temperature (TX) below the 10th percentile from the 1961-1990 baseline period
CSDI	Cold spell duration index	Number of days in periods with at least 6 consecutive days with minimum temperature below TN10%
Indices of warm temperature extremes		
Tn90%	Warm nights	Number of days with minimum temperature (TN) above the 90th percentile from the 1961-1990 baseline period percentile from the 1961-1990 baseline period
Tx90%	(percentile threshold)	Number of days with maximum temperature (TX) above the 90th percentile from the 1961-1990 baseline period percentile from the 1961-1990 baseline period
WSDI	Warm days	Number of days in periods with at least 6 consecutive days with minimum temperature above TX90%
SU	(percentile threshold)	Number of days with maximum temperature 25 °C

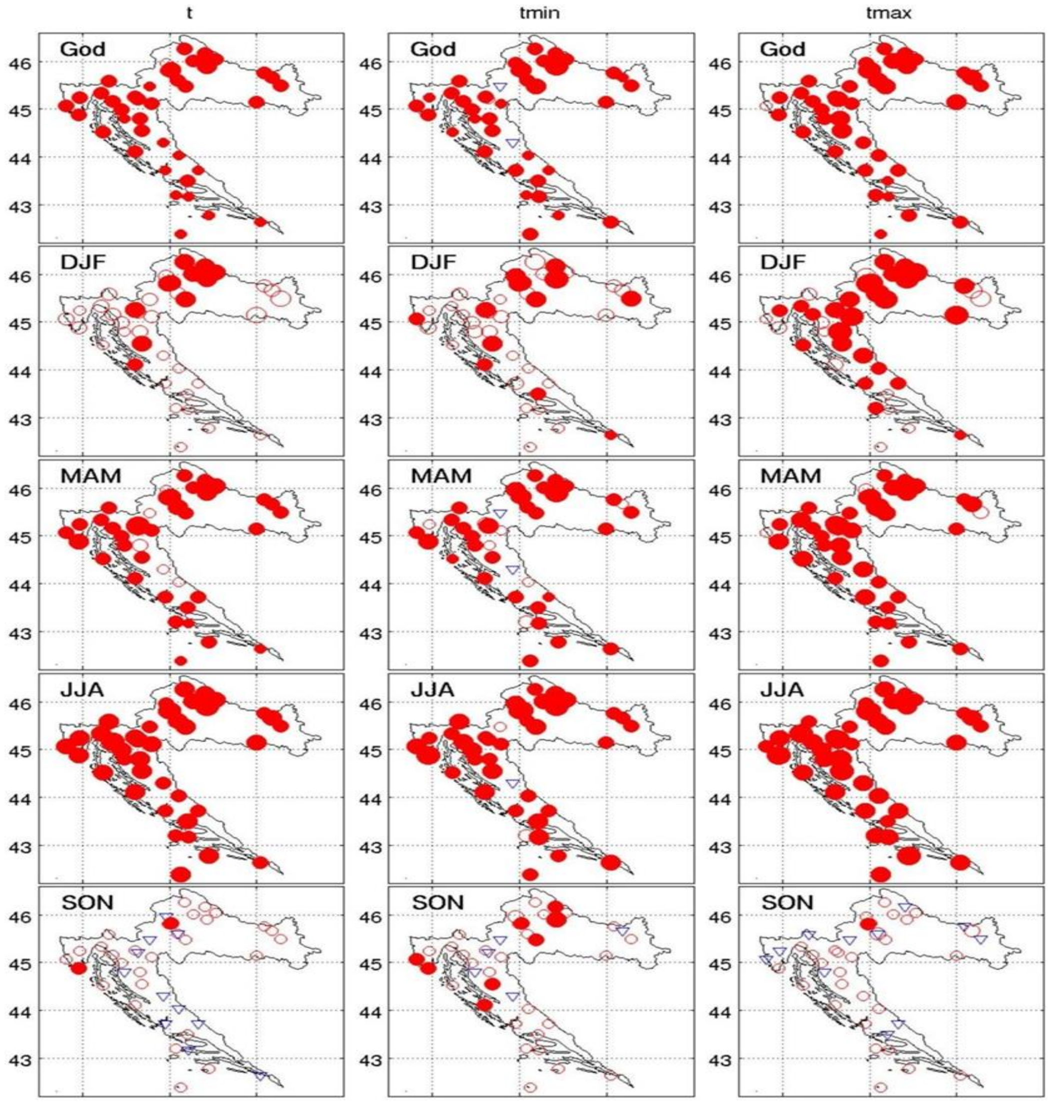


Figure 1: Decadal trends (°C/10yrs) in annual and seasonal (DJF-winter, MAM-spring, JJA-summer, SON-autumn) mean (t), mean minimum (tmin) and mean maximum temperature (tmax) values in the 1961-2010 period [10].

Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change (in °C) per decade relative to the respective average from the period 1961-1990: <0.2, 0.2-0.4, 0.4-0.6 and >0.6, respectively.

Table 3: Relative frequency of trend values (number of days in 10 years) in warm (SU, Tx90, Tx10, WSDI) and cold (FD, Tx10, Tn10, CSDI) temperature indices at 41 meteorological stations in Croatia [10]

Trend	**SU**	**Tx90**	**Tn90**	**WSDI**	**FD**	**Tx10**	**Tn10**	**CSDI**
≤-6,0	0.0	0.0	0.0	0.0	2.4	0.0	2.4	0.0
-5,9-4,0	0.0	0.0	0.0	0.0	7.3	7.3	17.1	0.0
-3,9-2,0	0.0	0.0	0.0	0.0	36.6	**63.4**	**39.0**	2.4
-1,9-0,0	0.0	0.0	0.0	0.0	**43.9**	29.3	31.7	**92.7**
0,1-2,0	4,9	0,0	2,4	0,0	7,3	0,0	7,3	4.9
2,1-4,0	29.3	0.0	2.4	29.3	2.4	0.0	2.4	0.0
4,1-6,0	**36.6**	2.4	12,2	**46.3**	0.0	0.0	0.0	0.0
6,1-8,0	29.3	**29.3**	12.2	14.6	0.0	0.0	0.0	0.0
8,1-10,0	0.0	26.8	22.0	9.8	0.0	0.0	0.0	0.0
10,1-12,0	0.0	17.1	**24.4**	0.0	0.0	0.0	0.0	0.0
12,1-14,0	0.0	19.5	14.6	0.0	0.0	0.0	0.0	0.0
14,1-16,0	0.0	4.9	4.9	0.0	0.0	0.0	0.0	0.0
16,1-18,0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0
18,1-20,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>20,0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0

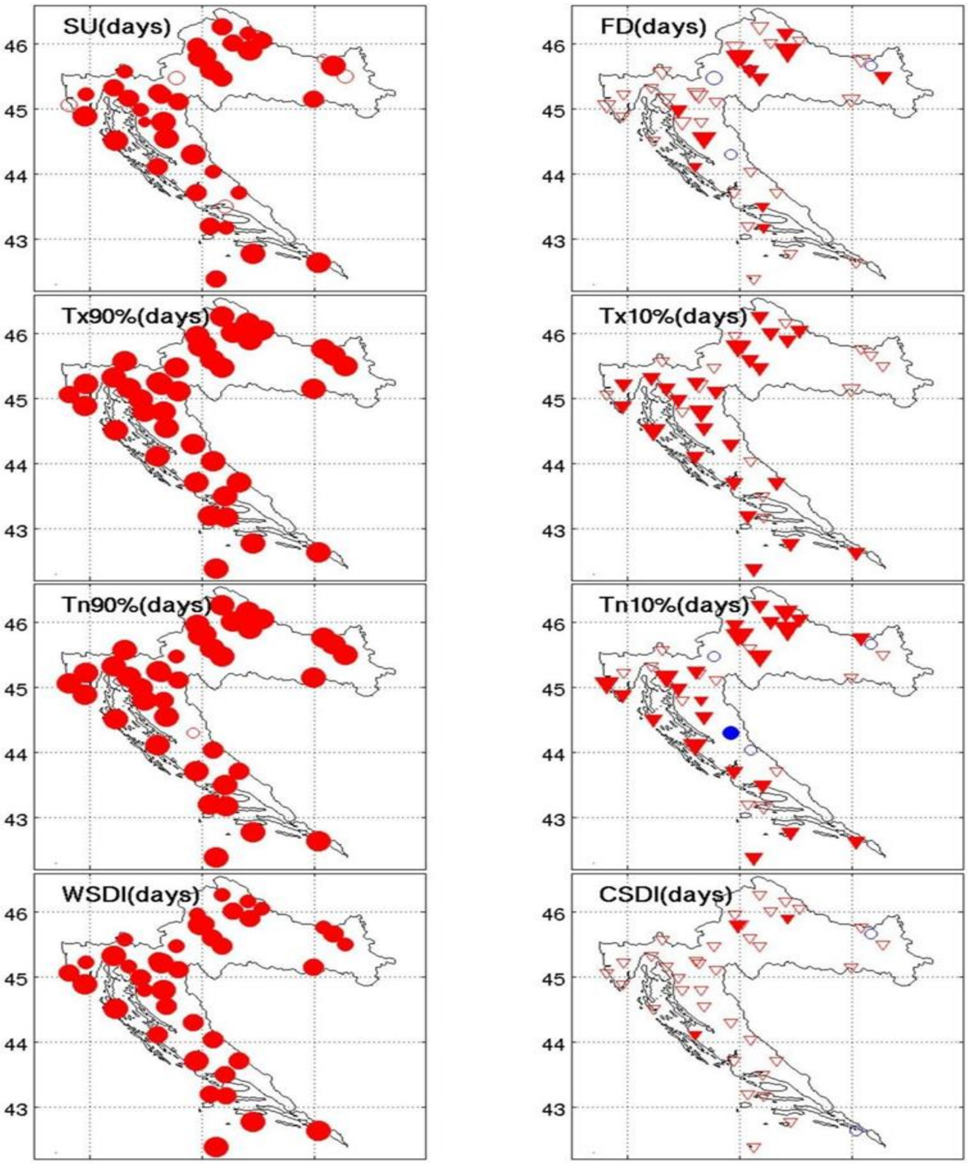


Figure 2: Decadal trends (days/10yrs) in annual extreme temperature indices in the 1961- 2010 period [10].

Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change (in days) per decade relative to the respective average from the period 1961–1990: <2, 2-4, 4-6 and >6, respectively.

3.2.4 Precipitation

Trends in annual and seasonal precipitation amounts give a general overview of the temporal change in precipitation over the country. During the recent 50-year period (1961 - 2010) the annual precipitation amounts (R) experienced prevailing insignificant trends that are increasing in the eastern lowland and decreasing elsewhere (Figure 3). The statistically significant decreases (filled symbols) are found for the stations in the mountainous region of Gorski kotar and in the Istria peninsula (northern Adriatic) as well as in the southern coastal region. Expressed per decade as percentages of the respective average values, these decreases range between -7 % and -2 %. Annual negative trends are mainly caused by decreasing trends in summer amounts (R- JJA), which are found to be statistically significant at most stations in the mountainous region and at some stations along the Adriatic and its hinterland (Figure 3 (b)). The statistical significance of the annual negative trend in Istria and Gorski kotar is also influenced by spring negative tendencies (from -8 % to -5 %; Fiure 3. (c)). Positive (circles) annual trends in eastern lowland are primarily caused by the significant increasing trends in autumn (Figure 3 (d)) and to a less extent in spring and summer. The geographical distribution of trends for seasons also shows interesting features. Summer precipitation shows a clear prominence of negative trend estimates all over the country and there is a number of stations for which this decrease is statistically significant, with the relative change between -11% and -6% per decade. In autumn, the trends are weak and mixed in sign, except in the eastern lowland where some locations show significant increasing trend in precipitation (8 % to 11 %). In spring results suggest no signal in the southern and eastern part of the country, while a negative tendency seems to affect the rest of the country, significantly only in Istria and Gorski kotar (-5 % to -7 %). During winter season (Figure 3 (e)), precipitation trends are not significant and they range between -11 % and 8 %. They are mostly negative at the southern and eastern parts as well as at Istria peninsula. The trends of mixed signs are found in the rest of the country.

Regional distribution of trends in precipitation indices, that define magnitude and frequency of precipitation extremes, shows complex structure, as it is also found for some Mediterranean regions.

Spatial distribution of trends in frequency of dry and wet precipitation extremes as indicated by number of dry days (DD), moderate wet days (R75) and very wet days (R95). The trends in DD are predominantly weak, but statistically significant positive trends (1 % to 2 %) appear at some stations in the mountainous region of Gorski kotar, Istria peninsula and in the southern coastal region. The trend pattern of R75 is spatially very similar to the annual precipitation one. The regional distribution of R95 trends shows no signal over the majority of the country. Statistically significant changes are present at few stations; positive over the northern lowlands and negative in the highlands of Gorski kotar as well as at the very southern coast.

Trends in the intensity of precipitation for wet days (Figure 3. (i)), as measured by the simple daily intensity index (SDII), reflect changes of trend magnitudes in two variables, annual amounts and annual number of wet days. For example, for two stations in different regions (indicated by two arrows in Figure 3. (i)), the same change in frequency of Rd (in these cases significant decrease, see Figure 3 (f)) but different changes in R, resulted in the similar significant increase in SDII at both stations. It implies that SDII is not suitable for explaining the causes of changes in R. Because of this fact, this index and its trends should be used with caution in application studies.

Table 4. List of the precipitation indices and their definitions [10]

No.	Indices	Unit	Definition
1	DD	days	Dry days (absolute extreme) (Number of days with daily precipitation amount Rd<1.0 mm)
2	SDII	mm/day	Simple daily intensity index (absolute extreme) (annual precipitation amount / annual number of wet days (Rd≥1.0 mm)
3	R75	days	Moderate wet days (percentile threshold) (Number of days with precipitation Rd>R75%, where R75% is the 75th percentile of the distribution of daily precipitation amounts at days with 1 mm or more precipitation in the 1961-1990 baseline period
4	R95	days	Very wet days (percentile threshold) (Number of days with precipitation Rd>R95%, where R95% is the 95th percentile of the distribution of daily precipitation amounts at days with 1 mm or more precipitation in the 1961-1990 baseline period
5	R25T	%	Precipitation fraction due to days with Rd<R25% (percentile threshold) (Fraction of annual total precipitation ∑Rd/Rt, where ∑Rd indicates the sum of daily precipitation less than the 25th percentile of precipitation at days with R25% in the 1961-1990 baseline period. a Rt is the total annual precipitation amount.
6	R25-75T	%	Precipitation fraction due to days with R25%≤Rd≤R75% (percentile threshold) (Fraction of annual total precipitation ∑Rd/Rt, where ∑Rd indicates the sum of daily precipitation equal to or exceeding the 25th percentile of precipitation at days with R25% and equal to or less than the 75th percentile of precipitation at days with R75% in the 1961-1990 baseline period. Rt is the total annual precipitation amount.

7	R75-95T	%	Precipitation fraction due to days with R75%<Rd≤R95% (percentile threshold) (Fraction of annual total precipitation ∑Rd/Rt, where ∑Rd indicates the sum of daily precipitation exceeding the 75th percentile of precipitation at days with R75% and equal to or less than the 95th percentile of precipitation at days with R95% in the 1961-1990 baseline period. Rt is the total annual precipitation amount.
8	R95T	%	Precipitation fraction due to very wet days (percentile threshold) (Fraction of annual total precipitation ∑Rd/Rt, where ∑Rd indicates the sum of daily precipitation exceeding the 95th percentile of precipitation at very wet days R95% in the 1961-1990 baseline period
9	Rx1d	mm	Highest 1-day precipitation amount (absolute extreme) (Maximum precipitation sums for 1-day intervals)
10	Rx5d	mm	Highest 5-day precipitation amount (absolute extreme) (Maximum precipitation sums for 5-day intervals)

Fraction of annual total precipitation due to different classes of daily precipitation was analysed over the full-scale of daily precipitation categories. Four classes with percentile thresholds define the following indices: R95T, R75-95T, R25-75T and R25T (Table 4). Two opposite categories, that of very high precipitation extremes (R95T) and that of light precipitation extremes (R25T), show prevailing weak trends that are quite mixed in sign over the country. Only some locations seem to be affected by significant trends. Significant positive trend in R25T is found in the western Croatia (including NW region, Gorski kotar and Istria) and along the southern Adriatic coast. In the eastern lowland of Croatia, a positive trend in annual precipitation amount is associated with a significant positive trend in R95T. Contribution to annual amounts of daily precipitation from the central part of the distribution (R25-75T) shows weak changes of mixed sign (-7% to 7 %). The similar is true for trends in the fraction of annual precipitation due to moderate wet days (R75-95T). Though, there is a significant positive trend found at few stations in the mountainous regions, as well as at the northern and middle Adriatic, despite the reduction in frequency of such days. Over the southern coastal region, the R75-95T shows negative trends that can be related to the negative tendency in R75.

The first information about temporal changes in annual extremes as defined by maximum 1-day precipitation (Rx1d) and multi-daily precipitation episode as defined by maximum 5-day precipitation (Rx5d) is presented by relative changes in their linear trends in Fig. 3. (f-g). Trend direction of both indices is generally in agreement along the respective regions. Trend is weak in magnitude and predominantly positive in the eastern lowland and along the coast; while it is mostly negative in NW area and in the mountainous regions (significant for Rx1d).

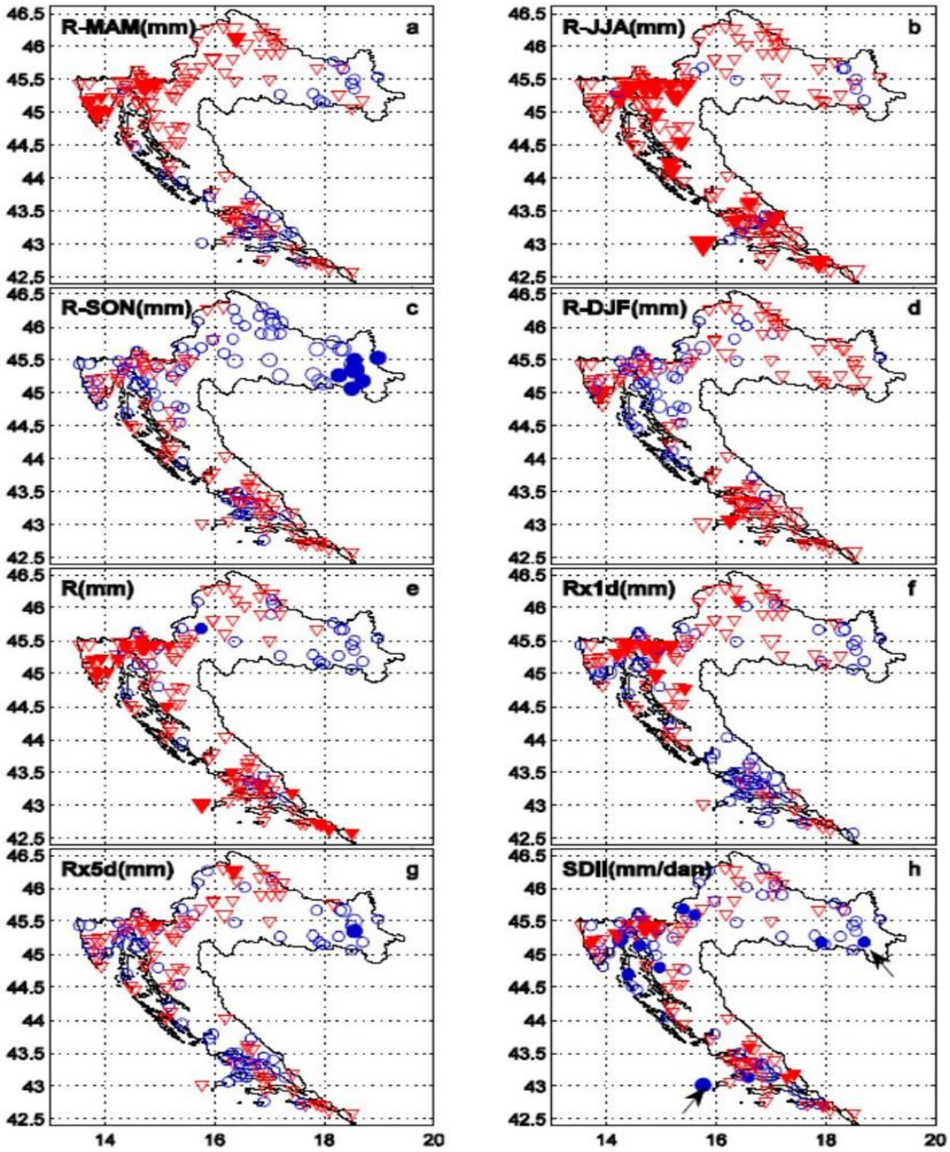


Figure 3: Decadal trends (%/10yrs) in seasonal and annual precipitation (R-MAM, R- JJA, R-SON. R-DJF, R) and precipitation indices (Rx1d, Rx5d, SDII, R75, R95, R25T, R25- 50T, R50- 75T, R75-95T, R95T and DD) in the 1961-2010 period [10].

Circles denote positive trends, triangles the negative one, whereas filling means statistically significant trend. Four sizes of symbols are proportional to the absolute value of change per decade relative to the respective average from the period 1961-1990: <5%, 5-10%, 10-15% and >15%, respectively.

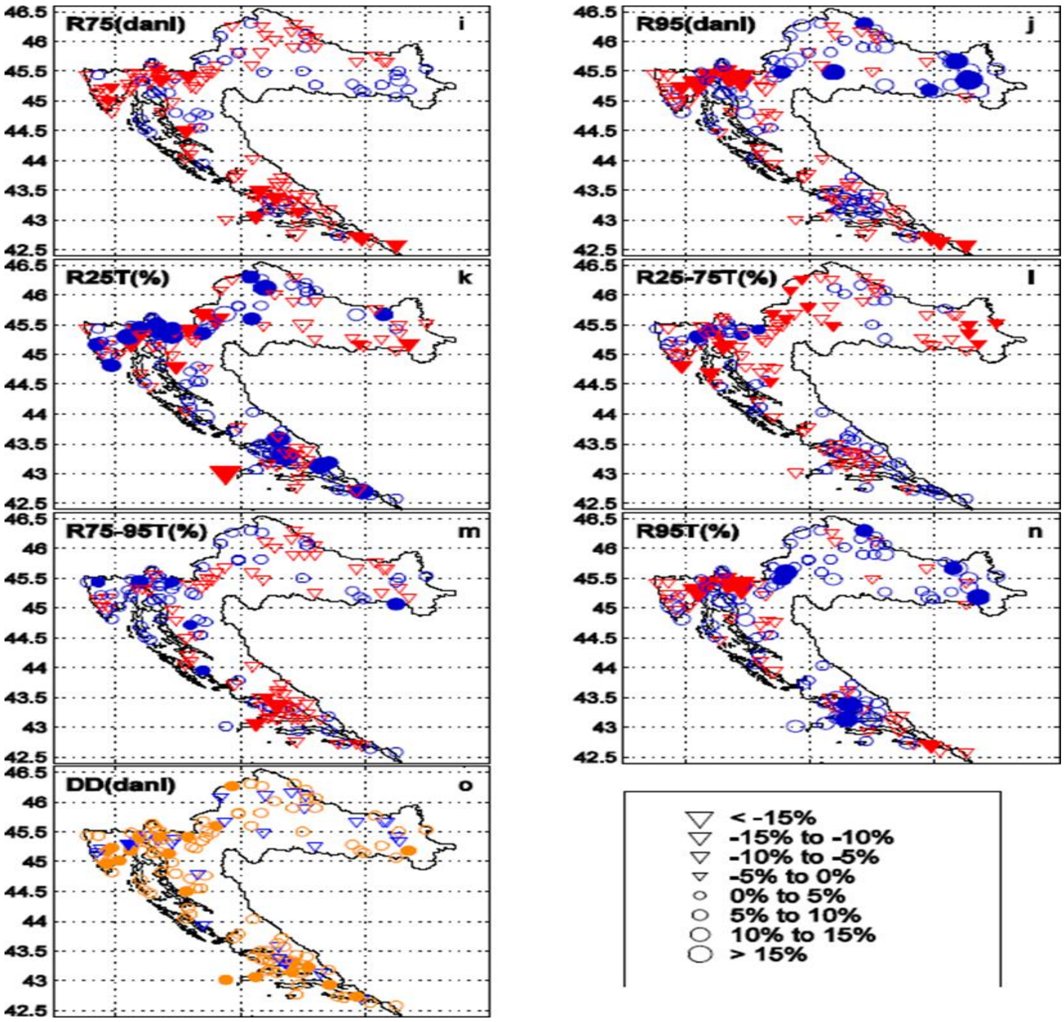


Figure 4: cont. [10]

3.3 Climate change scenarios

3.3.1 Introduction

In this subsection, the results of climate modelling for the most common climatological variables are presented. The results were based on the "An overview of current research and activities related to the impact of climate change and adaptation to climate change in the Republic of Croatia", "Draft Climate Change Adaptation Strategy in the Republic of Croatia for the period to 2040 with a view to 2070 (White book) and the "Report on Assessed Impacts and Vulnerability to Climate Change for Individual Sectors" prepared in the framework of the project "Strengthening the capacity of the Ministry of Environment and Energy for adaptation to climate change and preparation of the Draft Climate Change Adaptation Strategy"[1].

For the purposes of the Climate Change Adaptation Strategy of the Republic of Croatia to 2040 with the view to 2070 results of climate models projection for two periods were used, taking into account two scenarios for the development of greenhouse gas concentrations in the future: RCP4.5 and RCP8.5, as defined by the Intergovernmental Panel on Climate change – IPCC. Scenario RCP4.5 is considered a more moderate scenario, while RCP8.5 is treated as more extreme. Climate projections are made for two time periods: the first to end in 2040 and the second to end in 2070 [10].

3.3.2 Air temperature

Observed change

During the period from 1961 to 2010, the trends of mean, mean minimum, and mean maximum air temperatures show warming throughout Croatia. Trends in annual air temperature are positive and statistically significant, and changes are greater in the continental part of the country than on the coast and in the Dalmatian hinterland. The maximum air temperature was exposed to the biggest change (increase). The highest contribution to the overall positive air temperature trend was due to the summer trends, and the trends for winter and spring equally contributed to the increase in mean maximum temperatures. The slightest changes were in regard to the autumn air temperature. Observed warming is also reflected in all temperature extremes indices [10].

[1] More information on this project available: http://prilagodba-klimi.hr/dokumenti/

Future change for the RCP4.5 scenario

In the period from 2011 to 2040, mean annual air temperature values are expected to increase almost uniformly (1.0 to 1.2 °C) throughout Croatia. In the period 2041 – 2070, the expected trend of rising temperatures would continue and would amount to between 1.9 and 2 °C. Somewhat warmer could only be at the far west of the country, along the western coast of Istria.

In the period between 2011 and 2040, a clear signal of increase in average ground air temperature throughout Croatia is expected in all seasons. In winter and summer, the highest projected temperature increase would be from 1.1 to 1.3 °C in the coastal regions. In the spring, the increase could be 0.7 °C in the Adriatic to slightly more than 1.0 °C in the north of Croatia, and in the autumn the expected increase in temperature could be between 0.9 °C in the eastern regions to about 1.2 °C in the Adriatic, exceptionally up to 1.4 °C, in western Istria.

In the period from 2041 to 2070, the highest increase in mean air temperature, up to 2.2 °C, is expected in the Adriatic in summer and autumn. In winter and spring, the largest projected temperature increase is somewhat smaller - up to about 2.1 °C or 1.9 °C in continental areas. In winter and spring, the spatial distribution of temperature increase is reverse of those in summer and autumn: the increase is the smallest in the Adriatic and higher towards inland. In spring, the average temperature increase is of 1.4 to 1.6 °C on the Adriatic, with gradual increase of 1.9 °C to the north.

The projected change in maximum air temperature by 2040 are similar to those for mean (daily) temperature and are expected to increase in all seasons. Generally, the increase would be higher than 1.0°C (0.7 °C in spring in the Adriatic), but less than 1.5 °C. In the period 2041 – 2070, a further increase in maximum temperature is expected. It could be higher than in the previous period, and in relation to the reference climate it could reach 2.3 °C in summer and autumn on the islands [10].

The minimum temperature is expected to increase in the future climate as well. Until 2040 the highest expected increase in minimum temperature is in winter: up to 1.2 °C in northern Croatia and on the coast and up to 1.4 °C in Gorski Kotar, i.e. in the area that is usually the coldest. The slightest expected increase, less than 1.0 °C, would happen in spring. And in the period 2041-2070 the highest increase in the minimum temperature is expected in winter - from 2.1 to 2.4 °C in the continental part and from 1.8 to 2 °C in the coastal regions. In other seasons, the increase in the minimum temperature would be somewhat smaller than in winter.

Future change to the RCP8.5 scenario

According to this scenario, in the period from 2011 – 2040, the seasonal increase in temperature would be on average higher only by about 0.3 °C compared to RCP4.5. This coincidence of results in two different scenarios is also found in the projections of temperature increase from global climate models, according to which the increase in temperatures in all IPCC scenarios in most of the first half of the 21st century is very similar. However, in the period 2041 – 2070, the projected increase in temperature for the RCP8.5

scenario is significantly higher than that for the RCP4.5 and is between 2.6 and 2.9 °C in summer and from 2.2 to 2.5 °C in other seasons.

For the maximum temperature up to 2040, the expected seasonal increase in relation to the reference period is highest in summer (up to 1.7 °C in the coastal areas and on the islands), and the lowest in spring (0.9 – 1.1 °C). In winter and autumn, the expected increase in maximum temperature is between 1.1 and 1.3 °C. In the mid-21st century (2041 – 2070), the highest expected increase in mean maximum temperature is up to 3.0 °C in summer on the Adriatic islands and between 2.2 and 2.6 °C in other seasons.

For the minimum temperature the largest projected increase in the period 2011 – 2040 is over 1.5 °C in north–western Croatia, northern part of Gorski Kotar and in the eastern part of Lika in winter and in the coastal regions in summer. In spring and autumn, the expected increase is somewhat less, from 1.1 to 1.2°C. By 2070 the minimum temperature would increase from 2.2 to 2.8 °C in winter and from 2.6 to 2.8 °C in summer. In spring and autumn, the increase would be slightly less – between 2.2 and 2.4 °C.

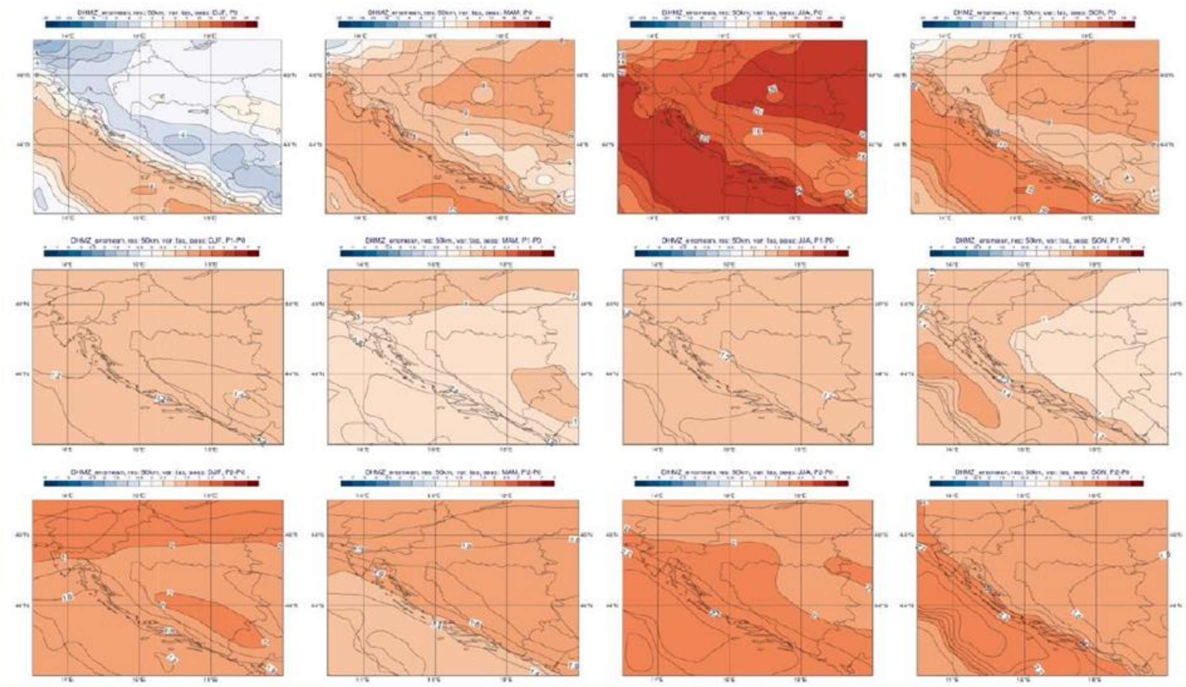


Figure 5.Air temperature (°C) ensembles-mean from the four integration by RegCM model. Left to right: winter, spring, summer and autumn [10].

Top: referent period 1971 – 2000; middle: change in the period 2011 – 2040.; bottom: change in period 2041 – 2070.

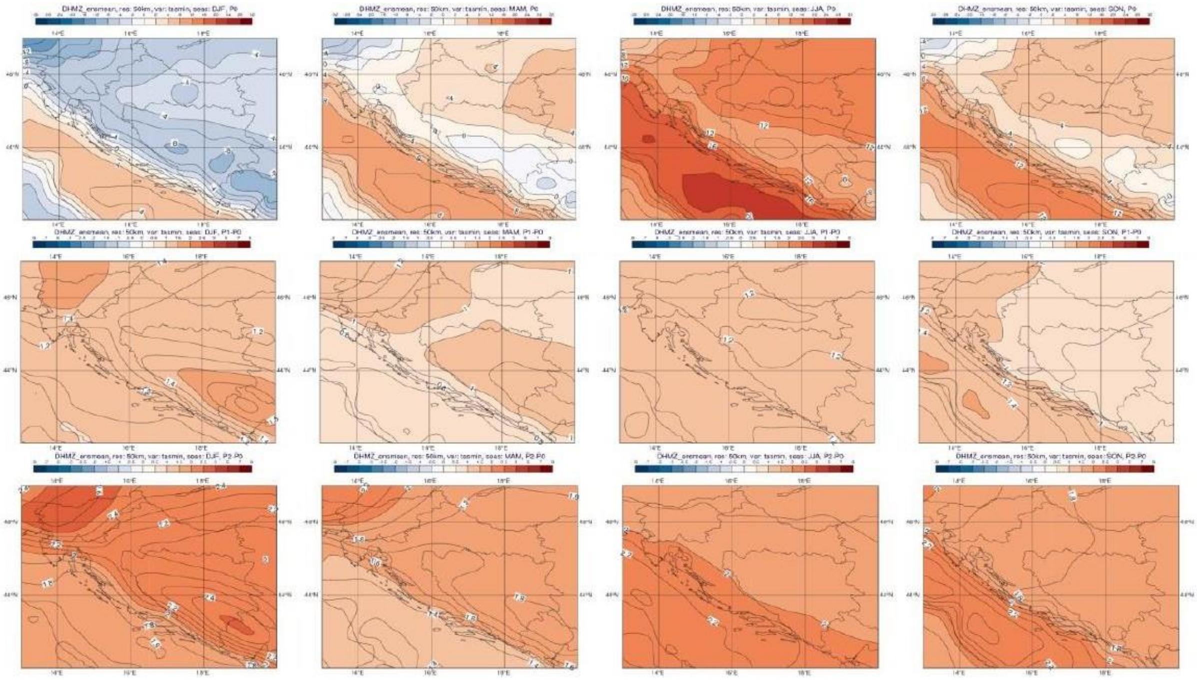


Figure 6: Minimum air temperature (°C) ensembles-mean from the four integrations by RegCM model [10].

Left to right: winter, spring, summer and autumn. Top: referent period 1971 – 2000.; middle: change in the period 2011 – 2040; bottom: change in period 2041 – 2070

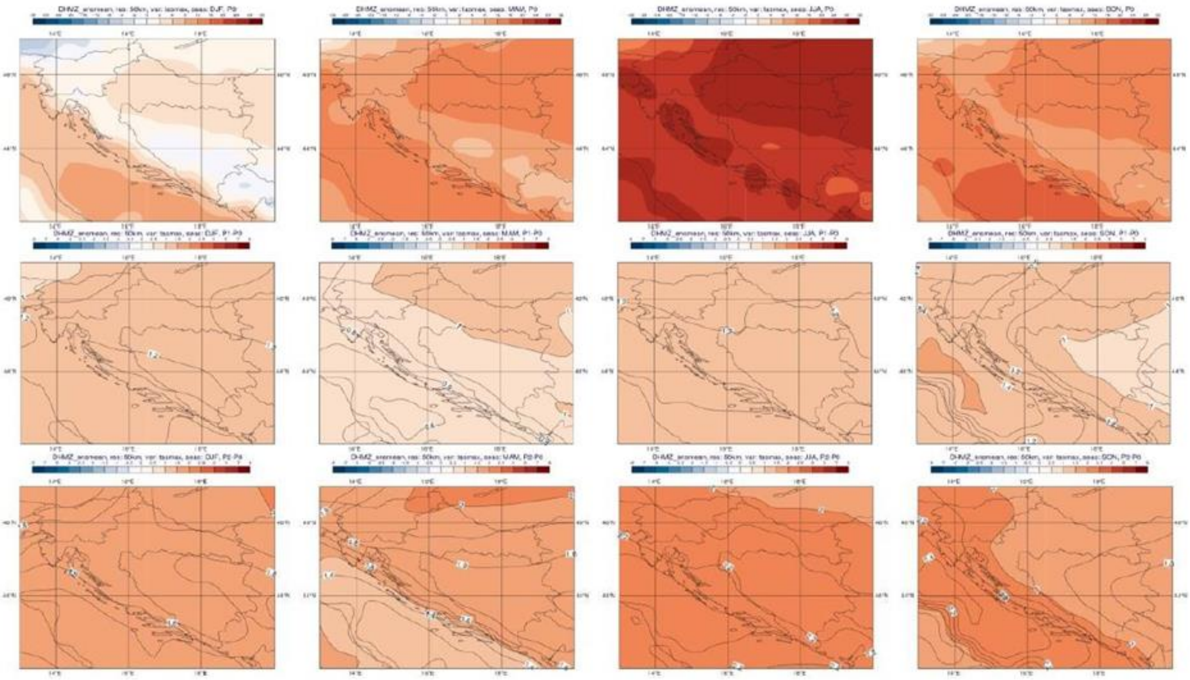


Figure 7: Maximum air temperature (°C) ensembles-mean from the four integrations by RegCM model [10].

Left to right: winter, spring, summer and autumn. Top: referent period 1971 – 2000; middle: change in the period 2011 – 2040; bottom: change in period 2041 – 2070.

3.3.3 Extreme temperature conditions

Future changes for the RCP4.5 scenario

In the period from 2011 to 2040, a rise in the number of hot days (when the maximum temperature is over 30 °C) is expected in summer, which could also result in prolonged periods with high air temperature (heat waves). An increase in the number of hot days from an average of 15–25 days in the reference climate period (1971 – 2000) would amount in most of Croatia to between 6 and 8 days, and more than 8 days in Eastern Croatia and somewhere in the Adriatic. In mountainous areas also, the rise of hot days in the future climate would be the same as in the vast majority of the country. The rise in the number of hot days would continue in the period 2041 – 2070. The increase of hot days' number of slightly more than 12 days is expected in the whole of Croatia, which in mountainous areas would lead to almost doubling of the number of hot days compared to the reference period.

In the future climate until 2040 the increase in number of summer days with warm nights (when the minimum temperature is higher than or equal to 20 °C) is expected, and the highest increase is projected for the Adriatic area. By 2070, a further significant increase in the number of days with warm nights is expected.

The expected number of winter ice days (when the minimum temperature is below -10 °C) would fall in the period between 2011 and 2040 compared to the reference climate. For the period 2041 – 2070, a further decrease in the number of ice days is projected.

Future changes for the RCP8.5 scenario

Under this scenario, a slight increase in hot days is expected by 2040, and by 2070 this increase would be about 30 % higher compared to the RCP4.5. Compared to the RCP4.5 scenario, the projected number of days with warm nights will only slightly increase by 2040, but significant increase is expected in the period 2041 – 2070, especially in eastern Slavonia and coastal regions. Further decrease of the number of ice days, especially in the period 2041 – 2070, is also expected.

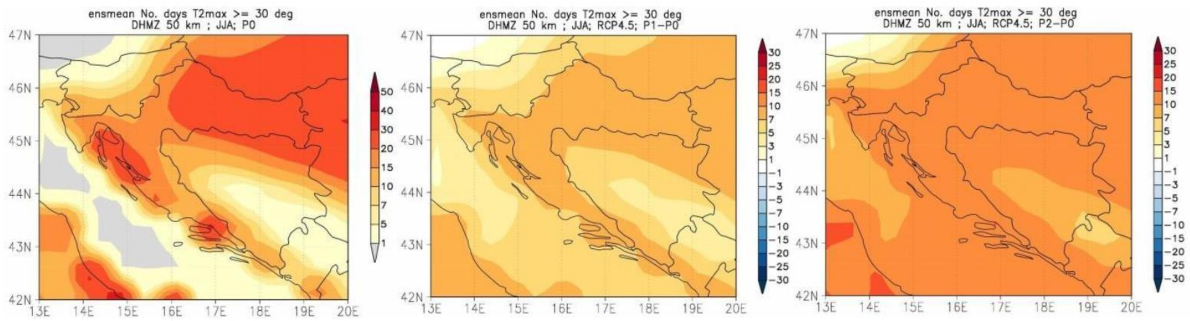


Figure 8.Number of the days with the maximum temperature above 30 °C as ensembles-mean from the four integration by RegCM model [10].

Left to right: winter, spring, summer and autumn. Top: referent period 1971 – 2000; middle: change in the period 2011 – 2040; bottom: change in period 2041 – 2070

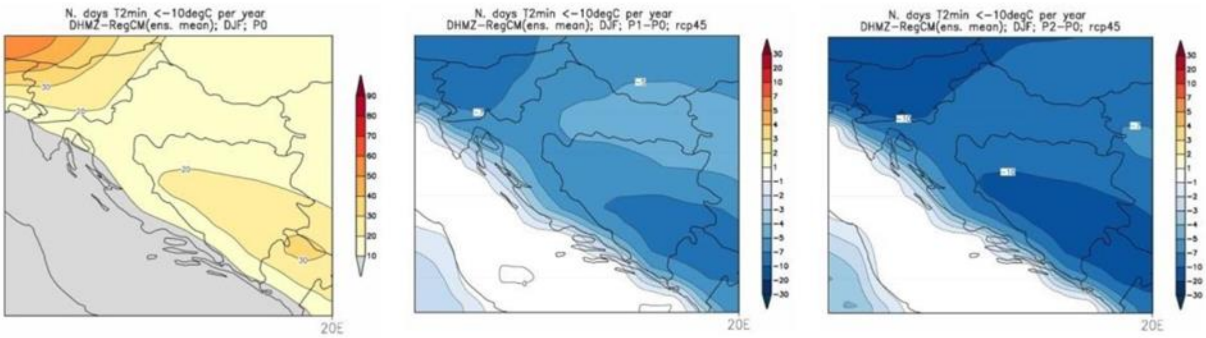


Figure 9.Number of winter days with minimum temperature lower than -10 °C (cold days) as ensembles-mean from the four integration by RegCM model [10].

Left: referent period 1971 – 2000.; middle: change in the period 2011 – 2040; right: change in the period 2041 – 2070.

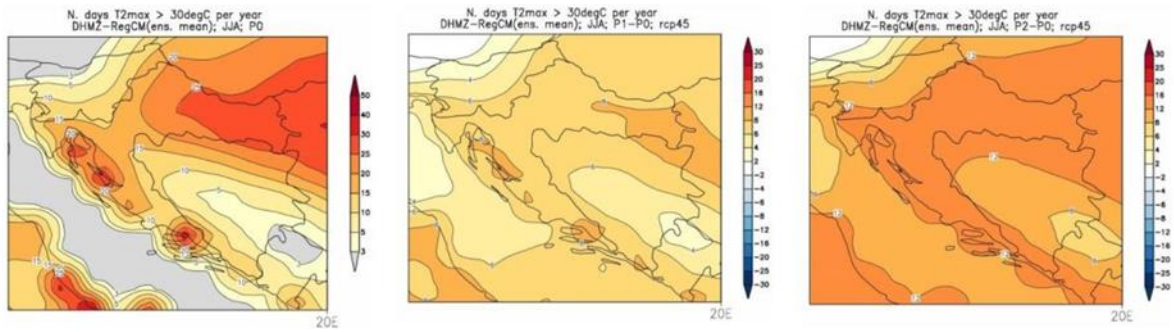


Figure 10. Number of summer days with the maximum temperature above 30 °C (hot days) as ensembles-mean from the four integrations by RegCM model [10].

Left: referent period 1971 – 2000.; middle: change in the period 2011 – 2040.; right: change in the period 2041 – 2070.

3.3.4 Precipitation

Observed movements

During the period from 1961 to 2010, annual precipitation levels in the Republic of Croatia show prevalent statistically insignificant trends, which are positive in the eastern lowlands (increase) and negative in other areas of Croatia (decrease). Poor trends are noticeable in most seasons, but the exception is the summer precipitation that has a clearly marked negative trend across the country (decrease). In autumn there are weak trends of mixed sign, and the increase in precipitation in the interior is mainly due to the increase in the number of days with large daily precipitation quantities. During the winter, precipitation trends are not significant and are mostly negative in the southern and eastern regions. In the rest of the country precipitation trends are of mixed. In spring, the results show that there are no significant changes in the total precipitation in the southern and eastern part of the country, while the negative trend (decrease) is present in the remaining parts.

Future change of precipitation for the RCP4.5 scenario

At an annual level, a very small decrease of average annual precipitation is projected until 2040, which will have no significant impact on the total annual volume. In north-western Croatia, the signal of change is going in the direction of a smaller annual precipitation increase. Until 2070 it is expected further reduction of the average annual precipitation (up to about 5 %), which will extend to almost the entire country, except at the northernmost and westernmost parts. The largest decrease is expected in the southern Lika region up to the Dalmatian hinterland along the border with Bosnia and Herzegovina (about 40 mm) and in the southernmost land areas (about 70 mm).

The projected change in the total amount of precipitation per season between 2011 and 2040 differ. In winter in Croatia as a whole, and in the spring in most of Croatia a smaller increase in precipitation is expected. In summer and autumn, the decrease in total precipitation will prevail throughout the country. The expected increase in precipitation in winter is between 5 and 10 % in the northern and central regions, and in spring the total precipitation growth in western regions will be smaller. In the spring considerably lower precipitation levels are expected in the eastern and southern regions. The largest summer precipitation decreases, 5–10 %, is expected in northern Dalmatia and southern Lika, whereas decrease in other parts should be less than 5 %. In autumn, the largest projected reduction in the total precipitation amount is about 20 mm in Gorski Kotar and in the northern part of Lika, which makes about 5 % of the total precipitation in that season, and in the far south the decrease is also about 5 %.

In the period 2041 – 2070, the decrease of precipitation is expected in all seasons, except in winter. The biggest decrease (slightly more than 10 %) will be in the spring in southern Dalmatia and in the summer, 10 – 15 %, in the mountainous areas and in northern Dalmatia. The largest increase in total precipitation, 5 – 10 %, is expected on the islands in autumn and in northern Croatia in winter.

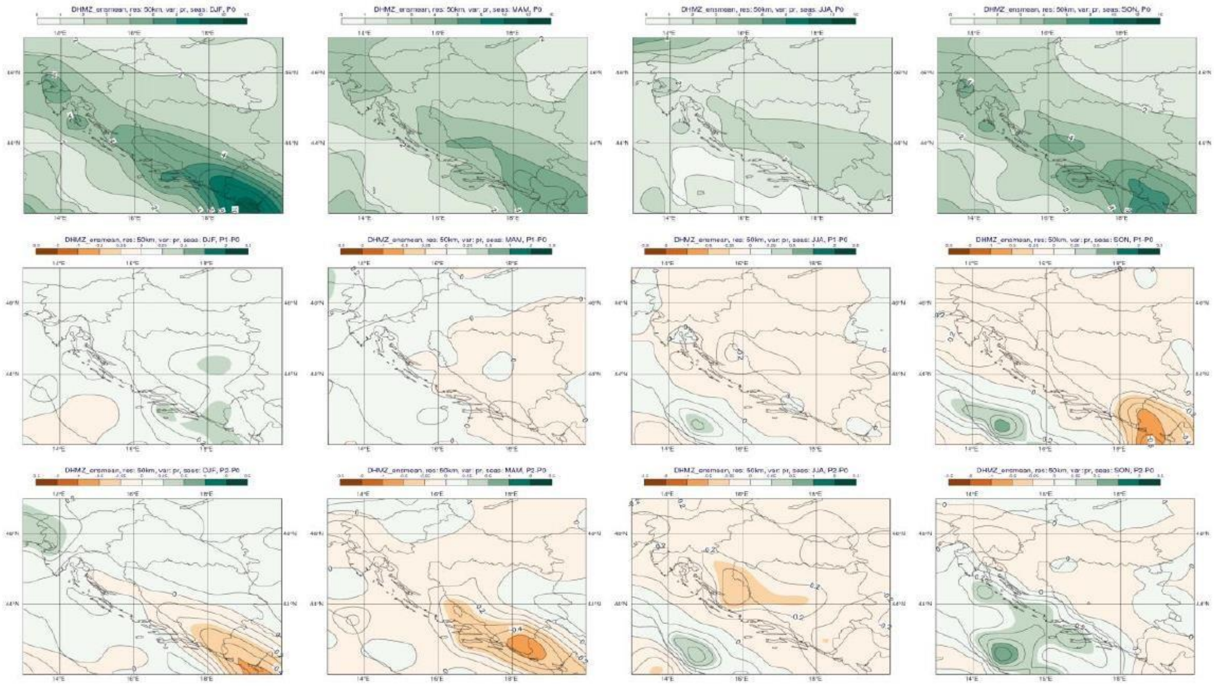


Figure 11: Total precipitation (mm/day) ensembles-mean from the four integrations by RegCM model. Left to right: winter, spring, summer and autumn [10].

Top: referent period 1971 – 2000; middle: change in the period 2011 – 2040; bottom: change in period 2041 – 2070.

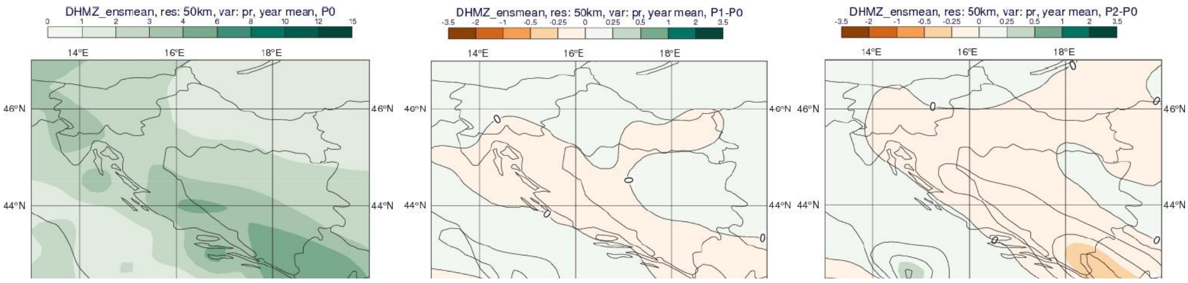


Figure 12: Total annual percipitation (mm/day) ensembles-mean from the four integration by RegCM model [10].

Left: referent period 1971 – 2000.; midle: change in the period 2011 – 2040; right: change in the period 2041 – 2070.

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4. Climate Analysis – MARCHE REGION, by UNICAM

4.1 Introduction

This chapter is a summary of the work carried out in previous European projects regarding climate change in Marche. These are:

- The LIFE SEC ADAPT project, which was financed within the framework of the Life Programme 2014-2020. The project's aim was to increase climate resilience of European urban areas and promote the Sustainable Energy Communities (SEC) model. It was implemented over the course of 40 months, between 1st September 2015 and 31st December 2018. It involved two regions, Marche and Istria, and 20 municipalities among Italy, Croatia, Greece and Spain.
- The LIFE PRIMES project, which was also financed within the framework of the Life Programme 2014-2020. The project's aim was to reduce damages from extreme weather events. It was implemented over the course of 34 months, between 1st October 2015 and 31st July 2018. It involved three regions, Emilia-Romagna, Marche and Abruzzo, and 10 municipalities among these regions.

The chapter will look at the climate analyses of Marche carried out in both projects, focusing on the analysis of past and current climate trends, and of future climate projections. The former focus on observing what happened in the past with regard to climate and estimating trends, while the latter analyze what might happen in the future through projections of climate models.

4.2 Analysis of past and current climate trends

Within LIFE SEC ADAPT, the analysis (Fioravanti et al., 2016) focused on the time series in the 1961-2015-time period coming from stations located in each of the municipalities involved in the project. The series were provided by the local "Centro Funzionale della Protezione Civile" for all municipalities but Pesaro and Urbino, whose data came from the "Valerio" and "Serpieri" observatories respectively. The stations2 provide daily series for precipitation, minimum temperature and maximum temperature. The mean temperature derives from the arithmetic mean of minimum and maximum daily temperature. Climate variations and trends were calculated through models and tests. Moreover, climate extremes were examined by calculating significant climate indices.

In terms of precipitation, the annual and seasonal trend analysis shows weak, statistically non-significant trends, apart from a negative trend in Fabriano. The seasonal analysis shows a small increase in spring for most stations. The only significant trends are in Ascoli Piceno and Urbino, where an increase in spring and a decrease in summer are measured respectively. The seasonal analysis in Fabriano shows a decrease in precipitation in all seasons apart from autumn.

[2] Ascoli Piceno, Fabriano, Fano, Jesi, Macerata, Pesaro, Senigallia, Servigliano, Spinetoli and Urbino.

As regards temperature, there is a clear sign of warming, with positive and statistically significant trends for almost all stations. The annual mean temperature increase in the 1961-2015 period is within 0.15 and 0.47oC in 10 years. The annual minimum temperature increase stays between 0.05 and 0.48oC in 10 years. There is a weak negative, non-significant trend in Servigliano, but this series may be not homogenous. The annual maximum temperature increase is between 0.05 and 0.45 oC in 10 years. Servigliano's measurement is again an outlier. The maximum temperature increases are stronger than the minimum temperature increases. The seasonal analysis shows stronger increases in summer and weaker in winter.

Table 1: Annual mean temperature increase (oC/10 years) from 1961 to 2015. Non-significant trends are in brackets.

	Annuale	Inverno	Primavera	Estate	Autunno
Ascoli Piceno	+0.32	(+0.21)	+0.33	+0.49	+0.22
Jesi	+0.22	+0.25	(+0.17)	+0.27	(+0.14)
Macerata	+0.33	+0.20	+0.38	+0.60	(+0.20)
Pesaro	+0.39	+0.19	+0.33	+0.57	+0.28
Fano	+0.37	+0.31	+0.32	+0.49	+0.31
Servigliano	+0.35	(+0.05)	+0.36	+0.63	+0.37
Urbino	+0.47	(+0.20)	+0.46	+0.75	+0.33
Fabriano	+0.15	(-0.01)	+0.13	+0.33	(+0.03)

With respect to precipitation extreme indices there are not significant variations in precipitation frequency and intensity. Only values from some stations are deemed statistically significant and there are some positive trends for the SDII (daily precipitation intensity), CDD (consecutive dry days), R95p (very rainy days) and R20 (very intense precipitation days) indices but these are statistically significant for few stations.

The analysis of temperature extreme indices confirms the warming tendency observed for mean values, as indices of heat extremes increase, while those showing cold extremes decrease. Freezing days (CD0) are strongly decreasing, while there is a clear increase of indices showing heat extremes, apart from the data retrieved in Jesi for some indices regarding maximum temperatures, which are deemed non-significant. There is a general increase of the indices on tropical nights (TR20), summer days (SU25), heat wave duration (WSDI) and very warm days (SU30).

As regards the PRIMES project, the analysis (Cacciamani et al., 2016) encompasses the three regions affected by the project (Emilia-Romagna, Marche and Abruzzo) as a whole and focuses on the period 1961-2015. The precipitation data does not include the year 2015 because some of the data was not published at the time. The time series were tested for consistency, quality and statistical homogeneity, with those not satisfying the standards being eliminated. Thus, 80 time series were selected for Marche. Starting from the selected stations, the authors produced a gridded daily analysis at 5x5km resolution. The daily minimum and maximum temperatures data come from a E-obs daily gridded data set with a 0.25ox0.25o available for the 1951-2015 period.

In terms of seasonal precipitation, the trends are statistically non-significant and are slightly negative in winter and summer, while slightly positive in spring and autumn. Annual precipitation trends are mostly negative in the whole region.

With respect to extreme precipitation, the trends of the 95th percentile of daily precipitation are greater in autumn. In terms of frequency of extreme events, the results reveal a complex pattern. In Marche, the trend is negative in winter, spring and autumn, while positive in summer.

As regards the frequency of areal intense precipitation, the number of days in which the areal average daily precipitation exceeds the warning threshold of 50 mm per day, Marche is divided in four warning macro-areas. In the region, over the 1961-2014 period, events are concentrated in autumn, followed by winter, spring and summer. The macro-area where more events were registered covers the southern Apennines. Finally, more events were registered in the latter half of the time period.

The topic that follows regards dry and wet days, with the former defined as the maximum number of consecutive days with below 1mm of precipitation during a season, and the latter defined as the opposite. In the time period 1961-2014 most dry days are in summer, located along the coast as regards Marche. On the other hand, winter wet days are concentrated in the Apennines. The trend for consecutive wet days is negative in spring and summer.

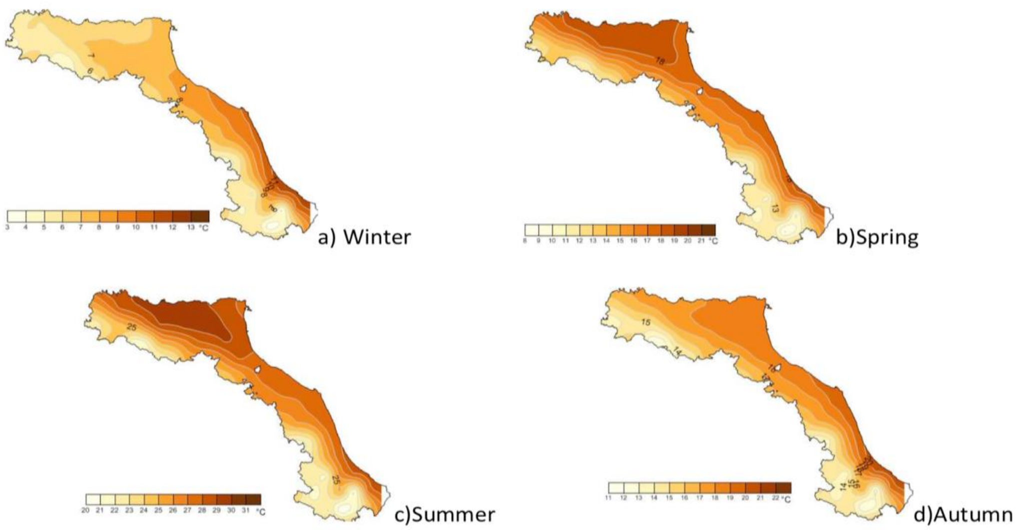

Figure 1: Climatology of seasonal maximum temperature over pilot areas.

In terms of minimum temperature, the trend coefficient is positive in all seasons, with a more marked increase in summer. The same can be said for maximum temperatures, with slightly higher coefficients. Heat wave duration is also on the rise, with peaks in 2003, 2006 and 2012.

4.3 Analysis of future climate projections

The projections of temperature and precipitation carried out in LIFE SEC ADAPT (Fioravanti et al., 2016) are based on the simulations produced in Med-CORDEX. The authors selected the outputs (ALADIN, GUF, CMCC, LMD) of four RCM (Regional Climate Models) providing forecasts up to 2100 in the two emission scenarios RCP4.5 (intermediate) and RCP8.5 (pessimistic). Every RCM, with a 50 km resolution grid, is inserted on a GCM (Global Climate Model), from which it acquires the initial and surrounding conditions in order to produce future projections. The simulations regarding the 1971-2000 time period were carried in the same way. The outputs of the models provided the daily data for each grid point located in Marche, which were then aggregated by season and year. The daily data also served as a base for the maximum and minimum temperature extreme indices already elaborated for the past and current trends. Future climate variations were assessed in terms of difference between a reference value in the period 1971-2000 and three 30-year time horizons (2021-2050, 2041-2060, 2061-2090).

Precipitation projections of mean values do not show a clear signal of increase or decrease in either scenario. In the RCP4.5 scenario three models forecast a decrease in cumulative annual precipitation between 33 and 83 mm, while the other an increase of 57 mm. The ensemble mean of all four models shows a slight decrease in precipitation. The range of projections for the 2071-2100 period stays between an 11% increase and a 5% decrease (3% decrease for the ensemble mean), with respect to an 800 mm mean value of cumulative annual precipitation. The seasonal analysis for the ensemble means shows a slight increase in winter, while there is a slight decrease in all other seasons.

Looking at temperature projections, the four models forecast an increase in maximum temperatures in a century between 1.8 and 3.2oC in the RCP4.5 scenario, and between 3.4 and 5.7 oC in the RCP8.5 scenario. Minimum temperature might increase between 1.6 and 3.0 oC in the RCP4.5 scenario, and between 3.3 and 5.1oC in the RCP8.5 scenario. The increase should be constant in time for both temperatures and scenarios. The increase in mean temperature is between 1.7 and 3.1 oC in the RCP4.5 scenario, and between 3.4 and 5.3 oC in the RCP8.5 scenario. The increase should also be constant in time for both scenarios. According to the seasonal analysis the highest temperature increase is expected in summer, while the lowest is expected in spring.

With regard to precipitation extreme indices, projections show that a gradual concentration of precipitation in more intense and less frequent events is to be expected. The extent of these variation is uncertain, and slight or moderate on average. In terms of the ensemble mean, maximum daily precipitation (RX1day) is expected to slightly increase: in the 2061-2090 time horizon the increase is 1.2mm in the RCP4.5 scenario, and 3.6mm in the RCP8.5 scenario. Very rainy-day precipitation (R95p) is expected to slightly increase in the ensemble mean, with a high spread between models. All models forecast an increase in daily precipitation intensity (SDII), between 0.1 and 0.9mm/day in the RCP4.5

scenario, and between 0.3 and 1.2mm/day in the RCP8.5 scenario. Since the ensemble mean shows a decrease in total precipitation, the SDII increase indicates a trend towards more intense, less frequent precipitation events. In terms of consecutive dry days (CDD), an increase in the duration of droughts is expected: the ensemble mean for the 2061-2090 period shows an increase of 8.7 days in the RCP4.5 scenario and 15.5 days in the RCP8.5 scenario. Lastly, there will be slight variations in the number of days with intense precipitation: in the 2061-2090 period these will range between -0.4 and 0.9 days in the RCP4.5 scenario and -0.9 and 2 days in the RCP8.5 scenario.

Figure 2: Maximum daily precipitation. Expected variations at the time horizons 2021-205, 2041-2070 and 2061-2090 with respect to the 1961-1990 time period in the RCP4.5 and RCP8.5 scenarios.

The analysis of temperature extreme indices indicates warming stronger by each passing time horizon. Freezing days (FD) are expected to strongly decrease, while tropical nights (TR20) will increase in the 2061-2090 time horizon: the former will lose between 7 and 31 days in the RCP4.5 scenario, and between 12 and 41 days in the RCP8.5 scenario, while the latter will gain between 14.6 and 33.5 days in the first scenario, and between 24 and 59 days in the other. All four models expect a decrease in cold nights (TN10P) and an increase in warm nights (TN90P) in the 2061-2090 time horizon: the former will decrease between 5.7 and 8.9% of days in the RCP4.5 scenario, and between 8.7 and 9.7% in the RCP8.5 scenario, while the latter will increase between 15.2 and 32.9% in the lower, and between 31.5 and 52.1% in the upper scenario. Similarly, cold days (TX10P) are decreasing and warm days (TX90P) are on the rise: at the 2061-2090 time horizon the former will decrease between 4.8 and 8.1% of days in the RCP4.5 scenario, and between 7.7 and 9.4% in the RCP8.5 scenario, while the latter will increase between 12.3 and 33.1% in the lower, and between 25.2 and 56.1% in the upper scenario. High increases in summer days and very hot days are expected: at the 2061-2090 time horizon a regional mean increase by between 22 and 45 days in the RCP4.5 scenario, and between 41 and 69 days in the RCP8.5 scenario is expected for the former, while the latter will increase by between 10 and 33 days in the lower, and between 13 and 69 days in the upper scenario. Finally, a regional mean increases between 23 and 90 days in the RCP4.5 scenario and between 56 and 176 days in the RCP8.5 scenario is expected for heat waves (WSDI).

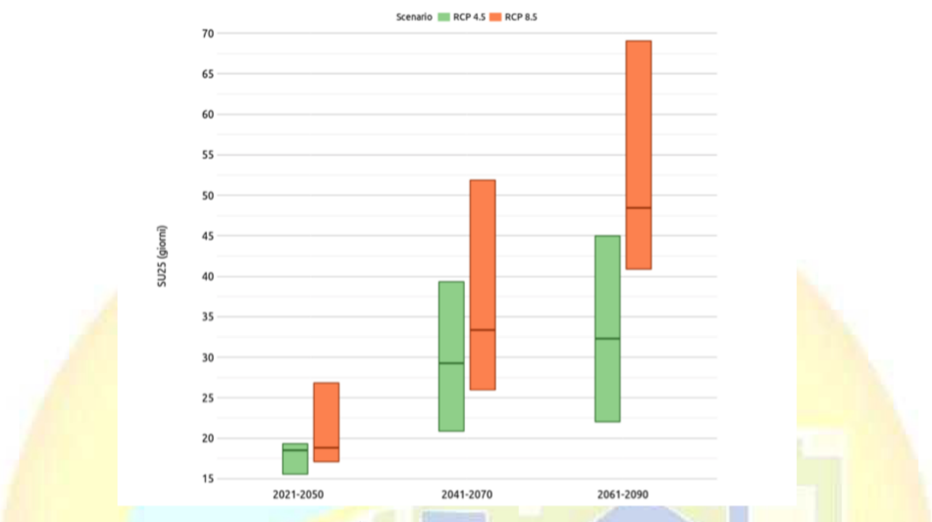

Figure 3: Summer days. Expected variations at the time horizons 2021-205, 2041-2070 and 2061-2090 with respect to the 1971-2000 time period in the RCP4.5 and RCP8.5 scenarios.

With respect to the PRIMES project, the analysis (Cacciamani et al., 2016) encompasses the three regions affected by the project (Emilia-Romagna, Marche and Abruzzo) as a whole and focuses on the RCP4.5 and RCP 8.5 scenarios over the period 2021-2050. The project follows two downscaling approaches: a statistical one and a dynamic one.

In the statistical approach and under the RCP4.5 scenario over 2021-2050, the total seasonal amount of precipitation is projected to slightly increase in the coast and to slightly decrease in the Apennine region. A decrease is expected in spring and summer, particularly on the Apennines, while an increase is expected in autumn. Similar changes are projected under the RCP8.5 scenario, apart from a slight decrease in precipitation in winter. With respect to extreme precipitation under the RCP4.5 scenario, the projections show a slight increase in winter. In spring and summer, the north of the region can expect an increase, while the southern part a decrease. A larger increase is projected in autumn over the whole region. The RCP8.5 scenario shows no significant differences compared to the RCP4.5. The index regarding the frequency of seasonal areal intense precipitation is difficult to predict and project, but shows decreases in winter and summer and a more complex pattern in autumn and spring. The projections of the maximum number of consecutive dry days under the RCP4.5 scenario show a slight increase in spring and summer, whereas there are no significant changes in autumn. Under the RCP8.5 scenario there is a slight increase in spring and summer and a slight decrease in autumn.

In terms of seasonal minimum temperature, the projected increase varies between 1.5 and 2 oC under the RCP4.5 scenario. As regards seasonal maximum temperature under the same scenario, the values for Marche are similar. Under the RCP8.5 scenario the seasonal minimum and maximum temperature have slightly higher values in summer and spring.

According to the dynamic approach, the seasonal amount of precipitation is set to increase in autumn and winter, and to decrease in spring and summer, under both scenarios. The frequency of extreme seasonal precipitation shows no appreciable change under both the RCP4.5 and the RCP8.5 scenario. In terms of frequency of seasonal areal intense precipitation, an increase is expected in many areas in autumn under both scenarios. In winter a decrease is projected in the RCP4.5 scenario, while the RCP8.5 will see an increase. A decrease is also expected in spring and summer, with the latter showing less robust data. Consecutive dry days are not expected to change in autumn and winter under the RCP4.5 scenario, but it could increase in spring and summer. Under the RCP8.5 scenario there is not a clear climate signal apart from some increase in autumn in some parts of Marche.

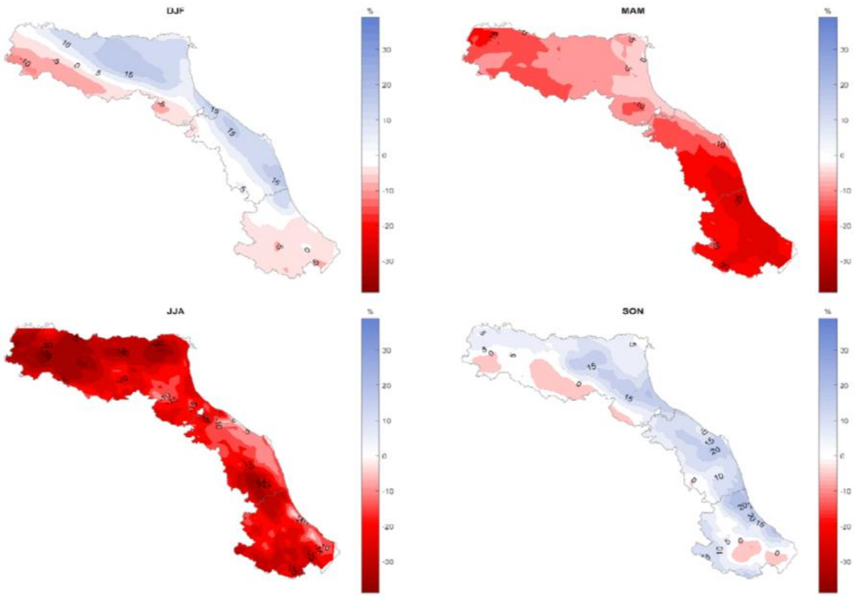

Figure 35: Seasonal climate change anomalies of precipitation for the period 2021–2050 with respect to 1981–2010, under the RCP4.5 scenario.

Figure 4: Seasonal climate change anomalies of precipitation for the period 2021-2050 with respect to 1981-2010, under the RCP4.5 scenario.

In terms of seasonal minimum temperature, an increase is expected between 1 and 1.5oC, especially in summer, under the RCP4.5 scenario, and a larger increase, over 1.5 oC, under RCP8.5. The same can be said for maximum temperatures, with similar values under both scenarios.

4.4 Closing remarks

This chapter sought to summarize the climate analysis carried out in the LIFE projects SEC ADAPT and PRIMES.

As regards past and current trends, according to the SEC ADAPT project, there are no clear trends for precipitation values and extreme indices, while the analysis of temperature values and extreme indices shows a general increase. The image is also not very clear in terms of future projections of total precipitation, although in terms of seasonal precipitation a slight reduction in spring, summer and autumn, and an increase in winter are expected. Temperatures are projected to rise, especially in summer under both scenarios. Extreme indices underline a tendency to less frequent, more intense precipitation events. Frost days will decrease, while tropical nights, summer days and heat waves will increase.

According to the analysis carried out in the PRIMES project for past and current trends, precipitation shows a slightly negative trend in winter and summer and a positive in spring and autumn, while the annual precipitation trend is negative. Days with precipitation greater than the 95th percentile are expected to increase in autumn. Frequency of areal intense precipitation is concentrated in autumn and winter, especially in the Apennines. Consecutive dry days are expected to increase in summer and decrease in autumn, while conversely wet days might decrease in summer and increase in autumn. Increases in minimum and maximum temperature are expected in summer, alongside the number of heat waves. In terms of future projections, decrease of precipitation in summer and increase in winter and autumn are expected, while extreme precipitation is expected to increase in spring. Both minimum and maximum temperatures are expected to rise, especially in summer and spring.

The outlook is not always clear but some change is likely to happen and will impact the region as a whole.

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5. Climate Analysis – ABRUZZO REGION, by Abruzzo Region

5.1 Introduction

One of the sources of this climate analysis is the "State of art of present and future climate over Emilia-Romagna, Marche and Abruzzo (ER-MA-AB) by using common data and common models", a report compiled in 2016 within the "Life Primes" European project by the Arpae-SIMC.

Another source is the "Linee guida per la predisposizione del Piano Regionale di Adattamento ai Cambiamenti" (in English, guidelines for the realization of regional plan of adaptation to climate change), including the Regional Climate profile, a document realized by the Department of Psycological Sciences, Health and Territory (DISPUTER) of the University "G. D'Annunzio" of Chieti-Pescara and CDCA (Documentation Centre Environmental Conflicts), in order to define some guidelines for the drafting of a regional plan of adaptation to climate change.

In this climate analysis any data concerning Abruzzo are reported giving a picture of the past and present situation of climate, together with future projections, with a particular focus on the extreme events caused by climate change.

5.1.1 Abruzzo Region

Abruzzo is a region of central Italy. Its western border lies 80 km (50 mi) east of Rome.

Geographically, Abruzzo, stretches from the heart of the Apennines to the Adriatic Sea, and includes mainly mountainous and wild land. The mountainous inland is occupied by a vast plateau including Gran Sasso, at 2,912 metres (9,554 ft) the highest peak of the Apennines, and Mount Majella 2,793 metres (9,163 ft). The Adriatic coastline is characterized by long sandy beaches to the north and pebbly beaches to the south.

Abruzzo is known as "the greenest region in Europe" as one third of its territory, the largest in Europe, is set aside as national parks and protected nature reserves: there are three national parks, one regional park, and 38 protected nature reserves. These ensure the survival of 75% of Europe's living species including rare species, such as the small wading dotterel, golden eagle, the Abruzzo chamois, Apennine wolf, and Marsican brown bear. Abruzzo is also home to Calderone, Europe's southernmost glacier. Like almost all Italian territory, Abruzzo Region is mainly characterized by historical towns. Abruzzo Region includes four provinces: L'Aquila, Chieti, Pescara and Teramo with 305 municipalities in total. The area and population for each province are listed in Table 1.

PROVINCE	AREA (km2)	POPULATION (January 1th, 2016)
Chieti	2.588	390.962
L'Aquila	5.034	303.239
Pescara	1.189	321.973
Teramo	1.951	310.339
Total	10.762	1.326.513

Table 1. Area and population in the four provinces in Abruzzo.

The GDP per capita in 2016 amount to € 22.835,3. Despite the decrease, especially over the period 2011-2014, it is worth to highlight that in 2015 the GDP per capita was the highest in the South of Italy and that in 2016 it was higher than the average data of the South of Italy (€ 17.146,00) approaching the national average (€25.890,50).

Table 2. Economical and occupational indicators for the Abruzzo Region. Source "SVIMEZ Report, 2017".

	2000	2015	2016	Average % rates per year of variation 2000-16	Average % rates per year of variation 2015-16
GDP	€ 30.643,3	€ 30.250,4	€ 30.192,8	-1,5	-0,2
GDP per capita	€ 24.295,0	€ 22.804,5	€ 22.835,3	-6,0	0,1
Employment rate (15-64 years) %	56,3	54,5	55,7		
n. of employees (thousands)	489,9	521,6	524,2		
Unemployment rate (total) %	10,2	12,6	12,1		
n. of jobseekers (thousands)	53,8	69,1	66,9		

Moreover, the GDP has decreased (-0,2%) in all regions affected by the terrible earthquake in August and October 2016. The trend of the regional GDP between 2000 and 2016 is reported in Table 2.

The employment data show that the performances in the Abruzzo Region are higher than those of the South Italy. The number of employees is +0,5% in 2016 (from 521.600 to 524.200 units) meanwhile the number of jobseekers decreases (-3,2% from 2015 to 2016). The employment rate grows (+1,2%) from 2015 to 2016 meanwhile the unemployment rate decreases (-0,5%).

The principal sectors of the regional economy are industry and tertiary, despite the role maintained by agriculture. The last one, in fact, boasts 27.383 active units (2016). The wheat is one of the most widespread products, with potatoes and beet. Moreover, important products are olive (with significant production of high-quality oil) and grapes employed to produce wine such as the DOP wines Montepulciano, Controguerra and Trebbiano of Abruzzo. The region has one of the highest productivity rates in Southern Italy and its economic structure is largely based on SMEs. In 2015, Abruzzo was the one of the most industrialised regions in Southern Italy (29.3% of value added from industry). Abruzzo in fact reaches industrialisation rates above the national average (66 enterprises per 10,000 residents vs. a national average of 64). The industrial activities include: electrochemical plants, cement and asphalt industries, sugar mill, milling, oil, brick and wood industries, foundries, wire drawing mills, paper mill, garment industry, glass industry, mechanical and electromechanical industry, automotive, motorcycle, food industry, manufacturing activities (14.953 local units), etc. The reachest area of industrial activities are the valley of Pescara and southern Vastese (province of Chieti). A decisive contribution to the regional economy comes from the tourist activities (12.815 local units for activity of accommodation and catering services) present principally in the many coastal centers, but also in the internal areas, which are characterized by an important environmental heritage (National Park of Gran Sasso and Monti della Laga, National Park of the Maiella Mountain, National Park of Abruzzo, Lazio and Molise and many areas protected by the Region). The development of an advanced tertiary sector benefits from the presence of the University of Chieti-Pescara, University of Teramo and University of L'Aquila. to these it is added the Gran Sasso National Laboratory for the research in the field of the particle physics.

The transport infrastructures include: 1) the Abruzzo International Airport; 2) four main ports located in Ortona, Vasto, Giulianova and Pescara that, over the years, became one the most important tourist ports of Italy and Adriatic Sea; 3) a railways network that show disparity between the Abruzzo coast and the inland areas; 4) three highways serving the Region (A24 Rome – L'Aquila – Teramo, A25 Torano – Avezzano – Pescara and A14 Bologna – Taranto).

In 2015, the 64.3% of the families declare to have access to Internet (versus the 66.2% of the National average). The 93.3% of the companies, with more than ten employees, of the industry and services sectors have a broadband connection (versus the 94.4 % of the National average).

5.2 General characteristics of the climate in Abruzzo

The regional territory of Abruzzo, both for geographical positioning and orographic complexity, is characterized by an extremely dynamic meteorological regime and a rather complex climate. Located at mid-latitudes in the Mediterranean area, it extends from west to east from the central Italian Apennine sectors to the eastern coasts of the middle Adriatic, suffering for most of the year from the marked contrast between the tropical air masses and those of polar origin (Arctic or continental). This contrast, especially in the autumn and winter seasons, favours the transit of low-pressure areas that are strongly influenced by the distribution of the orographic surface in the Abruzzo area, which mostly form a barrier on the north-south axis following the position of the Apennine reliefs. Furthermore, the presence of mountain ranges, which include the highest peaks of the Monti della Laga, Gran Sasso d'Italia and Majella massifs, leads to rapid changes in temperature and humidity on the Tyrrhenian and Adriatic coasts also due to the Foehn processes (hot and dry wind descending on the leeward side) and Stau (adiabatic cooling of humid air masses with condensation, due to forced elevation on the windward side), the latter responsible for periods of intense and persistent precipitation on mountain areas and foothills.

In periods of greater atmospheric stability, with high pressures predominantly of Afro-Mediterranean or Azorean character, the presence of high plateaus (Campo Imperatore, Cinque Miglia, Altopiano delle Rocche), internal basins (Valle dell'Aterno, Fucino, Valle Peligna, Valle del Salto) and Adriatic River valley areas, favours the phenomenon of thermal inversion at night with considerable excursions between the maximum daytime and night minimum values. In winter, coinciding with the arrival of low-pressure areas from the Tyrrhenian Sea, this phenomenon rarely generates gelicide (a dangerous event of freezing rain on contact with the ground), generally associated with the Po-Alpine area and beyond the Alps. From the pluviometric point of view, the average distribution of the annual cumulative (Series 1950-2000 Abruzzo Region) mainly follows the orographic layout, with minimum values between 600-800 mm per year along the coast and in the internal basins (protected by hills) and between 1000 -1200 mm on the areas close to the mountain ranges, with peaks up to 1400 mm on the Lazio borders where the effect of the humid currents coming from the Tyrrhenian and the Atlantic or Mediterranean perturbations is more direct.

The snowfalls, which from autumn to spring affect the medium-high mountain with ever-decreasing continuity, during the winter can often reach the flat and coastal areas of the Adriatic side, in conjunction with incursion of Arctic-continental air from the Balkan area, sometimes giving rise to phenomena of a certain importance in terms of extension, intensity and accumulation of the snow cover.

In general, for a climatic framework of the region of Abruzzo, it can be taken as reference the Köppen classification mod. Geiger of 1954 based on thermal discriminants, which allows a direct comparison with other areas of the earth. Basically, by virtue of the presence on the western borders of mountain ranges and coasts on the eastern borders, the regional climate gradually becomes milder as it moves from west to east, although it must be taken into account that the areas bordering on Lazio are slightly affected by the mitigating influence of the Tyrrhenian Sea and that the highest sectors of the region lie between the internal and the Adriatic sectors.

In particular, according to the recently updated Köppen-Geiger method (Kottek et al. 2006, Peel et al. 2007, Rubel et al. 2017) for the period 1986-2010, almost the entire region is characterized by the Mesothermal climate of type C (temperate) with the average temperature in the coldest month between 18 ° C and −3 ° C and where at least in a month the average temperature exceeds 10 ° C; these areas occupy the middle latitudes where the western currents are predominant all year round, but with evident differences of intensity according to the season, in function of the more or less marked undulation of the polar front and jet currents. The reference sub-climate is the Cf without an arid month on about 85-90% of the territory, with particular microclimatic areas belonging to the Cs sub-climate with a dry summer season.

Among the regional climate subtypes, bearing in mind that the global classification has limits of interpretation in local thermal-pluviometric distribution, we highlight:

- Csa: temperate climate with dry and very hot summer (Mediterranean hot summer climates - areas of Fucino and Valle Peligna;

- Csb: temperate climate with dry and hot summer (Mediterranean warm/cool summer) - areas of Piana del Cavaliere and Valle Roveto;

- Cfa: temperate climate without dry season with very hot summer (Humid subtropical) - hilly and coastal areas of the Adriatic side;

- Cfb: temperate climate without dry season with hot summer (temperate Oceanic) - inland areas of the Apennine hills and low mountains;

- Cfc: temperate climate without dry season with fresh and short summer (Subpolar Oceanic) - medium-high mountain of the Apennine areas.

On the highest areas of the region, in particular on Gran Sasso d'Italia and Majella, there are small areas influenced by microthermal mid-latitude climates (Dfb cold climate without dry season in hot summer) typically due to the cool temperate climate characterizing the pre-Alpine region and medium-high Apennine.

5.3 Analysis of the climatic trend in Abruzzo in the period 1930-2015

5.3.1 Methodology

To understand what the thermal trends at the regional level have been in the last 80-85 years, annual and seasonal analyzes are proposed for Abruzzo based on average daily temperature, maximum temperature, minimum temperature and on the distribution of these values on the regional territory. The dataset used was provided by the former National Hydrographic Service (current Functional Center of the Abruzzo Region) which, starting from the beginning of the 900, has installed meteorological stations throughout the national territory. Of the stations in Abruzzo, 22 time series were selected, taking into account the continuity of the measurements during the 20th century. These series have therefore been standardized with the use of the HOMER software resulting from the European COST Action ES601.

This operation is necessary in the climate series in order to take into account possible interferences in temperature trends unrelated to climate change but due to interference such as, for example, the reallocation of a measurement station, the change in the environment in which it was installed, instrumental maintenance, etc. (Mestre et al., 2013).

5.3.2 Analysis of the average daily regional temperature

The average daily temperature detected in the observation stations available in the Abruzzo region shows a growing trend (fig. 1):

- in the 1930-1979 (red line) the increase of temperature equals to 0.13°C per decade;
- in the 1950-2015 period (blue line) the increase equals to 0.42°C per decade;
- in the 1980-2015 period (black line) the increase equals to 0.60°C per decade.

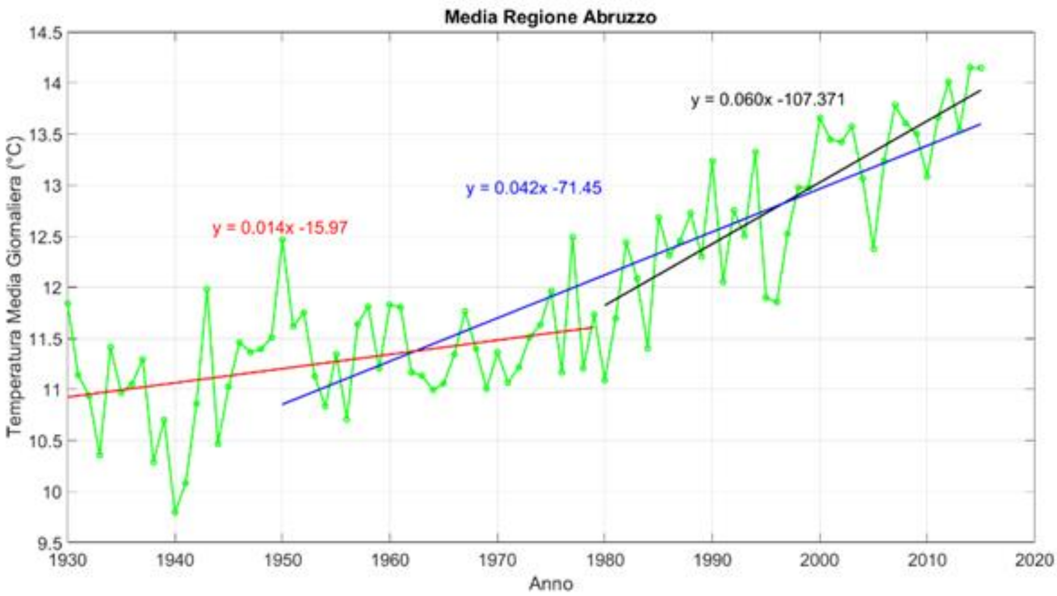

Figure 1: Time series of the average daily temperature, observed on a regional scale by averaging the measurement stations available in Abruzzo

Considering the average daily temperature registered in every station of the region, from a seasonal point of view the increase of temperature in the 1950-2015 period is bigger during spring and summer, equalling to 0.46°C per decade, while in autumn and winter it goes from 0.30°C and 0.37°C. However, during the recent period of time (1980-2015) it hasn't been registered any clear distinction between spring-summer and autumn-winter, but there are (fig. 2) bigger differences between singular seasons:

- during spring, there's an increase of 0.75°C per decade;
- during summer the increase equals to 0.69°C per decade;
- in autumn the increase is smaller, equalling to 0.42°C per decade;

- during winter, the increase equals to 0.51°C per decade.

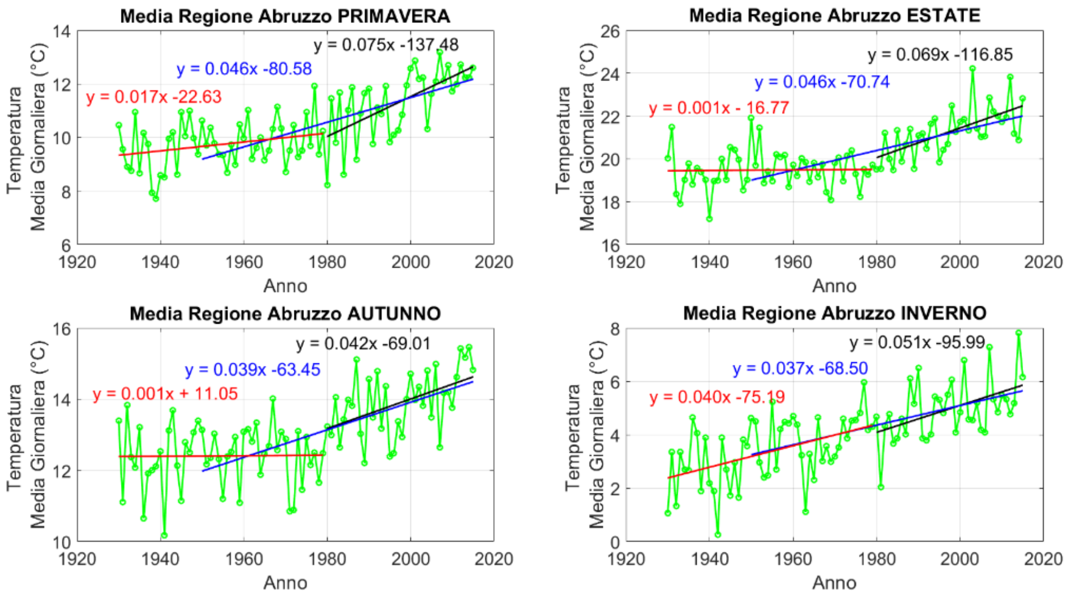

Figure 2: Seasonal time series of average daily temperature, observed on a regional scale by averaging the measurement stations available in Abruzzo (starting from the first graph: spring, summer, autumn and winter).

5.3.3 Analysis of the regional maximum temperature

Considering the trend of the average maximum temperatures (fig. 3), it's clear that:

- during the 1930-1979 period there's a small increase of 0.10°C per decade;
- during the 1950-2015 period the increase of temperature is way bigger, equalling to 0.63°C per decade;
- during the 1980-2015 period the increase equals to 0.78°C per decade.

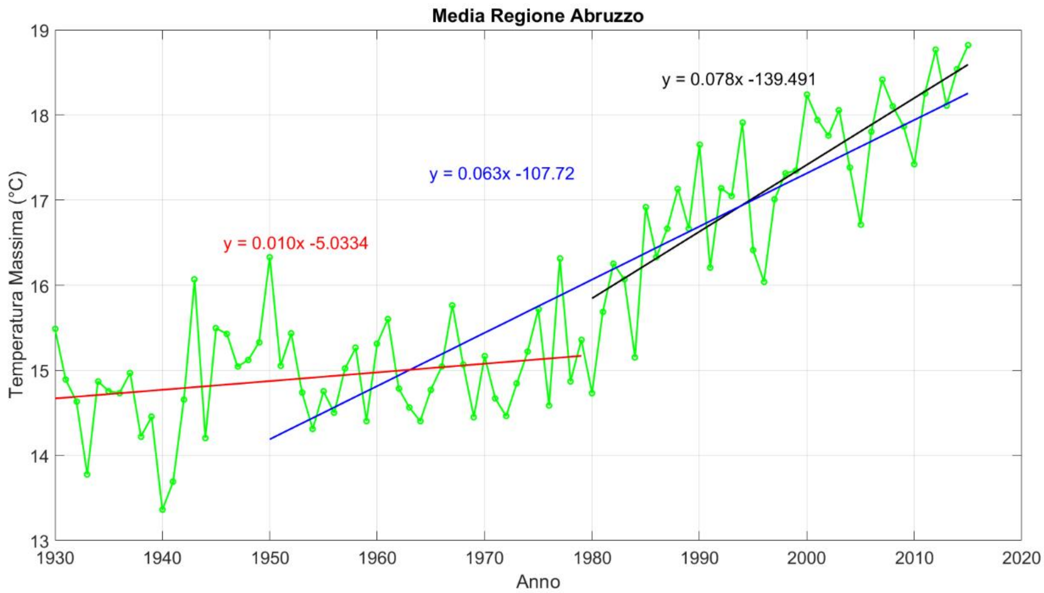

Figure 3: Time series of the maximum temperature, observed on a regional scale mediating all the measurement stations available in Abruzzo.

5.3.4 Analysis of the minimum regional temperature

The average minimum temperatures observed in all the stations of the region show that (fig. 4):

- during the 1930-1979 period there's an increase of a 0.18°C per decade;
- during the 1950-2015 period there's an increase of a 0.22°C per decade;
- during the 1980-2015 period there's an increase of a 0.42°C per decade.

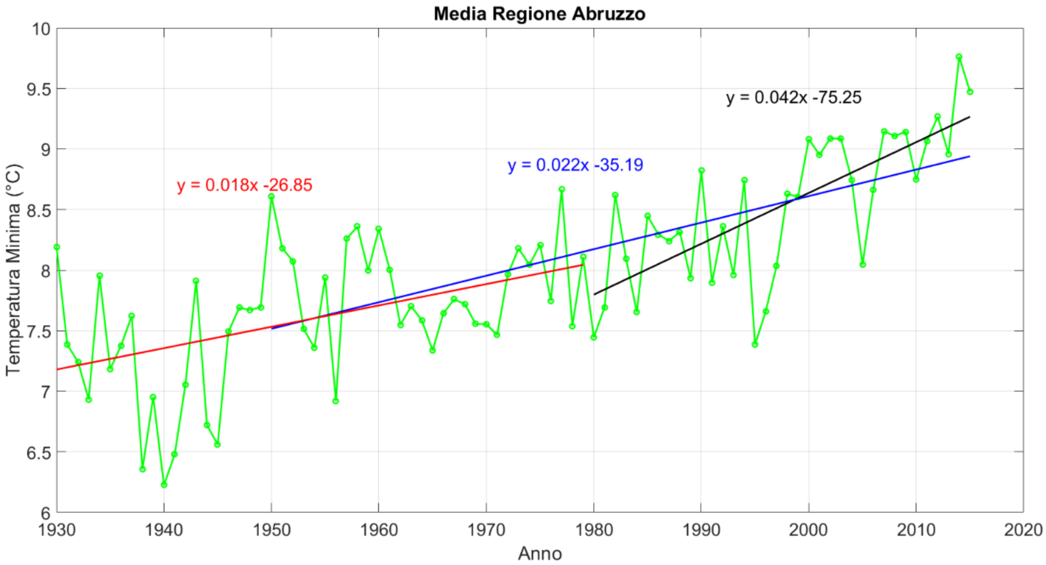

Figure 4: Time series of the minimum temperature, observed on a regional scale mediating all the measurement stations available in Abruzzo.

5.3.5 Consideration of the analysed trends

The trend of the temperatures shows, in many cases, a common characteristic: in the year 1980 there has been an abrupt increase of the slope of the trend lines between the 1930-1979 period (red line) and the 1980-2015 period (black line).

The angular coefficient, which stands for the slope of the lines of tendency, demarcates a consistent change during the two periods (fig. 5).

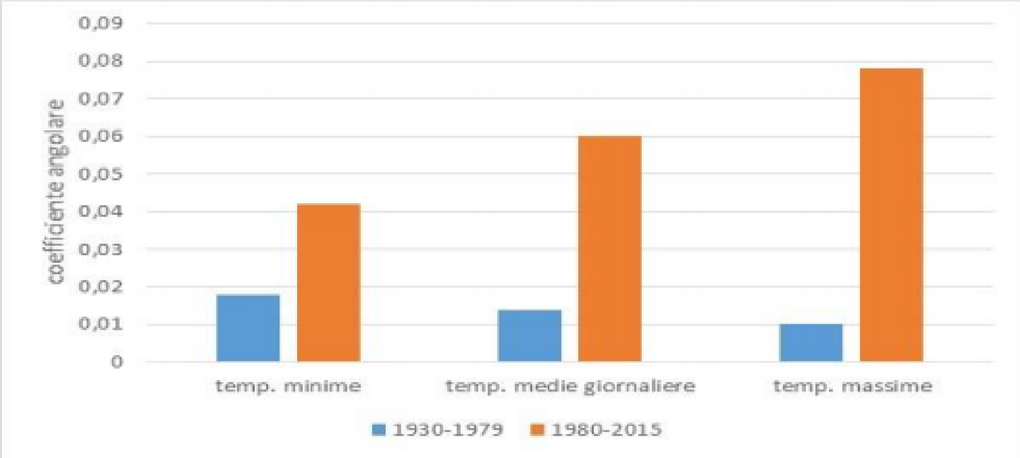

Figure 5: Trend of the angular coefficient of the lines of tendency in the periods 1930-1979 and 1980-2015

Although in every examined case the tendency lines underline clear increases of the angular coefficient, the biggest increase concerns the maximum temperatures. The collocation in the 1980 of the sudden rises of temperatures is confirmed by other similar studies.

5.4 Territorial analysis

5.4.1 Daily mean temperature

From the territorial point of view the 22 stations were analyzed with the most complete data record possible starting from 1930, since many stations have been recently activated and others have been abandoned over the years. For each station the rate of change of the average daily, maximum and minimum temperature was calculated for the 3 different time intervals: 1930-1979, 1950-2015, 1980-2015. Against a regional average of 0.042 ± 0.007 ° C / year in the period 1950-2015, areas such as Sulmona are observed with more pronounced increases (0.047 ° C / year), followed by L'Aquila (0.045 ° C / year), and by the municipalities of Montazzoli, Lanciano, Teramo, Scerni, Palmoli and Barisciano with 0.044 ° C / year. On the other hand, considering the most recent period (1980-2015), the increase rates are more marked with a regional average increase rate of 0.060 ± 0.015 ° C / year. From a territorial point of view, the municipality of Teramo has the most marked increases of 0.072 ° C / year, followed by the municipalities of Montazzoli, Castel di Sangro, Scerni and Assergi. Other municipalities also above the regional average even if with lower rates than the previous ones are: Pescara, Guardiagrele, Nereto and Sulmona. On the contrary, Pescasseroli, Palena, Scanno, Barisciano and Penne have rates of temperature variation below the regional average.

5.4.2 Maximum temperatures

The analysis of the rates of changes in the average daily temperature provides a view of average trends which, if integrated with that of maximum and minimum temperatures, can be more clearly interpreted. Against a regional average of the maximum temperature variation rate of 0.063 ± 0.009 ° C / year in the period 1950-2015, small differences can be observed from area to area: the site where we differ most from the average is Sulmona (0.067 ± 0.010), followed by Teramo, Pescara, Lanciano, Palmoli, Campotosto, Assergi and Barisciano with values between 0.064 and 0.065 ° C / year. In the period 1980-2015 the average regional variation rate of the maximum temperature is 0.078 ± 0.018 ° C / year and greater variations are observed from site to site: in some areas the variations are above the regional average, such as Teramo, Pescara, Isola del Gran Sasso and Sulmona. The sites of Penne, Barisciano, Scanno and Pescocostanzo, as for the average daily temperature, even for the maximum the rates of change are below the average regional ones.

5.4.3 Minimum temperatures

The comparison between average daily and maximum temperatures allows us to establish that in sites such as Scerni, Assergi, Montazzoli and Castel di Sangro, where the average daily temperature is higher than the regional average, the greatest impact seems to be on minimum temperatures, ie areas microclimatic in which the nocturnal cooling capacities of the atmosphere become less and less effective.

5.5 Analysis of collected data and future projections

5.5.1 Precipitation

A negative trend has been detected during winter (although there is a positive trend over the coastal area) and summer, while a positive trend has been detected during spring and autumn over 1961-2014.

In future years, a slightly increase in precipitation (up to 5%) is projected during winter season over the coastal areas from, while a slightly decrees is expected to occur over the Apennine mountains (the inner part of the region, up to 5%). Also, decrease in precipitation is expected during spring and summer seasons, more intense over (up to - 20%).

An increase of autumn precipitation over the whole area of study is projected, with peaks of 30%, with the only exception of the mountains area (inner region) where a slightly decrease is projected.

Finally, spring is projected to be poor in precipitation, while autumn is projected to be wetter (up to 35%), exception doing the south-west part of the region (mountains area) where a small decrease (up to -5%) is projected.

5.5.2 Extreme precipitation

The frequency of extreme events is defined as the number of days when the daily precipitation exceeds the 95th daily climatological percentile. Summer is characterized by positive trends over great part of the region, while in autumn there is generally a negative trend.

About future projections, a slightly increase during winter season can be observed over great part of areas (around - 5%) exception doing the mountain areas where a decrease is projected up to 10%. Autumn seems to be the season with higher intensity of changes (around 30%).

5.5.3 Frequency of Areal Intense Precipitation

This index is defined as the number of days in which the areal average daily precipitation exceeds warning threshold (50 mm/day). During autumn there have been more events than the other months of the year, reaching a maximum in winter (especially in November). The first half of the year registered a small number of events.

In future, a general decrease is foreseen during winter and summer over quite all macro-areas.

5.5.4 Dry and wet days

This index is defined as the maximum number of consecutive dry (if the precipitation registered in that day is below 1 mm) or wet (if the precipitation registered in that day is equal or greater with 1 mm) days during a season.

About dry days, summer presents a positive significant trend, while a similar but not significant signal is detected during winter and spring. The highest value of consecutive dry days is registered during summer, when average values up to 29 consecutive days were registered in some areas. Autumn registered a decrease in dry days.

About wet days, negative trends have been registered during spring followed by negative trends during summer. Autumn is the only season with a general positive trend.

In the future trends, about dry days a slightly increase is projected during spring and summer (up to 10%) over the period 2021-2050 respect to 1971-2000. Autumn doesn't present significant changes.

During spring a small increase is noted (up to 5%), while the projections for summer maintains small intensity, with a slightly increase (up to 8%), except the mountains where a slightly decreases is noted. Autumn is the season where a decrease in consecutive dry days is presented everywhere, even if the intensity is small (up to -8%).

Autumn is the season with more intense signal of changes, characterized by an increase of amount of precipitation, followed by a decrease of consecutive number of dry days and an increase of the frequency of extreme precipitation. In addition, the projections of areal intense precipitation, underlay a possible increase along the coastal area and in the Apennines. Also, an increase of extreme and intense precipitation has been founded during spring, while summer is projected to maintain a drier behaviour.

5.6 Climate change: comparison between data in Abruzzo and those at global level

Starting from the regional climatic peculiarities and in function of the variability that occur over time on the climatic trend, analyzing the thermal trend of the last century is of fundamental importance to assess impacts and define strategies or plans for adaptation to climate change. In the last Evaluation Report (Fifth Assessment Report 2013/2014 - AR5) of the Intergovernmental Panel on Climate Change (IPCC) data on global warming are proposed, which are useful for a comparison with the analysis on the thermal trend in the Abruzzo region and, therefore, to understand what the impact of this phenomenon on our region is. In the Northern Hemisphere, the period between 1983 and 2012 was probably the hottest of the last 1400 years, while the last three decades have been the hottest worldwide since 1850. Data on the average temperature of the earth's surface and ocean combined show a warming of 0.85 [0.65-1.06] ° C in the period from 1880 to 2012, calculated on the average of several independent datasets. Moreover, the total increase between the average of the 1850-1900 period and the 2003-2012 period is 0.78 [0.72 - 0.85] ° C. According to the National Climatic Data Center (NOAA) 2014, 2015, 2016 and 2017 were the hottest years since 1850 in the Northern Hemisphere, with a temperature increase trend per decade of 0.07 ° C.

On the basis of these premises, table 3 shows the comparisons between the trends of thermal variation at the global level, for the northern hemisphere and Europe (land and / or oceans, source NOAA) compared to those detected through the analysis average regional temperatures. In line with the previous calculations, the trends are expressed in ° C per decade and are divided into 3 different time intervals 1930-1979, 1950-2015, 1980-2015.

Table 3. Decadal variations of the regional average temperature, at the global level, for the northern hemisphere and for Europe in different time intervals (global and northern hemisphere: land + oceans - Europe: only emerged lands).

	Temperature trend variation in °C/decade Period 1930-1979	Temperature trend variation in °C/decade Period 1950-2015	Temperature trend variation in °C/decade Period 1980-2015
GLOBAL	+0.02	+0.13	+0.16
NORTHERN HEMISPHERE	-0.01	+0.15	+0.23
EUROPE (land)	-0.02	+0.21	+0.44
ABRUZZO	+0.13	+0.42	+0.60

The comparison between data, taking into account that the greater the geographical radius of the survey, the greater the indecision of the data due to the lack of precise surveys on vast areas of the planet, highlights how global warming manifests itself in a more incisive way at local level. In particular, in Abruzzo, the tendency to increase average thermal values per decade is more marked than the European average, especially from 1950 onwards.

In a publication concerning analyzes of extreme climatic values in the Marche and Abruzzo regions in the period 1980-2012 (Scorzini et al. 2018), the increase in absolute maximum values equal to + 1.27 ° C / decade on nine stations of the total analyzed. These differences from the rest of the continent can be attributed to the combination of the direct influence of the Mediterranean Sea, which is also gradually warming up (Mediterranean SST averaged global variation 1982-2018: + 1.2 ° C - source CEAM), to the partial variation of the complex processes that regulate the trend of baric fields at mid-latitudes, as well as the most well-known problems linked to the increase in urbanization (eg: coastal linearization), the change in land use, and atmospheric pollution.

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6. Requirements of the CoM for Joint SECAPs and of the Joint_SECAP project

In 2012, the possibility of preparing a Joint SECAP was officially introduced in the Covenant of Mayors initiative as a result of feedback and recommendations from its signatories. The introduction of an option to develop what is now known as the joint SECAP aimed at aligning the action plan development process with the needs expressed by local authorities.

In the Quick Reference Guide Joint Sustainable Energy & Climate Action Plan of Covenant of Mayor, a joint Secap is defined as follows: "A joint SECAP refers to a plan that is carried out collectively by a group of neighbouring local authorities. This means that the group engages in building a common vision, preparing an emission inventory, assessing climate change impacts and defining a set of actions to be implemented both individually and jointly in the concerned territory. The joint SECAP aims at fostering institutional cooperation and joint approaches among local authorities operating in the same territorial area". The whole process realization consists of:

a) DEFINITION OF THE JOINT SECAP OPTION AND COUNCIL DECISION FOR THE ADHESION;

b) RISK ASSESSMENT AND VULNERABILITY REPORT (& BASELINE EMISSION INVENTORY);

c) DESIGN OF **JOINT ACTIONS** TO BE INCLUDED IN S(E)CAPS;

d) PLAN IMPLEMENTATION AND MONITORING

The Guidebook "How to develop a Sustainable Energy and Climate Action Plan (SECAP)'" aims at supporting local authorities in the European Union (EU) Member States joining the Covenant of Mayors for Energy and Climate (2030 target). It provides detailed, step-by-step guidance to local authorities to develop an effective SECAP, in particular:

- Define the key elements of the initiative
- Elaborate a Baseline Emission inventory (BEI)
- Perform a Risk and Vulnerabilities Assessment (RVA)
- Develop a Sustainable Energy and Climate Action Plan (SECAP)
- Support the implementation and monitoring of the SECAP.

The choice of adaptation actions must be determined thanks to the needs of the municipalities group, considering both the indications and examples deriving from the guidelines drafted by the JRC of the Covenant of Mayors - Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 3: Policies, key actions, good practices for mitigation and adaptation to climate change and Financing SECAP(s).The actions for adaptation (mitigation and energy poverty) will be uploaded on mycovenant, with the same standard of the SECAP template - English (en) - Working document ONLY.

The Covenant of Mayors provides two possible methodological options for the development of a joint S*(E)*CAP:

-Option 1 - 'individual CO2 reduction commitment': each municipality in the group individually commits to reducing CO_2 emissions by at least 40% by 2030. Each municipality is required to report the action plan in the individual profile of mycovenant platform. Each member of the group has to upload the action plan into their individual profile and each municipal council has to approve the document.

-Option 2 - 'shared CO2 reduction commitment': the group of municipalities collectively commits to reducing CO2 emissions by at least 40% by 2030. The group is required to provide only one action plan for the whole group in mycovenant. The action plan document to upload is a common one and includes all the members of the group, thus, each municipal council has to approve it.

The design and implementation of the JOINT-S*(E)*CAP is carried out depending on whether one of the two previous possible options is chosen.

The Joint_SECAP Project, in pursuing the objectives of the project, as regards the adaptation policies, has implemented a methodological path inspired by the guidelines drafted by the JRC of the Covenant of Mayors - Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 3: Policies, key actions, good practices for mitigation and adaptation to climate change and Financing SECAP(s), that:

a) has identified 9 target areas within the same risk zone and with similar vulnerability factors, to facilitate data and good-practice exchange and better use of available resources;

b) has identified what best practices (successful examples) have delivered effective results in similar contexts in reaching similar targets and objectives than those set by the local authority, in order to define the most appropriate actions and measures.

c) has identified the existing municipal, regional and national policies, plans, procedures and regulations that affect energy and climate issues within the local authority.

d) carried out a climatic analysis of the territorial contexts to which the various target areas belong;

e) produced a risk and vulnerability assessment;

f) established a long-term vision with clear objectives, with the identification of a "0" scenario and an "optimal scenario"

g) activated a process of confrontation with stakeholders and experts throughout the process: from risk assessment to selection of joint_actions

h) identified a path to choose criteria for the selection of measures and joint actions aimed at improving local adaptation capacity and to respond to the impact of climate change and reduce the sensitivity of the target areas.

i) has identified operational methods for the involvement of local administrations in the implementation phase, through the activation of seminars in which the project is explained, as well as the construction of a web platform that aims to facilitate the exchange of information and experiences;

j) has identified in the Joint Coordinator the figure of connection, promotion, implementation of the project during and after the end of the project.

7. Guidance manual for project activities: timing and actors involved

The orientation manual for project activities contains specific indications for the construction of the various planned activities to which specific deliverables correspond. It is also a useful guide in cases of project repeatability in other territories.

The documents that are part of this manual are listed below, in the form of templates, notes, tutorials for an effective definition of the contents of the various activities to which the different target areas will have to refer for the implementation of the project. These documents were illustrated and shared between the partners.

The following table refers to the duration of activities, actors engaged, coordinators of activities:

ACTIVITIES	DURATIONS	ACTORS ENGAGED	Coordination
CONTEXT ANALYSIS AND PILOT AREAS	01-2019/01-2020	Municipalities, Experts	VELALUKA
CASE STUDIES	01-2019/01-2020	Experts	UNICAM
VULNERABILITY AND RISK ASSESSMENT	01-2019/06-2020	Municipalities, Experts, Stakeholders	IRENA
JOINT SECAP SUPPORT SYSTEM PLATFORM	03-2019/06-2021	Experts	Pescara Municipality, UNICAM
THEMATIC FOCUS GROUP	10-2019/ 10-2020	Municipalities, Experts, Stakeholders	PGKC
FINAL CLIMATE SCENARIO	10-2019/10-2020	Municipalities, Experts, Stakeholders	SPLIT-DALMATIA
SEA GUIDELINES	5-2020/ 3-2021	Experts	Pescara Municipality
PRELIMINARY SCOPING REPORT	5-2020/ 3-2021	Municipalities, experts	San Benedetto Municipality
JOINT ACTION IMPLEMENTATION	5-2020/3-2021	Joint Coordinators-Stakeholders, Municipalities, Experts	Abruzzo Region
CAPACITY BUILDING - EVALUATION GRID	11-2021/6-2021	Joint Coordinators, Experts	SDEWES CENTRE, UNICAM

7.1 Collection on experiences and plans

Introduction

Action 3.2 - Context analysis is part of WP3 'Definition and implementation of a Support and Monitoring Platform for Joint SECAPs'. The context analysis is essential to collect information and resources that will be used during the other activities of the project and is considered as the knowledge-base of data to learn and disseminate values of each territorial context.

The present template regards sub-activity A.3.2.1, which aims to investigate all existing policies, plans, measures and funding tools already put in place in each territorial context (district level) with a special focus on energy and climate issues. The sub-activity will produce a deliverable (D.3.2.1) conceived as a database form, listing and briefly describing all the identified elements, that will be useful during the implementation phase (WP4), and especially for the implementation of the common online platform.

The present template is therefore divided in two parts: Part 1 is dedicated to the identification and description of climate adaptation policies, plans (SEAPs) and measures put in place in partners' countries/regions; Part 2 identifies and describes the funding tools (programmes, schemes, grants, etc.) that are currently available at national, regional and local level to finance climate adaptation measures (e.g. optimization of water consumption, adaptation of building codes to future climate conditions and extreme weather events, realization of flood defences, urban forestation, green infrastructure, etc.). Partners have to fill in every part of the template, providing as many relevant details as possible whilst respecting the maximum number of words/characters indicated.

Part 1: Climate adaptation policies, plans and measures

National level climate adaptation policies/strategies/plans	*Please describe any relevant strategy, policy and/or plan at national level, focusing on its parts related to climate change adaptation (providing the information below for EACH instrument). Please provide as much detail as possible, also highlighting any criticalities that may occur in the implementation, managing and monitoring phases.*
Title	
Time scope (currently being drafted , approved, into force, upgrading, under revision, expiring)	
Brief description (including objectives)	
Concrete climate change adaptation measures foreseen (if any)	
Implementation and monitoring mechanisms/procedures	
Status of implementation	
Associated funding (if any)	
Regional level climate adaptation policies/strategies/plans	*Please describe any relevant strategy, policy and/or plan at regional level, focusing on its parts related to climate change adaptation (providing the information below for EACH instrument). Please provide as much detail as possible, also highlighting any criticalities that may occur in the implementation, managing and monitoring phases.*
Title	
Time scope (currently being drafted, approved, into force, upgrading, under revision, expiring)	
Brief description (including objectives)	
Concrete climate change adaptation measures foreseen (if any)	
Implementation and monitoring mechanisms/procedures	
Status of implementation	
Associated funding (if any)	

Local level plans	*Please describe any relevant strategy and/or plan at Local level (local adaptation strategy, SEAP, SECAP, etc.), providing the information below for EACH instrument. Please provide as much detail as possible, also highlighting any criticalities that may occur in the implementation, managing and monitoring phases. Please also indicate whether and why the instrument can be considered as a good practice.*
Title	
Time scope (currently being drafted, approved, into force, upgrading, under revision, expiring)	
Brief description (including objectives)	
Concrete climate change adaptation measures foreseen (if any)	
Implementation and monitoring mechanisms/procedures	
Status of implementation	
Associated funding (if any)	
Is the plan a good practice? If yes, why?	

Part 2: Funding tools

Category	Max number of words	Notes
European funding	1,250	*Please describe any European provision for funding climate change adaptation measures (EU projects, technical assistance, etc.) that you deem relevant, i.e. which have influenced regulations or practices in your country/region.*
National funding	1,250	*Please describe any national provision for funding climate change adaptation measures, including funds deriving from European resources (e.g. structural funds allocated through the National Operational Programmes) and opportunities related to public-private partnership schemes.*
Regional funding	1,250	*Please describe any regional provision for funding climate change adaptation measures (if any), including funds deriving from European resources (e.g. structural funds allocated through specific actions of the Regional Operational Programmes) and opportunities related to public-private partnership schemes.*
Local funding	1,250	*Please briefly describe any relevant experience/good practice of how local authorities achieved public funding for successfully designing, implementing and managing climate change adaptation measures (own funds, resources from other local and supra-local authorities, etc.)*
Other funding schemes	750	*Please describe any other sources of funding available in your country other than public funding (public-private partnerships schemes, Bank loans, etc.)*

7.2 Case studies template

The following factsheet is meant to ease the collection of significant case studies, that can be useful, on one hand, to improve the Joint_SECAP Guidelines for Vulnerability and risk assessment, and, on the other hand, to feed the Joint_SECAP Support System Platform with comparable information related to climate change adaptation measures.

In particular, the factsheet has the purpose to highlight and thoroughly describe the contribution that the Case study brings to the Vulnerability and risk assessment methodology and practice, also highlighting similarities and differences with the Joint_SECAP Guidelines, in order to integrate and enrich them during the project implementation.

Project partners are therefore requested to fill in the factsheet, starting from the information and links provided in the Guidelines, and integrating them through further research, with the aim of providing as much details as possible on the Case study.

Title of the Case study	
General data	
Promoter	*Please insert the name of the organization that promoted the case study (i.e. for a project, the Lead partner/main beneficiary):*
Timeframe	*Please insert the year(s) of reference (i.e. for a project, the years of implementation):*
Target area and scale	*Please indicate the area covered by the case study, specifying if it is a municipal, regional, or national-level initiative:*
Brief description	*Please describe briefly the Case study, explaining its context, main objectives, climate-related actions, outputs and results, as well as the key actors involved:*
Contribution of the Case study to the Joint_SECAP guidelines for Vulnerability and Risk assessment (See 7.3)	
Modules of the guidelines relevant to the case study	*Please select one or more Modules that you think the Case study gives a significant contribution to (i.e. through methodologies, methods, tools…). Refer to the Joint_SECAP Guidelines for further information on Modules:* ☐ M1 PREPARING THE RISK ASSESSMENT (describes the context of the assessment - processes, knowledge, institutions, resources and external factors –, identifies its objectives, expected outcomes and scope, and defines tasks, responsibilities and time planning) ☐ M2 DEVELOPING IMPACT CHAINS

	(identifies and clusters impacts and risks, identifies hazard and intermediate impacts, vulnerability and exposure of the system) ☐ M3 IDENTIFYING AND SELECTING INDICATORS (identifies and select indicators for hazards, vulnerability and exposure) ☐ M4 DATA ACQUISITION AND MANAGEMENT (regards the collection, quality check, storage and management of data) ☐ M5 NORMALIZATION OF INDICATOR DATA (provides normalized data for each indicator in a standardized value) ☐ M6 WEIGHTING AND AGGREGATING OF INDICATORS (evaluates the influence of the indicators on the respective risk component, assigns different weights, aggregates individual indicators into composite indicators of the risk components hazard, vulnerability and exposure) ☐ M7 AGGREGATING RISK COMPONENTS TO RISK (aggregates the risk components into a composite risk indicator) ☐ M8 PRESENTING THE OUTCOMES OF YOUR RISK ASSESSMENT (describes how to elaborate the risk assessment report, taking into account both the objective and the target audience of the assessment)
Description of the contribution of the Case study to the Joint_SECAP guidelines	*Please provide a detailed description of how the Case study contributes to the modules selected above, i.e. by explaining the methodological approach adopted, the methods and tools used, etc. The lines corresponding to the modules that are NOT been selected above shall be left blank:* M1: M2: M3: M4: M5: M6: M7: M8:
References	
Website(s)	*Please include the link to the official website and/or other webpages where information on the Case study can be found:*
Bibliography	*Please include references to books, papers or articles providing relevant information on the Case study:*
Images	*Please include pictures or graphs you deem relevant to illustrate the Case study:*

7.3 Vulnerability And Risk Assessment

7.3.1 The Methodology

Introduction

JOINT_SECAP project is about defining joint district-level strategies and actions for climate change adaptation in the Interreg Italy-Croatia Programme area, especially for those weather and climate changes and hydrogeological risks affecting coastal areas.

The present chapter has been developed in order to support the implementation of sub-activity A.3.2.2, dedicated to the description of climate-related risks and vulnerabilities that would potentially affect each territory where partners are intended to develop and implement joint adaptation measures. More specifically, this chapter outlines a common methodology for the mapping of climate risks and vulnerabilities in target areas (Deliverable D.3.1), based on international literature and official guidelines.

Various documents looked at how to prepare a risk and vulnerability assessment in the past. This chapter builds on some of them. First, it is essential to establish the key definitions on this topic. One fundamental document is the fifth Assessment Report (AR5) published by the Intergovernmental Panel on Climate Change between 2013 and 2014. Three working groups (I, II and III) prepared three reports on the physical science basis (IPCC, 2013), impacts, adaptation and vulnerability (IPCC, 2014a), and mitigation of climate change (IPCC, 2014b) respectively.

The definitions are all cited from the IPCC 2014 WG2 Glossary.

Adaptation: "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects."

Adaptive Capacity: "The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences."

Coping capacity: "The ability of people, institutions, organizations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse conditions in the short to medium term."

Exposure: "The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected."

Hazard: "The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts."

*Impacts (*Consequences, Outcomes): "Effects on natural and human systems. In this report, the term impacts is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts."

Resilience: "The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation."

Risk: "The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term risk is used primarily to refer to the risks of climate-change impacts."

Sensitivity: "The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise)."

Vulnerability: "The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. See also Contextual vulnerability and Outcome vulnerability."

Outcome vulnerability (End-point vulnerability): "Vulnerability as the end point of a sequence of analyses beginning with projections of future emission trends, moving on to the development of climate scenarios, and concluding with biophysical impact studies and the identification of adaptive options. Any residual consequences that remain after adaptation has taken place define the levels of vulnerability (Kelly and Adger, 2000; O'Brien et al., 2007)."

Contextual vulnerability (Starting-point vulnerability): "A present inability to cope with external pressures or changes, such as changing climate conditions. Contextual vulnerability is a characteristic of social and ecological systems generated by multiple factors and processes (O'Brien et al., 2007)."

Guidelines

The Vulnerability Sourcebook is a document by the German Federal Ministry for Economic Cooperation and Development (BMZ), published by GIZ in cooperation with Adelphi and EURAC research. The document aims to offer an approach to vulnerability assessments, building on lessons learned in various contexts (Fritzsche *et al.*, 2014).

The document was recently updated with a Risk Supplement, that takes the new concept of climate risk, expressed in the IPCC AR5 (IPCC 5th Assessment Report), into account (GIZ and EURAC, 2017), as 'The potential for consequences [= impacts] where something of value is at stake and where the outcome is uncertain (...). Risk results from the interaction of vulnerability, exposure, and hazard (...).'

Therefore, the concept of climate change vulnerability described in the Vulnerability Sourcebook has been replaced by the concept of risk of climate change impacts.

The AR5 risk concept focuses on assessing the risk of specific consequences or impacts that may harm a system. The Vulnerability of the system is now one of three components of the risk, together with Hazard and Exposure. The risk of climate-related impacts results from the interaction of these components.

Figure 1: Illustration of the core concepts of the IPCC WGII AR5 (Source: IPCC 2014, p. 1046)

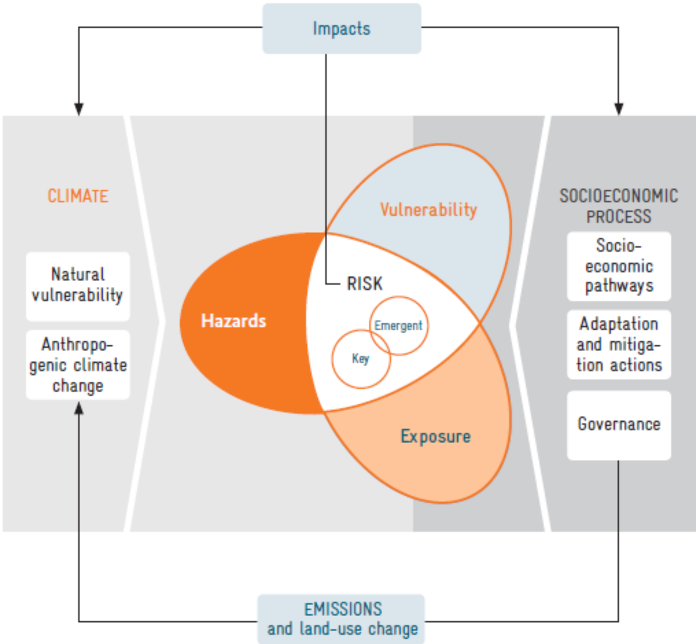
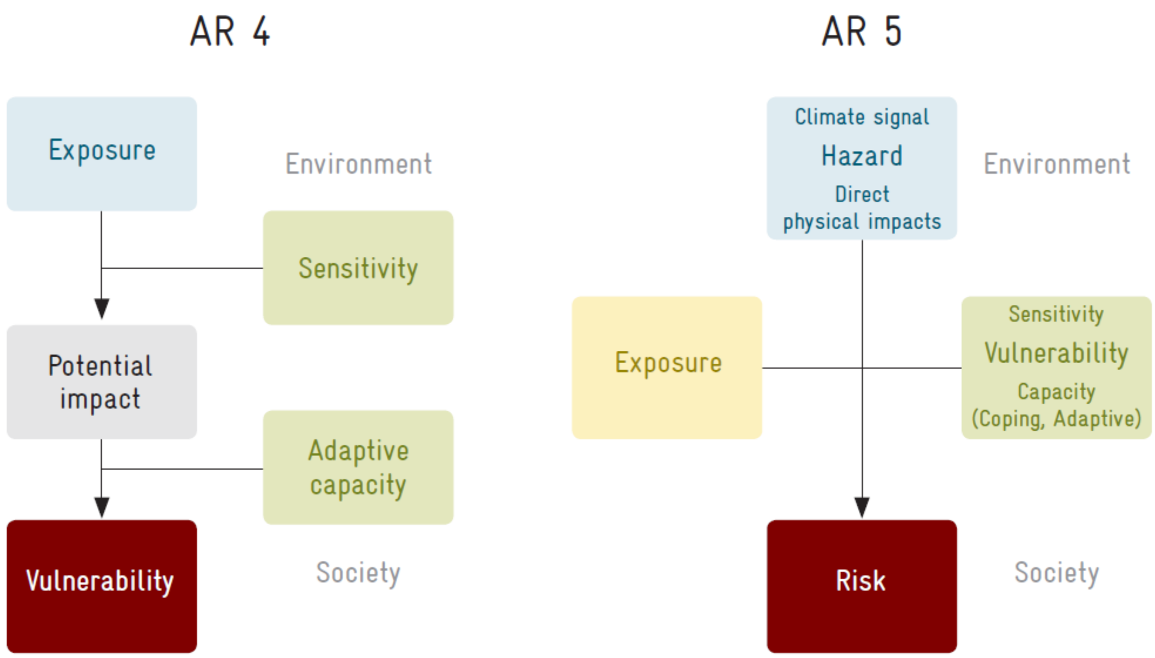


Figure 2: Comparison of the components of climate change vulnerability (AR4)2 and climate risk (AR5) (Source: Risk Supplement to the Vulnerability Sourcebook)



The objective of this document is to provide practical guidance on how to carry out a risk assessment, integrating the Vulnerability Sourcebook guidelines with the new approach conveyed in the Risk Supplement. As in the Vulnerability Sourcebook and in the Risk Supplement, the following guidelines are structured in eight modules:

- m1 Preparing the risk assessment
- m2 Developing impact chains
- m3 Identifying and selecting indicators
- m4 Data acquisition and management
- m5 Normalisation of indicator data
- m6 Weighting and aggregating of indicators
- m7 Aggregating risk components to risk
- m8 Presenting the outcomes of your risk assessment.

M1 Preparing the risk assessment

The first module consists of four closely interlinked Steps, forming an iterative process:

1. Understand the context in which the assessment is taking place
2. Define clear objectives and expected outcomes for the assessment
3. Determine the thematic, spatial and temporal scope of the assessment and outline potential methods
4. Prepare an implementation plan that defines tasks and responsibilities for participants and stakeholders, as well as the schedule for the assessment, taking into account available resources

Risks related to extreme events can and should be considered as well as risks related to slow onset trends. If feasible, scenarios for other drivers of risk (e.g. population growth) can be included as part of vulnerability or exposure.

As regards PROCESSES, it is useful to identify and understand the other adaptation processes taking place within the context, such as an adaptation strategy or plan at the national or regional level. This could be useful in understanding the possible connections and synergies between this assessment and other processes taking place at the same time.

As for KNOWLEDGE, it is essential to get an overview of existing knowledge on climate change and its impacts as it applies to targeted areas, in order to circumscribe the scope of the assessment, and select data and information accordingly. This “scoping” phase takes into account existing information and materials from national and international sources, such as national adaptation plans, studies, IPCC reports, and climate change information portals[3].

As regards INSTITUTIONS relevant to the assessment, understanding their interests and expectations through an accurate ‘stakeholder-mapping’ will help outlining the assessment objectives, and finding out which institutions can contribute to the assessment, and how. Stakeholders can be ‘mapped’ according to their resources relevant for the assessment (e.g. financial, knowledge, access to networks or data, experience, political influence, reputation). This can also serve to explore possible synergies, and to find out how conflicting interests can be dealt with. Local institutions, experts and stakeholders should be involved throughout the entire assessment, not only to ensure that their perspectives and expertise are considered, but also to create a sense of shared ownership and increase acceptance and impact of the assessment. Local institutions can be involved through bilateral consultations or a ‘kick-off’ workshop aimed at defining the cornerstones of the assessment. To ensure robust, on-going dialogue with participating institutions, encourage exchange and reinforce a common understanding of the assessment’s goals and outputs, a steering committee or technical working group can be set up.

[3] For example, the World Bank’s Climate Change Knowledge Portal (CCKP) or the IPCC Data Distribution Centre (DCC).

Figure 7: Key questions in assessing the context of a vulnerability assessment

Processes
- What are ongoing or planned processes related to adaptation?
- Which (ongoing) activities should or could benefit from the VA?
- Which activities could the VA benefit from?

Knowledge
- What is already known about climate change and its impacts?
- Have there already been vulnerability or impact assessments?
- Which information gaps should be filled by the VA?

Institutions
- Which institutions will or should be involved in the VA?
- What are their specific interests and objectives regarding the VA?
- What and how can they contribute to the VA?

Resources
- When are results from the VA needed?
- Which (financial, human, technical, etc.) resources can be dedicated to conducting the VA?
- Which relevant information and data are available for the VA?

External developments
- Are there important external factors that should to be taken into account?
- How do these external factors potentially influence the system under review?

Source: adelphi/EURAC 2014.

Step 1: Understand the context of the risk assessment

The first step regards the understanding of the context in which the assessment is going to take place. Each context is unique, so it is essential to carefully understand and explore it. There are five key factors, and for each of them a few guiding questions, to take into account: processes, knowledge, institutions, resources and external developments.

Key institutions to consider when developing a risk assessment (Source: The Vulnerability Sourcebook, 2014)

Level	Potential partners and stakeholders
Community Level	Local communities, farmer associations, community leaders, local non-governmental organisations (NGOs) and authorities, local businesses and companies, donor organisations
District or provicial level	District or provincial governments, national entities such as ministries, statistical offices, meteorological offices, local NGOs, scientific institutes, private sector companies, international organisations, donor organisations
National level	Ministries responsible for environment, spatial planning, natural resources (particularly water), planning and finance as well as resource-related sectors (such as agriculture), statistical offices and meteorological offices, NGOs working at the national level, international organisations, donor organisa-tions, private sector companies
Science & research	Local universities (specifically, departments working on natural resources, rural or urban development, biodiversity, geography, disaster risk reduction etc.), research institutions

Identifying available RESOURCES - technical, human and financial - is crucial for determining the scope of the assessment. Time (deadlines, timeframes, etc.) is also a critical resource and will probably be decisive in the choice of the assessment methods.

As for EXTERNAL DEVELOPMENTS, it is essential to get a broader view of external factors (i.e. conflicts, movements of refugees, trade policies, etc.) that might have an influence on the system under review. Such a 'plausibility check' can indicate whether changes are mainly driven by climatic factors or rather driven by non-climatic factors.

Step 2: Identify objectives and expected outcomes

The objective of the assessment and intended outputs (usually responding to a particular need or information gap) should be defined as clearly as possible. This will ease the choice of an appropriate methodological approach to fulfil the objective, and help managing the expectations of participating institutions and stakeholders.

The following **key questions** will help define the overall objectives for the assessment:

- What processes will the assessment support or feed into? Are there on-going activities in the field of adaptation that should be taken into account when designing and implementing the assessment?
- What do you want to learn from the assessment?
- What do you want to use this knowledge for?
- Who is the target audience for the results of the assessment?
- What outputs do you expect?

Step 3: Determine the scope of the risk assessment

The following questions can be used as a guide to determine the scope of the assessment:

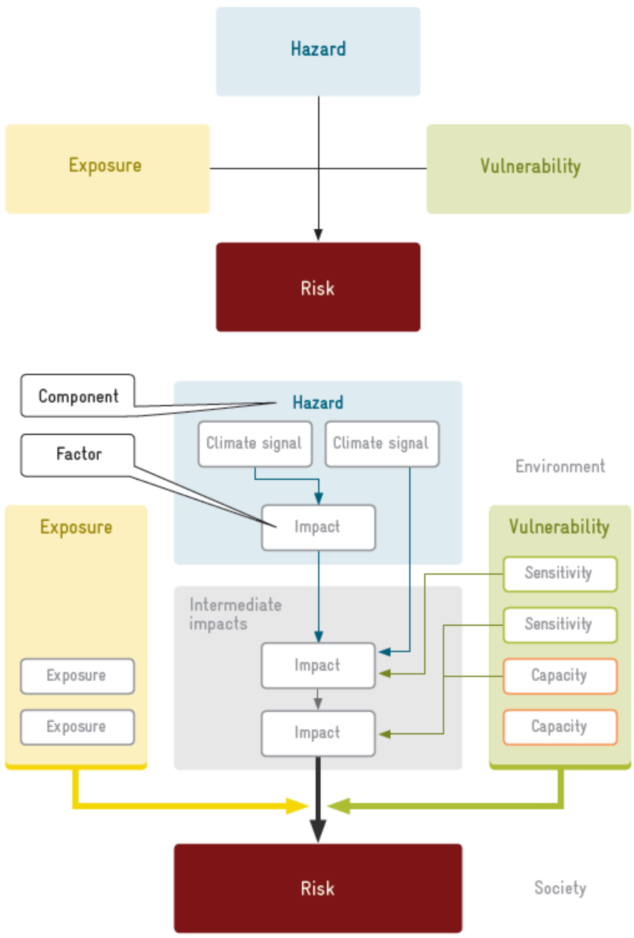
- What exactly is the risk assessment about? What is its subject or thematic focus? Are you considering particular social groups? Will the assessment focus on just one subject, or on combined subjects? What are the exposed elements you are focusing your assessment on?
- What climate-related risks do you intend to assess? (Consider risks related to hazardous events, such as a flood, as well as risks related to trends, such as increasing temperatures) What climate risks and impacts occurred in the past? Which known risks and impacts may be relevant for the future?
- What major non-climatic drivers influence current and future climate-related risks? Future climate risks will not only depend on the future climate, but also on future socio-economic conditions. These have an effect on the exposure (e.g. population growth in urban areas may influence the number of people exposed to a potential impact) or the vulnerability (e.g. increase in per-capita income may decrease the vulnerability).
- What is the concrete geographical scope of the assessment?
- What is the time (reference) period of the assessment?
    - Current climate risks related to impacts from current climate variability, climate extremes and recent changes of climate conditions, e.g. 1986 – 2015;
    - Future climate risks related to impacts due to future climate variability, climate extremes, and future climate change, e.g. 2021 – 2050.
- What are the right methods for the vulnerability assessment? Do you plan to run quantitative models (e.g. climate or hydrological models) or will you primarily rely on participatory approaches or a mixture of the two? Selection of methods will depend on available resources (time, finances, software), technical expertise, and expected outcome of the assessment.

Step 4: Prepare an implementation plan

This step consists in the development of a concrete work plan for implementing the risk assessment, defining specific tasks, clear responsibilities and realistic time planning, taking into account available resources. Data acquisition, preparation and processing can represent a scheduling bottleneck: data availability and quality should be evaluated as early as possible, especially if the schedule is tight. It can be helpful to include milestones in the planning, and to monitor them during implementation.

M2 Developing impact chains

An impact chain is an analytical tool that helps better understand, systemise and prioritise the factors that drive risk in the system of concern, as well as their cause-and-effect relationships.



As shown in the figure above, a chain is composed of risk components - hazard, vulnerability, exposure (see coloured boxes) - and underlying factors (white boxes). The HAZARD component includes factors related to the climate signal and direct physical impact. The VULNERABILITY component consists of sensitivity and capacity factors. The EXPOSURE component is comprised by one or more exposure factors. In contrast to these three components, INTERMEDIATE IMPACTS are not a risk component by themselves but merely an auxiliary tool to fully grasp the cause-effect chain leading to the risk. By definition, they are a function of both hazard and vulnerability factors, which means that all impacts identified which do not only depend on the climate signal but also on one or several vulnerability factors need to be placed here.

The principles to consider when collecting the various factors to generate an impact chain are as follows:

- To avoid double counting a factor needs to be allocated to one risk component only.
- The factors allocated to one component should be – at least predominantly – independent of factors of other components. Factors which are influenced by other factors of at least two different components should be treated as intermediate impacts.
- Factors representing potentially hazardous events can either be allocated to the hazard component or can be classified as intermediate impacts, based on whether the specific factor can be influenced by measures or activities taken within the system of concern.

Relevant factors need to be phrased as critical states (e.g. 'lack of precipitation') in order to facilitate the risk assessment, avoiding neutral expression (e.g. 'precipitation').

Impact chains development is an iterative process that encompasses 5 Steps:

- *Step 1: Identify climate impacts and risks* affecting the system of concern, through:
  - Review of potential impacts and risks based on the knowledge sources identified in Module 1
  - Brainstorming of potential impacts and risks with key stakeholders to complete the list
  - Clustering impacts and risks into larger groups united by similar topics, giving each cluster a unique title
  - Prioritization and selection of key clusters as the focus of the assessment
  - Arrangement of impacts and risks within clusters: (a) highlighting of causal relationships among the impacts and risks within each cluster; (b) discard any other factors unrelated to climate change that affect the impacts and risks

This step will result in one (or a set of) impacts and risks to focus the assessment on. The final wording of the risk can be composed of the impact (risk of what), the hazard (impact from what) and the exposed elements (what or who is at risk).

- *Step 2: Determine hazard and intermediate impacts:* starting with the selected risk, work from the bottom up by identifying related intermediate impacts that lead to the risk, until you reach the hazard (direct physical impact or climate signal) that represents the essential trigger(s).
- *Step 3: Determine vulnerability,* identifying natural or physical attributes or properties of the system that make it susceptible to adverse effects of the changing climate signal(s) identified in the

previous step, thus contributing to the risk. Also, for factors of vulnerability, a wording that implies a critical state is recommended.

- Sensitivity
- ‘Which attributes make the system vulnerable to potential negative impacts of the hazard(s) under consideration?
- Sensitivity includes the physical environment as well as socio-economic or
- cultural aspects such as soil condition, irrigation systems or land use patterns.
- Capacity
- ‘Which abilities of the societal system are in place or missing to reduce the risk of concern – now and in future?’
- The capacity factors comprise those aspects that characterize the ability (or lack of ability) to cope with an adverse situation as well as those aspects that determine the ability (or lack of ability) to adapt to future situations (see definition of coping capacity and adaptive capacity in chapter II). In order to identify (lacking) capacities, consider aspects directly linked to the risk as well as more generic issues. You may find it helpful to keep the four dimensions of adaptive capacity in mind:
- Knowledge: is there knowledge or expertise available or missing which might aid adaptation?
- Technology: are there technical options available or missing which could enhance capacity?
- Institutions: how does the institutional environment contribute to capacity?
- Economy: which economic and financial resources are available or missing for enhancing capacity or implementing adaptation measures?
- *Step 4: Determine exposure*, identifying the elements of the system that could be adversely affected, thus determining exposure.
- The term ‘exposure’ has a new meaning in the IPCC AR5 concept. It now refers to the presence of something of value in the system of concern. While the scoping in Module 1 already provided initial ideas about the exposed elements in question, this now needs to be further specified. We recommend formulating this component in a way that expresses the relevance of the exposed elements in the system of concern. In most cases, the exposure component will consist of considerably less factors than hazard or vulnerability and, in fact, oftentimes one exposure factor might be enough to express the relevance.
- *Step 5: Brainstorm adaptation measures (optional),* identifying the measures that could help decrease vulnerability and/or exposure within the system of concern. This can serve to identify possible gaps in the impact chain and is especially helpful where the assessment is designed to support the development and monitoring and evaluation (M&E) of adaptation interventions.

To ensure that the assessment takes gender and disadvantaged groups into account, for each component in the impact chain (except those representing climate signals or direct physical impacts) it should be considered whether there is a dimension specific to women or disadvantaged groups. Another way of including women and disadvantaged groups is to take a gender-neutral impact and ask: “how does it particularly affect women and disadvantaged groups?”. Most likely, specific factors related to gender issues or disadvantaged groups can be found amongst the factors of the vulnerability component.

M3 Identifying and selecting indicators

M3 is aimed at identifying parameters that allow to quantify, assess and measure the relevant factors that intensify or mitigate climate change factors, as identified in the previous module. At least one indicator has to be selected for each relevant factor. These indicator values will be aggregated to risk components (hazard, vulnerability and exposure) and thus contribute to the composite risk score.

A good indicator is: valid and relevant, i.e., it represents well the factor you want to assess reliable and credible and also allows for data acquisition in the future precise in its meaning, i.e. stakeholders agree on what the indicator is measuring in the context of the vulnerability assessment clear in its direction, i.e. an increase in value is unambiguously positive or negative with relation to the factor and risk component practical and affordable, i.e., it comes from an accessible data source appropriate, i.e., the temporal and spatial resolution of the indicator is right for the risk assessment

Risk component	Factor	Possible indicator
Hazard (Climate signal)	Heavy precipitation events	Number of days per year with rainfall greater than 50mm
Hazard (Direct physical impact)	Floods	Number of disastrous flood events in one year
Vulnerability (Sensitivity)	Land use prone to erosion	% of land cover classes with a high risk for erosion
	Steep slopes	% of slopes with a gradient greater than 30%
Vulnerability (Capacity)	Poverty	% of people living at less than US$ 2 per day
Exposure	Population density	Number of inhabitants per km^2
	Relevance of rainfed agriculture	% of rain-fed agricultural area within a district

The Module consists of 4 steps:

- *Step 1: Selecting indicators for hazards, i.e.* biophysical or physical characteristics, or climate parameters (directly measured or modelled). Potential data availability and frequency of data values required should be considered in this phase.
- *Step 2: Selecting indicators for vulnerability and exposure*
- *Step 3: Check if your indicator is specific enough* – Does it have a clear direction and, if possible, an 'event character'? What is the exact spatial extent which should be covered by your data? What spatial resolution should your data have? What time period will the data need to cover? How frequently and at what intervals do you plan to repeat the assessment for monitoring purposes?
- *Step 4: Create a list of provisional indicators for each factor* - The results of previous steps should be captured in a table or spread sheet, recording all potential indicators with any relevant additional information, or 'metadata' (i.e. a brief description of the indicator, the factor and vulnerability component it represents, a brief explanation of the reasons for selecting this indicator, the spatial and temporal coverage required for the indicator data, the unit of measurement or spatial resolution required, the required period for updating indicator values, the potential data sources). Since selecting indicators is an iterative process, this step will result in a list of provisional indicators, which will be confirmed in Module 4.

M4 Data acquisition and management

Based on the draft list of indicators developed in Module 3, the next steps are gathering the required data (Step 1), checking their quality (Steps 2), and documenting and storing them in a suitable database (Step 3). Steps 1 and 2 could show that data is either not available or has significant quality constraints: in this case the indicator framework should be revised. Module 4 will however result in a final indicator list.

Step 1: Gather your data

Key questions:

- What kind of data (measured, modelled, statistical…) do you need? The scale of the assessment, the extent of the area covered and the outputs expected are crucial in deciding what data to look for.
- Do the data already exist? Who can provide them? Important aspects to be considered include data sharing policies of data providing institutions, data acquisition procedures (i.e. formal agreements with data providing bodies), respect of property rights for the distribution and publication of data, or products derived therefrom.
- What alternatives are available if the preferred data sources prove unreliable? What can you commit in terms of time and other resources for generating data?

Step 2: Data quality check

Key questions:

- Are the data in the format you expected? Are all the files legible and ready for further processing?
- Is the temporal and spatial coverage as planned? This is crucial to determine whether data can be combined and compared.
- Are there any missing values or 'outliers' in your data? Smaller data gaps can be filled with interpolation, while outliers may indicate an error in the data capture method.
- Are the data in the right geographical projection? Different sources of spatial data may use different coordinate systems and projections. An option could be using a common geographic reference system such as the UTM (Universal Transverse Mercator), or an alternative data source, a proxy, an alternative indicator or alternative means of data acquisition such as expert input.

Step 3: Data management

Once datasets are collected (Step 1) and checked for quality (Step 2) they should be stored in a common database to avoid the risk of redundancy and data loss, and documented with metadata in compliance with international standards (such as ISO 19115 and the Dublin Core Standard). Depending on the scope of the assessment, responsibilities for database management and maintenance may also need to be assigned.

M5 Normalisation of indicator data

Module 5 aims at providing normalised data for each indicator in a standardised value range from 0 to 1, ready for aggregation. The term 'normalisation' refers to the transformation of indicator values measured on different scales and in different units into unit-less values on a common scale. The Vulnerability Sourcebook uses a standard value range from 0 to 1, where '0' means 'optimal, no improvement necessary or possible' and '1' means 'critical, system no longer functions.

Module 5 foresees two steps:

- *Step 1: Determine scale of measurement*, choosing among nominal, ordinal/categorical or metric for each indicator
- *Step 2: Normalise indicator values* into values between 0 and 1, by applying (1) the min-max method for metric indicator values, checking carefully the *direction* of the value range (lower values should reflect positive conditions in terms of risk and higher values more negative conditions), and defining thresholds if needed; or (2) a five-class evaluation scheme for categorical indicator values, followed by the transformation of normalised indicator values on a categorical scale to the value range 0 – 1.

Table 3: Class values and description

Metric class value within range of 0 to 1	Categorical class value within the range of 1 to 5	Description
0 – 0.2	1	optimal (no improvement necessary or possible)
› 0.2 – 0.4	2	rather positive
› 0.4 – 0.6	3	neutral
› 0.6 – 0.8	4	rather negative
› 0.8 – 1	5	critical (could lead to severe consequences)

Table 16: Transformation of normalised indicator values on a categorical scale to the value range 0 – 1

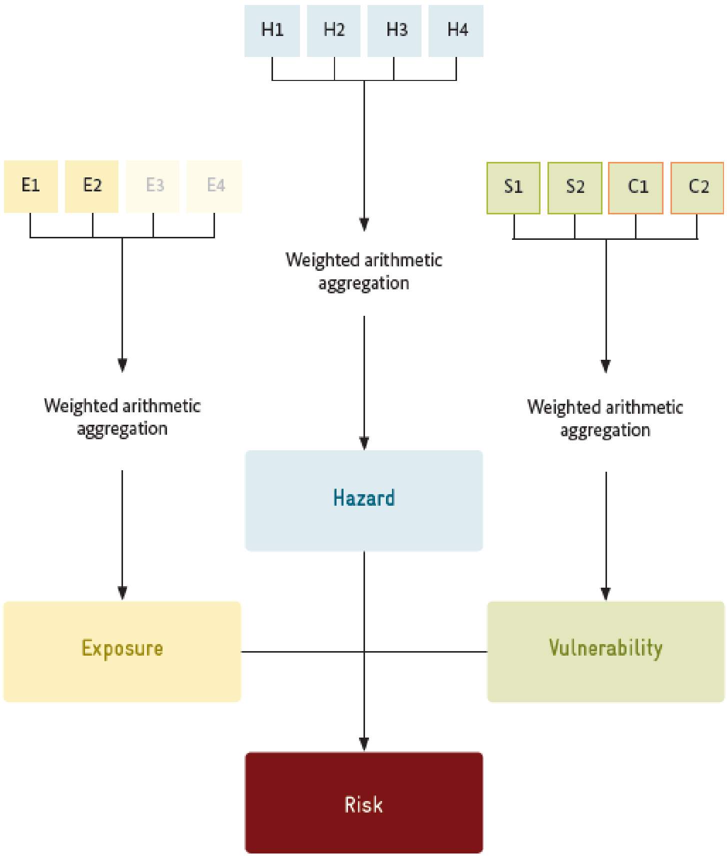
indicator values — categorical			Indicator value range (0 to 1) metric
Class No.	Class value within range of 0 to 1	Description	Values
1	0 – 0.2	optimal (no improvement necessary or possible)	0.1
2	> 0.2 – 0.4	rather positive	0.3
3	> 0.4 – 0.6	neutral	0.5
4	> 0.6 – 0.8	rather negative	0.7
5	> 0.8 – 1	critical (system no longer functions)	0.9

M6 Weighting and aggregating of indicators

This module explains how to weight indicators if some of them are considered to have a greater influence on risk components (hazard, vulnerability and exposure) than others, and how to aggregate individual indicators of the three risk components to combine the information from different indicators into a composite indicator representing a single component.

Two steps are foreseen:

- *Step 1: Weighting of indicators* – evaluation of the influence of the different indicators on the respective risk component, and assignment of different weights based on existing literature, participatory processes or expert opinion
- *Step 2: Aggregation of indicators* - aggregating individual indicators into composite indicators of the three risk components, i.e. by applying the 'weighted arithmetic aggregation' method: individual indicators are multiplied by their weights, summed and then divided by the sum of their weights to calculate the composite indicator (CI) of a vulnerability component.



M7 Aggregating risk components to risk

This module shows how to aggregate the risk components hazard, vulnerability and exposure into a composite risk indicator through a one-step approach - consistent with the IPCC AR5 risk concept – that uses the weighted arithmetic mean to combine the three components.

$$Risk = \frac{(Hazard * w_H) + (Vulnerability * w_V) + (Exposure * w_E)}{w_H + w_V + w_E}$$

Results can be classified as follows:

Table 4: Risk classes

Metric risk class value within range of 0 to 1	Risk class value within the range of 1 to 5	Description
0 – 0.2	1	very low
> 0.2 – 0.4	2	low
> 0.4 – 0.6	3	intermediate
> 0.6 – 0.8	4	high
> 0.8 – 1	5	very high

M8 Presenting the outcomes of your risk assessment

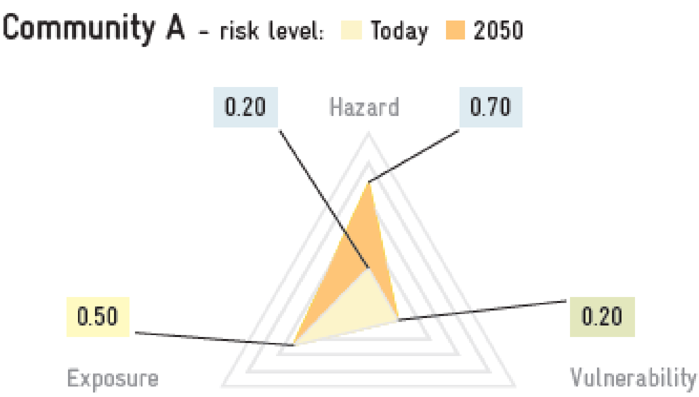
- *Step 1: Plan your risk assessment report -* This report should a readily accessible document providing a clear description of the risk assessment's objectives, the methods applied and the key findings, as well as all the background information needed to interpret and comprehend results. Both the objective and the target audience of the risk assessment must be taken into account, and the content, style and language of the report should be tailored both to its recipients and to the person who will be presenting it. Additional results of the risk assessment - lessons learnt – should be described as well.
- *Step 2: Describe your assessment* – The risk assessment report should embed four core sections:

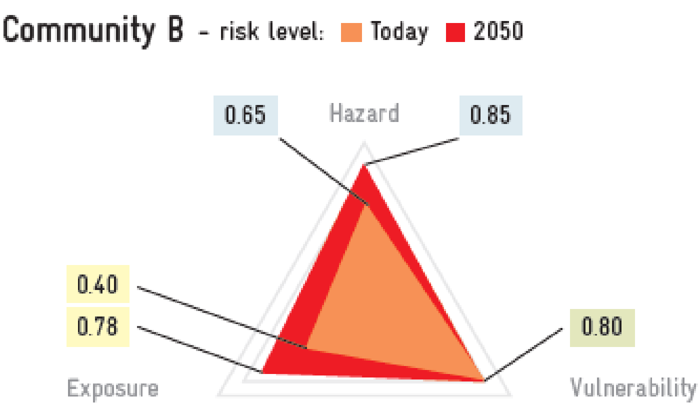
1) Context and objectives – more specifically: (a) The context, in which the vulnerability assessment is conducted; (b) Objectives and approach of the vulnerability assessment; (c) Institutions and key stakeholders or target groups involved; (d) The system and impact(s) under review, as well as the geographical scope and timeframe; (e) Resources and timeframe of the assessment.
2) Methodology and implementation – focusing on: (a) The assumed cause-effect relationships underlying the assessment, including the impact chains developed; (b) Selected factors and indicators and the method(s) used in quantifying the information on data quality, listing any data gaps and how they were dealt with; (c) The selection criteria for the stakeholders and experts, and the number of experts (as well as their sectors/geographic areas or professional background) that were consulted (in case of an expert assessment); (d) The weighting used and the process(es) by which it was determined; (e) The aggregation approach used for assessing vulnerability; (f) Information on data sources and calculations for future assessments in the case of monitoring and evaluation (M&E).
3) Findings - This chapter should include: (a) Values for individual indicators, the risk components, as well as overall risk; (b) Challenges and opportunities encountered at the various stages of the risk assessment; (c) Lessons learnt. Uncertainties and knowledge gaps included in the assessment should also be transparently described and – if possible – quantified.
4) Conclusions for on-going or forthcoming (policy) processes, such as adaptation strategies and planning, including concrete recommendations for further assessments or adaptation measures.

- *Step 3: Illustrate your findings* by means of maps (normally produced using a GIS), graphs, tables and radar diagrams.

Figure 17: Example of an option to present risk and its components in a tabular form and in form of radar diagrams

		Hazard	Exposure	Vulnerability	Risk	Risk Level
Community A	Today	0.20	0.50	0.20	0.30	low
	2050	0.70	0.50	0.20	0.47	intermediate
Community B	Today	0.65	0.40	0.80	0.62	high
	2050	0.85	0.78	0.80	0.81	very high





References

Fritzsche, K., Schneiderbauer, S., Bubeck, P., Kienberger, S., Buth, M., Zebisch, M. & Kahlenborn, W. (2014). *Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability* assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GIZ and EURAC (2017), *Risk Supplement to the Vulnerability Sourcebook. Guidance on how to apply the Vulnerability Sourcebook's approach with the new IPCC AR5 concept of climate risk*. Bonn: GIZ.

Web portals

Covenant of mayors https://www.covenantofmayors.eu/en/

Climate Adapt (EEA) https://climate-adapt.eea.europa.eu/

CMCC https://www.cmcc.it/

Intergovernmental Panel on Climate Change (IPCC) https://www.ipcc.ch/about/

ISPRA http://www.isprambiente.gov.it/it/temi/cambiamenti-climatici

Ministero dell'Ambiente https://www.minambiente.it/

PAP/RAC http://paprac.org/

Data sources

Climate Adapt - Urban Adaptation Map Viewer https://climate-adapt.eea.europa.eu/knowledge/tools/urban-adaptation

Copernicus - Climate Data Store https://cds.climate.copernicus.eu/#!/home

ESA - Climate Change Initiative http://www.esa-ghg-cci.org

Adaptation Plans and Strategies

Croatian Draft Climate Adaptation Strategy http://prilagodba-klimi.hr/wp-content/uploads/docs/Draft%20CC%20Adaptation%20Strategy.pdf

Italian National Adaptation Strategy https://www.minambiente.it/sites/default/files/archivio/allegati/clima/documento_SNAC.pdf

Italian National Adaptation Plan - First Public Consultation Draft https://www.minambiente.it/sites/default/files/archivio_immagini/adattamenti_climatici/documento_pnacc_luglio_2017.pdf

Italian National Adaptation Plan - other consultation documents available at https://www.minambiente.it/pagina/consultazione-su-piano-nazionale-adattamento-cambiamenti-climatici

EU projects

LIFE Master Adapt https://masteradapt.eu/?lang=en

Climate analysis (English) https://masteradapt.eu/wordpress/wp-content/uploads/2017/09/MA-report-A1.pdf

Guidelines (Italian) https://masteradapt.eu/wordpress/wp-content/uploads/2018/03/MA-linee-guida-A1-1.pdf

LIFE PRIMES http://www.lifeprimes.eu/?lang=en

Reports available at http://www.lifeprimes.eu/index.php/scenari-climatici-report/

LIFE SEC ADAPT http://www.lifesecadapt.eu/

Climate Assessment on Local and Regional Levels. Methodological Document

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Methodology_for_the_definition_of_climate_baseline_and_future_scenarios_DEF.pdf

Regional Climate Baseline and Future Climate Projections - Istria (Croatian)

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Report_on_climate_baseline_at_regional_level_IDA_ISTRIA_REGION.pdf

Regional Climate Baseline and Future Climate Projections - Marche (Italian)

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Report_on_climate_baseline_at_regional_level_MARCHE_REGION_FINAL.pdf

Vulnerability and Risk Assessment Analysis - Istria (Croatian)
http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf

Vulnerability and Risk Assessment Analysis - Marche (Italian)
http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/ITALY_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Marche_Region_compressed.pdf

EMPOWERING https://www.empowering-project.eu/en/sample-page/

LIFE FRANCA https://www.lifefranca.eu/en/

LIFE DERRIS http://www.derris.eu/en/

LIFE BLUEAP http://www.blueap.eu/site/en/

RESIN - CLIMATE RESILIENT CITIES AND INFRASTRUCTURES http://www.resin-cities.eu/home/

IVAVIA Guidelines (English) http://www.resin-cities.eu/fileadmin/user_upload/Resources/Design_IVAVIA/IVAVIA_Guideline_v3_final__web.compressed.pdf

Table of contents

Summary

Please describe briefly (max 2000 characters) the risk and vulnerability assessment process putting in evidence:

- Who coordinated the process
- Which impact chains were developed
- Who was in charge of technical elaboration
- When the assessment started and when it was concluded
- Which groups of stakeholders and key actors were involved
- If there were any difficulties in developing the assessment
- The results of the assessment process

M1-Preparing the risk assessment

1) Was the context area identified in the proposal confirmed? If not, please explain why.

2) Are there local or territorial plans already in place that were considered while preparing the assessment?

- If so, please list the local plans
- If so, please list the territorial plans

3) Was this module jointly developed with local actors/stakeholders?

- If so, please list which actors
- If not, please explain why

4) Were there any difficulties in involving key actors in this process?

M2-Developing impact chains

1) Which hazards were chosen for the assessment and why?

2) Which impact chains were identified and developed? Were they all finalized and included in the assessment?

- If not, please explain why.

3) Who developed the impact chain(s)?

- Co-ordinating authority with internal staff
- External consultant
- Mixed group with co-ordinating authority, consultants

4) Which data, projects and reports were used to develop the impact chain(s)?

5) Was this module jointly developed with local key actors/stakeholders?

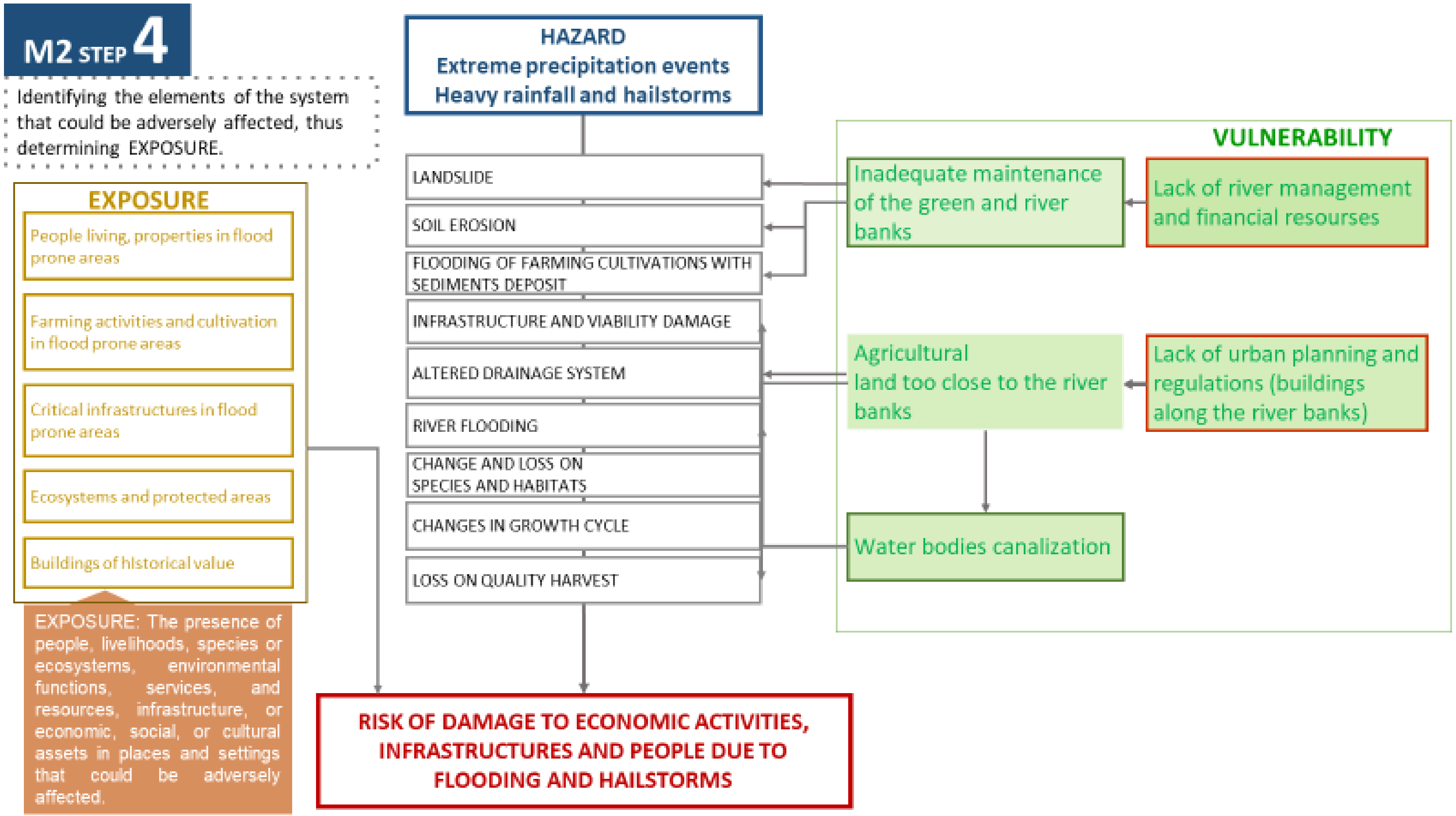
- If so, please list which actors
- If not, please explain why

6) Were there any difficulties in developing impact chains?

7) Was the method described in the tutorial used for the assessment? Was other method used?

- If so, please list them and explain why they were used (please include appropriate references).

8) Please include schemes of the impact chains as shown in the picture below


M2 STEP 4
Identifying the elements of the system that could be adversely affected, thus determining EXPOSURE.
HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms
EXPOSURE
People living, properties in flood prone areas
Farming activities and cultivation in flood prone areas
Critical infrastructures in flood prone areas
Ecosystems and protected areas
Buildings of historical value
EXPOSURE: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.
LANDSLIDE
SOIL EROSION
FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT
INFRASTRUCTURE AND VIABILITY DAMAGE
ALTERED DRAINAGE SYSTEM
RIVER FLOODING
CHANGE AND LOSS ON SPECIES AND HABITATS
CHANGES IN GROWTH CYCLE
LOSS ON QUALITY HARVEST
VULNERABILITY
Inadequate maintenance of the green and river banks
Lack of river management and financial resourses
Agricultural land too close to the river banks
Lack of urban planning and regulations (buildings along the river banks)
Water bodies canalization
RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS

M3-Identifying and selecting indicators, M4-Data acquisition and management

1) List for each impact chain:

- How many climate change factors (single factors within Exposure and Vulnerability) were identified?
- How many indicators were selected?
- Is there at least one indicator for each factor? If not, please explain why.
- Were indicators identified in other reports used? If so, please explain which ones.
- Were specific indicators developed for your target area?

2) Who developed the indicators?

- Co-ordinating authority with internal staff
- External consultant
- Mixed group with co-ordinating authority, consultants and stakeholders

3) Was this module jointly developed with local key actors/stakeholders?

- If so, please list which actors
- If not, please explain why

4) What kind of indicators were used?

- Qualitative (please specify how many)
- Quantitative (please specify how many)

5) What kind of obstacles did you face in selecting indicators?

6) What was the detail level for each the indicators? Please provide a number for each category.

- Territorial/regional level
- District level (*i.e.* Joint_SECAP target area)
- Municipal/local level
- Sub-municipal level

7) Were there any issues in finding data and populating indicators? If so, please elaborate.

8) Did you create a database for the assessment? Does the database also have a geographic base (GIS)?

9) Did you provide metadata for each indicator? If not, please explain why.

M5-Normalization of indicator data, M6-Weighting and aggregating of indicators, M7-Aggregating risk components to risk

1) What methods and instruments were used to normalize, weigh and aggregate data? Those described in the tutorial? If you used a different method, please indicate which one (list references), for what data it was used and why.

2) Who normalized, weighed and aggregated data?

- Co-ordinating authority with internal staff
- External consultant
- Mixed group with co-ordinating authority, consultants

3) Did you elaborate the data and indicators with a GIS tool?

- If so, please list the GIS tools

4) Were there any issues in carrying out these activities?

- If so, please elaborate.

M8-Presenting the outcomes of your risk assessment

1) How was the data presented? Please provide proof (Pictures, reports..) – in order to include in the report

- Reports
- Maps
- Tables
- Charts
- Etc.

2) What instruments were used to present the data? Please provide proof (Pictures, screenshots..) – in order to include in the report

- Public meetings
- Websites
- Etc.

3) Who presented the data?

- Co-ordinating authority with internal staff
- External consultant
- Mixed group with co-ordinating authority, consultants and stakeholders

4) Were the data presented at a district level?

- If not, please explain why.

5) Were there any issues in carrying out these activities?

- If so, please elaborate.

7.3.2 The Tutorial

Vulnerability and Risk Assessment

Tutorial

M1

See Annex n.1
(already sent by email on 20th Nov 2019)

M1 Preparing the risk assessment

Describes the context of the assessment: processes, knowledge, institutions, resources and external factors; identifies objectives, expected outcomes and scope; defines tasks, responsibilities and time planning

4 Interlinked steps

1. Understand the context of the risk assessment
2. Identify objectives and expected outcomes
3. Determine the scope of the risk assessment
4. Prepare an implementation plan

Step 1: Understand the context of a climate risk assessment for adaptation

At what stage of adaptation planning is your assessment taking place? And what are the development and adaptation priorities (if already defined)?

Which institutions and resources can and should be involved in your risk assessment?

Step 2: Identify objectives and expected outcomes

Which processes will the climate risk assessment support or feed into?

What do you and key stakeholders wish to learn from the assessment?

Who is the target audience for the risk assessment results?

Step 3: Determine the scope of the assessment

What exactly is your risk assessment about?

What climate related risks do you intend to assess?

What is the time period of the assessment?

What are the right methods for your climate risk assessment?

Step 4: Prepare an implementation plan

Which people and institutions are involved?

What is the time plan of the risk assessment?

What resources are required?

M2

M2 Developing impact chains

An impact chain is an analytical tool that helps better understand, systemise and prioritise the factors that drive risk in the system of concern, as well as their cause-and-effect relationships.

M2 STEP 1

Identify climate RISKS affecting the system. This step will result in one (or a set of) impacts and risks to focus the assessment on. The final wording of the risk can be composed of the impact (risk of what), the hazard (impact from what) and the exposed elements (what or who is at risk).

HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms

HARZARD: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts

START FROM HERE

RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS

RISK: The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term risk is used primarily to refer to the risks of climate-change impacts

M2 STEP 2

Determine HAZARD and INTERMEDIATE IMPACTS.

IMPORTANT: starting with the selected risk, work from the bottom up by identifying related intermediate impacts that lead to the risk, until you reach the hazard (direct physical impact or climate signal) that represents the essential triggers.

HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms

LANDSLIDE

SOIL EROSION

FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT

INFRASTRUCTURE AND VIABILITY DAMAGE

ALTERED DRAINAGE SYSTEM

RIVER FLOODING

CHANGE AND LOSS ON SPECIES AND HABITATS

CHANGES IN GROWTH CYCLE

LOSS ON QUALITY HARVEST

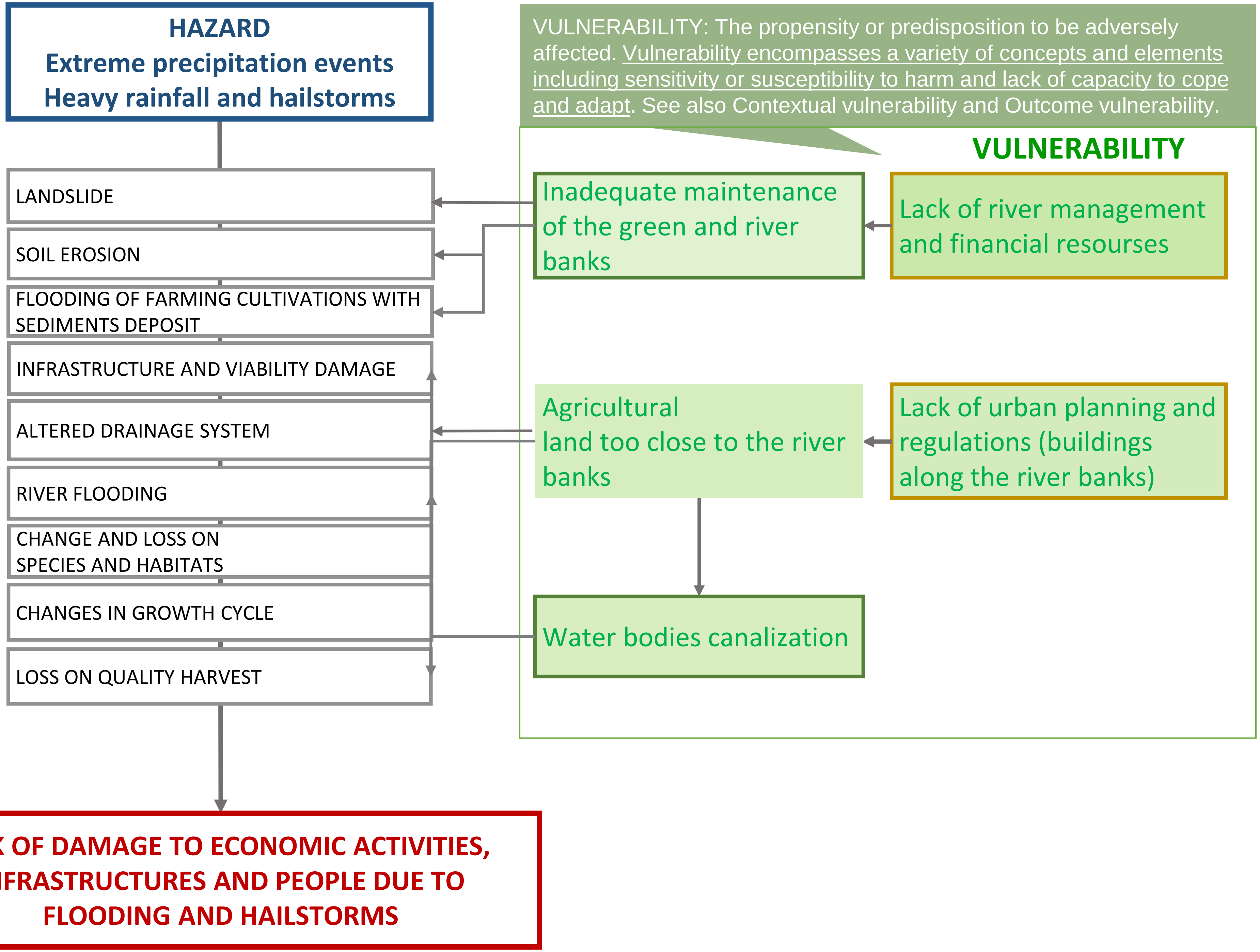
RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS

IMPACTS (Consequences, Outcomes): Effects on natural and human systems. In this report, the term impacts is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts.

M2 STEP 3

Determine VULNERABILITY, identifying natural or physical attributes or properties of the system that make it susceptible to adverse effects of the changing climate signal(s) identified in the previous step, thus contributing to the risk.

IMPORTANT: Also for factors of vulnerability, a wording that implies a critical state is recommended.

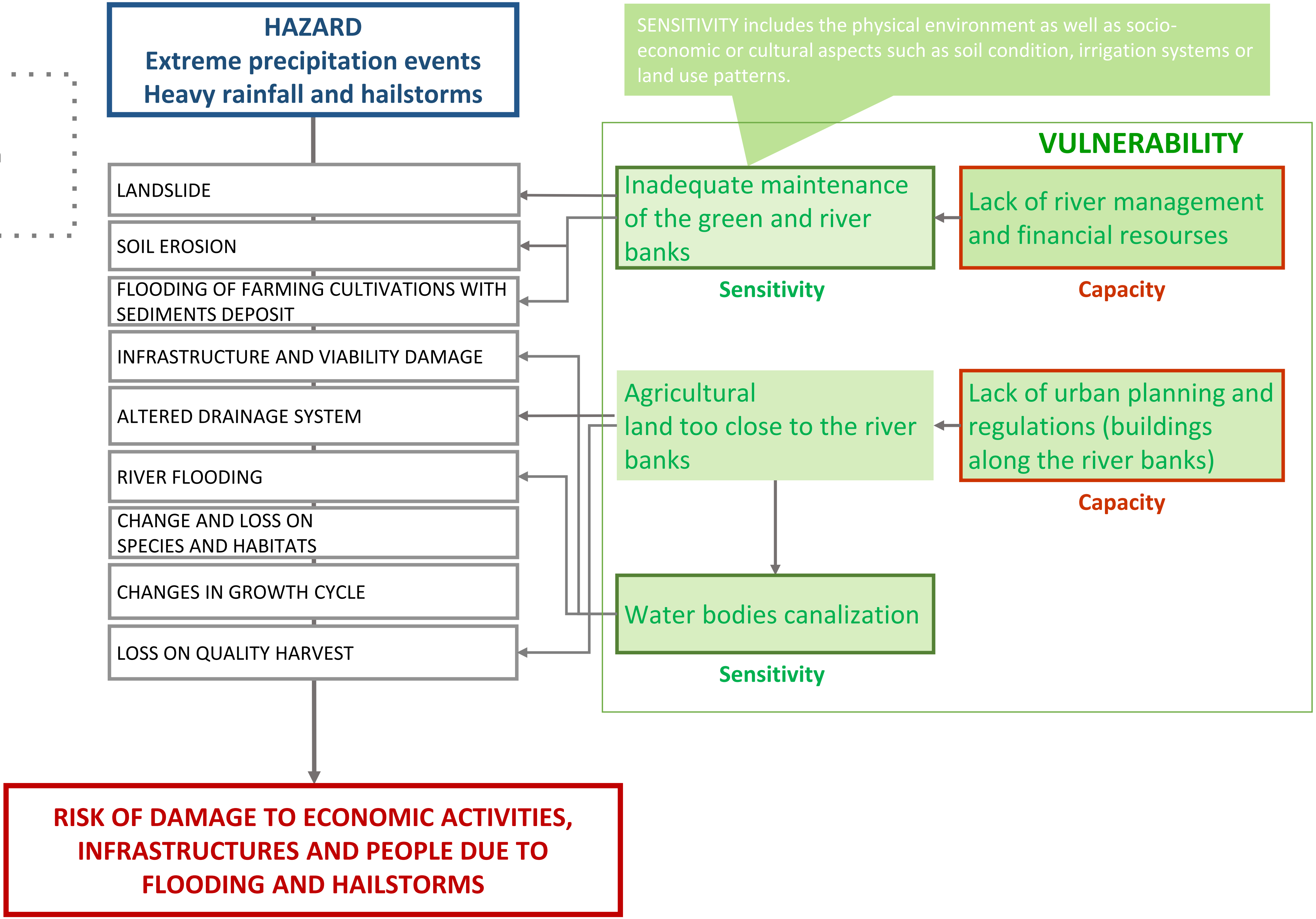


M2 STEP 3

Within the VULNERABILITY define:

- **Sensitivity:**

Which attributes make the system vulnerable to potential negative impacts of the hazard(s) under consideration?



M2 STEP 3

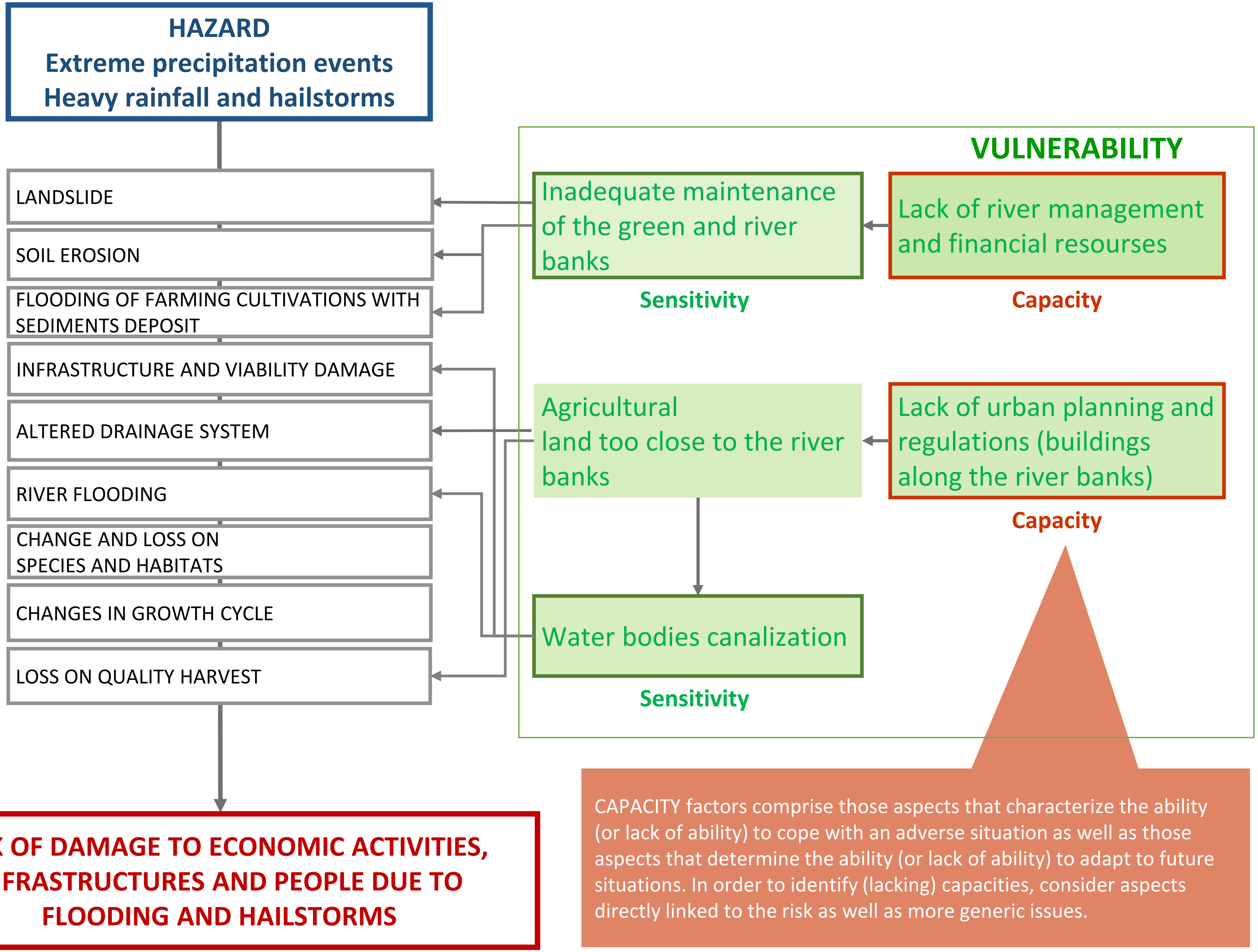
Within the VULNERABILITY define:

- **Capacity:**

Which abilities of the societal system are in place or missing to reduce the risk of concern – now and in future?

IMPORTANT: You may find it helpful to keep the four dimensions of adaptive capacity in mind:

- Knowledge: is there knowledge or expertise available or missing which might aid adaptation?
- Technology: are there technical options available or missing which could enhance capacity?
- Institutions: how does the institutional environment contribute to capacity?
- Economy: which economic and financial resources are available or missing for enhancing capacity or implementing adaptation measures?



M2 STEP 4

Identifying the elements of the system that could be adversely affected, thus determining EXPOSURE.

HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms

- LANDSLIDE
- SOIL EROSION
- FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT
- INFRASTRUCTURE AND VIABILITY DAMAGE
- ALTERED DRAINAGE SYSTEM
- RIVER FLOODING
- CHANGE AND LOSS ON SPECIES AND HABITATS
- CHANGES IN GROWTH CYCLE
- LOSS ON QUALITY HARVEST

EXPOSURE
- People living, properties in flood prone areas
- Farming activities and cultivation in flood prone areas
- Critical infrastructures in flood prone areas
- Ecosystems and protected areas
- Buildings of hIstorical value

EXPOSURE: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

VULNERABILITY
- Inadequate maintenance of the green and river banks
- Lack of river management and financial resourses
- Agricultural land too close to the river banks
- Lack of urban planning and regulations (buildings along the river banks)
- Water bodies canalization

RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS

M3

M3 Identifying and selecting indicators

M3 is aimed at identifying parameters that allow to quantify, assess and measure the relevant factors that intensify or mitigate climate change factors, as identified in the previous module. IMPORTANT: At least one indicator has to be selected for each relevant factor. These indicator values will be aggregated to risk components (hazard, vulnerability and exposure) and thus contribute to the compositive risk score

M3 STEP 1

Selecting indicators for hazards, i.e. biophysical or physical characteristics, or climate parameters. Potential data availability and frequency of data values required should be considered in this phase.

HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms

No. of days with precipitation> 100mm

- LANDSLIDE
- SOIL EROSION
- FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT
- INFRASTRUCTURE AND VIABILITY DAMAGE
- ALTERED DRAINAGE SYSTEM
- RIVER FLOODING
- CHANGE AND LOSS ON SPECIES AND HABITATS
- CHANGES IN GROWTH CYCLE
- LOSS ON QUALITY HARVEST

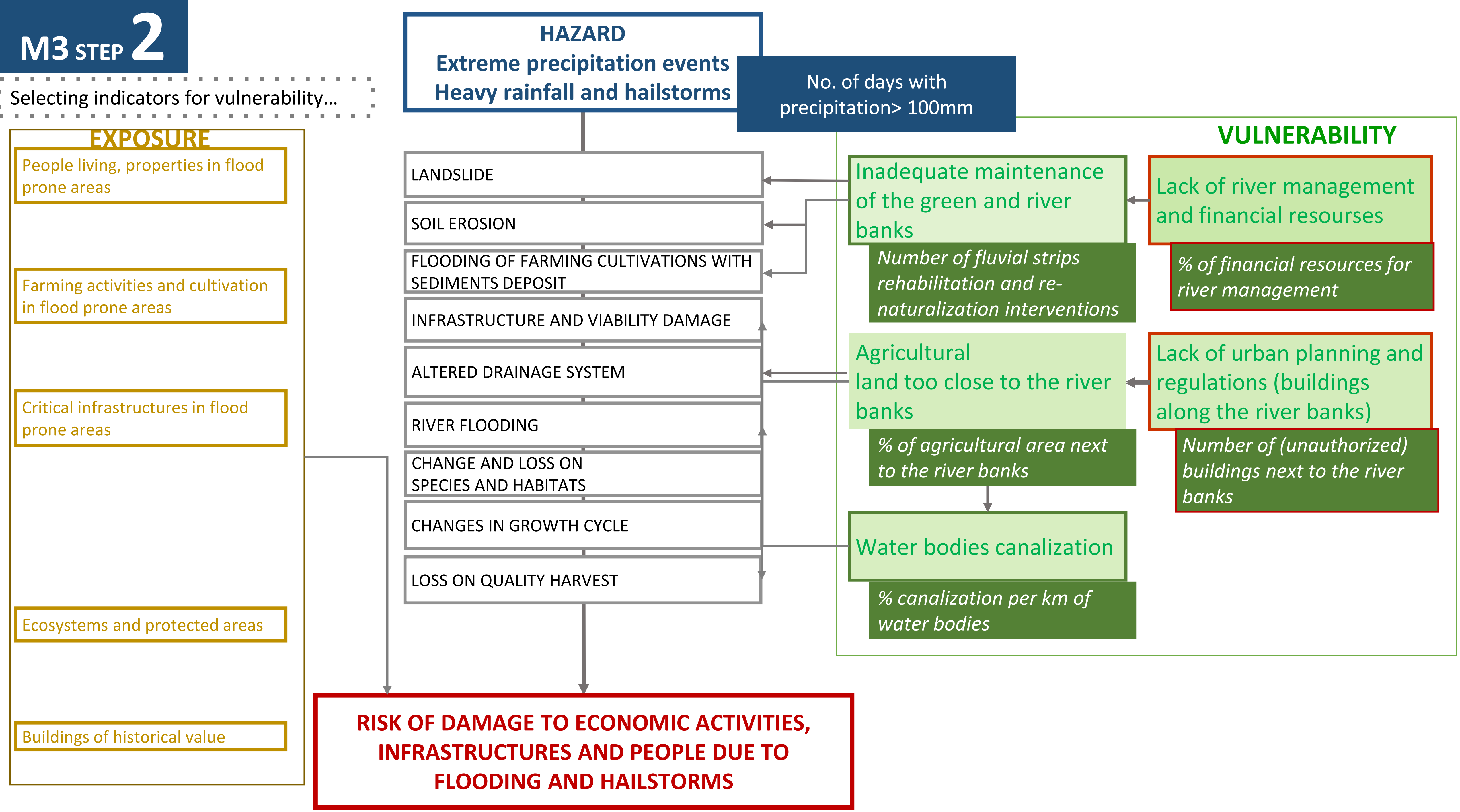
VULNERABILITY

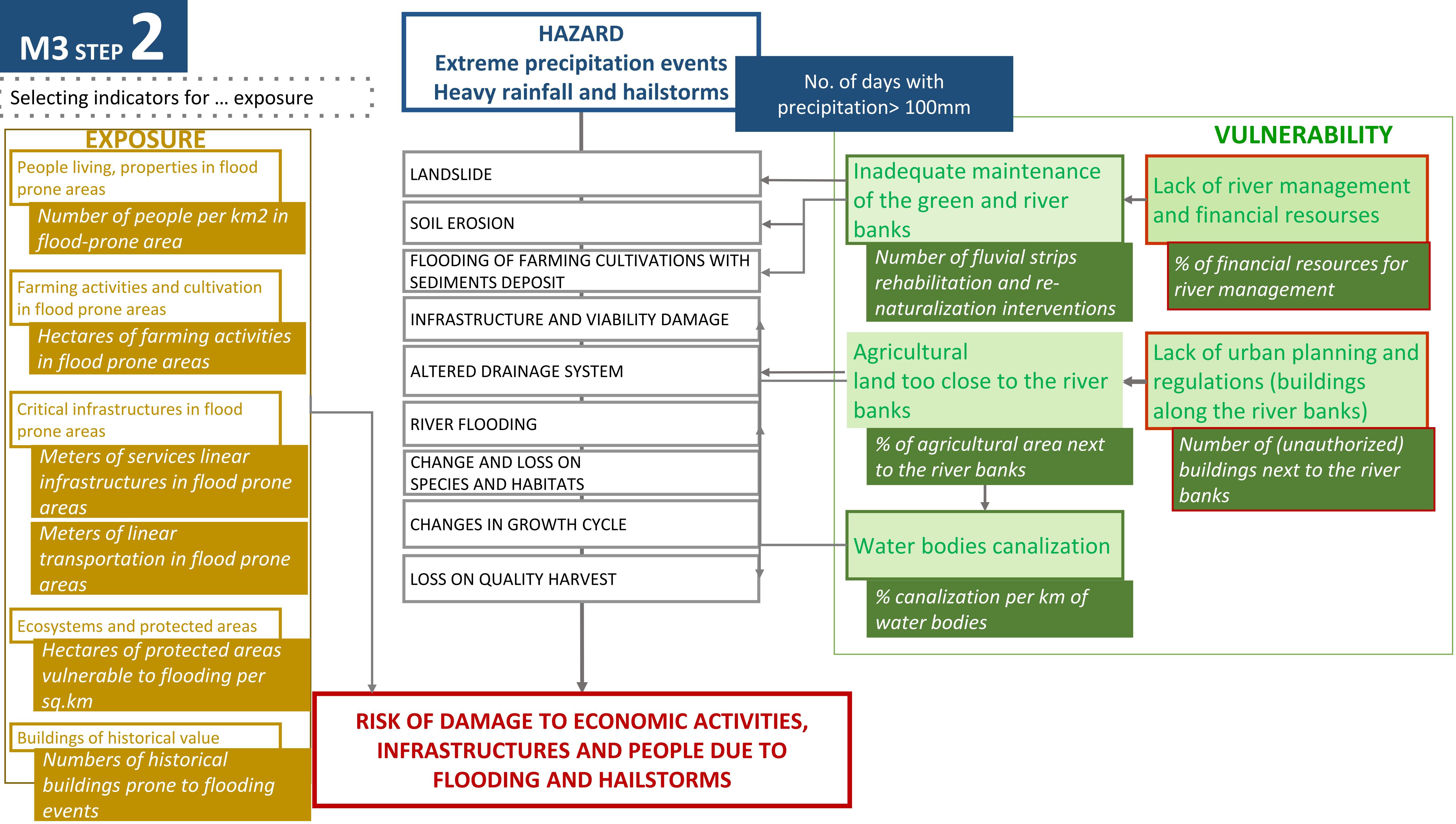
- Inadequate maintenance of the green and river banks
- Lack of river management and financial resourses
- Agricultural land too close to the river banks
- Lack of urban planning and regulations (buildings along the river banks)
- Water bodies canalization

EXPOSURE

- People living, properties in flood prone areas
- Farming activities and cultivation in flood prone areas
- Critical infrastructures in flood prone areas
- Ecosystems and protected areas
- Buildings of hIstorical value

RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS


M3 STEP 2
Selecting indicators for vulnerability…
HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms
No. of days with precipitation> 100mm
EXPOSURE
People living, properties in flood prone areas
Farming activities and cultivation in flood prone areas
Critical infrastructures in flood prone areas
Ecosystems and protected areas
Buildings of historical value
LANDSLIDE
SOIL EROSION
FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT
INFRASTRUCTURE AND VIABILITY DAMAGE
ALTERED DRAINAGE SYSTEM
RIVER FLOODING
CHANGE AND LOSS ON SPECIES AND HABITATS
CHANGES IN GROWTH CYCLE
LOSS ON QUALITY HARVEST
VULNERABILITY
Inadequate maintenance of the green and river banks
Number of fluvial strips rehabilitation and re-naturalization interventions
Lack of river management and financial resourses
% of financial resources for river management
Agricultural land too close to the river banks
% of agricultural area next to the river banks
Lack of urban planning and regulations (buildings along the river banks)
Number of (unauthorized) buildings next to the river banks
Water bodies canalization
% canalization per km of water bodies
RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS


M3 STEP 2
Selecting indicators for … exposure
HAZARD
Extreme precipitation events
Heavy rainfall and hailstorms
No. of days with precipitation> 100mm
EXPOSURE
People living, properties in flood prone areas
Number of people per km2 in flood-prone area
Farming activities and cultivation in flood prone areas
Hectares of farming activities in flood prone areas
Critical infrastructures in flood prone areas
Meters of services linear infrastructures in flood prone areas
Meters of linear transportation in flood prone areas
Ecosystems and protected areas
Hectares of protected areas vulnerable to flooding per sq.km
Buildings of historical value
Numbers of historical buildings prone to flooding events
LANDSLIDE
SOIL EROSION
FLOODING OF FARMING CULTIVATIONS WITH SEDIMENTS DEPOSIT
INFRASTRUCTURE AND VIABILITY DAMAGE
ALTERED DRAINAGE SYSTEM
RIVER FLOODING
CHANGE AND LOSS ON SPECIES AND HABITATS
CHANGES IN GROWTH CYCLE
LOSS ON QUALITY HARVEST
VULNERABILITY
Inadequate maintenance of the green and river banks
Number of fluvial strips rehabilitation and re-naturalization interventions
Lack of river management and financial resourses
% of financial resources for river management
Agricultural land too close to the river banks
% of agricultural area next to the river banks
Lack of urban planning and regulations (buildings along the river banks)
Number of (unauthorized) buildings next to the river banks
Water bodies canalization
% canalization per km of water bodies
RISK OF DAMAGE TO ECONOMIC ACTIVITIES, INFRASTRUCTURES AND PEOPLE DUE TO FLOODING AND HAILSTORMS

Check if your indicator is specific enough

Does it have a clear direction and, if possible, an ‘event character’? What is the exact spatial extent which should be covered by your data? What spatial resolution should your data have? What time period will the data need to cover? How frequently and at what intervals do you plan to repeat the assessment for monitoring purposes?

Create a list of provisional indicators for each factor

Component	Factor	Indicator
Hazard	Extreme precipitation events Heavy rainfall and hailstorms	No. of days with precipitation> 100mm
Exposure	People living, properties in flood prone areas	Number of people per km2 in flood-prone area
	Farming activities and cultivation in flood prone areas	% of agricultural area next to the river banks
	Critical infrastructures in flood prone areas	% canalization per km of water bodies
	Ecosystems and protected areas	% of financial resources for river management
	Buildings of historical value	Number of (unauthorized) buildings next to the river banks
Vulnerability	Inadequate maintenance of the green and river banks	Number of fluvial strips and re-naturalization interventions
	Agricultural land too close to the Tronto river banks	% of agricultural area next to the river banks
	Water bodies canalization	% canalization per km of water bodies
	Lack of river management and financial resourses	% of financial resources for river management
	Lack of urban planning and regulations (buildings along the river banks)	Number of (unauthorized) buildings next to the river banks

M4

M4 Data acquisition and management

M4 Based on the draft list of indicators developed in Module 3, the next steps are gathering the required data (Step 1), checking their quality (Steps 2), and documenting and storing them in a suitable database (Step 3). Steps 1 and 2 could show that data is either not available or has significant quality constraints: in this case the indicator framework should be revised. Module 4 will however result in a final indicator list

M4

Module 3
Proposed indicators list with name, unit of measurement and potential data sources

Module 4

STEP 1
Gather your data assessment

1. **What kind of data do you need?**
2. **Do the data already exist or do they have to be generated?**
3. **What can you commit in terms of time and other resources for generating data?**

STEP 2
Data quality check

1 **Are the data in the format you expected?**
2 **Are all the files legible and ready for further processing?**
3. **Is the temporal and spatial coverage as planned?**
4. **Are there any missing values or 'outliers' in your data?**
5. **Are the data in the right geographical projection?**

STEP 3
Data management

1. **How are data transformed into relevant, readable formats?**
2. **How do you structure and compile your data in a common database?**
3. **How can you document your data with metadata and/or data fact sheets?**

See Annex n.2

OUTCOMES
A final indicator list

A database containing all the data for assessment

A complete indicator factsheets

Data that you planned to use is not available?

Poor data quality ?

M5

M5 Normalisation of indicator data

Module 5 aims at providing normalised data for each indicator in a standardised value range from 0 to 1, ready for aggregation. The term ‘normalisation’ refers to the transformation of indicator values measured on different scales and in different units into unit-less values on a common scale. The Vulnerability Sourcebook uses a standard value range from 0 to 1, where ‘0’ means ‘optimal, no improvement necessary or possible’ and ‘1’ means ‘critical, system no longer functions’.

Step 1 Determine the scale of measurement

In a **metric scale** you have ordered, numerical values where the difference between two values is clearly defined and of the same interval (temperature, pressure, and so on).

An **ordinal scale** indicates that one given value is greater or lesser than another, but the interval between values is undefined or unknown (school marks, education level and so on).

For a **nominal scale** you simply name or categorise your values (names, postal codes, crop types).

Table 10: Level of measurement

Scale of measurement: Generic category	Category	Main characteristic	Example
Metric		Order, equal interval, =/≠ ; <> ; +/-	Temperature
Categorical	Ordinal	Order, interval undefined, =/≠ ; <>	Education level
	Nominal	No order =/≠	Type of crop

Table 9: Examples of indicators, units and scales of measurement

Indicator	Measurement unit	Scale of measurement
Amount of precipitation	mm	metric
Temperature	°C	metric
Soil type	none (descriptive classes)	nominal
Land use land cover	none (descriptive classes)	nominal
Willingness to implement climate adapation measures	ranking in 5 classes (very low, low, medium, high, very high)	ordinal
Access to water	ranking in classes	ordinal
Governance efficiency	ranking in classes	ordinal

Source: adelphi/EURAC 2014.

Step 2 Normalise your indicator values

- Normalisation of metric indicator values

- Normalisation of categorical indicator values

Normalisation of metric indicator values

Indicators measured using a metric scale are normalised by applying the minmax method. This method transforms all values to scores ranging from 0 to 1 by subtracting the minimum score and dividing it by the range of the indicator values.

Formula 1

$$X_{i,\,0\ to\ 1} = \frac{X_i - X_{Min}}{X_{Max} - X_{Min}}$$

where

X_i represents the individual data point to be transformed,

X_{Min} the lowest value for that indicator,

X_{Max} the highest value for that indicator, and

$X_{i,0\ to\ 1}$ the new value you wish to calculate, i.e. the normalised data point within the range of 0 to 1.

Normalisation of metric indicator values

Number	Household income [US$/month]	Normalised value
1	1,150	1.00
2	1,009	0.81
3	949	0.73
4	780	0.51
5	775	0.5
6	620	0.29
7	570	0.23
8	490	0.12
9	410	0.01
10	400	0.00

$$X_{i,\,0\ to\ 1} = \frac{X_i - X_{Min}}{X_{Max} - X_{Min}}$$

Normalise your categorical indicator values

Five-class evaluation scheme

It's necessary to allocate indicator values on the basis of the best knowledge available (be it from existing literature, local experts or any other reliable source).

Class No.	Description
1	optimal (no improvement necessary or possible)
2	rather positive
3	neutral
4	rather negative
5	critical (system no longer functions)

Transformation from five-class scheme into a " 0 to 1 scheme"

Table 16: Transformation of normalised indicator values on a categorical scale to the value range 0 – 1

indicator values — categorical: Class No.	Class value within range of 0 to 1	Description	Indicator value range (0 to 1) metric: Values
1	0 – 0.2	optimal (no improvement necessary or possible)	0.1
2	> 0.2 – 0.4	rather positive	0.3
3	> 0.4 – 0.6	neutral	0.5
4	> 0.6 – 0.8	rather negative	0.7
5	> 0.8 – 1	critical (system no longer functions)	0.9

M6

NOTE: You can use the excel template for aggregating indicators of exposure and vulnerability components

M6 Weighting and aggregating of indicators

This module explains how to weight indicators if some of them are considered to have a greater influence on risk components (hazard, vulnerability and exposure) than others, and how to aggregate individual indicators of the three risk components to combine the information from different indicators into a composite indicator representing a single component.

Step 1 Weighting indicators

Weighting indicators helps you describe the risk components *hazard, vulnerability* and *exposure*. The different weights assigned to indicators can be derived from existing literature, stakeholder information or expert opinion. There are different procedures for assigning weights: from sophisticated statistical procedures (such as principal component analysis) to participatory methods.

Step 2 Aggregation of indicators

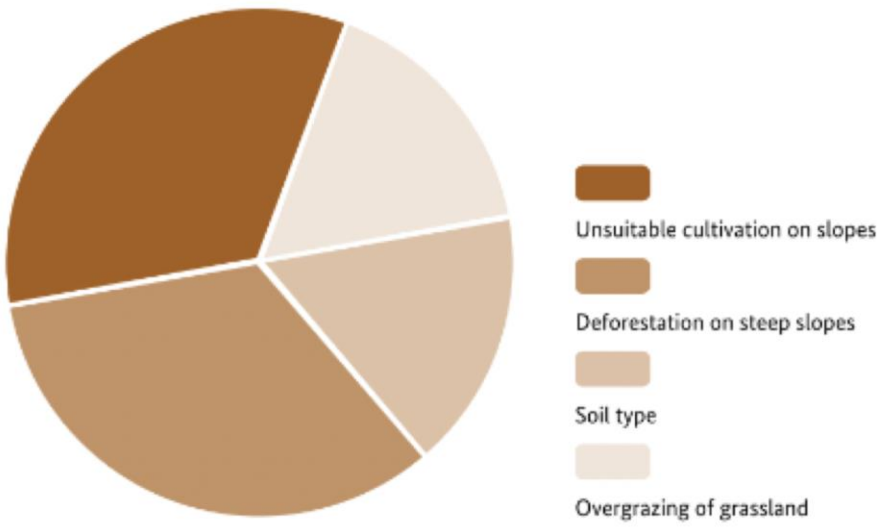
Aggregation allows you to combine the normalised indicators into a composite indicator representing a single risk component.

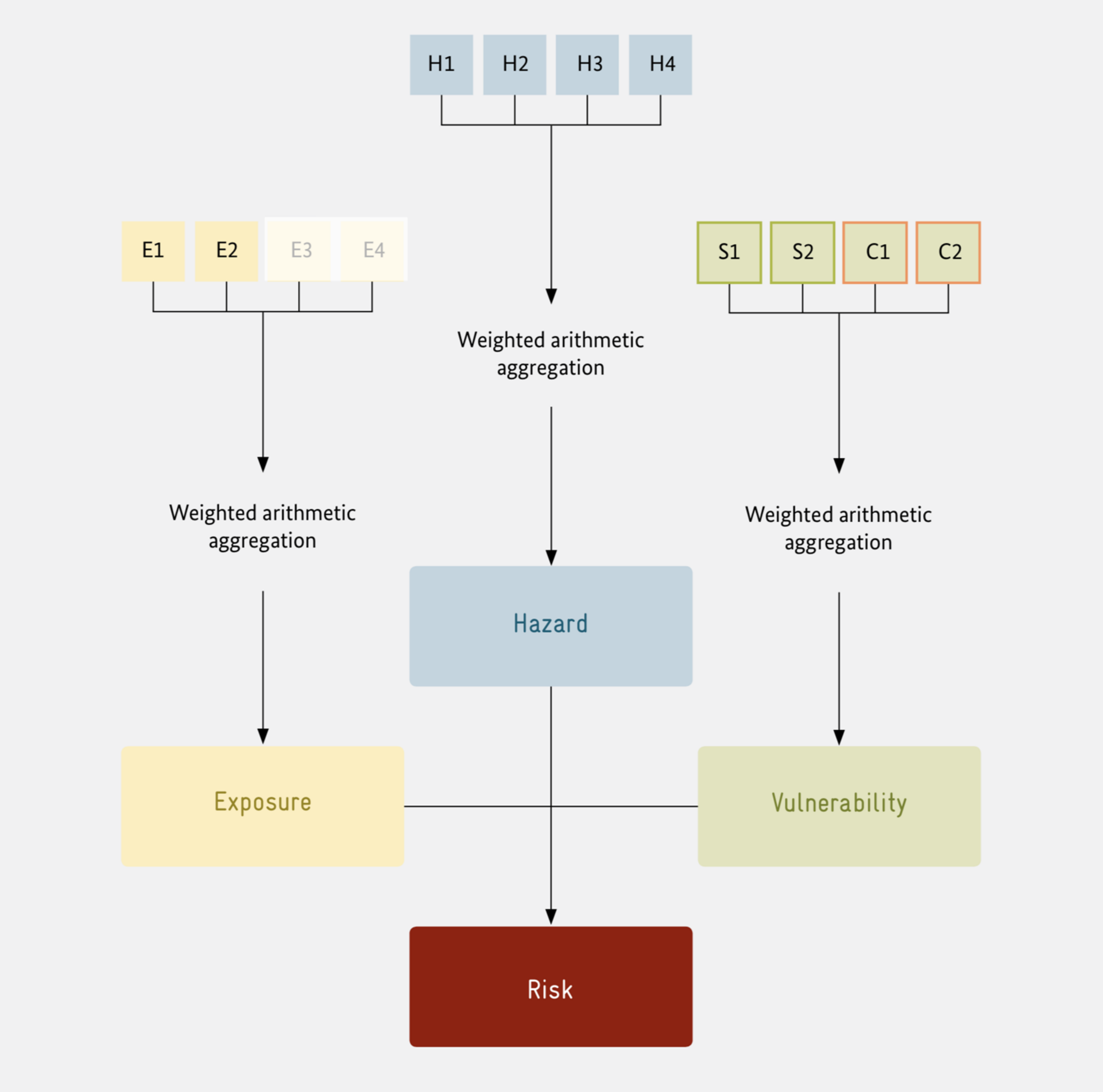
See Annex N.3

Step 2 Aggregation of indicators

If certain factors are more important than others, different weights should be assigned to them and corresponding indicators. This means that indicators that receive a greater (or lesser) weight thus have a greater (or lesser) influence on the respective vulnerability component and on overall vulnerability.

Figure 28: Different weighting applied to four factors describing sensitivity to erosion





Aggregating single factors to risk components (in practice the number of indicators may derivate from the count of indicators shown in this conceptual visualisation) *Source: Giz- Eurac 2018,*

Step 2 Aggregation of indicators

For aggregating individual indicators into composite indicators, the Vulnerability Sourcebook recommends a method called 'weighted arithmetic aggregation'.

CI is the composite indicator

I is an individual indicator

w is the weight assigned to the indicator

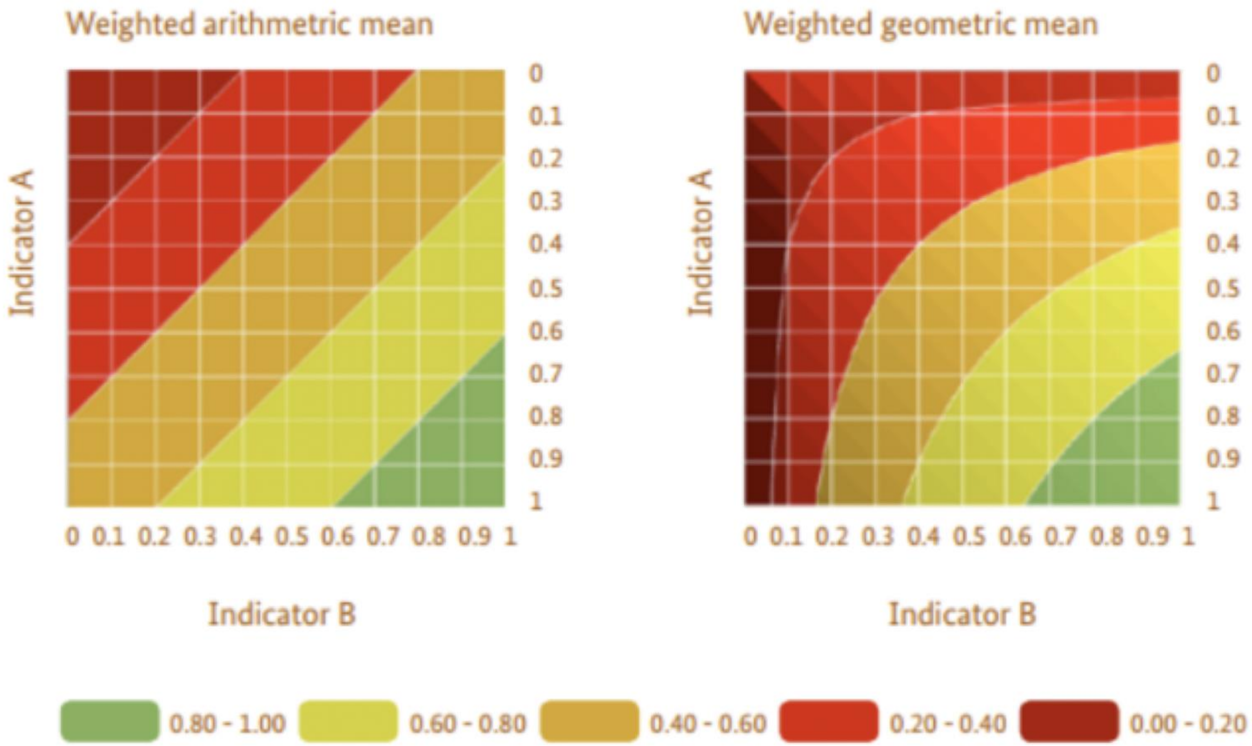
$$CI = \frac{(I_1 * w_1 + I_2 * w_2 + \dots I_n * w_n)}{\sum_1^n w}$$

NOTE: *It is important to consider especially extreme negative values for single indicators or vulnerability components throughout a vulnerability assessment. They indicate aspects of the system under review that are especially problematic, and that are to be taken into account when planning adaptation measures. This, again, highlights the importance of considering not just aggregated values but individual indicators as well*

NOTE: *See example: Giz- Eurac 2018, Climate Risk Assessment for Ecosystem-based Adaptation, a guidebook for planners and practitioners (page 61-62)*

Step 2 Aggregation of indicators

Another method for aggregating individual indicators into composite indicators is ‘weighted geometric aggregation’. Weighted geometric aggregation involves a multiplication of individual indicators to arrive at a composite indicator. In contrast to arithmetic aggregation, it only allows partial compensability (OECD 2008)



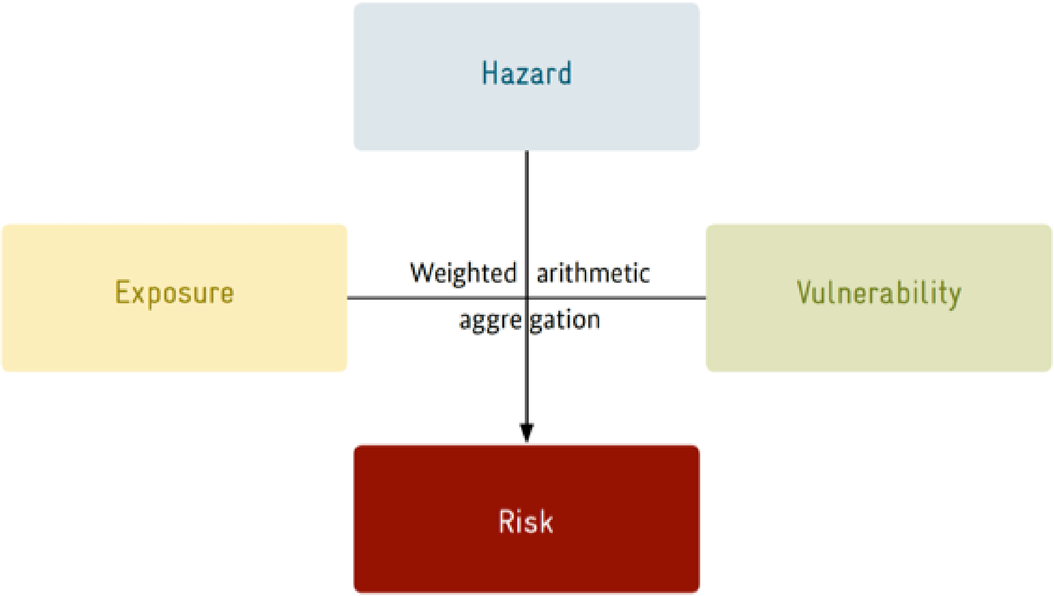
M7

M7 Aggregating risk components to risk

This module shows how to aggregate the risk components hazard, vulnerability and exposure into a composite risk indicator through a one-step approach - consistent with the IPCC AR5 risk concept – that uses the weighted arithmetic mean to combine the three components.

One step approach

$$Risk = \frac{(Hazard * w_H) + (Vulnerability * w_V) + (Exposure * w_E)}{w_H + w_V + w_E}$$



NOTE: there is an alternative approach for aggregation based on the combination of risk factors with the help of an evaluation matrix. For more detail see *GIZ-2017 Risk Supplement to the vulnerability sourcebook*

Source: GIZ-2017 Risk Supplement to the vulneability sourcebook

Risk Classes

Metric risk class value within range of 0 to 1	Risk class value within the range of 1 to 5	Description
0 – 0.2	1	very low
› 0.2 – 0.4	2	low
› 0.4 – 0.6	3	intermediate
› 0.6 – 0.8	4	high
› 0.8 – 1	5	very high

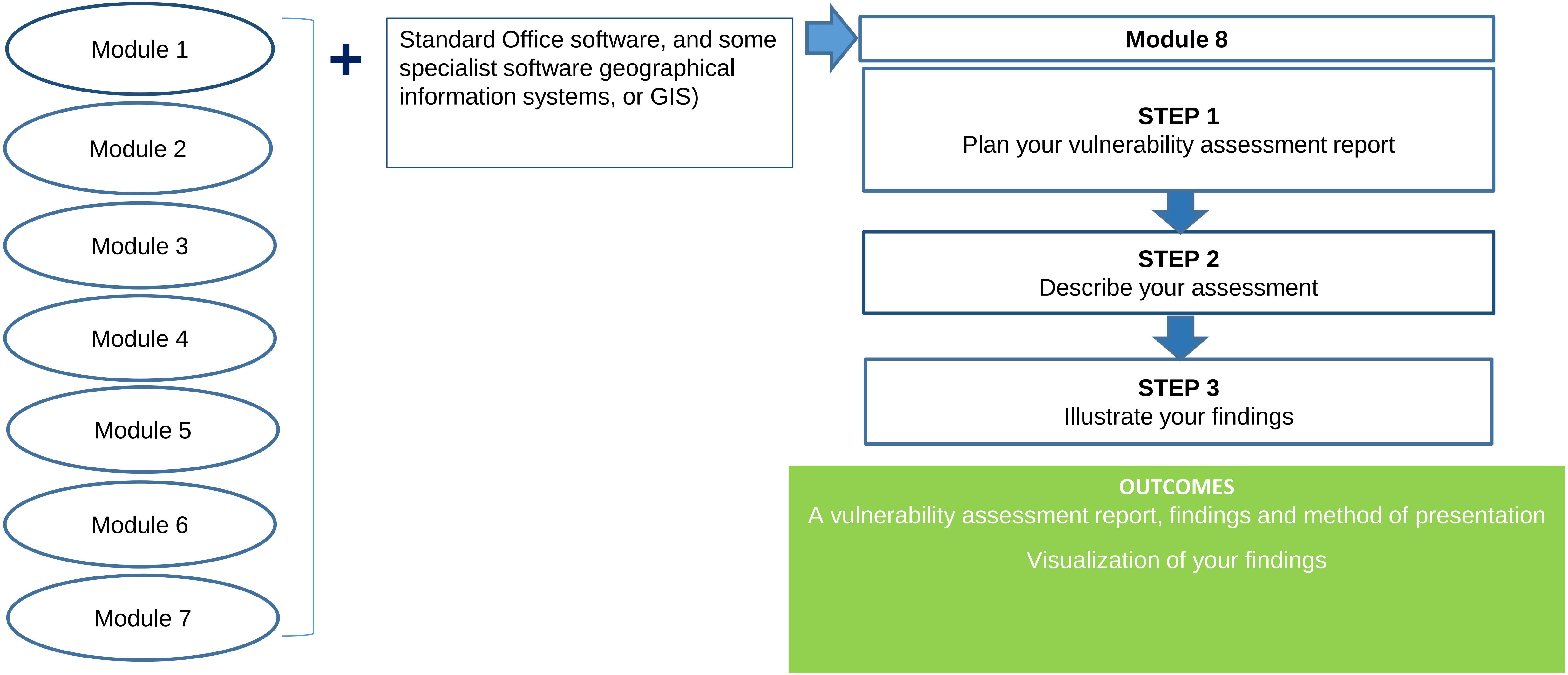
Source: GIZ-2017 Risk Supplement to the vulneability sourcebook

M8

M8 Presenting the outcomes of your risk assessment

This module will show you how best to **SUMMARISE** and **PRESENT THE FINDINGS** of assessment.

M8


Module 1
Module 2
Module 3
Module 4
Module 5
Module 6
Module 7
+
Standard Office software, and some specialist software geographical information systems, or GIS)
Module 8
STEP 1
Plan your vulnerability assessment report
STEP 2
Describe your assessment
STEP 3
Illustrate your findings
OUTCOMES
A vulnerability assessment report, findings and method of presentation
Visualization of your findings

Source:
1) Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
with supporting documents:
2)The Vulnerability Sourcebook Annex

PP….. Name ………………………. Area TARGET……………………..	
Title of the VA	(Tentative) Title of your vulnerability assessment
Context (Module 1; Step 1)	
Context	**Describe the general context of your VA (Module 1; Step 1) in terms of:**
	What are related processes?
	What knowledge is already available?
	Which institutions play a role?
	What resources are available?
	Which external developments are important?
Objectives and expected outcomes (Module 1; Step 2)	
Objectives	**Describe the general objective of your VA (Module 1; Step 2):**
	What process will the assessment support or feed into? Are there on-going activities in the field of adaptation that should be taken into account?
	What do you want to learn from the assessment?
	What do you want to use this knowledge for?
	Who is the target audience for the result of the assessment?
Expected outcomes	**Describe the expected outcomes of your VA (Module 1; Step 2):**
	What outcomes do you expect?
Scope of the Vulnerability Assessment (Module 1; Step 3)	
	Describe the specific topic of your vulnerability assessment:
Thematic scope	What exactly is your vulnerability assessment about?
Already identified impacts / vulnerabilities	**Possibly refer to potential climate impacts that shall be addressed in the vulnerability assessment:**
	What climate-related risks do you want to asses? What climate related risks and impacts occurred in the past? Which known risks and impacts may be relevant for the future?
	What major non climatic drivers influence current and future climate related risks?
Geographical scope	**Describe the spatial (geographical) scope of your vulnerability assessment:**
	What is the geographical scope of your assessment?
Temporal scope	**Describe the time period of your vulnerability assessment:**
	What is the time period addressed in the assessment? (current and future climate related risks)

Methodological approach	**Outline the methods foreseen for the vulnerability assessment:**
	What are the right methods for your VA?

1) Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
with supporting documents:

PP….. Name ……………………… Area TARGET……………………						
Existing knowledge (Module 1; Step 1)						
	Name	Date of publication	Scope / Sector of study	Key information / Impacts	Knowledge gaps	Remarks
Existing policies/plans						
National/Supra-regional						
P1	Policies/plans 1					
P2	Policies/plans 2					
P*n.*	*Insert progressive number*					
...	...					
Regional						
P*n.*	Policies/plans *n.*					
P*n.*	Policies/plans *n.*					
...	...					
Local						
P*n.*	Policies/plans 1					
P*n.*	Policies/plans 2					
...	...					
Existing fundings						
European						
F1	Funding 1					
F2	Funding 2					
F*n.*	*Insert progressive number*					
National						
F*n.*	Funding *n.*					
F*n.*	Funding *n.*					
...	...					
Regional						
F*n.*	Funding *n.*					
F*n.*	Funding *n.*					
...	...					
Local						
F*n.*	Funding *n.*					
F*n.*	Funding *n.*					
...	...					
Existing project						
European						
PR1	Project 1					
PR2	Project 2					
PR*n.*	*Insert progressive number*					

National						
PR*n.*	Project *n.*					
PR*n.*	Project *n.*					
...	...					
Regional						
PR*n.*	Project 1					
PR*n.*	Project 2					
...	...					
Local						
PR*n.*	Project 1					
PR*n.*	Project 2					
...	...					
Existing studies and report						
European						
SR1	Study and/or report 1					
SR2	Study and/or report 2					
SR*n.*	*Insert progressive number*					
...	...					
National						
SR*n.*	Study and/or report 1					
SR*n.*	Study and/or report 2					
...	…					
Regional						
SR*n.*	Study and/or report 1					
SR*n.*	Study and/or report 2					
...	…					
Local						
SR*n.*	Study and/or report 1					
SR*n.*	Study and/or report 2					
...	…					

Source:
1) Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
with supporting documents:
2)The Vulnerability Sourcebook Annex

PP….. Name ……………………… Area TARGET……………………

Identification of impacts from sources that address climate change (M1_1)

Climate related Impacts	P*n.*	...	F*n.*	...	PR*n.*	...	SR*n.*	...
Impacts on ecosystems (water, soil, air quality, biodiversity, ...)								
ex. Loss of biodiversity	X				X		X	
...								
...								
Impacts on ecosystems services (provision of food and water)								
...								
...								
...								
Impacts on natural resources (agriculture, fishery, forestry)								
ex. Decrease in crop yields	X		X				X	
...								
...								
...								
Impacts on natural processing (industry and services)								
ex .Energy supply problems			X		X		X	
...								
...								
Impacts on the social and cultural sphere (individual, societal groups)								
ex. Impact on human health	X		X				X	
...								
...								

Please note that the compilation of the table is indicative, for sample purposes only

Source: 1)
Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/ with supporting documents:
2)The Vulnerability Sourcebook Annex

PP….. Name ……………………… Area TARGET……………………						
Conditions and resources for implementation (Module 1; Step 4)						
		Financial	**Human**	**Technical**	**Available time**	
Own resources available		**number**	**number**	**specify equipment**	**specify available time**	
		…	…	…	…	
		Tasks	**Functions**	**Resources**	**Available time**	**Potential conflicts of interest**
Human	***Partner (name)***					
	Internal 1 (name)					
	Internal 2 (name)					
	Internal *n.* (name)					
	...					
	Expert 1 (name)					
	Expert 2 (name)					
	Expert *n.* (name)					
	…					
	Participants Area Target n.					
	Name 1					
	Name 2					
	Name *n.*					
	...					
	Participants Area Target n.					
	Name 1					
	Name 2					
	Name *n.*					
	...					
		Needs / interests in VA	**Functions**	**Resources**	**Available time**	**Potential conflicts of interest**
Stakeholder	***Stakeholder (name)***					
	Stakeholder 1.					
	Stakeholder 2					
	Stakeholder n.					
	...					

Source:
1) Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
with supporting documents:
2)The Vulnerability Sourcebook Annex

PP….. Name ………………………. Area TARGET……………………..	
Indicator and data factsheet	
Number of factsheet	IMP_1 (……)
INDICATOR	
Indicator:	**Name of the indicator**
Vulnerability component:	**Which vulnerability component is described by the indicatori?** (e.g. Impact)
Description: (position in the impact chain)	**Futher description of the indicator**
DATA	
Source of data:	**Who provides data?**
Availability or/and costs:	**What are the conditions to obtain the data?**
Type of data:	**In which format are the dataavailable?** (e.g. geo- data, shape file)
Spatial level:	**Coverage and scale of the data** (e.g. local coverage)
Statistical scale:	**Which statistical scale do the data have?** (e.g. Metric)
Unit of measurement:	**In which unit are the data provided?**
Method of calculation:	**Which method has been applied for calculation?**
Input-indicators needed:	**Are sub-inidcators needed? Which?**
Time reference and frequency of measurement:	**For which year(s) are data avaliable?**
Expected trend without adaptation:	**Trend of the indicator value without adaptation** (e.g. Decrease)
Classes and thresholds:	**Which classes or thresholds are proposed or determined? Is this a common use classification?** (e.g. proposed thresholds. More than 100mm, 100 to 0mmm; 0 to -100mm; less than - 100mm)
Rating:	**Which sale or classes should be used for the assessment?** (e.g. Scale from 0 to 1 (using 200 mm precipitation as zero-point)
Additional comments	

Source: 1)
Fritzsche, Kerstin; Stefan Schneiderbauer, Philip Bubeck, Stefan Kienberger, Mareike Buth, Marc Zebisch and Walter Kahlenborn 2014: The Vulnerability Sourcebook: Concept and guidelines for standardised vulnerability assessments. Bonn and Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
with supporting documents: Risk supplement to the Vulnerability Sourcebook and the guidebook Climate Risk Assessment for Ecosystem-bases adaptation www.adaptationcommunity.net › wp-content › uploads › 2018/06 ›

PP….. Name ……………………… Area TARGET……………………. Sub Area Target

Impact chain ….

		Description of factor	Indicator	Assessment scale: Lowest value	Assessment scale: Highest value	Observed value	Normalised value	Weighting factor for each indicator	Composite Indicator
Hazard									
	Example	*Too much precipitation in wet season*	*Number of days with precipitation Max or = 120 mm*	*2*	*10*	*3*	0,125	*1*	0,125
	1						*0*		
	2						*0*		
	3						*0*		
	4						*0*		0
	5						*0*		
	6						*0*		
	7						*0*		
	8						*0*		
Exposure									
	Example	*People living in flood-prone areas*	*Number of people per Kmq in flood-prone areas*	*0*	*3000*	*210*	0,07	*1*	0,07
	1						0		
	2						0		
	3						0		
	4						0		0
	5						0		
	6						0		
	7						0		
	8						0		
Vulnerability									
	Example	*Lack of urban planning*	*% of households depending on agricolture for income*	*25*	*75*	*60*	0,7	*1*	0,7
	1						0		
	2						0		
	3						0		
	4						0		0
	5						0		
	6						0		
	7						0		
	8						0		

M6.2 AGGREGATION OF INDICATORS

M7. RISK SCORE

Area target or sub Area target -RISK SCORE

	Composit indicator (TOTAL)	Weighting factors	RISK
Hazard			
Example	*0,125*	*1*	
Exposure			
Example	*0,07*	*1*	
Vulnerability			
Example	*0,7*	*1*	**0,298333**

7.4 Joint_SECAP Support System Platform

Technical procedural guideline for the creation of a geo-referenced web platform for the cataloguing of SECAPs and of Action Plans

1.Introduction the European Joint_SECAP project

2.General technical characteristics of the platform:

a. The platform is built with European funds and therefore is to be considered as property of the European Community and UNICAM, through the project, is the manager of the platform on behalf of the consortium partners;

b. The URL to be acquired will be *www.Joint_SECAP.eu* or similar, to be agreed;

3.General technical characteristics of the service. The service must include:

a. The development of a Content Management System for the management of alphanumeric contents which will allow to:

Compile, export and print Action Plan sheets in the shared format at project level;

i.ii. Monitor the implementation and the results of individual actions and of the plan;

ii.Export and share documents and data in different electronic formats (proprietary and open: docx, xlsx, pdf, csv, etc.).

b. A user profiling system;

c. The development of a GIS / WebGIS for the management, visualization and querying of data on a geographical basis;

d. The supply of a user manual in English;

e. Maintenance of the platform for the duration of the project

4.Technologies and methodologies

c. The platform must be in an open-source mode

d. The sizing and purchase of hardware resources dedicated to hosting the platform must be provided The platform’s contents

The platform must be structured in the following sections:
SECTION 1 - PRESENTATION Joint_SECAP: Presentation of the project and of the activities (text provided by partners), description and purpose of the platform

SECTION 2 - RESULTS: presentation of the project's results and link to the project's website deliverables. The deliverables will be the following:

• Best practice

• Context Analysis (pdf images)

• Climate scenarios

• Impact chains

• Intervention scenarios

• Coherence analysis

• Action plan or joint actions

SECTION 3 - WEBGIS: the webgis must represent:

• The risk level of each intervention area (shape files provided by partners)

• Vulnerability maps (shape files provided by partners)

• Geolocation of SECAP files / interventions (only for cards in section 5 that have geographical references)

SECTION 4 - SECAP STRATEGY The following information will be included:

• Institution: is the public body (Municipality or Associative Form) that owns the Strategy Plan.

• Plan Type: the 'Single municipality' data is displayed when the plan belongs to a single municipality, 'Joint' in the other cases.

● Insertion Status: indicates whether the strategy is provisional (Draft) or confirmed (Confirmed);

● Province / Region: is the province to which the plan owner belongs

● Institution type: indicates whether the entity in charge of the plan is 'Municipality' or an 'Association Form'

● Associated Municipalities: in the case of Joint SECAPs, the Municipalities belonging to the Association Form are displayed.

● Title: it is the descriptive title of the plan.

● Reference Year: is the reference year of the plan.

● Reduction target type: it is possible to choose between two items 'Absolute reduction' and 'Pro capita reduction'.

- CO2eq emissions
- CO2eq emissions Absolute Reference Year [t]: indication of emissions in the reference year in absolute value.
- Absolute CO2eq% reduction target: CO2eq reduction target compared to the reference year.
- Membership Date: date of joining the Covenant of Mayors initiative.
- Approved SECAP: indication of whether the SECAP has been approved or not.
- CO2eq pro capita Emissions Per Year [t]: indication of pro capita emissions in the reference year (value required only if a pro capita reduction target has been chosen).
- CO2eq pro capita % reduction target: pro capita CO2 reduction target compared to the reference year (value required only if a pro capita reduction target has been chosen).
- Approval Date: date of the approval resolution of the SECAP if the user has checked the "approved SECAP" box.

SECTION 5 - ACTION CARD: this function allows partners to create, view and edit a new action card for the institution. All of the action sheets of a given institution refer to the one Plan Strategy that can be created for the institution itself. The following information will be included:

- Plan: this is the title of the action plan to which the sheet refers.
- Institution: it is the local body (Municipality or Association Form) that holds the card.
- SECAP type: the 'Single municipality' data is displayed when the plan belongs to a single municipality, 'Joint' otherwise.
- Province / Region: this is the province to which the plan owner belongs
- Type of Institution: indicates whether the entity in charge of the plan is 'Municipality' or an 'Association Form'
- Title: it is the descriptive title of the action sheet.
- Sheet Type: indicates whether the sheet is 'Quantifiable' or not in terms of CO2eq reductions and / or Renewable energy production and / or Energy savings.
- Type of intervention: indicates whether the intervention is mitigation, adaptation or both
- Sector / Field of Action / Type of Action: this allows to indicate the references to the list of the measures and actions of adaptation and mitigation defined by the project partners, or to define other actions that are not included in the standard list of actions (drop-down list). If the 'Other Action Type' is chosen, the 'Other Action Type' field writing is enabled.

- Other Action Type: allows you to indicate a type of action not present in the list of types. Insertion is enabled only when the 'Other' Action Type is chosen.

- Description: is a descriptive field of the action, this allows to provide a brief description of the action, with particular reference to the assumptions that led to its inclusion in the Plan, to the general objectives and to the overall relevance within the Plan.

- Service, Person or Company in charge: allows to first indicate the person responsible for implementing the action

- Start Date of Implementation (month / year): indication of the start of implementation (realization) of the action in the month / year format.

- End of implementation date (month / year): indication of the end of implementation (implementation) of the action in the month / year format.

- Estimated cost: estimate of the financial resources necessary for the implementation of the action.

- Local Authority Resources (%): percentage share of the financial resources allocated by the institution.

- Regional Funds and Programs (%): percentage share of financial resources from regional funds and programs.

- National Funds and Programs (%): percentage share of financial resources from national funds and programs.

- EU Funds and Programs (%): percentage share of financial resources from the European Union.

- Private Funds (%): percentage share of financial resources from private individuals.

- TOTAL FUNDS (%): sum of the percentage shares indicated above.

- Methodology: allows partners to indicate the calculation methodology used for the quantification of the results of the action in terms of saved CO2 and / or energy saving, and / or renewable energy production, and / or risk reduction with reference to the standard list methodologies shared at project level.

- Other Calculation Methodology: allows partners to indicate a calculation methodology not present in the list of methodologies. Insertion is enabled only when the 'Other Methodology' method is chosen.

- Risk reduction: allows you to indicate the percentage risk reduction.

- Expected energy savings [MWh / a]: allows users to indicate the energy savings that may be expected with the action in MWh / a.

- Expected renewable energy production [MWh / a]: allows you to indicate the production of renewable energy that may be expected with the action in MWh / a.

● Expected CO2eq Emission Reduction [t / a]: allows you to indicate the expected CO2eq reduction with the action in t / a.

● Monitoring indicators: it is possible to indicate one or more indicators of implementation and / or result that will be used for monitoring the action.

SECTION 6 - PLANNING AND MONITORING TOOLS: section dedicated to support tools for planning and assessing impacts:

• Access to tools selected by partners

• Links to projects and tools for energy and climate planning.

7.5 Guidance Notes for the Construction of Scenarios, Participative Processes and The Preliminary Scoping Report

7.5.1 Methodology for the definition of alternative scenarios of intervention

What is a scenario and what is it used for?

*"…a description of a **possible set of events** that might reasonably take place. The main purpose of developing scenarios is to stimulate thinking about possible occurrences, assumptions relating these occurrences, possible opportunities and risks, and **courses of action**"*

What does a scenario analysis consist of?

Scenario analysis provides the means by which decision-makers can anticipate change and prepare particularly when studies involve stakeholders as active participants with agency, not merely passive recipients of information. Stakeholders typically include people such as government officials, private business owners and local resource users, and the outcomes of these processes depend heavily on the contributions by participants.

The Joint SECAP scenario planning

It has the aim to explore what will happen in the future (on a defined timescale: 2030) starting from a series of factors that are identifiable in the present (vulnerabilities and risks that have been characterized for each of the target areas), by encouraging a reflection between an option "0" (or Scenario 0) that describes the target's area evolution if no intervention on vulnerabilities and risks is undertaken, which means the confirmation the current environmental protection policies and an alternative option, namely "Optimal scenario" option.

Already in this phase, and for the purpose of sharing the optimal scenario it will be necessary to:

1) Select a Joint Action Coordinator for each target area that will coordinate the activities at the district level, sharing procedures and objectives within the partnership. This is a new and relevant figure that will be tested during the project in order to coordinate climate and energy measures at a wider territorial level, necessary for climate adaptation plans. At the very beginning, the relevant stakeholders, local and regional authorities will be involved in order to understand common objectives and priorities. Participation activity will be organized in each target area to provide support for engagement and to plan effective solutions for climate change adaptation in a responsive and timely manner. It routinely targets issues that are sensitive to stakeholder's interests and can improve policy-making.

2) Combine the Scenario construction with the SEA /Strategic Environmental Assessment_SEA.

Act. 4.2 -Preliminary Strategic Environmental Assessment:

In relation to the optimal scenario, the implementation of an external and internal consistency analysis was chosen.

D.4.2.1 Guidelines for the application of the SEA to Joint SECAP: the guideline report is a methodological document, exploitable in every EU area, independently from the project. It will support local institutions to face easily the Joint SECAP process;

D.4.2.2 Preliminary Scoping report for the 8 project district areas: the Scoping report is a site-specific document, applied to each project area, and able to carry on a successful SEA process.

Construction of Plan Scenarios Integrated with the Strategic Assessment (SEA)

PHASE OF THE "JOINT_SECAP" ACTION PLAN CONSTRUCTION PROCESS	**Planning Process**	**Evaluation Process**
➢ **Orientation and Setting**	**1. Risks and vulnerabilities Raisonné summary**	
➢ **Elaboration and editing**	**2.a Determination of general objectives of the Plan by the Administration** ***List*** **2.b Construction of the scenario "0"** ***(see Table 1) and annex***	**Scoping D.4.2.2** **External Coherence Analysis** ***Report/ sheet***
	2.c Construction of the Plan alternatives through the participatory process ***(see Participation modes sheets-Annex A)*** **2.d Alternatives evaluation and construction of the "optimal scenario"** ***(see table 2)*** **2.e Specific objectives and action lines of the scenario** ***List***	**Internal Coherence Analysis** ***Report/ Sheet*** ***Selection of indicators (among the ones identified for the risks and vulnerabilities)***
➢ **Approval and dissemination**	**3. Plan approval and awareness raising among the population and the stakeholders**	

1. Risks and vulnerabilities summary raisonné

- **Output**: Summary planned as conclusion step of the Risk and Vulnerability Methodology

2.a Determination of the Plan's general objectives by the Administration

- The objectives are the declaration of what the P/P intends to achieve through all its forecasts.

Output: List

2.b Construction of the scenario "0"
describes the evolution of the target area if no action is taken regarding vulnerabilities and risks, confirming the current environmental protection policies, but taking into consideration the climatic scenarios by 2030 (See Annex All.A)

- **Output: Report of a few pages**
  Application Table 1)

Table 1: Climate Risks presenting a threat to Target area……. As identified in the Risk and Vulnerability assessment for target area to 2030; an estimation of their development and reliability of estimation

Risk	Risk Level	Expected change in intensity	Expected change in frequency	Reliability of estimation
Denomination (Rif. M2)	!;!!;!!!;	+; -; =; ?	+; -; =; ?	*; **;***

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
***: Low; ** Moderate; *** High**

Evaluation Process: External Coherence Analysis

The external coherence analysis verifies the general objectives of the Plan comparing them with the objectives of the higher-level plans identified in the context analysis

- **Output**: **Report of a few pages / External Coherence Table: Plan Objectives / Higher Level Objectives / consistency / inconsistency / indifference**

2.c Development of the plan's alternatives with a participative process

It expects the definition of "reasonable Plan alternatives" through the activation of a participatory process with stakeholders (local and regional authorities). Plan alternatives will be built through a participatory process. The annex b) identifies three different methods of participation to choose from.

- **Output: Report of a few pages/ Scheme**

2.d Alternatives evaluation and construction of the "optimal scenario"

The comparison and the evaluation within the participatory process will lead to the identification of an "optimal scenario" which aims to achieve the best possible environmental benefits of the Action Plan. The path taken through the participation activity and the optimal / shared scenario selected through this path will be described with the support of Tab. 2.

Tab.2 Elaboration, evaluation and sharing of scenarios

Brief description of the definition process, evaluation and sharing of scenarios	
Description of the participatory method used	
List of key actors involved and role of each one of them(local and regional authorities)	
List of stakeholders	
Brief description of the "optimal shared scenario"	Aims:

2.e Specific objectives and action lines of the optimal scenario

2.e.1 The specific defined objectives must be concrete, measurable and evaluable. They must correspond to the means and to the actions that are activated by the Plan.

Example of a specific objective: the general objective: "Improve air quality" can be expressed by the specific objective "Reduction of the concentration in the air of a certain percentage of a specific substance, in a specific area and within a given time interval".

- **Output:** List

2.e.2 The Action Lines is a set of measures that characterize the optimal scenario, compared to other alternatives and to the scenario "0".

- **Output:** List

Evaluation process: internal Coherence Analysis

The internal coherence analysis allows to verify the existence of contradictions within the "optimal scenario". It examines the correspondence between the knowledge base, objectives, plan actions and indicators.

- **Output**: **Report of a few pages/ internal coherence table: Objectives of the Plan / actions / indicators; consistency; inconsistency; indifference; Indicators Table**

3. Plan approval and awareness raising of population and stakeholders

Structure of Scenario Report for Each Target Area

Content

Executive Summary

Briefly summarize main results, in a website-friendly form, to be used for dissemination purposes.

Introduction

Description of the task and the process of the development of the final scenario.

Climate scenarios

Scenario 0

Each partner should fulfil table with an estimation of their development and reliability of estimation of risks for target area to 2030 – this is in accordance with the project's Methodology for the definition of alternative scenarios of intervention. Furthermore, highlight the difficulties you had in applying the methodology (e.g. the lack of data, difficulties in relations with the entities that develop the strategies and manage the resources...).

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Example: Risk of drought in agriculture	**!;!!;!!!;**	**+; -; =; ?**	**+; -; =; ?**	***; **;*****

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
*: Low; ** Moderate; *** High

Final scenario

Each Partner should first describe and explain criteria used to develop the final scenario. Afterwards describe the final scenario and accompanying measures per sector and hazard. The textual part should entail the following example table:

SECTOR	HAZARD	MEASURES
Agriculture (3)	Drought	Education of farmers with regards to financial support and entrepreneurial skills
		Selection of locations for irrigation accumulations
		Building irrigation accumulation
…	…	…

Each partner should furthermore comment how participation and consultation influenced the final scenario and which are the actors who have contributed the most.

Comparison of final scenarios

Comparison of final scenarios considering different focus aspects. Analysis if there are any joint measures in the Adriatic and which are the most common measures which all regions introduced in the development of the final scenario.

7.5.2 Participatory Methods

Introduction

A participatory approach advocates actively involving ‘the public’ in decision-making processes, whereby the relevant ‘public’ depends upon the topic being addressed. The public can be average citizens, the stakeholders of a particular project or policy, experts and even members of government and private industry. In general, policy processes can be seen as a three-step cycle of planning, implementation and evaluation, whereby a participatory approach may be used in some or all of these steps.

Distinctions have been made between levels of participation, depending upon whether one’s objective is:

-transmitting information (unidirectional);

-consultation (bi-directional, but the consulted party frames the issue);

-active participation: based on a partnership in which citizens, stakeholders, experts and/or politicians actively engage in (policy) debate. All parties involved can frame the issue to a greater or lesser extent.

General guidelines and tips for participatory methods

The two primary considerations when planning a participatory event are context and structure. The organizers, in consultation with the advisory/steering committee, often answer the context questions.

Context encompasses:

the purpose and topic of the project

the geographic scope and focus

the legislative and jurisdictional (e.g. relevant connections to policy-making bodies) contexts

the time frame and process for decisions

funding sources and

the cultural, political and institutional considerations that influence all of the above.

Structural considerations include:

identification and recruitment of the participants

preparation of any introductory material

promotion

the event

evaluation

final report printing and dissemination

The general steps

The general steps in developing and implementing public participatory methods constitute the following:

Recruit a project team.

Define the purpose and goals of the strategy.

Determine the scope and focus of a public involvement process.

Understand the legislative, legal, jurisdictional and social context for the issue and any decision(s) to be made.

Determine who should be involved and why.

Understand the time frame and process for decisions.

Design the plan (choosing one or multiple methods).

Assemble the funding.

Set adequate timelines and other resources required to make the process work.

Recruit participants.

Promote the event.

Implement the plan.

Evaluate the process and results.

Produce and disseminate final report.

Participatory approach for the Joint_SECAP Project

In an effort to enhance participation in all project phases, from planning to evaluation, many different techniques have been devised and adapted. Some techniques aid analysis of the issues at hand, while others focus on facilitation and coordination of the group process itself. Many of these techniques, alone or in combination, can be useful in any participatory processes. For the scenario development of the Joint_SECAP project the following Participatory methods are taken into account and can be used by the Partners, accordingly to their preferences and, or passed experiences:

A. European Awareness Scenario Workshop
B. Experts Panel
C. Focus Group

Comparative chart for participatory methods

METHOD	OBJECTIVES	PARTICIPANT
European Awareness Scenario Workshop	Raise awareness, identify and discuss differences and similarities of problems and solutions	Experts, residents, Policy makers, business community
Expert Panel	Synthesise a variety of inputs on a specialised topic and produce recommendations.	Experts
Focus Group	Expose different groups' opinions on an issue and why these are held (reasoning).	6-12 Stakeholders and/or citizens

References

Slocun M., (2003), Participatory Methods Toolkit: a Practitioner's Manual. Author, Editor, Stef Steyaert. Publisher, King Baudouin Foundation: www.kbs-frb.be

A_ EASW European Awareness Scenario Workshop

A.1_Definition

The European Awareness Scenario Workshop Method allows the direct participation of social groups from civil society. The setting of a EASW Workshop offers the participants a direct opportunity for exchanging and discussing their points of view, doubts, suggestions and wishes regarding a particular topic or problem with experts and decision-makers. Furthermore, it is a tool for promoting dialogue, furthering involvement and for managing a constructive discussion between various actor groups.

The tool is not only used for raising awareness and providing information; it can also be used to identify responsibilities and priorities. The workshops involve more people in planning and decision-making processes, with the hope that realistic solutions can be found.

A.2_Objectives

• It helps raising awareness of future problems in the community. • It helps developing a common definition of a desirable development. • It allows discussions with different social groups about obstacles on the way towards a future worth living. • It allows to identify and discuss the differences and similarities of problems and solutions as perceived by the different groups of participants. • On the one hand a Scenario Workshop helps to develop and generate utopian ideas. On the other hand, it allows to plan first steps that can be realized in the near future or even to develop an action plan for the implementation of solution trails. • It supports attempts to work out solutions together. • It allows an exchange of knowledge, opinions and ideas between experts, residents, private-sector representatives and policy-makers

A.3_Fields of Application

Environmental issues, transportation, recovery of former industrial areas, new information and communication technologies, local welfare systems, participatory urban planning, participatory design with children, energy resources.

A.4_How does it work

An EASW is attended by about 25-50 people selected from the various stakeholders involved.

The participants at the EASW should represent equally four different social categories:

1-Residents: this group is made up of "representative" residents' and includes, whenever possible, representatives from local special-interest associations or from local residents organized movements.

2-Technological experts: this group is made up of experts in technology, representatives of firms within the jurisdiction of the municipality, researchers and consultants on the themes under discussion.

3-Policy makers: this group is made up of politicians, public officials, local administrators, civil servants etc.

4-Private-sector representatives: this group is made up of businessmen representing the local or regional business community in those sectors closely linked to the themes discussed at the EASW.

The participants are guided in the formulation of future visions regarding the topic that is being discussed, which means the definition of an integrated set of objectives for the long period, and in the identification of some priority actions that should be developed in the short/medium period. During the development of visions, the participants are guided and helped to build their autonomous point of view, following an integrated approach, taking into account the complexity and interdependencies that characterize it.

Use and role of Scenarios

The Workshop Scenario enables the participants to discuss topics that concerns them directly. Doing so participants become more *aware* of the role they can play in promoting change. EASW is a bridge that helps to project itself into a concrete future, understanding that we are all actors of change. The use of scenarios plays a fundamental role, allowing participants to evaluate different alternatives. The scenarios are used to think in terms of "who" and "how", identifying problems and solution in alternative scenarios. The method allows to highlight the relationship between solutions and costs: it is not simply the description of a future idyllic situation but to be aware that every solution has a social, economic and environmental costs that you must be prepared to support. The presentation of different kind of scenarios that vary according to the "who" and "how" variables, gives the participants the capacity of stimulating their imagination.

The workshop's phases

Each meeting can last one or two days, according to the type of topic. Each participant should build his own independent point of view regarding the future of the local environment in which he lives. The participants should be organized in four groups according to common interests. The organizing team provides participants with starting points and objectives of the workshop.

The main phases that the workshop should go through are:

1-the start-up of the participation process to the definition of a common vision. Each group begins with the formulation of negative and positive visions for specific chosen thematic areas.

2- the individuation of common intervention strategies. The workshop provides proposals on the operational actions needed to be taken to realize the future

3- the definition of key intervention.

A.5_Expected output and/or results

In order to ensure a successful workshop, it is extremely important to accurately define the results that we aim to achieve. The participatory method works through a correct definition of objectives and expected results.

A.6_Basic conditions for a successful EASW

Topic: It must be a *real* topic that can be translated into tangible discussion subjects; something with defined boundaries and on which it is easy to focus the participants' attention. **Participants:** the topic should raise the effective interest of the participants who must have different opinions on how to deal with it and passions towards possible solutions. **Time:** it is necessary to take decisions quickly and to obtain results that are visible. **Expected results:** It is fundamental to define from the very beginning the results you intend to achieve and to organize the workshop in order to ensure that these results will be achievable. **Communicating the expected results:** all the people that are involved in a workshop must know what results will be achieved during the various work sessions. **Flexibility:** It is important not to forget that EASW is a tool and not the aim of the workshop. **Creativity:** It is always necessary to have a creative approach to the organization and management of an EASW.

A.7_References

EASW Guidance for MedStrategy Projects, Archanon Asterousion Municipality;

Gnaigger A. & Schroffener G. (2003), Tool-kit scenario workshop, interacts

Pamiers (1998), The European awareness scenario workshop methodology, ADAGE Environment;

TOOLKIT: www.cordis.lu/easw/home.htm

B_ Expert Panel

B.1_Definition

The expert panel is a group of people, considered to be particularly experienced, formed with the intent to analyze and resolve a given issue by identifying behaviours that would determine higher level performances.

B.2_Objectives

The main task of an expert panel is usually synthesising a variety of inputs – testimony, research reports, outputs of forecasting methods, etc. and produce a report that provides a vision and/or recommendations for future possibilities and needs for the topics under analysis.

B.3_Fields of application

Expert panels are particularly appropriate for issues that require highly technical knowledge and/or are highly complex and require the synthesis of experts from many different disciplines. This methodology is particularly appropriate for technical, scientific, professional or social issues that require highly technical knowledge and / or are very complex and also require the synthesis of experts from very different disciplines. This method is not designed to actively involve the broad public.

B.4_How does it work

The preparation for an expert panel includes specifying the task, determining the desired composition of the panel and then recruiting panel members, a panel chair and support staff. Once formed the expert panel is expected to investigate and study the topics assigned and set forth their conclusions and recommendations in written reports.

Organization of a focus group:

1. Preparatory phase:

- Defining the project: a project must be formulated carefully to ensure a clear understanding of the nature of the task, its aim and extent, any limitations or restrictions and the range of disciplinary expertise required among the members of panel that will undertake it.

- Recruiting support staff: the Panel Chair serves as facilitator and team builder for the panel and as lead architect/integrator of the panel's report; the Technical Writer that may prove very useful to include in the staff complement.

- Recruiting panel members: the two key dimensions of this phase are composition and balance. Composition concerns the mix of expert knowledge and experience needed for the panel to understand, analyse and draw sound conclusions about the issues before the panel. Balance concerns the even-handed representation of differing points of view that can be expected to affect the conclusions on issues the panel will address. Sometimes balance can be achieved by having opposing views represented in the panel membership.

2. Conducting the expert panel: The expert panel is expected to investigate and study the topics assigned and set forth their conclusions and recommendations in written reports. Members of the panel are expected to contribute their own expertise and good judgement in the conduct of the study. The experts should strive for a consensus report, but not at the expense of substantially watering down analyses and results. It is much better to report serious disagreements and explain why the disagreements exist than to paper over such problems. Lack of consensus on all points is not a failure of the panel and will not be treated as such.

3. Preparing the panel report: The report that expert panels prepare should be given early and careful attention. Experience with many panels shows that consensus building and report writing are the most difficult parts of the study process. Upon completion of the study report should be disseminated to appropriate persons and in general made available to the public.

The report can be submitted for peer review, prior to public dissemination. If a study is of special topical interest, arrangements may be made to schedule a public session after submission of the final report at which issues, findings, conclusions and recommendations of the report are presented.

B.5_Expected output and/or results

The method highlights the value of structured tasks that support transparent, quantitative characterizations of expert panel recommendations.

Standard output of expert panel discussions are minutes and study report that provides a vision and/or recommendations for future possibilities and needs for the topics under analysis. The report/s that expert panels prepare should be given early and careful attention. The following tips are important:

- Start early.
- Define early, no matter how tentatively, the ‘architecture’ of the report. Refine it and fill it in as the study unfolds.
- Give writing assignments to panel members as soon as it is practical to do so.
- Produce writing assignments on time, even if they are rough and incomplete.

Some elements that should be included in the report are the following: charge; description of panel composition; scientific uncertainty; distinguishing evidence from assumptions; distinguishing analysis from policy choice, especially in risk-related issues; citation of other relevant reports; managing study completion consensus and disagreement.

B.6_Basic conditions for a successful Expert Panel

Experts’ knowledge of the subjects under evaluation is the principal advantage of this tool. It fosters: significant reductions in time allocations; cost effectiveness; credibility of the conclusions; adaptability to a variety of situations encountered in evaluation. The tool's limitations which should be minimised essentially, derive from a series of risks: because the panel must come up with consensus-based conclusions, its organisation tends to eliminate minority points of view and tone down conclusions; the point of view of a 'dominant' expert can be over-influential within the panel; experts have a tendency to go beyond their field of competence.

Time and costs: Realistic estimates of time and costs are especially difficult in the early stages; underestimating is common. Estimates must include provision for assembling the panel and staff, holding meetings, preparing the report and seeing it through a review process and publishing and disseminating the final result.

Human resources: Experts must have recognised expertise in the field under evaluation, be independent, be able to work in a group and be available for a continuous work.

Main budgetary items: Personnel (professional, technical and support staff salaries, honoraria for experts, research associates and assistants, subcontracts, especially for technical services, honoraria for peer reviewers); Travel (experts), Accommodation (for experts, if required but not included in honoraria); Food (meals for Experts, if required but not included in honoraria); Recruitment (experts); Communications (printing and dissemination of final report, translation costs (if required)); Facilities (location for the expert panel to meet, location for public presentation of the final report, if applicable); Materials and Supplies (As required by the expert panel and researchers).

Some inevitable uncertainties regarding the budget include:

- estimating the number of occasions on which the panel will be convened;
- estimating the number of days on each such occasion, during which the panel will deliberate;
- forecasting the likelihood that the panel will have to re-convene after the peer review comments have been received (if applicable).

-

B.7_References

Cittalia – Fondazione, ANCI Ricerche, (2016), La partecipazione dei giovani: diritto, scelta, opportunità: https://community.agendaurbana.it/documenti/la-partecipazione-dei-giovani-diritto-scelta-opportunit%C3%A0

Slocun M., (2003), Participatory Methods Toolkit: a Practitioner's Manual. Author,. Editor, Stef Steyaert. Publisher, King Baudouin Foundation: www.kbs-frb.be

C_FOCUS GROUP

C.1_Definition

The term "focus group" is a combination of two social scientific research methods:

(i) the focused interview, in which an interviewer elicits information on a topic without the use of a fixed questionnaire guide;
(ii) a group discussion, in which a small number of a relatively heterogeneous, but carefully selected group of people with some common or similar characteristics or a shared cultural background discuss a topic raised by a skilled moderator.
A focus group can thus be described as a guided group discussion that is focused on a specific topic.

A focus group is a planned discussion among a small group (6-12) of stakeholders facilitated by a skilled moderator. In contrast to an ordinary group discussion, purposive information on the focal issue is given as input and/or stimulus to the focus groups. It is designed to obtain information about (various) people's preferences and values pertaining to a defined topic and why these are held by observing the structured discussion of an interactive group in a permissive, non-threatening environment.

C.2_Objectives

Focus groups are good for initial concept exploration, generating creative ideas.

It is designed to obtain information about (various) people's preferences and values pertaining to a defined topic and why these are held by observing the structured discussion of an interactive group in a permissive, non-threatening environment.

They are often used to test, evaluate and/or do a programme review. They are not effective for providing information to the general public or responding to general questions, nor are they used to build consensus or make decisions. They are particularly useful when participants' reasoning behind their views is of interest, as well as the process by which participants' develop and influence each other's ideas and opinions in the course of discussion. Focus groups are useful to:

- gauge the nature and intensity of stakeholders' concerns and values about the issues;
- obtain a snapshot of public opinion when time constraints or finances do not allow a full review or survey;
- obtain input from individuals as well as interest groups;
- obtain detailed reaction and input from a stakeholder or client group to preliminary proposals or options;
- collect information on the needs of stakeholders surrounding a particular issue or concept;

- determine what additional information or modification may be needed to develop consultation issues or proposals further.

C.3_Fields of application

Applied initially in the field of social research, then widespread in advertising and market surveys, over time the Focus Group has expanded in the context of multiple projects and initiatives of animation and local development as a tool to detect needs and perceptions of participants with respect to a product / service that is being developed or to a given phenomenon that is being observed.

C.4_How does it work

To prepare for the focus group event the members must first determine the questions to be addressed by the focus group and the targeted participants. Next, the focus group participants and a moderator are recruited. At the focus group event, which usually lasts for a few hours, the moderator leads the group through a semi-structured discussion to draw out the views of all of the participants and then summarises all of the main issues and perspectives that were expressed. After the event the research staff analyses all results of the focus group(s) conducted and produces a report. The focus group has a duration of not less than 90 minutes or more than 120 minutes.

Organization of a focus group:

1. Preparatory phase:

- Defining personnel (administrators, researchers and moderator) and tasks;

- Defining concepts to investigate;

- Generating questions: create a set (2-5 key questions) of questions in a loose-running order, with specific prompts to facilitate participant understanding and to encourage replies. The questions provide the order and structure of the group discussion and the list and order should be prepared but should be flexible and adapted to the group's natural conversation process. They should be clear, relatively short and use simple wording. Accompany the questions with sufficient background to minimise assumptions and place them in the appropriate context.

- Defining logistics and recruiting participation: Select a location that is easy to find, minimises distraction, provides a neutral environment and that ideally facilitates sitting in a circle. The recruitment of participants is one of the most critical and delicate points. The composition of the group, the skill of the moderator, the resulting interaction, will undoubtedly influence the quality of the discussion.

How to select the group members: try to make the group representative of your target; do not use regulars; the moderator should not know members; choose people who can communicate effectively.

2. Conducting the focus group: the moderator welcomes the group, introduces him/herself and gives relevant background information and an overview of the topic. Emphasise that this is an opportunity for participants to give voice to their opinions and that the researchers are there to learn from the participants. The moderator explains what the results of the focus group will be used for and what form the data will take. The moderator outlines the ground rules. Emphasise that one person speaks at a time and that the session is being recorded to ensure that all comments are noted. The moderator asks the introduction question (if any) and then moves to the other questions/topics, as pre-decided. The moderator briefly summarises the main points of view and then asks if the summary is accurate or if anything was missed.

3. Post focus group: at the end of the discussion the results will be transcribed in full by the recorder (if any) or by the moderator himself and summarized in a final report.

C.5_Expected output and/or results

Standard output of focus group discussions are video (or audio) tapes, minutes and possibly notes. Whether to produce full transcripts or not strongly depends on the research interests, the resources available, and the sheer amount of discussions to be transcribed. What is recommended as minimum is to produce short transcripts of interesting parts of a discussion.

C.6_Basic Conditions for a successful Focus Group

Time: Focus groups require at least one month of planning plus the time required for writing the final report.

Costs: This method is relatively low in cost for each individual event but the total cost will depend upon how many focus groups are conducted on the subject. (Often multiple focus groups are held on a given topic.)

Naturally, the cost per focus group declines when the focus group is part of a general research programme or when several groups are conducted on the same topic.

Main budgetary items: Personnel; Travel (for project team and/or for participants); Accommodation (only necessary for all-day and non-local events); Food (light refreshments, meals for participants and project team, if event is all-day); Recruitment and Promotion; Communications; Facilities (location for the Focus Group to meet); Materials and Supplies (cost to rent recording equipment (if applicable).

Interreg Italy - Croatia Joint_SECAP EUROPEAN UNION

C.7_References

Cittalia – Fondazione, ANCI Ricerche, (2016), La partecipazione dei giovani: diritto, scelta, opportunità: https://community.agendaurbana.it/documenti/la-partecipazione-dei-giovani-diritto-scelta-opportunit%C3%A0

Jäger, C., (1997), Focus Groups in Integrated Assessment: A Manual for Participatory Research. In ULYSSES Working Paper WP−97−2.

Ochieng NT, Wilson K, Derrick CJ, Mukherjee N. The use of focus group discussion methodology: Insights from two decades of application in conservation. Methods Ecol Evol. 2018; 9:20–32. https://doi.org/10.1111/2041-210X.12860

Slocun M., (2003), Participatory Methods Toolkit: a Practitioner's Manual. Author, Editor, Stef Steyaert. Publisher, King Baudouin Foundation: www.kbs-frb.be

Structure of the Thematic Focus Group(s) Report

Contents

Background and Methodology

[Explain briefly the overall focus groups goals, research methodology (demographic structure of attendees) and focus group findings]

Focus Group I:

[For each focus group held, describe the main topics of discussion, present the group profile, the discussion and its findings. Please include also short transcripts of interesting parts of discussion. Finally, provide moderator's comments – both on the process and on the findings, i.e. what worked well, what could have been done differently to ensure better results, what are the open questions that emerged afterword]

- **Topics**
- **Group Profile**
- **Findings for Focus Group I**
- **Comments from Focus Group I**

Focus Group II:

- **Topics**
- **Group Profile**
- **Findings for Focus Group II**
- **Comments from Focus Group II**

[Add as many "Focus group" paragraphs as needed.]

Executive Summary

[Briefly summarize the conducted focus group activities in simple words, outline its main results, in a website-friendly form, to be used for dissemination purposes]

Annex(es)

[Include photos, i.e. online meetings screenshots or any other visual and supporting material]

7.5.3 Preliminary Scoping Report for the project target areas

Contents

The following structure / index is proposed for the Scoping Report that the pilot areas of the project will have to draft as part of the process of the Joint SECAP Strategic Environmental Assessment. The main regulatory reference - common to all pilot areas of the project - is the Directive 2001/42/EC which defines the subject and introduces the Scoping Report (art. 5, paragraph 4).

According to the Directive 2001/42/EC, the **Scoping Report represents the basic tool to launch the participatory process** – provided for by the Strategic Environmental Assessment (SEA) procedure –, and to draft the subsequent Environmental Report. In particular, **it defines the scope and the detailed information to be included in the subsequent Environmental Report**, which is the main report of the SEA process.

The proposed structure/index aims to ensure a homogeneous design for the different Scoping Reports drafted by the 8 pilot areas of the Joint_SECAP project, so that the different experiences present elements of comparability and all form an organic structure.

Nevertheless, the individual chapters may be freely articulated and developed by each partner depending on each pilot area's specific characteristics and issues, and in accordance with any local regulation in force.

The length proposed for each chapter is provided only as a guide; it is provided exclusively as a reference to understand each individual part relevance within the Scoping Report. In general, it is recommended to be rather concise and consistent, disregarding any in-depth studies or specific extended discussions which will later be included in the Environmental Report.

Structure of the Scoping Report

Chapter	Notes to draft the chapters	Proposed number of pages
1. Legal framework	*Briefly describe the main norms regulating the SEA at the national and, if relevant, at the regional level*	1
2. Plan main objectives	*Concisely describe the Plan objectives; general or specific objectives depending on the Plan articulation, in a consistent way to understand the scope of interest and the field of intervention of the Plan*	3
3. Main scopes of interest and themes	*Pre-emptively and preliminarily identify the scopes of interest and the main issues that will be assessed in the Plan, the major sectors, depending on the major expected impacts and on the territory sensitivity characteristics; consistently with the preliminary function of the Scoping Report.* *Describe here the natural protected areas system eventually present in the pilot area, of interest in the Environmental Implication Assessment.*	5-10
4. Assessment methodology provided for by the Environmental Report	*Briefly describe the assessment methodology that is expected to be used for the Environmental Report*	5-10
5. Specific methodological recommendations on the *Environmental Implication Assessment*	*Briefly describe the methodology that will be used to carry on the Environmental Implication Assessment, drafting the Appropriate Assessment Report*	2
6. Environmental Report Index	*Provide an indicative index for the Environmental Report that will be drafted in the subsequent phases of the Strategic Environmental Assessment procedure, its plan and its contents.*	2
7. List of the ERA - Environment Responsible Authorities	Provide an indicative list of the Authorities with environmental responsibility, classified by type and function (i.e. local/supralocal institutions /level/etc.)	2
8. Survey for the ERA - Environment Responsible Authorities	Write a draft of the survey to propose to the Authorities with environmental responsibility in order to facilitate their involvement in the participatory process	4

Summary Table of Contents

Each partner will draft the Scoping report in his local language. Moreover, each partner is asked to draft a short summary of the Scoping Report in English language. The Summary could be 3-5 pages length and will be developed according to the following proposed table of contents:

1. Introduction
2. Plan focus; main expected impacts and area sensitivity
3. Methodological framework for the Environmental Report (main steps, table of contents, ERA survey, etc.)
4. List of ERA – Environmental Responsible Authorities

7.5.4 Guidelines for the coherence analysis

7.6 Joint_SECAP Actions

7.6.1 Joint Action Implementation

Introduction

The Covenant of Mayors for Climate and Energy (CoM) is the European initiative that involves together local and regional authorities that voluntarily make efforts to implement the European Union's climate and energy objectives in their territory. Signatories share a vision of decarbonised and resilient cities, where citizens have access to secure, sustainable and affordable energy, and are committed to reduce CO_2 emissions by at least 40% by 2030, to increase their resilience to the impacts of climate change and to alleviate energy poverty. The CoM commitments are translated into actions through the Sustainable Energy and Climate Action Plans (SECAPs).

The whole process for the Joint Secap realization consists of:

a) DEFINITION OF THE JOINT SECAP OPTION AND COUNCIL DECISION FOR THE ADHESION;

b) RISK ASSESSMENT AND VULNERABILITY REPORT *(& BASELINE EMISSION INVENTORY);*

c) DESIGN OF **JOINT ACTIONS** TO BE INCLUDED IN S*(E)*CAPS;

d) PLAN IMPLEMENTATION AND MONITORING.

The aim of the document is to give a specific overview of **what a Joint action is** and to give **instructions on how to fill in the attached document by each partner** which consists in the definition of **at least one joint action** per pilot area. Practical recommendations, best practices and useful resources are also included. Thus, with reference to the above mentioned 4 steps towards the joint PAESC definition, the document focuses on part a. and c. since the risk assessment and vulnerability report has been already developed following the JOINT_SECAP methodology (activity 3.1, deliverable D.3.1; activity 3.2, D.3.2.2). The JRC guidelines for the development of the risk assessment and vulnerability *(and the Baseline Emission inventory)* are also a fundamental document to be taken into consideration for the joint PAESC realization: Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 2: Baseline Emission Inventory (BEI) and Risk and Vulnerability Assessment (RVA).

Last but not least, it is worth to highlight that the Interreg JOINT-SECAP project is focused on the adaptation part of SECAPs, but in this document some information regarding the mitigation (energy) and energy poverty are provided and written in italic in parenthesis because they are not analysed in depth as done for climate adaptation. By the way, more information are available at the Covenant of Mayors website (click on the link) for all the three aspects (mitigation, climate adaptation and energy poverty).

Definition and Implementation of Joint_SECAP for Climate Change Adaptation

Definition

A joint Secap is defined as follows: "*A joint SECAP refers to a plan that is carried out collectively by a* ***group of neighbouring local authorities****. This means that the group engages in building a common vision, preparing an emission inventory, assessing climate change impacts and defining a set of actions to be implemented both individually and jointly in the concerned territory. The joint SECAP aims at fostering* ***institutional cooperation*** *and* ***joint approaches*** *among local authorities operating in the same territorial area*." [4]

The grouping is justified by the fact that the development, implementation and monitoring of SECAPs are facilitated when municipalities are clustered in supra-local structures that allow them to share their human and financial resources and their means. In addition, the implementation of concrete projects often covers territories beyond the municipal boundaries both in terms of critical size to achieve profitability, in terms of geographical location, or in terms of call up of funding sources.

Options

The Covenant of Mayors provides two possible methodological options for the development of a joint S*(E)*CAP:

- **Option 1 - 'individual CO2 reduction commitment'**: each municipality in the group individually commits to reducing CO_2 emissions by at least 40% by 2030. Each municipality is required to report the action plan in the individual profile of mycovenant platform. Each member of the group has to upload the action plan into their individual profile and each municipal council has to approve the document.

- **Option 2 - 'shared CO2 reduction commitment'**: the group of municipalities collectively commits to reducing CO2 emissions by at least 40% by 2030. The group is required to provide only one action plan for the whole group in mycovenant The action plan document to upload is a common one and includes all the members of the group, thus, each municipal council has to approve it.

The design and implementation of the JOINT-S*(E)*CAP is carried out depending on whether one of the two previous possible options is chosen.

[4] Definition and figure from „Quick Reference Guide Joint Sustainable Energy & Climate Action Plan"

Plan Implementation and Monitoring

When the JOINT SECAP is designed and shared among stakeholders, it has to be approved by all the municipalities involved through a Council decision and it has to be uploaded on mycovenant in orded to be submitted, analyzed by the CoM office and approved. If necessary, changed will be made in order to be in line with the request of JRC/CoM offices.

Once the plan is approved by Municipalities and CoM it has to be implemented and monitored according with Quick Reference Guide 2020 - Monitoring SECAP implementation updating information on mycovenant.

Conclusions

JOINT ACTIONS elaboration is only one step in the overall JOINT SECAP process and it should not be considered as an objective in itself, but rather as a tool that allows to:

— Outline how the municipalities will look like in the future (vision), in terms of energy, resilience, infrastructure and land use, mobility population, consumption patterns and climate projections;

— Analyse current actions in the field of (energy) and climate and try to build a systematic joint action shared among Municipalities and with the stakeholders;

— Translate the vision into practical actions assigning deadlines and a budget for each of them.

Here is a list of **recommendations** for drafting successful JOINT ACTIONS:

✓ Take inspiration from good practices actions https://www.covenantofmayors.eu/plans-and-actions/good-practices.html and other shining examples (as listed before)

✓ Set priorities and select joint actions / measures through a participatory approach among municipalities and stakeholders

✓ Specify timing, clear responsibilities, governance, budget and financing sources of each joint action

✓ Perform regular reviews of the Joint Actions through official CoM monitorings (at least one every two years) and intermediate internal monitorings

✓ Update joint actins considering changes and goals of the group of municipalities

Annex I – joint SECAP actions by each partner.

7.6.2 Joint_SECAP Actions repertoire

Introduction

The scope of this document is to give extra information to Interreg JOINT-SECAP project partners on how to fill the SECAP template - English (en) - Working document ONLY in order to have the same standards among Partners and to be able to compare the methodology, the governance, the type of actions, the sectors involved and other aspects specific for Joints Actions, as described by the document part 1 of activity 4.3. The template has to be filled according with the CoM requirements as specified by JRC guidelines and CoM website information in all the excel sheets. Specifically, this document includes information useful for the JOINT ACTIONS of Interreg JOINT-SECAP project Partners regarding **adaptation to climate change**.

For the Interreg JOINT-SECAP project purpose, we ask you to fill in data **for at least 1 adaptation JOINT ACTION per pilot areas** even if you are strongly encouraged to have more than one!

The following information concern the SECAP TEMPLATE, - sheet „action“, that is divided into 5 sections:

- Actions;
- A. Mitigation;
- B. Adaptation;
- C. Energy poverty;
- Further information.

All the sections have different points that have to be filled in compulsory or voluntary fields.

For "Actions", « Adaptation" and «Further information» there will be given **extra information** for Interreg JOINT-SECAP project partners in order to have the same standard for all and compare data in the third document _________________. There aren't information regarding „A. Mitigation"and „C. Energy poverty" because these sections aren't in the scope of the project that focuses the attention on the adaptation side.

Actions

The "Actions" section aims at introducing general information. The Table of "Action" section and information are following.

1) Type of action

For Interreg JOINT-SECAP project partners is compulsory to have at least 1 joint action with the „ADAPTATION" option.

2) Title of action

In case of JOINT ACTION please start the title with "JOINT ACTION:", otherwise use "INDIVIDUAL ACTION:", followed by the title.

3) Origin of the action

No extra information is given for this part. Please use the drop-down list according to the CoM excel template options.

4) Responsible body

No extra information is given for this part.

5) Short description

In this section, please describe the action including the group (number the municipalities involved out of the total), the goal and the reason why the action is joint by the group of municipalities. Please include at the beginning one of the following text, modified according to your group information (i.e. all the Municipalities implement together a joint action; part of the Municipalities implement together a joint action; each Municipality implement individually an action) and action:

- Number of Municipalities involved: _______ Total number of Municipalities of the target area:__________
- All the municipalities join this action because ______________________________. The action has the goal of to________________________________...
- The Municipalities __________________, ____________________, _______________________ of the SECAP join this action because ______________________________. The action has the goal of ________________________________...
- The Municipality/ies ____________________________, ________________________________, individually implement this action with the goal to ……

6) Implementation timeframe

No extra information is given for this part. Please follow the CoM requirements.

7) Implementation status

No extra information is given for this part. Please follow the CoM requirements.

8) Stakeholders involved

No extra information is given for this part regarding the drop-down list.

Regarding the additional comments please describe how the group of municipalities choose the list of stakeholders, the involvement process and their management. In particular please indicate how many meetings and the type of meetings. Please also indicate the governance process regarding the action. Please follow this text modified according with your action:

The stakeholders were involved thanks to 1/2/3… European awareness workshop/ Expert panel /focus group/ meetings managed by the "Joint Action Coordinator for Climate and Energy"[5] /territorial coordinator/_____________________. The role of stakeholders _____________, __________ were to define funds/define the governance/contribute for ______________ / design the action /___________________________

9) Total implementation costs

No extra information is given for this part regarding. Please follow the CoM requirements.

[5] As defined by Interreg Joint-SECAP project

Actions

Actions

1) Type of action

- ☐ Mitigation
- ☐ Adaptation
- ☐ Energy poverty

ⓘ Only in combination with 'Mitigation' and/or 'Adaptation' actions

2) Title of the action

3) Origin of the action [Drop-down]

4) Responsible body

5) Short description

1000 characters left

6) Implementation timeframe

Start: [Drop-Down]

End: [Drop-Down]

7) Implementation status	[Drop-Down]	
8) Stakeholders involved	[Drop-down]	ⓘ For multiple choice, insert additional rows as needed
	Additional comments	
9) Total implementation costs		€
	Source of funding: [Drop-down]	
	Investment costs:	€
	Non-investment costs:	€

B. Adaptation

18) Climate hazard(s) addressed

No extra information is given for this part. Please follow the CoM requirements.
19) Sector(s)

No extra information is given for this part. Please follow the CoM requirements.
20) Outcome(s) reached

Please explain the outcomes reached thanks to the implementation in a joint group as following:
This action has the following outcomes _______________, ___________________________, _________________________ reached thanks to _____________________________.
21) Vulnerable population group(s) targeted

No extra information is given for this part. Please follow the CoM requirements.
22) Avoided cost

No extra information is given for this part. Please follow the CoM requirements.
23) Life expectancy of the action

No extra information is given for this part. Please follow the CoM requirements.

24) Return on investment

No extra information is given for this part. Please follow the CoM requirements.
25) Jobs created

No extra information is given for this part. Please follow the CoM requirements.
26) Other figures

No extra information is given for this part. Please follow the CoM requirements.

B. Adaptation

ⓘ **Only for actions addressing adaptation. Click on the [+/-] buttons on the left to expand or collapse**

18) Climate hazard(s) addressed	[Drop-down]			ⓘ For multiple choice, insert additional rows as needed
19) Sector(s)	[Drop-down]			ⓘ For multiple choice, insert additional rows as needed
20) Outcome(s) reached	Description:			
	Related indicator:		[numerial value]	[Unit]
21) Vulnerable population group(s) targeted	[Drop-down]			ⓘ For multiple choice, insert additional rows as needed
22) Avoided cost		€		

23) Life expectancy of the action		years
24) Return on Investment		%
25) Jobs created		full-time equivalent

26) Other figures	[Please specify]	[numerial value]	[Unit]

Further Information

30) Weblink

Please add the weblink of the Interreg Joint-SECAP project (website and/or platform) where is possible to get information about the action (if available)
31) Video link

Please add the video link of the Interreg Joint-SECAP project (website and/or platform) where is possible to get information about the action (if available) and/or video link of “focus group” or other meetings, if available, regarding this specific action.
32) Picture

Please add pictures of “focus group” or other meetings, if available, regarding this specific action.

	Further information	
30)	Weblink	www.
31)	Video link	www.
32)	Picture	[upload]

Partners Contribution

Every Partners have to fulfil the excel TEMPLATE with at least 1 Joint ACTION according to the information given by the documents designed in the activity 4.3 of Interreg Joint-SECAP project. Please use the number of excel sheets "Key actions" or "Actions" according to the number of actions you are going to describe and attach them in the following sub-paragraphs. The scope of the following information is to understand the type of actions selected as joint actions by the partners, the involvement of stakeholders, the approach and other information that will be summarized and analysed in the part 3 of the activity 4.3 document. Of course, the following actions will be part of the 9 Joint SECAPs that the 9 target area will design for the deliverable.

PPn
ACTION 1

….

ACTION 2

….

ACTION 3

Conclusion

Analysis and comparison of joint actions included by PP

7.7 Capacity Building-Evaluation Grid

Evaluation grid to compare and disseminate the different target areas experiences

PPn……
Target Area …………………………………………………………………………….
P.M……………………………………………………………………………………..
Joint Coordinator………………………………………………………………………….

1. Description of the project organizational structure: identification of the roles, functions and types of personnel involved

Organizational structure		
Role	Function attributed	Internal or external personnel to the administration
PPn……"………………………"		

2. Do you believe that the contents of the Context Analysis as identified by the project are exhaustive to build the reference framework for identifying the risks and vulnerabilities of the territories, or do you believe that the keys to reading and the knowledge to be put in place must be implement?
If so, with what content.

Context analysis			
Do you believe that the contents of the Context Analysis as identified by the project are exhaustive?	YES	NO	Specify any corrective measures to suggest
PPn……"………………………"			

3. Was the methodology used to identify vulnerabilities and risks easy to use? Are there any corrections to suggest? Was the knowledge and data available at local level for the application of the methodology sufficient? If not, what were the strategies implemented to overcome these limits? Were there any other critical issues?

Vulnerability and risk methodology				
Do you think that the methodology used to identify vulnerabilities and risks has been easy to use?	YES	NO	Specify any corrective measures to suggest	
PPn……"………………………"				
Were the knowledge and data available locally for the application of the methodology sufficient?	YES	NO	If not, what were the strategies implemented to overcome these gaps?* *specify	Are there any other critical issues that emerged in the application of the methodology?* *specify
PPn……"………………………"				

4. Was the methodology used to build the scenarios effective? If not, what could be improved? Was the Focus Groups formula successful in moving from the "0" scenario to the optimal scenario? Do you think it could be useful to suggest other ways of involving local stakeholders, among those identified by the project, or even other approaches?
How did the selection of stakeholders take place? Was the selection adequate? Would it have been useful to identify some other type of Stakeholder?
Did the transition from the "0" scenario to the optimal / final scenario reveal any critical issues between the various interests shown by the stakeholders? What strategies have you put in place to reach the shared choices?
Do you believe that the Preliminary scoping report contributed to the formulation of the shared optimal scenario? If so, how?

Construction of scenarios and preliminary scoping report				
Was the methodology used to build the scenarios effective?	YES	NO	Specify corrections or suggestions for other projects	
PPn……"………………………"				
Was the Focus Groups formula successful in moving from the "0" scenario to the optimal scenario?	YES	No	Possible other ways of involving stakeholders	
PPn……"………………………"				
How did the selection of stakeholders take place?			Describe how to select:	
PPn……"………………………"				
Was the choice of stakeholders satisfactory?	YES	No	Could it be useful to identify some other type of Stakeholders? * * Specify which and why	
PPn……"………………………"				
The transition from the "0" scenario to the optimal / final scenario has brought out some critical issues among the various interests shown by the stakeholders	YES	No	If YES, what strategies have you put in place to reach shared choices?* * Specify	Do you think that a review of how scenarios are constructed can help improve these aspects?* * Specify
PPn……"………………………"				
Do you think that the Preliminary scoping report contributed to the formulation of the shared optimal scenario?	YES	No	If YES, how?* * Specify	If not, how could this relationship between the first step of the SEA process and the construction of the optimal scenario be improved?* * Specify
PPn……"………………………"				
Can SEA Process, in its entirety, constitute an aid to the construction of a joint SECAP?	YES	NO	If YES, why?* * Specify	
PPN……"………………………"				

5. Do you believe that the contents of the Platform are sufficiently useful and understandable for the implementation of the project, even after its closure? Do you believe that the repertoire of best practices contained in the Platform and the reference to tools that support the actions, can be useful for the implementation of the project? Is the manual clear enough? If not, what changes should be made?

WEB Platform			
Do you believe that the contents of the Platform are sufficiently useful and understandable for the implementation of the project, even after its closure, especially for the exchange of experiences?	YES	NO	If not, briefly describe how it could be improved
PPN……”………………………”			
Can the repertoire of best practices contained in the Platform and the reference to tools that support the actions, be useful for the implementation of the project?	YES	NO	If not, briefly describe how it could be improved Could you suggest other best practices and tools?
PPN……”………………………”			
Do you think that the manual for the use of the Platform is sufficiently clear?	YES	No	What changes could be made?* * Specify
PPN……”………………………”			

6. What are the reasons that led you to choose certain joint actions to be developed rather than others in your target areas? Do you think that the selection method used can / should also be used for the identification of future actions? What would you possibly change? What were the major difficulties you faced in compiling the model for joint action?

Joint Actions			
What are the reasons that led you to choose certain joint actions rather than others in your target areas?			Briefly illustrate
PPN……"………………………"			
Do you think that the selection method used can / should also be used for the identification of future actions?	YES	No	What would you change?* *Briefly specify
PPN……"………………………"			
Did you find any difficulties in filling out the joint action form?	Si	No	If YES , which ones?* *Briefly specify
PPN……"………………………"			

7. Do you already have a plan to implement joint actions in the future? What do you think are the favorable or unfavorable conditions for this implementation?

Joint Actions Implementation			
Do you already have a plan to implement joint actions in the future?	Si	No	What do you think are the favorable or unfavorable conditions for this implementation?* Briefly specify
PPN……"………………………"			

8. Express a general opinion regarding the overall organization of the project in a discursive form. Are there any aspects to improve / correct?

PPN……”………………………”	Specify

Sitography

LIFE Master Adapt https://masteradapt.eu/?lang=en

Climate analysis (English) https://masteradapt.eu/wordpress/wp-content/uploads/2017/09/MA-report-A1.pdf

Guidelines (Italian) https://masteradapt.eu/wordpress/wp-content/uploads/2018/03/MA-linee-guida-A1-1.pdf

LIFE PRIMES http://www.lifeprimes.eu/?lang=en

Reports available at http://www.lifeprimes.eu/index.php/scenari-climatici-report/

LIFE SEC ADAPT http://www.lifesecadapt.eu/

Climate Assessment on Local and Regional Levels. Methodological Document

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Methodology_for_the_definition_of_climate_baseline_and_future_scenarios_DEF.pdf

Regional Climate Baseline and Future Climate Projections - Istria (Croatian)

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Report_on_climate_baseline_at_regional_level_IDA_ISTRIA_REGION.pdf

Regional Climate Baseline and Future Climate Projections - Marche (Italian)

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/Report_on_climate_baseline_at_regional_level_MARCHE_REGION_FINAL.pdf

Vulnerability and Risk Assessment Analysis - Istria (Croatian)
http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf

Vulnerability and Risk Assessment Analysis - Marche (Italian)

http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/ITALY_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Marche_Region_compressed.pdf

EMPOWERING https://www.empowering-project.eu/en/sample-page/

LIFE FRANCA https://www.lifefranca.eu/en/

LIFE DERRIS http://www.derris.eu/en/

LIFE BLUEAP http://www.blueap.eu/site/en/

RESIN - CLIMATE RESILIENT CITIES AND INFRASTRUCTURES http://www.resin-cities.eu/home/
IVAVIA Guidelines (English) http://www.resin-cities.eu/fileadmin/user_upload/Resources/Design_IVAVIA/IVAVIA_Guideline_v3_final__web.compressed.pdf

Annex - Case studies

Title of the Case study	**VULNERABILITY AND RISK ASSESSMENT ANALYSIS** **PROCJENA RANJIVOSTI I RIZIKA**
General data	
Promoter	IDA – Istrian Development Agency in the scope of LIFE SEC ADAPT PROJECT - *Upgrading Sustainable Energy Communities in Mayor Adapt initiative by planning Climate Change Adaptation strategies* (LIFE 2014 – 2020 – Climate Change Adaptation programme) Source: http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.1
Timeframe	September 2015 - June 2019 Source: https://ida.hr/hr/bn/eu-projekti/aktualni-eu-projekti/detail/2/life-sec-adapt-upgrading-sustainable-energy-communities-mayor-adapt-initiative-planning-climate-change-adaptation-strategies/
Target area and scale	Municipality of Istrian region territory, 2.820 m^2, population 208.055 (data from 2011.) Source: http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.4 https://www.istra-istria.hr/index.php?id=263 https://www.istra-istria.hr/index.php?id=14
Brief description	The Case study, named *Vulnerability and Risk Assessment analysis* is focused on providing a detailed assessment of climate change risks and vulnerability for the Municipality of Istrian region territory. Sectors of particular interest within the Istrian region, reviewed and assessed in the document are: health, tourism, water supply and water quality, ecosystems and biodiversity, and spatial planning and coastal area management. Evaluating the impacts that climate change will have on local selected economic sectors, the best actions to limit or reduce risks and related economic and social costs are identified, thus better orienting the future climate change adaptation strategies. The first step regards the vulnerability assessment starting from the evaluation of the exposure, sensitivity, and adaptive capacity to the impact of climate change in a long - term period of each specific key sector identified. This assessment determines the level of vulnerability, after which the results are matched with the risk assessment analysis that, through the evaluation of the consequence and of the probability of a climate change impact on the same sectors previously analyzed, allows to estimate the level of risk of the system. The final matrix, matching vulnerability and risk results of each urban system analyzed, provides a clear overview of the most important sectors of interventions on which the urban local adaptation strategy should focus in order to significantly reduce the climate change impact on the municipal urban system. Source: http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.4

<table>
<tr><th colspan="2">Contribution of the Case study to the Joint_SECAP guidelines for Vulnerability and Risk assessment</th></tr>
<tr><td>Modules of the guidelines relevant to the case study</td><td>Please select one or more Modules that you think the Case study gives a significant contribution to (i.e. through methodologies, methods, tools…). Refer to the Joint_SECAP Guidelines for further information on Modules:

√ M1 PREPARING THE RISK ASSESSMENT
(describes the context of the assessment - processes, knowledge, institutions, resources and external factors –, identifies its objectives, expected outcomes and scope, and defines tasks, responsibilities and time planning)

√ M2 DEVELOPING IMPACT CHAINS
(identifies and clusters impacts and risks, identifies hazard and intermediate impacts, vulnerability and exposure of the system)

√ M3 IDENTIFYING AND SELECTING INDICATORS
(identifies and select indicators for hazards, vulnerability and exposure)

√ M4 DATA ACQUISITION AND MANAGEMENT
(regards the collection, quality check, storage and management of data)

√ M5 NORMALIZATION OF INDICATOR DATA
(provides normalized data for each indicator in a standardized value)

√ M6 WEIGHTING AND AGGREGATING OF INDICATORS
(evaluates the influence of the indicators on the respective risk component, assigns different weights, aggregates individual indicators into composite indicators of the risk components hazard, vulnerability and exposure)

√ M7 AGGREGATING RISK COMPONENTS TO RISK
(aggregates the risk components into a composite risk indicator)

☐ M8 PRESENTING THE OUTCOMES OF YOUR RISK ASSESSMENT
(describes how to elaborate the risk assessment report, taking into account both the objective and the target audience of the assessment)</td></tr>
<tr><td>Description of the contribution of the Case study to the Joint_SECAP guidelines</td><td>Please provide a detailed description of how the Case study contributes to the modules selected above, i.e. by explaining the methodological approach adopted, the methods and tools used, etc. The lines corresponding to the modules that are NOT been selected above shall be left blank:

M1:

Adopting the European Union's Climate Change Adaptation Strategy, in April 2013, the European Commission established a framework and mechanisms to raise EU countries' preparedness for present and future climate impacts, raising them to a whole new level. The EU's Climate Change Adaptation Strategy aims to make Europe more resilient to climate change and sets out its three key objectives, which are complementary to Member States' activities:

• Promoting action towards the Member State: The Commission encourages all Member States to adopt comprehensive adaptation strategies, which will provide assistance in providing guidance in the implementation of the process, as well as financial resources that will enable the establishment and capacity building of adaptation and the implementation of concrete measures. The European</td></tr>
</table>

	Commission will encourage the adaptation of Cities by voluntarily joining the same initiatives of the European Union, which will be based on the initiative of the Mayor Agreement • Promoting better information in the decision-making process by addressing adaptation gaps and further developing the Climate Adaptation Platform (ADAPT) as a starting point for all information on climate change adaptation processes across Europe. • Promoting adaptation processes in key, vulnerable, sectors through agriculture, fisheries and cohesion policy, ensuring that European infrastructure is more resilient and encouraging the use of insurance mechanisms against natural or human-caused disasters. Lack of knowledge, the European Union addresses itself through research and through the European Climate Change Adaptation Platform. Launched in March 2012, this platform provides several useful tools to support adaptation policy and decision making. Some of the platform's tools are: an adaptation planning tool, a database of completed projects and studies completed, and information on adaptation activities carried out at all levels, from EU, national and regional, to the local level. The CLIMATE - ADAPT platform has been established to provide access to databases and exchange of information regarding expected climate change across Europe, as well as strategies and possible ways to adapt to potential changes (http: //climate-adapt.eea.europa.eu/) . There are different scenarios for assessing the impact of climate change, so that measures to slow down unwanted processes are taken into account, as well as ways to adapt to such changes. Pursuant to the decision of the Croatian Parliament to promulgate the Law on Ratification of the United Nations Framework Convention on Climate Change (UNFCC) of 23 January 1996, Croatia assumed the obligations of the United Nations Framework Convention on Climate Change and produced the First National Report of the Republic of Croatia to the UNFCCC (Ministry of Environment and Physical Planning, 2001). Currently, the sixth national report of the Republic of Croatia under the UNFCCC (Croatian Hydro-Meteorological Institute, 2013) is in force, while in mid-May 2016, the Ministry of the Environment and Nature began implementing a project entitled ''Capacity building of the Ministry of Environment and Nature for climate change adaptation and the preparation of the draft Climate Change Adaptation Strategy '', which is currently in its final stages. The purpose of this document is to identify sectors that are vulnerable to climate change, to conduct a sensitivity analysis of sectors of particular importance to the Istrian region, and to draw conclusions about the potential risks of adverse effects of climate change in the observed area. The objective of activity C.2 is to provide the cities and municipalities involved in the implementation of the project with a detailed analysis of the vulnerability and risk assessment of climate change impacts in their respective cities and municipalities. Through assessing the impact that climate change will have on locally selected sectors of particular importance, the best measures will be identified to limit or, at the same time, reduce the risks and associated economic and social costs, and thereby provide good a landmark to guide their future climate change adaptation strategies. In accordance with the methodology developed by the Istrian Development Agency (IDA), cities and municipalities will carry out vulnerability and risk assessments in two consecutive steps. The first step involves assessing vulnerability, starting with an assessment of exposure, sensitivity and ability to adapt to the impact of climate change over the long term on a sector-specific basis for each city or municipality.

	This assessment enables cities and municipalities to determine the level of vulnerability (low, medium or high) for each sector of particular importance. The results are then collated with a risk assessment analysis which, through an assessment of the consequences and likelihood of climate change impact on the sectors previously analyzed, enables the assessment of system risks (high, medium, low). The final matrix, which responds to the vulnerability and risk outcomes of each urban system analyzed, provides a clear overview of the most important areas of intervention to which an urban local adaptation strategy should focus in order to significantly reduce the impact of climate change on the urban / municipal urban system. Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.7-8,10-11 Sectors selected for climate change effects analysis: • Tourism • Environmental protection and biodiversity • Water supply and water quality • Health Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.19 Expected effects of climate changes by sectors (long term variations) **Health sector:** - Medium temperature heat wave: Mortality, primarily due to cardiovascular disease and increased hospitalization Spreading of transmissible and infectious diseases Changes in allergy patterns Heat stress Pulmonary diseases Number of alergic persons - Drought: Air quality deteoration Trace elements accumulation - Strong precipitation: Injuries and death Disease spreading due to water contamination

	Increased mortality/injuries due to car accidents - Thunderstorms (sea level): Injuries and death **Water supply and water quality sector**: -Medium temperature heat wave: Increased water demand Problems with drinking water quality maintenance – low subterranean water sources and slower water renewal Increased maintenance cost Increased evaporation/outflow of water Spreading of algae and bacteria - Drought: Water shortage - Problems with water quality maintenance Increased maintenance cost Low subterranean water sources and slower water renewal Water/soil salinisation - Strong precipitation: Flood damage Increased maintenance cost Problems with drinking water quality maintenance - Thunderstorms (sea level): Problems with drinking water quality maintenance Salt water penetration into subterranean water storage and surface waters **Tourism sector:** -Medium temperature heat wave: Changes in tourist numbers Changes in landscape Cost increases (for example for cooling) - Drought: Changes in tourist numbers Changes in vistas Cost increases (for example for water supply) - Strong precipitation: Damage on tourist infrastructures – increased repair costs and maintenance costs

	Flood damage Landslide damage - Thunderstorms (sea level): Damage on tourist infrastructures – increased repair costs and maintenance costs Degradation of areas near the sea (beaches…) **Agriculture and forestry sector**: -Medium temperature heat wave: Changes in cultivation cycles Increase/decrease of certain species - Drought: Damage or degradation of yield quality Desertification Salt water penetration due to intensive irrigation Decrease of area of useful agricultural land Changes in cultivation cycles - Strong precipitation: Land erosion Flood damage Landslide damage Damage or degradation of yield quality Decrease of area of useful agricultural land - Thunderstorms (sea level): Damage or degradation of yield quality Decrease of area of useful agricultural land Salt water penetration into subterranean water storage and surface waters **Parks and protected areas / biodiversity / land ecosystems**: -Medium temperature heat wave: Change in demands and patterns of behavior Increased maintenance costs due to extensive use of water New invasive species in flora and fauna Change and loss of species and habitats - Drought: Change and loss of species and habitats

		New invasive species in flora and fauna
		Increased maintenance costs due to extensive use of water
		Higher probability of fire
	- Strong precipitation:	Damage on infrastructures and vegetation
		Change and loss of species and habitats
	- Thunderstorms (sea level):	Damage on infrastructures and vegetation
		Change and loss of species and habitats
	Sea and coastline:	
	-Medium temperature heat wave:	Appearance of invasive allochthonous species
	- Drought:	-
	- Strong precipitation:	Decrease of bathing water quality
		Damage on coastal infrastructure
		Damage due to landslide
	- Thunderstorms (sea level):	Damage on coastal infrastructure
		Coast erosion
		Salt water penetration
		Changes in surface waters
		Damage on water drainage systems

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.20-23

M2:

Vulnerability: The characteristics and circumstances of a community, system, or property that make them vulnerable to the harmful effects of (some) danger. There are many aspects of vulnerability that arise from various physical, social, economic and environmental factors. Examples could include poor design and construction of facilities, inadequate property protection, lack of public information and awareness, limited official recognition of risk and preparedness measures, and disregard for wise environmental management. Vulnerability varies significantly within the community and over time. This definition recognizes vulnerability as a characteristic of an element of diverse interests (community, system or property) that is independent of its exposure. However, in common usage, the

	word is often used in a broad sense, including exposure to natural elements (which may or may not be caused by climate change or variation). The above definition can be considered comprehensive because it does not specify what "vulnerability" means within a specific thematic area, such as the effects of climate change, for example. Therefore, when talking about the effects of climate change, it is a good idea to mention the definition of "vulnerability" proposed by the International Panel on Climate Change (IPCC), which reads: Vulnerability to climate change is the degree of sensitivity of geophysical , biological and socio-economic systems, as well as their diminished capacity to cope with the adverse effects of climate change. The term "vulnerability" may thus refer to the vulnerable systems themselves, for example in low lying islands or coastal cities; the effects on these systems, for example in the event of flooding of coastal cities and agricultural areas or forced migration caused by these events; or the mechanisms themselves that cause these effects, such as, for example, the disintegration of the ice layer in western Antarctica. The International Panel on Climate Change (IPCC) (IPCC, Climate Change 2001: Scientific Basis. Third Assessment Report of the Intergovernmental Panel on Climate Change, 2001) defines vulnerability as "a function of the shape, size and degree of climate variation to which a system is exposed, its sensitivity to climate change and its adaptability '. The European Union has taken on this definition, adding that vulnerability is "the degree of sensitivity of a system to the adverse effects of climate change, including climate variability and extreme weather events, and its inability to cope with these phenomena" (European Commission, 2013). Vulnerability can be expressed in the form of a function: Vulnerability = f (Exposure, Sensitivity, Adaptability) a is calculated by the formula: V = E + S - AC where: • E = Exposure - the extent to which the system is exposed to significant climate change (IPCC 2001). • S = sensitivity - the extent to which the system is adversely or favorably affected by climate variability or change (IPCC 2014). • AC = adaptive capacity - the ability of systems, institutions, humans and other organisms to adapt to potential damage, seize opportunities, or respond to consequences (IPCC 2001). Exposure + Sensitivity = Potential impact The sum of exposure and sensitivity determines the potential impact of climate change. Exposure, sensitivity, and adaptability values are given in integers and take discrete values from 1 to 5, with 1 being the lowest level of exposure, sensitivity, and ability to adjust, and 5 being the highest degree of the same functions. The same formula is used in all vulnerability calculations. Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf p.26

The intensity of an event describes the severity and magnitude of an individual hazard, whether expressed in a qualitative or quantitative form. Intensity itself is defined as a pre-established minimum threshold (minimum threshold) that determines whether an event, whether extreme or not, can be considered a hazard. Identifying and determining a minimum level of intensity values is essential for identifying and identifying extreme events, hazards that have occurred in the past, and for assessing the likelihood of their recurrence in the future. The likelihood of extreme events, risks (hazards) can be determined in several ways, but all must be based on the use of real, historical data. For the purpose of analyzing the probability of occurrence of extreme events, hazard (hazard), this document will look at historical climatic data for the past 30 years, while a numerical estimate of the probability of occurrence of an individual extreme event, hazard (hazard) will be assigned in the future based on the frequency of occurrence of the observed event. of an extreme event in the observed past period.

Frequency of occurrence of an individual extreme events (hazard) (over the past 10-year period):	Assessment of the probability of occurrence of an individual extreme event (hazard)
More than 25 times	5 (almost certain)
Between 10 and 24 times	4
Between 5 and 9 times	3
Between 1 and 4 times	2
Never	1 (almost impossible)

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.28

M3:

The matrix attributing the colors to the numerical values of the indicators, and following the analysis of the resulting numerical values of exposure, vulnerability, ability to adapt, and later risk, is presented below.

Class	**Value**	**Status**	**Transformed indicator value '0 – 1'**	**Color**
1	0,0 – 0,2	Optimal	0,1	
2	0,2 – 0,4	Positive	0,3	

3	0,4 – 0,6	Neutral	0,5	
4	0,6 – 0,8	Negative	0,7	
5	0,8 – 1,0	Critical	0,9	

The process of determining exposure, sensitivity and later vulnerability for each sector will be performed in accordance with the logical framework above, the transformation tables above, and graphically presented in the above table with the visual characteristics indicated, and based on, at the time of making this document, available numerical data and indicators. This document was created in accordance with the methodology for developing vulnerability and risk assessments within the Life SEC Adapt project.

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf p.27

Health sector - Exposure variable (EX) contains the following indicators:

EX01 – Mean daily air temperature (TM)

EX02 – Number of tropical nights (TR20)

EX03 - Number of hot days (HD)

EX04 – Duration of warm periods (WSDI)

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.32

Tourism sector - Exposure variable (EX) contains the following indicators:

EX01 – Mean maximum daily air temperature (tasmax)

EX02 – Number of hot days (HD)

EX03 – Number of warm days (SU25)

EX04 – Total average rainfall

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.49

Water supply and water quality sector - Exposure variable (EX) contains the following indicators:

	EX01 – Mean daily air temperature (TM) EX02 – Total average rainfall EX03 – Duration of droughts (CDD) Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf , p.70 **M4:** Regarding data acquisition and management, the data collection is listed below: **Health sector**: Health Sector Exposure Analysis on Climate Change Impact - Following on from the individual findings of the six cities analyzed in the Current City Climate Assessment Report, variability and changes in climate trends can be observed that can be considered as indicative indicators of an individual's exposure to climate change . On the basis of all the conducted surveys, the average value was considered as relevant for the region of Istria. SENSITIVITY INDICATOR SE01 - Population - population figures refer to official data according to the 2011 census and are taken from the official website of the Central Bureau of Statistics (www.dzs.hr). SENSITIVITY INDICATOR SE02 - Population density - Population density data were obtained by dividing the population (data downloaded from the official website of the Central Bureau of Statistics - www.dzs.hr) by the total area of the settlement (data taken from the Spatial Plan of the County of Istria). SENSITIVITY INDICATOR SE03 - Population 65+ - Population over 65 (breakdown by settlements), refer to official data according to the 2011 census and are downloaded from the official website of the Central Bureau of Statistics (www.dzs.hr) SENSITIVITY INDICATOR SE04 - Population under 5 years - data on the population under 5 (division by settlements), refer to official data according to the census conducted in 2011 and are taken from the official website of the Central Bureau of Statistics (www.dzs.hr). SENSITIVITY DIRECTOR SE05 - Settlement of the settlement For the indicated indicator, the data on settlement construction were used in such a way that the average of six cities for which a single settlement analysis was performed was taken. SENSITIVITY INDICATOR SE06 - Availability of health services -. Data on the distance from the JLS to the Pula General Hospital were recorded in kilometers and minutes, and these were obtained using the application of the Croatian Auto Club (www.hak.hr). ADJUSTMENT ABILITY INDICATOR AC01 - Degree of education of the population - the birth value of the degree of education of the population was obtained by looking at the number of residents over 15

	years of age who have completed high school and higher (division by settlements). Data refer to official data according to the census conducted in 2011 and are taken from the official website of the Central Bureau of Statistics (www.dzs.hr) . ADAPTATION ABILITY INDICATOR AC02 - Per capita GDP - at the time of drafting this document, the most recent publicly available and available data related to gross domestic product for the Republic of Croatia at the county level is 2015. Data refer to official data and are taken from the official release of the Central Bureau of Statistics (www.dzs.hr). Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.32-37, 39, 41 **Tourism sector**: Following the findings of the Report on the Assessment of the Current State of Climate Indicators for the City of Poreč - Parenzo / City of Pula and the City of Rovinj, variability and changes in climate trends in the Western Istrian region can be observed, which can be considered as indicative indicators of the Istrian region's exposure to climate change. The data are relevant to all the areas located on the coast of the Istrian region - for exposure indicators SENSITIVITY INDICATOR SE01 - Share of Tourism Revenues- According to the data from the Master Plan of Tourism of the County of Istria 2015 - 2025, clusters in the area of Istria have been defined, and the overview of tourism revenues in the cluster area is given in the table below. SENSITIVITY INDICATOR SE02 - Number of arrivals, number of nights spent In accordance with the data of the Poreč Tourist Board, the table below provides information on the number of arrivals and the number of nights spent in the County of Istria from 1998 to 2016. Through daily rainfall analysis for a period of 30 years (from 1986 to 2015), and on the basis of data from the State Hydrometeorological Institute recorded at the climatic station Poreč / Rovinj / Pula, a significant increase in the number of days with precipitation on an annual level was detected, as well as the rising trend. Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.50, 56, 59 **Water supply and water quality sector**: EXPOSURE INDICATOR EX01 - Average daily air temperature (TM) - trend - In the regional report on the current state of climatic indicators in the Istria County, temperatures in Istria are shown by analyzing seasonal and annual values of mean (tsred), mean minimum (t-min)) and mean maximum (t-max) air

	temperatures and mean values of extreme temperature indices, according to data from the 1981-2010 reference period. for the meteorological stations Abrami (Buzet), Čepić (Labin) and Poreč, while for Pazin, Pula and Rovinj the values were taken from 1971 to 2000. The associated weather changes (trend) were examined according to a longer period: 1981-2015 for Abrami (Buzet), Cepic (Labin) and Porec, 1971-2000. and for Pazin, Pula and Rovinj the period 1961-2015 was taken. EXPOSURE INDICATOR EX02 - Total average rainfall - trend Rain conditions in Istria are shown by analysis of seasonal and annual rainfall amounts as well as mean values of extreme rainfall indices, according to data from the reference period 1981-2010 for Abrami (Buzet) meteorological stations, Čepić. (Labin) and Poreč, while values from 1971 to 2000 were taken for Pazin, Pula and Rovinj stations. The associated time changes (trend) were examined according to a longer period: 1981-2015 for Abrami (Buzet), Čepić (Labin) and Poreč, 1971 - 2000 and for Pazin, Pula and Rovinj the period 1961-2015 was taken. SENSITIVITY INDICATOR SE01 - Amount of water required for households - According to EUROSTAT data, the average water consumption in the household sector in the Republic of Croatia, in the period 2001-2013, ranged between 43 and 52 m3 / inhabitant. Data on water consumption in the household sector from 2006 to 2016 were obtained from the Istrian Water Supply Ltd., Buzet. SENSITIVITY INDICATOR SE03 - Quantity of water consumed in industry - Data on consumption of water consumed in industry in the Istria County in the period from 2006 to 2016 were obtained by the Istrian Water Supply Ltd., Buzet. ADJUSTMENT ABILITY INDICATOR AC01 - Degree of education - The numerical value of the level of education of the population was obtained by looking at the number of the population over 15 years of age who have completed high school and higher in the area of Istria. Data refer to official data according to the census conducted in 2011 and are taken from the official website of the Central Bureau of Statistics (www.dzs.hr). DANGER H01 - Number of dry periods of 7 consecutive days or more - Through analysis of daily rainfall for a period of 30 years (from 1986 to 2015), and based on data from the State Hydrometeorological Institute, the average duration of dry periods (consecutive series of days) has been determined with a daily precipitation of Rd <1 mm) of 6.50 days for the observation period. Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.71-72, 75-77, 86

M5:

Exposure, sensitivity, and adaptability values are given in integers and take discrete values from 1 to 5, with 1 being the lowest level of exposure, sensitivity, and ability to adjust, and 5 being the highest degree of the same functions. The same formula is used in all vulnerability calculations for 1. Potential climate effect (ci), 2. Exposure factors, 3. Sensitivity factors and 4. Adjustment capacity.

In order to be able to carry out a computational process for determining the exposure for the sector concerned, it is necessary, after determining the impact that individual indicators have on exposure and assigning a class value, to equalize the parameter values in such a way that the numerical values for each indicator are transformed in the ''0 - 1'' range.

Class	Limit value	Description	Transformed indicatior value '0 – 1'
1	0,0 – 0,2	Optimal	0,1
2	0,2 – 0,4	Positive	0,3
3	0,4 – 0,6	Neutral	0,5
4	0,6 – 0,8	Negative	0,7
5	0,8 – 1,0	Critical	0,9

The matrix attributing the colors to the numerical values of the indicators, and following the analysis of the resulting numerical values of exposure, vulnerability, ability to adapt, and later risk, is presented in the table below.

Class	Value	Status	Transformed indicatior value '0 – 1'	Color
1	0,0 – 0,2	Optimal	0,1	

2	0,2 – 0,4	Positive	0,3		
3	0,4 – 0,6	Neutral	0,5		
4	0,6 – 0,8	Negative	0,7		
5	0,8 – 1,0	Critical	0,9		

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.26-27

M6:

Health sector:

Indicator EX01 - Mean daily temperature (TM); assigned weight 2

Indicator EX02 - Tropical nights (TR20); assigned weight 1

Indicator EX03 – Number of hot days (HD); assigned weight 2

Indicator EX04 – Trajanje toplih razdoblja (WSDI); assigned weight 1

Indicator SE01 - Population; assigned weight 1

Indicator SE02 – Population density; assigned weight 1

Indicator SE03 – Population older than 65 years; assigned weight 1

Indicator SE04 – Population younger than 5 years; assigned weight 1

Indicator SE05 - Construction development; assigned weight 1

Indicator SE06 - Health services accessibility; assigned weight 2

Indicator AC01 – Population education level; assigned weight 1

Indicator AC02 – Amount of GDP per capita; assigned weight 1

Indicator AC03 – Population educated through prevention programmes; assigned weight 1

Tourism sector:

Indicator EX01 - Mean maximum daily temperature (tmax); assigned weight 2

Indicator EX02 - Number of hot days (HD); assigned weight 1

Indicator EX03 - Warm days (SU25); assigned weight 1

Indicator EX04 – Total average rainfall; assigned weight 2

Indicator SE01 - Share of tourism revenue; assigned weight 2

Indicator SE02 – Number of arrivals, number of nights spent; assigned weight 1

Indicator AC01 – Amount of funds invested in events and development of new tourism programs; assigned weight 1

Water supply and water quality sector:

Indicator EX01 - Mean daily temperature (TM); assigned weight 1

Indicator EX02 – Total average rainfall; assigned weight 2

Indicator EX03 – Duration of droughts (CDD); assigned weight 2

Indicator SE01 - Amount of water needed for households; assigned weight 1

Indicator SE02 – Amount of water needed for irrigation; assigned weight 1

Indicator SE03 – Amount of water consumed in the industry; assigned weight 1

Indicator AC01 – Population education level; assigned weight 1

Indicator AC02 – Regulations restricting water consumption (for example, in summer - dry periods) or adopting provisions that promote water savings; assigned weight 1

Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.32,33, 38, 42, 55, 57, 58, 74, 76, 77, 83

M7:

Indicators for Health sector are aggregated in the following way:

POTENTIAL IMPACT (PI)	Increased mortality due to extreme weather conditions
EXPOSURE (EX)	EX01 - Average daily air temperature (tm)

	EX02 - Tropical Night (TR20) EX03 - Number of hot days (HD) EX04 - Warm Period Duration (WSDI)
SENSITIVITY (SE)	SE01 - Population SE02 - Population density SE03 - Population 65+ SE04 - Population under 5 years old SE05 - Settlement of settlements SE06 - Availability of Health Services
ADAPTATION ABILITY (AC)	AC01 - Degree of education of the population AC02 - GDP per capita AC03 - Number of residents educated through prevention programs
OBSERVED RISK (H)	H01 - Heat wave

Indicators for Tourism sector are aggregated in the following way:

POTENTIAL IMPACT (PI)	Changes in tourist flows
EXPOSURE (EX)	EX01 - Mean maximum daily air temperature EX02 - Number of hot days (HD) EX03 - Number of warm days (SU25) EX04 - Total average rainfall
SENSITIVITY (SE)	SE01 - Share of tourism revenue SE02 - Number of arrivals, number of nights
ADAPTATION ABILITY (AC)	AC01 - Marketing Investments AC02 - Investments in events and developme new tourism programs
OBSERVED RISK (H)	H01 - Daily precipitation of 3 consecutive da more

	Indicators for Water supply and water quality sector sector are aggregated in the following way: POTENTIAL IMPACT (PI): Reduction of available quantities (shortages) drinking water due to decrease in well yield decrease in flow rate EXPOSURE (EX): EX01 - Mean Daily Air Temperature (TM); EX02 - Total average rainfall; EX03 - Drought Duration (CDD) SENSITIVITY (SE): SE01 - Amount of water required for househ; SE02 - Amount of water required for irrigatio; SE03 - The amount of water consumed for in purposes ADAPTATION ABILITY (AC): AC01 - Degree of education of the populatio; AC02 - Regulations restricting water consum example, in summer - drought periods) or ac provisions that promote water savings OBSERVED RISK (H): H01 - Number of dry periods of 7 days or mo Source:http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf, p.32, 49, 70 **M8: /**
References	
Website(s)	http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/C2_Risk_and_Vulnerability_Assessment_analysis/REPORTS/CROATIA_REGIONAL_LEVEL/Report_Risk_and_Vulnerability_Region_of_Istria.pdf https://ida.hr/hr/bn/eu-projekti/aktualni-eu-projekti/detail/2/life-sec-adapt-upgrading-sustainable-energy-communities-mayor-adapt-initiative-planning-climate-change-adaptation-strategies/ https://www.istra-istria.hr/index.php?id=263 https://www.istra-istria.hr/index.php?id=14
Bibliography	/

Images

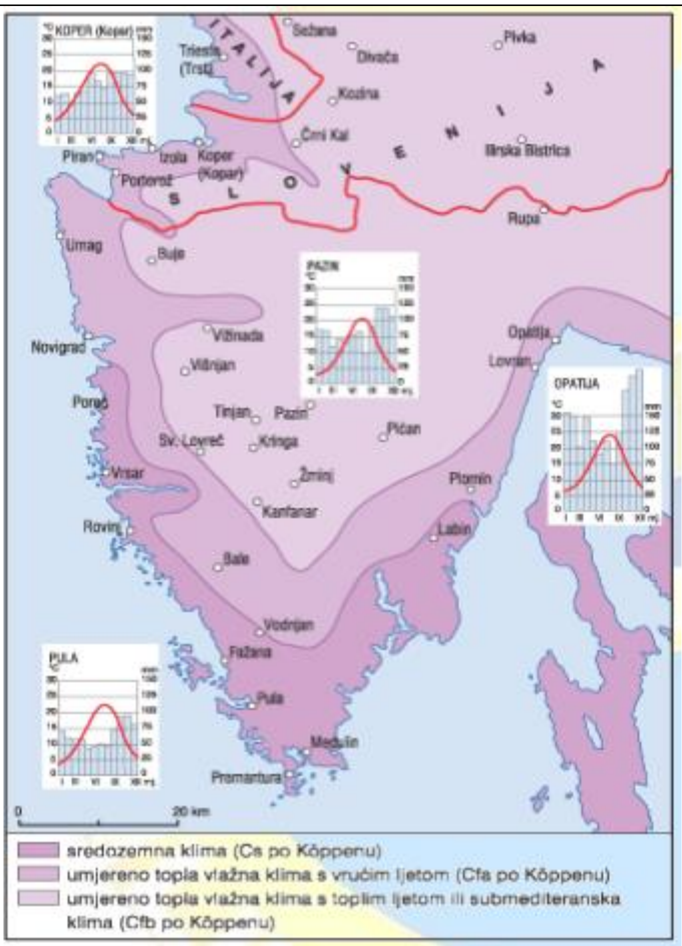


Image 1 - Climatological view of Istria

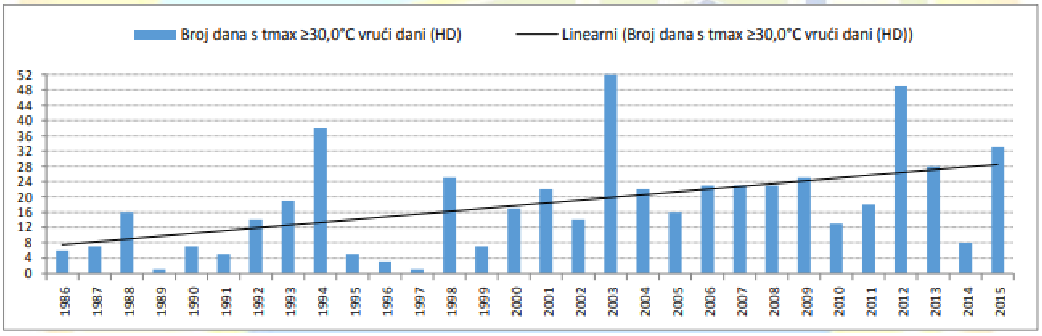


Image 2 – Representation of number of days with daily temperature equal or higher than 30 30,0 °C (hot days) in western Istria in 1986 – 2015 year period

Title of the Case study	**Risks and Vulnerabilities assessment in the Municipality of Cartagena**
General data	
Promoter	*Please insert the name of the organization that promoted the case study (i.e. for a project, the Lead partner/main beneficiary):* • **LIFE ADAPTATE project Lead Partner:** Instituto de Fomento de la Región de Murcia (INFO) • **Type of organization:** Development agency • **Description:** Instituto de Fomento de la Región de Murcia (INFO) is the development agency for the region of Murcia, an autonomous community of south-eastern Spain. The institute's main role is to boost the development of small and medium-sized enterprises in Murcia by promotion of the economy, investment-raising, elimination of obstacles and encouragement of competitiveness. • **Website**: http://www.institutofomentomurcia.es/web/portal/en
Timeframe	*Please insert the year(s) of reference (i.e. for a project, the years of implementation):* • **LIFE ADAPTATE project implementation period:** 01 September 2017 to 30 September 2021
Target area and scale	*Please indicate the area covered by the case study, specifying if it is a municipal, regional, or national-level initiative:* It is a municipal initiative. The case study covers the area of Cartagena Municipality.

<table>
<tr>
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<td>
Cartagena is a Spanish city located in the southeast of the Region of Murcia, in the Mediterranean Coast. There are 214,759 people living in the municipality, being the second largest municipality in the Region of Murcia. The metropolitan area of Cartagena, known as Campo de Cartagena, has a population of 409,586 inhabitants.
<table>
<tr><td>Country</td><td>Spain</td></tr>
<tr><td>Autonomous community</td><td>Murcia</td></tr>
<tr><td>Province</td><td>Province of Murcia</td></tr>
</table>


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<tr>
<td>Brief descriptio n</td>
<td>
Please describe briefly the Case study, explaining its context, main objectives, climate-related actions, outputs and results, as well as the key actors involved:
Context:
LIFE ADAPTATE project aims to increase the commitment of European municipalities with the Covenant of Mayors for Climate and Energy by the development of local adaptation plans which will be integrated in the previous mitigation objectives of several municipalities, giving a comprehensive approach to the fight against climate change.
One of the specific objectives of LIFE ADAPTATE is to develop Sustainable Energy and Climate Action Plans (SECAP) in 6 municipalities in 3 different countries (Latvia, Portugal and Spain).
One of the target areas in Spain is the Municipality of Cartagena. Its SECAP and its pilot action will encourage the adoption of measures to adapt the municipality to climate change, including green areas as an adaptation measure against heat waves.
According to the Covenant of Mayors methodology, each SECAP is based on a Baseline Emission Inventory (BEI) and a Climate Risk & Vulnerability Assessment(s) (RVAs) which provide an analysis of the current situation. These elements serve as a basis for defining a comprehensive set of actions that local authorities plan to undertake in order to reach their climate mitigation and adaptation goals.
Thus, the Case study “Risks and vulnerabilities assessment in the Municipality of Cartagena” serves as a baseline document in the creation Cartagena’s SECAP.
Main objectives
Whereas SEAPs were not required to address climate change adaptation at all, SECAPs must do so. Unlike mitigation, adaptation has neither a unified ambition nor a quantitative threshold target, since appropriate actions will depend highly on local
</td>
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</table>

	conditions. Similar to mitigation, however, an essential precursor to action is to establish a baseline, specifically through a Risk and Vulnerability Assessment (RVA). As part of an RVA, Municipality of Cartagena was supposed to identify relevant climate hazards, along with the level of risk and expected changes in intensity and frequency. • **Climate-related actions** In order to analyse the historical events that the municipality has suffered and its resilience to climate change and natural hazards, available information on these topics have been compiled in The State Meteorological Agency and Statistical Portal of the Region of Murcia – CREM. The first step in the analysis was is to select the key climate variables for the municipality. The following indicators were assessed: – Rainfall (mm/day) – Number of rainy days (days) – Duration of dry periods (days) – Percentile 95 of daily rainfall (mm) – Maximum temperature (°C) – Percentile 95 Max. temperature (°C) – Minimum temperature (°C) – Percentile 5 Min. temperature (°C) – Number of warm days (days) – Number of warm nights (days) – Number of freezing days (days) – Change in duration of heat waves (days) – Heating degree days (°C day) – Cooling degree days (°C day) – Forest fires (ha affected per year) • **Outputs and results** Based on the above climate assessment, the climate hazards with greater consequences on the municipality were identifies as follows: • <u>High hazard risk level:</u> Extreme heat Droughts • <u>Moderate hazard risk level:</u> Floods Sea level rise

	Storms • Low hazard risk level: Extreme cold Extreme precipitation Forest fires Furthermore, socio-economic, physical and environmental vulnerabilities were described, as well as the factors that tend to increase them. Detected vulnerabilities have are evaluated to have the following adaptive capacity: • Very low Population density Population growth • Low Urban heat islands % old buildings Economic activity sensitive to climate change % of areas not accessible for services • Medium Presence of forest Buildings in risky areas Presence of affected coastal areas % population living in risky areas % sensitive population (elderly and similar) • High Difficulty to assess risky areas • Very high Soil pollution Water pollution % population with low cultural level Finally, The municipality of Cartagena has identified the sectors that will be affected (positively or negatively) by climate change. Those sectors are: Buildings, transport, energy, water, waste, land use planning, agriculture & forestry, environment & biodiversity, health, civil protection and emergency and tourism. For each sector, negative impacts were further assessed according to their expected effect on the municipality.

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- **Key actors involved**

Different types of stakeholders must be involved in the Climate Adaptation Plan development. The following groups of stakeholders were identified as important for the Municipality of Cartagena: municipal departments, municipal agencies and companies, regional government, civil organizations and similar, active in the fields of environment, infrastructure and services, transport, tourism, education, emergency services, urban and land planning, entrepreneurship, utility services, telecommunications, etc.
</td></tr>
<tr><td colspan="2">Contribution of the Case study to the Joint_SECAP guidelines for Vulnerability and Risk assessment</td></tr>
<tr><td>Modules of the guidelines relevant to the case study</td><td>

Please select one or more Modules that you think the Case study gives a significant contribution to (i.e. through methodologies, methods, tools…). Refer to the Joint_SECAP Guidelines for further information on Modules:

☒ M1 PREPARING THE RISK ASSESSMENT
(describes the context of the assessment - processes, knowledge, institutions, resources and external factors –, identifies its objectives, expected outcomes and scope, and defines tasks, responsibilities and time planning)

☒ M2 DEVELOPING IMPACT CHAINS
(identifies and clusters impacts and risks, identifies hazard and intermediate impacts, vulnerability and exposure of the system)

☒ M3 IDENTIFYING AND SELECTING INDICATORS
(identifies and select indicators for hazards, vulnerability and exposure)

☐ M4 DATA ACQUISITION AND MANAGEMENT
(regards the collection, quality check, storage and management of data)

☐ M5 NORMALIZATION OF INDICATOR DATA
(provides normalized data for each indicator in a standardized value)

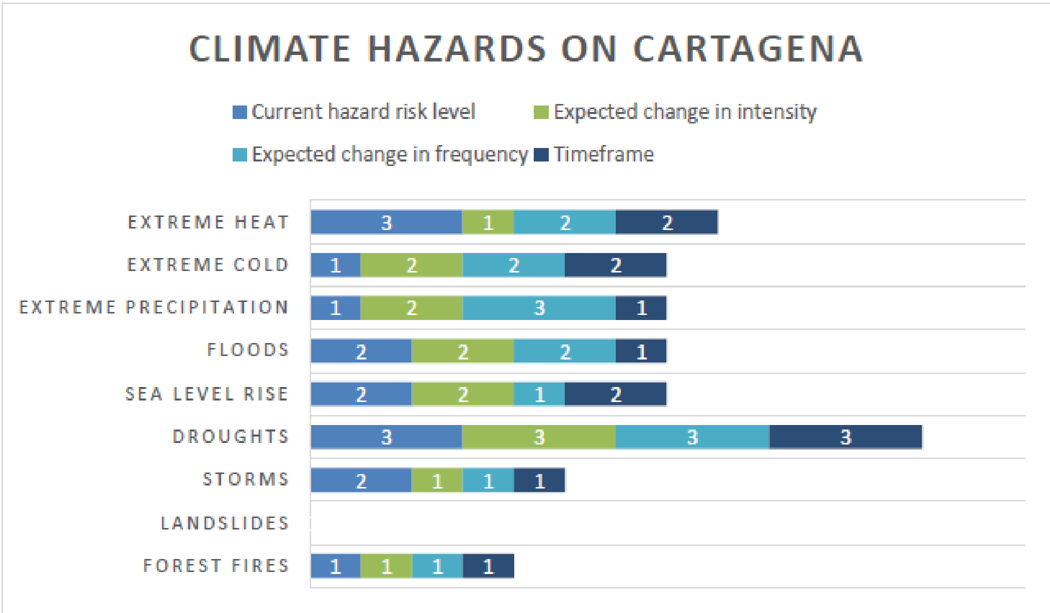
☐ M6 WEIGHTING AND AGGREGATING OF INDICATORS
(evaluates the influence of the indicators on the respective risk component, assigns different weights, aggregates individual indicators into composite indicators of the risk components hazard, vulnerability and exposure)

☐ M7 AGGREGATING RISK COMPONENTS TO RISK
(aggregates the risk components into a composite risk indicator)

☐ M8 PRESENTING THE OUTCOMES OF YOUR RISK ASSESSMENT
(describes how to elaborate the risk assessment report, taking into account both the objective and the target audience of the assessment)
</td></tr>
</table>

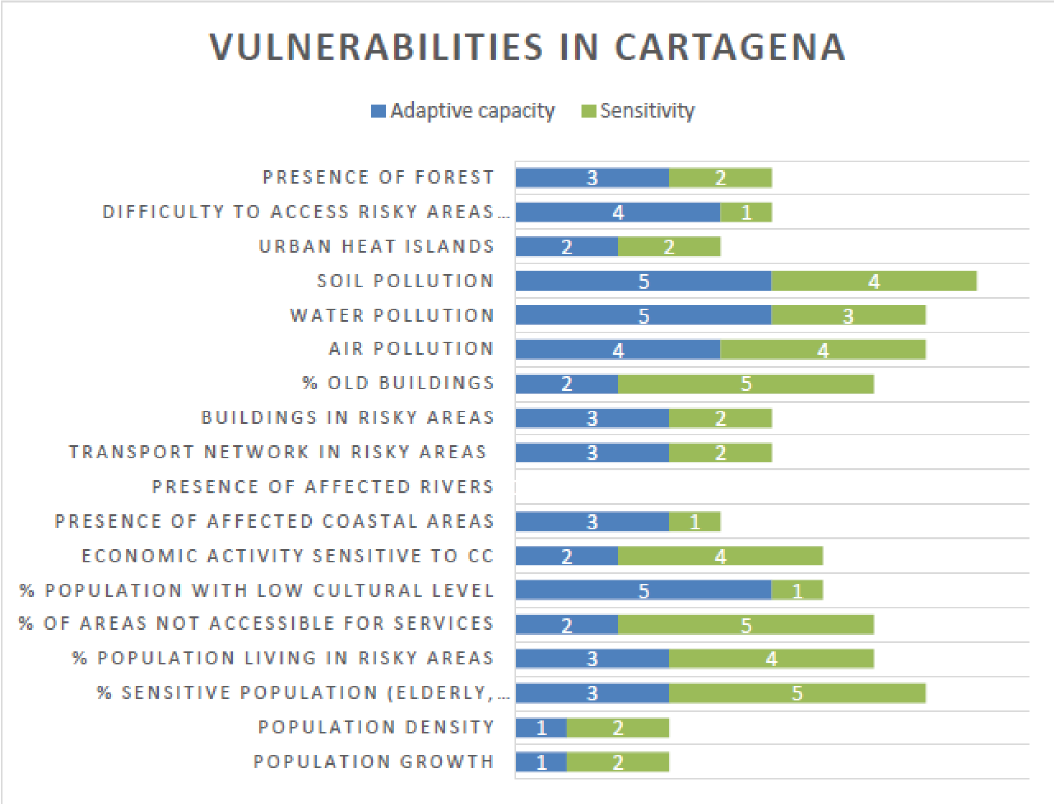
Description of the contribution of the Case study to the Joint_SECAP guidelines	*Please provide a detailed description of how the Case study contributes to the modules selected above, i.e. by explaining the methodological approach adopted, the methods and tools used, etc. The lines corresponding to the modules that are NOT been selected above shall be left blank:* M1: Cartagena case study describes well how the working group was structured, who were the persons in charge, their names and positions. Furthermore, a rather long stakeholder list is included with details of every stakeholder's type of organization, sector and relevant competences. It also gives and extensive description of the geographical, historical, cultural and urban context. M2: A number of hazards were identified and scored on the basis of a current hazard risk level, expected change in intensity, expected change in frequency and timeframe of occurrence. M3: A number of relevant indicators were identified, described one by one, and summed up in a clear table-form preview. Baseline data were presented as well as projections for the year 2100. Vulnerabilities were also described and assessed based on their adaptive capacity and the degree to which a system is affected by or responsive to a hazard. M4: M5: M6: M7: M8:
References	
Website (s)	*LIFE ADAPTATE project website:* http://lifeadaptate.eu/en/project/
Bibliography	*Please include references to books, papers or articles providing relevant information on the Case study:* • Life ADAPTATE – Municipality of Cartagena, Spain (2019), URL: http://lifeadaptate.eu/wp-content/uploads/Deliverable-D.10.-Risks-and-Vulnerabilities-Assessment.pdf • Compete4SECAP D5.4: UPGRADING FROM SEAP TO SECAP FOR INTEGRATED CLIMATE ACTION -A Quick Access Guide (2019), URL: https://compete4secap.eu/fileadmin/user_upload/EnMS/D5_4_SECAP_upgrade_guide_190916.pdf • Municipality of Cartagena official website, URL: https://www.cartagena.es/

	• European Comission's project database: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6361
Images	*Please include pictures or graphs you deem relevant to illustrate the Case study:*

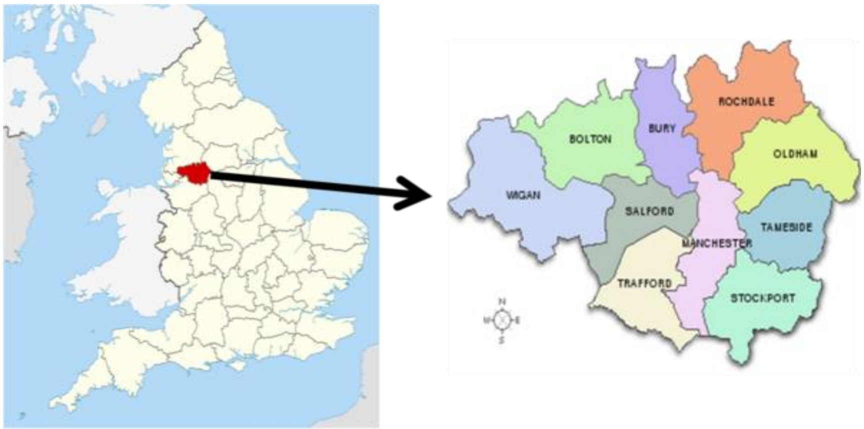


LEGEND:

Current hazard risk level (HRL)	Expected change in intensity (CI)	Expected change in frequency (CF)	Timeframe (T)
1- Low	1- Decrease	1- Decrease	1- Long term
2- Moderate	2- No change	2- No change	2- Medium term
3- High	3- Increase	3- Increase	3- Short term
			4- Current



Legend:
1 – Very low, 2 – Low, 3 – Medium, 4 – High, 5 – Very high

Title of the Case study	Resin project, Manchester risk assessment
General data	
Promoter	*Please insert the name of the organization that promoted the case study (i.e. for a project, the Lead partner/main beneficiary):* *RESIN* – TNO, the Netherlands Organization for applied scientific research, regulated by public law, independent (not part of any government, university or company), www.tno.nl, (project coordinator) THE UNIVERSITY OF MANCHESTER United Kingdom https://www.manchester.ac.uk/
Timeframe	*Please insert the year(s) of reference (i.e. for a project, the years of implementation):* *RESIN – 05/2015-11/2018*
Target area and scale	*Please indicate the area covered by the case study, specifying if it is a municipal, regional, or national-level initiative:* *Greater Manchester covers an area of 1,277 km^2 with a population of 2.7m and is comprised of 10 local authority districts (Municipalities). Greater Manchester (GM) was at the heart of the industrial revolution, becoming the world's first industrial city.*  Map of the ten GM districts in context of England (Matt Ellis, GMCA)
Brief description	*Please describe briefly the Case study, explaining its context, main objectives, climate-related actions, outputs and results, as well as the key actors involved:* *This document has been prepared in the framework of the European project RESIN – Climate Resilient Cities and Infrastructures*

	This Case studycontains the results of GM's first climate change risk assessment of critical infrastructure undertaken as part of the Horizon 2020 RESIN project. The risk assessment methodology drew on established approaches developed by high profile organisations including the Intergovernmental Panel on Climate Change and the UK Cabinet Office. It provides an evidence-based risk assessment informed by the best available data on the current occurrence of extreme weather and climate change hazards in GM, and on the direction of future climate change projections that will influence the frequency and intensity of these hazards locally. *The goal of this risk assessment is to establish the most prominent risks in this context, not to identify all possible risks. Six extreme weather and climate change hazards fall within the scope of the risk assessment:* *Fluvial flooding* *Pluvial flooding* *High temperatures* *Water scarcity* *Storms (high winds and lightening)* *Geohazards (subsidence and landslides)* *This matches the hazards covered within the critical infrastructure chapter of the UK Climate Change Risk Assessment 20173. Within the GM assessment, however, pluvial and fluvial flooding have been considered as separate hazard themes. This is to reflect the different processes underlying these two forms of flooding, and variations in their occurrence in GM.* *Urban critical infrastructure sectors covered within the GM risk assessment have been established with reference to the GM Spatial Framework (GMCA 2015), which identifies GM's critical infrastructure sectors as:* *Transport: air (Manchester Airport), rail, port (Salford) tram (metrolink), road, walking and cycling).* *Energy: gas, electricity, heat.* *ICT: digital connectivity.* *Water and waste water: water supply and water treatment.* *Social infrastructure: schools and education, health services, community facilities.* *Green infrastructure.* *There are four key elements to the risk assessment approach followed within the GM case study which are now outlined:* *1. Identify extreme weather and climate change impacts to critical infrastructure*

	2. Determine likelihood of extreme weather and climate change impact occurrence *3. Assess the consequences of extreme weather and climate change impacts for critical infrastructure* *4. Assess extreme weather and climate change risk to critical infrastructure* *This risk assessment has increased political awareness and commitment to actions to adapt to climate change and GM resilience involved in initiatives such as the 100 Resilience Cities Initiative or the UNISDR campaign to make cities more resilient - my city is ready in 2014, etc.* *The risk assessment methodology drew on established approaches developed by high profile organisations including the Intergovernmental Panel on Climate Change and the UK Cabinet Office,.. The assessment has been supported by over 40 individuals working in and around GM RESIN steering group, the majority who have considerable experience (over 5 years) of working in associated fields(individuals from GM including representatives from the Low Carbon Hub, Transport for Greater Manchester and the Civil Contingences and Resilience Unit, the Civil Contingences and Resilience Unit, ARUP, Natural England and City of Trees)*
Contribution of the Case study to the Joint_SECAP guidelines for Vulnerability and Risk assessment	
Modules of the guidelines relevant to the case study	*Please select one or more Modules that you think the Case study gives a significant contribution to (i.e. through methodologies, methods, tools…). Refer to the Joint_SECAP Guidelines for further information on Modules:* • M1 PREPARING THE RISK ASSESSMENT (describes the context of the assessment - processes, knowledge, institutions, resources and external factors –, identifies its objectives, expected outcomes and scope, and defines tasks, responsibilities and time planning) • M2 DEVELOPING IMPACT CHAINS (identifies and clusters impacts and risks, identifies hazard and intermediate impacts, vulnerability and exposure of the system) ☐ M3 IDENTIFYING AND SELECTING INDICATORS (identifies and select indicators for hazards, vulnerability and exposure) • M4 DATA ACQUISITION AND MANAGEMENT (regards the collection, quality check, storage and management of data) ☐ M5 NORMALIZATION OF INDICATOR DATA (provides normalized data for each indicator in a standardized value) ☐ M6 WEIGHTING AND AGGREGATING OF INDICATORS (evaluates the influence of the indicators on the respective risk component, assigns different weights, aggregates individual indicators into composite indicators of the risk components hazard, vulnerability and exposure) • M7 AGGREGATING RISK COMPONENTS TO RISK

	(aggregates the risk components into a composite risk indicator) ☐ M8 PRESENTING THE OUTCOMES OF YOUR RISK ASSESSMENT (describes how to elaborate the risk assessment report, taking into account both the objective and the target audience of the assessment)
Description of the contribution of the Case study to the Joint_SECAP guidelines	*Please provide a detailed description of how the Case study contributes to the modules selected above, i.e. by explaining the methodological approach adopted, the methods and tools used, etc. The lines corresponding to the modules that are NOT been selected above shall be left blank:* M1: *Report City Assessment Report Greater Manchester* this study describes in more detail the economic, social and physical characteristics, current adaptation plans and strategies, the current political situation and the organization working on the plan, the implementation of adaptation and critical infrastructure protection measures to help us better understand options and tools and products for support for decisions that can best suit a particular local context M2: The climate change impact chains developed within the GM RESIN case study offer several functions that can support climate change adaptation and resilience building strategies and actions. These centre on their communication and awareness raising functions, in addition to their role in supporting the development of adaptation and resilience responses. Organisations with responsibilities related to climate change adaptation and resilience could therefore benefit from developing and using impact chains. Given the potential benefits offered by climate change impact chains, it certainly gives us a way to develop them for our own needs. M3: M4: from the risk assessment report critical gives an evidence-based risk assessment, informed from the best available data on the current occurrence of the threat of extreme weather and climate change which is very important because it tells us about the importance of data for future climate change projections that will affect frequency and intensity these hazards locally. M5: M6: M7: from this Climate Change Risk Assessment analysis GM's critical infrastructure offers the following benefits that we must include in our risk assessments: ▯ Awareness raising ▯ Prioritization ▯ Resource allocation ▯ Strategy and action development M8:
References	
Website(s)	*Please include the link to the official website and/or other webpages where information on the Case study can be found:* https://resin-cities.eu/greatermanchester/

	https://resincities.eu/fileadmin/user_upload/Resources/City_report_GM/GM_Impact_Chains_Final_Report_-_Final_Draft.pdf
Bibliography	*Please include references to books, papers or articles providing relevant information on the Case study:*
Images	*Please include pictures or graphs you deem relevant to illustrate the Case study:*

Table 1: Extreme weather and climate change impacts to GM's critical infrastructure

	Fluvial flooding	**Pluvial flooding**	**High temperatures and heat waves**	**Water scarcity**	**Storms (high winds and lightening)**	**Geohazards (subsidence and landslides)**
Transport	- Flooding of road network - Flooding of rail network - Road bridge failure due to scour - Rail bridge failure due to scour	- Flooding of road network - Flooding of rail network	- Rail buckling due to high temperatures		- Storm damage to road network - Storm damage to rail network	- Slope and embankment failure on road network - Slope and embankment failure on rail network
Energy (Gas and Electricity)	- Flooding of energy infrastructure (esp. substations) - Flooding of power stations	- Flooding of energy infrastructure (esp. substations)	- Increased energy demand for cooling - Damage to energy infrastructure from high temperatures	- Lack of cooling water for power generation	- Storm damage to energy infrastructure	
ICT (Digital Connectivity)	- Flooding of ICT infrastructure	- Flooding of ICT infrastructure			- Storm damage to ICT infrastructure	
Water Supply and Waste Water Treatment	- Flooding of water supply and waste water treatment infrastructure - Sewer flooding and combined sewer spills	- Flooding of water supply and waste water treatment infrastructure - Sewer flooding and combined sewer spills	- Increased demand for water	- Low groundwater levels and reduced recharge - Water supply and demand deficit (water scarcity) N.B. Also links to temp rise.		
Public Buildings	- Flooding of properties	- Flooding of properties	- Overheating of buildings	- Reduced water availability for buildings		- Subsidence
Green and Blue Infrastructure			- Loss of green and blue infrastructure functions	- Loss of green and blue infrastructure functions	- Tree fall	

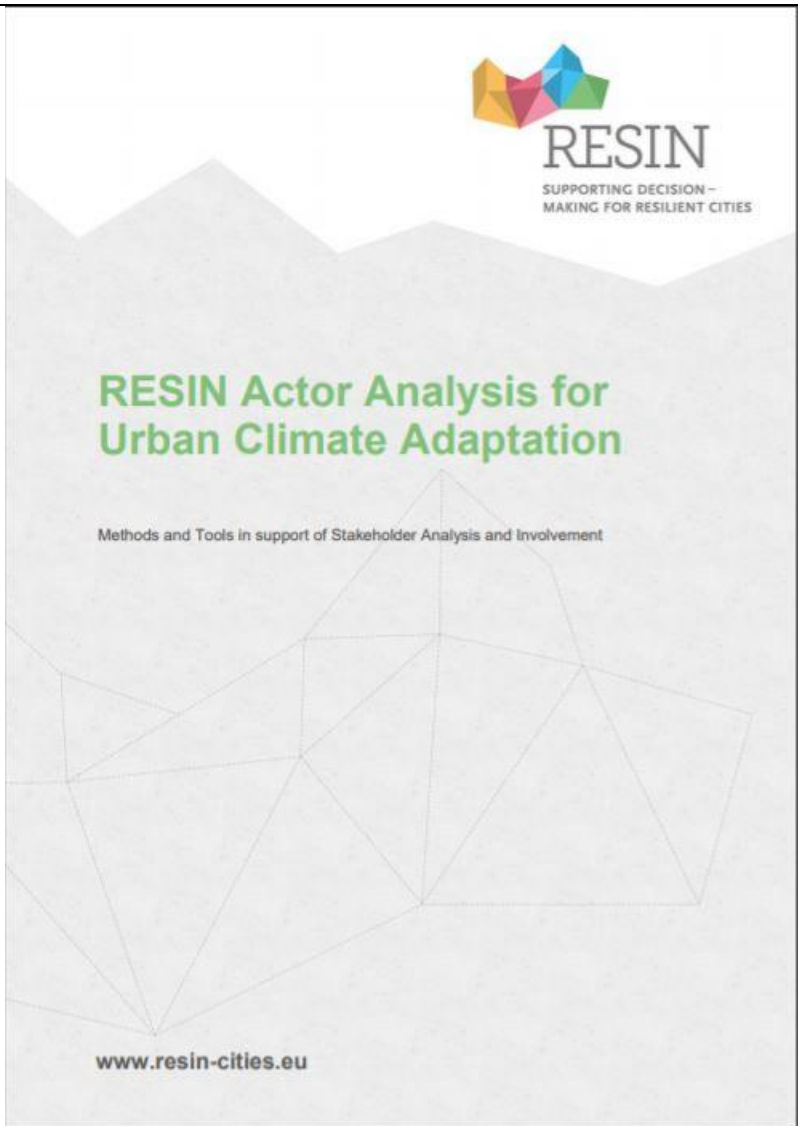
Title of the Case study	Case Study – RESIN stakeholder mapping, Community engagement in Scotland
General data	

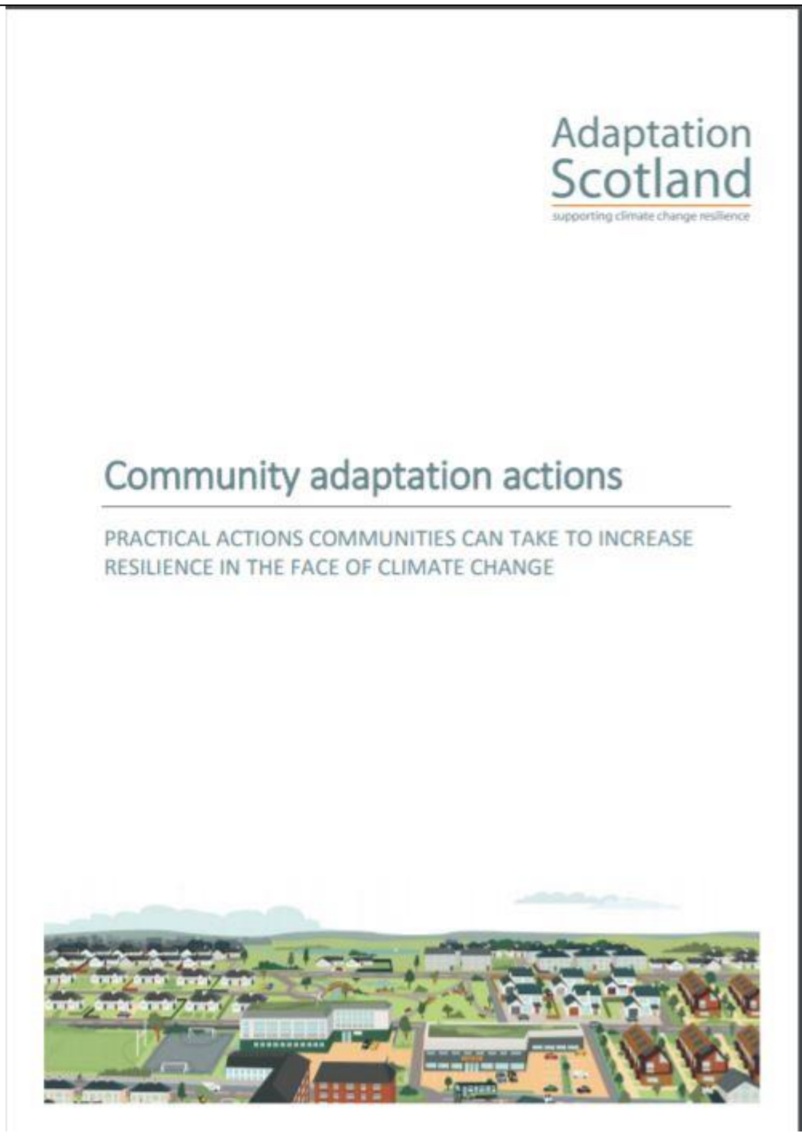
Promoter	*RESIN* – TNO, the Netherlands Organization for applied scientific research, regulated by public law, independent (not part of any government, university or company), www.tno.nl, (project coordinator) *Adaptation Scotland* – programme funded by the Scottish Government (www.adaptationscotland.org.uk) and delivered by Sniffer sustainability charity (www.sniffer.org.uk)
Timeframe	*RESIN* – 05/2015-11/2018 *Community adaptation actions* – material first published in 2014. updated in 2017.
Target area and scale	*RESIN* – municipal level (Manchester (UK), Paris (FR), Bratislava (SLK), Bilbao (ESP), Alba (ITA), Almada (P), Athens (GR), Burgas (BG), London (UK), Lathi (FIN), Newcastle (UK), Nijmegen (NL), Padua (ITA), Radom (PL), Reykjavik (ICL), Sfantu Gheorghe (ROM), Strasbourg (FRA), Ghent (B), Vilnius (LIT), Warsaw (PL), Zadar (CRO) Community adaptation actions – national level, Scotland
Brief description	The case study presented is examining two different actions taken in terms of stakeholder mapping and community engagement. Stakeholder mapping material used is from the deliverables and work done as a part of the RESIN project (*RESIN* – Supporting Decision-making for Resilient Cities, contract no. 653522, www.resin-cities.eu, contracted under Horizon 2020 call). While community engagement is examined by comparing the Joint_SECAP actions to the ones developed and implemented by Adaptation Scotland (www.adaptationscotland.org.uk, the programme funded by the Scottish Government and delivered by sustainability charity Sniffer). The fill titles of the examined materials are as follows: - RESIN Actor Analysis for Urban Climate Adaption – Methods and Tools in support of Stakeholder Analysis and Involvement; - Community adaptation actions – Practical actions communities can take to increase resilience in the face of climate change. The objective of the case study is to improve Joint_SECAP Guidelines for Vulnerability and Risk Assessment by collecting and analyzing available and chosen examples. *Stakeholder mapping* It is evidential and known form climate and resilience literature that the stakeholder involvement is essential for the development and implementation for adaptation strategies. The timely involvement of the right stakeholder contributes to well considered decisions for measures with impact. The very fist step to have a clear understanding of whom to involve when and how, a systematic stakeholder mapping and analysis should be conducted. The starting point

	is to seek for "Why?" in order to understand stakeholder issues and interests at stake following by many other related questions. The material of the case study proposed activities to be adopted: (1) Identification of stakeholders, (2) Differentiation between and categorization of stakeholders, (3) Identification of relationships between stakeholders. Next, each activity is assigned a set of methods and tools, and each one of them was analyzed and summed up in categories *purpose*, *resources*, *strengths*, and *weaknesses*. The analyzed methods and tools per activity are as follows: (1) Brainstorm session (e.g. focus group), semi-structured interviews, snowball mapping; (2) Interest-influence matrices, radical transitiveness, stakeholder led categorization, Q method, salience method; (3) Actor-linkage matrices, social network analysis, knowledge mapping, institutional analysis. *Community engagement* *RESIN* project next steps to be taken to create trust and gain commitment from those (to be) part in the process of developing and deciding on adaption plan. *RESIN* project provides experiences from partners with some supporting approaches to indeed engage, create trust and seek commitment to involve stakeholders and keep them involved through the process of strategy planning and engagement. The following approaches are described: - Mutual gains approach, - Participant ladder, - Rebuild by design, - Context of use analysis, - Capacity building. The Adoption Scotland material describes practical actions that communities can take to increase resilience and adapt to change in climate. It is foreseen as a starting point for further discussion with communities and community-facing organizations. There are over twenty actions described across three categories: (1) Community adaption actions in the natural environment; (2) Community adaption actions for built assets (schools, community centers, homes); (3) Community adaption actions that raise awareness and build capacity to adapt. Each action is further described by answering the following questions: - What adaption action could our community take?

	- What climate change impacts can this action be taken in response to? - How does this action contribute to climate change adaption? - What other benefits does this action have? - Who should be involved? - Where has this action been taken already? Case study team cross compare the described material with Joint_SECAP planned approaches and actions.
Contribution of the Case study to the Joint_SECAP guidelines for Vulnerability and Risk assessment	
Modules of the guidelines relevant to the case study	*Please select one or more Modules that you think the Case study gives a significant contribution to (i.e. through methodologies, methods, tools…). Refer to the Joint_SECAP Guidelines for further information on Modules:* • M1 PREPARING THE RISK ASSESSMENT (describes the context of the assessment - processes, knowledge, institutions, resources and external factors –, identifies its objectives, expected outcomes and scope, and defines tasks, responsibilities and time planning) • M2 DEVELOPING IMPACT CHAINS (identifies and clusters impacts and risks, identifies hazard and intermediate impacts, vulnerability and exposure of the system) ☐ M3 IDENTIFYING AND SELECTING INDICATORS (identifies and select indicators for hazards, vulnerability and exposure) • M4 DATA ACQUISITION AND MANAGEMENT (regards the collection, quality check, storage and management of data) ☐ M5 NORMALIZATION OF INDICATOR DATA (provides normalized data for each indicator in a standardized value) ☐ M6 WEIGHTING AND AGGREGATING OF INDICATORS (evaluates the influence of the indicators on the respective risk component, assigns different weights, aggregates individual indicators into composite indicators of the risk components hazard, vulnerability and exposure) ☐ M7 AGGREGATING RISK COMPONENTS TO RISK (aggregates the risk components into a composite risk indicator) • M8 PRESENTING THE OUTCOMES OF YOUR RISK ASSESSMENT (describes how to elaborate the risk assessment report, taking into account both the objective and the target audience of the assessment)

Description of the contribution of the Case study to the Joint_SECAP guidelines	M1: *Step 4: Prepare an implementation plan* is a part of the Module that would be good to practice findings in the case study from the project RESIN. Early planning on stakeholder mapping and involvement could/should be even starting point of the Step 4. It is crucial to have clear picture on the stakeholder, their identification, interests, risks and ways to communicate with them. M2: *Step 5: Brainstorm adaption measures (optional)* is a part of the Module that foreseen engagement of the stakeholders in order to fulfill possible gaps within the impact chains and other material. M3: M4: *Step 1: Gather your data* is a starting point of the Module and an important step in project area since there is general challenge of gathering useful, reliable, and detailed data. M5: M6: M7: M8: At the end the work done should be presented to the stakeholders. It is important that the trust and acceptance is accomplished among stakeholders and action proposals. The relationship has to be built from the very beginning and nurture so that the implementation of the actions goes without serious interuptinos. *General comment* Case study found the high importance of the stakeholders mapping and engagement. It is crucial to define 'the strategy' to manage stakeholders and be familiar with the methodologies and tools to be used to meet the objectives of the actions. Different situations with different stakeholder will in given time define the proper method and tool. It is advised to have an annex to Joint_SECAP methodology in terms of listing the key facts, activities, models and tools to deal with stakeholders.
References	
Website(s)	http://www.resin-cities.eu/resources/actor-analysis/ https://www.adaptationscotland.org.uk/how-adapt/your-sector/communities
Bibliography	*Please include references to books, papers or articles providing relevant information on the Case study:*
Images	*RESIN* Actor Analysis for Urban Climate Adaption – Methods and Tools in support of Stakeholder Analysis and Involvement

	 Community adaptation actions – Practical actions communities can take to increase resilience in the face of climate change

	 Adaptation Scotland supporting climate change resilience Community adaptation actions PRACTICAL ACTIONS COMMUNITIES CAN TAKE TO INCREASE RESILIENCE IN THE FACE OF CLIMATE CHANGE

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