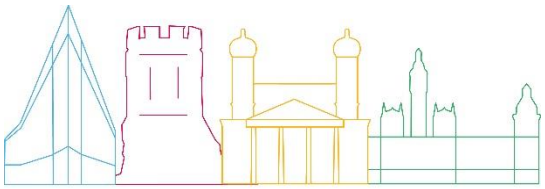
D3.3 ARCH city baseline report

Baseline reviews for the cities of Bratislava, Camerino and Valencia

30 April 2020



Deliverable No.	D3.3
Work Package	WP3
Dissemination Level	PU
Author(s)	Chapters i-v by Eleanor Chapman, Serene Hanania (ICLEI) Individual city report authors vary. See individual cover pages for details.
Co-Author(s)	Individual city report co-authors vary. See individual cover pages for details.
Due date	2020-03-31
Actual submission date	2020-04-30
Status	For submission
Revision	1
Reviewed by (if applicable)	Chapters i-v by Saskia Maresch (DIN) Chapters i-v by Eleanor Chapman, Serene Hanania (ICLEI) Individual city report reviewers vary. See individual cover pages for details.

This document has been prepared in the framework of the European project ARCH – Advancing Resilience of historic areas against Climate-related and other Hazards. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820999.

Contact

arch@iais.fraunhofer.de

www.savingculturalheritage.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

Table of contents

Executive Summary

This report establishes the baseline for the municipalities of Bratislava, Camerino, Hamburg and Valencia, with respect to their selected cultural heritage sites. All four are pilot municipalities in the research project ARCH: Advancing resilience of historic areas against climate-related and other hazards. The ARCH project has a multi-dimensional thematic focus on 1) cultural heritage management, 2) disaster risk reduction and 3) adaptation to climate change, and as such all three dimensions are addressed in each city's baseline review. The primary aim of this report is to introduce the scientific partners to the pilot cities, and specifically to their selected cultural heritage sites for further analysis in the context of the ARCH project. A secondary aim is, through the writing process, to equip the city partners (as lead authors) with expanded knowledge of the governance frameworks relevant to all three thematic areas mentioned.

The first five chapters (i through to v) provide an introduction to all four baseline reviews, covering the aims of the reviews, the methodology used to conduct them, and the relationship of this report to other ARCH tasks and deliverables. This is followed by each city's baseline review in turn. Each review has the same structure, as follows: chapter 1 provides an overview of the city profile (with a brief physical description, along with demographic and economic data), chapter 2 introduces the historic areas of cultural heritage significance selected for study within the ARCH project, chapters 3, 4 and 5 outline the existing governance frameworks at international, national, regional and local levels concerning cultural heritage management; disaster risk reduction; and climate adaptation. Chapter 6 identifies the hazards and associated impacts relevant to the selected historic areas (along with existing resilience-building measures that are already planned or implemented), as well as classifying these according to established frameworks and standards, and outlining a possible direction for future risk and vulnerability assessment within the ARCH project. Chapter 7 provides results of a preliminary resilience assessment using the original short version of UNDRR's Disaster Resilience Scorecard for Cities. Chapter 8 concludes with a reflection on the information compiled for the review, identifying key local objectives and related priorities for future work in the context of the ARCH project, as well as outlining relevant policies, strategies or projects that may be supported by the ARCH project.

For the **City of Bratislava**, the target historic areas that will be addressed by the ARCH research team are: the medieval town centre (monument preservation reserve), the Devin Castle located on the dolomite cliff above the Danube River, and Celto-Roman structures on the Bratislava Castle hill. These sites face risks from a number of different hazards. The town centre is greatly threatened by pluvial flooding, as the majority of objects are preserved in situ. Additional threats to these objects come from moisture and humidity, and there is a risk of danger to visitors too, which could mean closing some sites to the public in future. The cliff below Devín Castle suffers from erosion, which could force the castle to close if it continues to worsen. The remaining castle walls are also threatened by cliff movement as well as rapidly changing temperatures. Gaps in knowledge exist concerning the future trajectory of this erosion and how it may evolve for different climate change scenarios, and modelling possible trends to help select the type and extent of adaptation measures to be implemented at Devín Castle is an example of possible support from the ARCH project team.

Bratislava has already conducted two vulnerability assessments; the first to prioritise the most vulnerable sectors and groups, and the second to analyse the impacts of recent heatwaves and pluvial flooding on the population and selected critical infrastructure. The City would like to take this analysis further to include cultural heritage protection, to be able to adapt the historical centre and other valuable cultural heritage sites to the impacts of future climate scenarios. The City's new Action Plan for Climate Change Adaptation is currently in preparation, which provides a good opportunity for the ARCH project to support actions and strategies that will require implementation.

Furthermore, whereas the issue of fluvial flooding and associated disaster risk management is very well elaborated in the City's existing governance frameworks, similar policies to help prevent and deal with other hazards caused or exacerbated by climate change need further elaboration – especially pluvial flooding from intense rainfall, and heatwaves. Bratislava municipal staff, intend to utilise their experience and data, and mobilise local stakeholders, to better understand the cascading effects of climate change impacts on their cultural heritage sites, planning adaptation pathways and suitable measures – as part of a wider resilience-building approach.

The **Municipality of Camerino's** target historic area is the entire Old Town, which suffered serious damage due to a major earthquake in central Italy in 2016. Many buildings were destroyed or seriously damaged, and all residents and businesses were relocated. The area remains abandoned while the reconstruction process continues. The Old Town is home to many buildings and objects of historical, architectural and artistic cultural heritage significance, many of which were seriously damaged or destroyed and are in need of restoration, as well as facing the threat of further damage from future seismic activity. Of these, Ducal Palace and Santa Maria in Via's Church will be the focus of the ARCH project, in addition to analysis at the urban and district scales. Aside from the clear threat posed by seismic hazards (and related geomorphological hazards such as landslides) the Old Town is also impacted by climatic hazards such as heavy snowfall.

Investigations conducted for this report found that maps and information about earthquakes and geomorphological hazards are available to municipal staff, but these are currently not utilised to define future risk scenarios. The local civil protection office has defined procedures for post-disaster management, however, pre-disaster planning is hindered by a lack of detailed risk scenarios for future emergencies. Furthermore, critical infrastructure providers currently have no specific agreement with the municipality for resilience improvement, but rather support the municipality on an ad-hoc basis when disasters occur. This means there is potential to improve Camerino's resilience to seismic and climatic hazards through the identification and use of detailed risk scenarios, and planning of institutional strategies to lead future actions for current post-earthquake reconstruction, mitigate the effects of future events and enhance the preparedness for natural hazards;

Specific objectives to support Camerino's improved resilience through the ARCH Project include: 1) improving the predictive models and risk assessment methods; 2) increasing the knowledge base on the geological-structural setting of the "Camerino hill" and the geomorphological processes, thereby determining the hydrogeological hazard scenarios for the historical centre; 3) better understanding the vulnerability of historical buildings with reference to construction materials and techniques; 4) monitoring cultural heritage of

significant value in order to provide alerts and real-time information about damage resultant from natural hazards and degradation due to environmental conditions; 5) developing guidelines for managing and securing artefacts and artwork after seismic events.

For the **City of Valencia**, the selected target historic areas are two large cultural landscapes: the Huerta irrigated peri-urban farmland, one of six remaining such landscapes in Europe and the Albufera, a large coastal lagoon, supporting a diverse range of species including birdlife and fish, and bordered by land for rice cultivation. These two geographic areas partly overlap with one another. Both are of high historic, cultural, natural and agricultural heritage significance. The Huerta in particular has been legally recognised as performing an important social function, supporting food sovereignty, human welfare, sustainable development and climate change mitigation and is included on a register of Globally Important Agricultural Heritage Systems (GIAHS), managed by the UN Food and Agriculture Organization (FAO).

Hazards faced by the Huerta include flooding, wave action in specific locations, convective storms, extreme temperature and drought, and insect infestation. The Albufera is also threatened by convective storms, as well as wildfire risk associated with extreme temperatures, water temperature rise, decrease in rainfall, heavy rains, sea level rise, and pollution.

Among the key strategies and policies that are expected to align with the ARCH project´s research agenda are those developed by the municipal and regional departments of agriculture and climate change, in key documents such as the city's Sustainable Energy and Climate Action Plan and the regional Climate Change Strategy 2020-2030. However, some gaps have been identified in relation to the basic scientific knowledge which should be available prior to developing any resilience strategy for Huerta and Albufera, such as a more detailed vulnerability analysis, or impact modelling on agriculture, aquatic and forest ecosystems, in order to be able to better assess the several meteorological, climatological, hydrological, biological and human-induced hazards identified. Due to the complexity and size of both geographical areas, further discussion with stakeholders is also needed in order to prioritise specific support needs which might be addressed via the ARCH project.

At the time of writing, three priority objectives can be identified with respect to building resilience of both the Huerta and Albufera cultural landscapes: 1) to acknowledge and explore how the Huerta and Albufera help to mitigate the effects of climate change in the urban environment of València, 2) to understand and demonstrate in detail the impacts of possible climate change scenarios on the Huerta and Albufera, and 3) to design detailed resilience strategies in order to cope with these identified impacts.

At the time of writing, the baseline review for the City of Hamburg was not yet complete. This document will be revised and re-submitted on completion of Hamburg's baseline review at a later date.

Gender Statement

This report has been developed with regard to the guidance provided in the ARCH Project Handbook (D1.2, Part 7) with respect to gender aspects in publications and research. Efforts have been made in the writing and review process to ensure the use of gender inclusive language.

I. Introduction

This report has been prepared for the European Commission-funded research project ARCH: *Advancing Resilience of historic areas against Climate-related and other Hazards*. The ARCH project will develop decision support tools and methodologies with a view to improving the resilience of cultural heritage to hazards, including those resulting from a changing climate. The project team includes local government staff from the pilot cities of Bratislava (Slovakia), Camerino (Italy), Hamburg (Germany), and Valencia (Spain), and will focus in particular on the needs and capacities of these locations, however results will also be extrapolated for use by other local governments elsewhere in Europe.

II. Purpose of this report

The purpose of this report is to:

- provide the ARCH consortium, as well as local stakeholders in each city (both inside and outside the city administration) with relevant existing information regarding the governance of cultural heritage in the pilot cities, with a particular focus on disaster risk reduction and climate adaptation, in order to provide a common understanding for collaboration;
- act as a baseline by which to refine project objectives and specific tasks, and review progress over the course of the project;
- provide a basis for ARCH city partners to develop a local work plan, in conjunction with local partners (D3.2);
- provide a basis for ARCH city partners to review, confirm and/or adjust the priorities identified prior to commencement of the project.

III. Structure of this report

This report is structured as follows. The first five parts (i through to v) provide a common context for all four baseline reviews, covering the purpose of the reviews, the methodology used to conduct them, and the relationship of this report to other ARCH tasks and deliverables. This is followed by each city's baseline review in turn. Each review has the same overall structure, as follows: chapter 1 provides an overview of the city profile (with a brief physical description, along with demographic and economic data); chapter 2 introduces the historic areas of cultural heritage significance selected for study within the ARCH project; chapters 3, 4 and 5 outline the existing governance framework at international, national, regional and local levels concerning cultural heritage management, disaster risk reduction, and climate adaptation. Chapter 6 identifies the hazards and associated impacts relevant to the selected historic areas (along with existing resilience-building measures that are already planned or implemented), as well as classifying these according to established frameworks and standards, and outlining a possible direction for future risk and vulnerability assessment within the ARCH project. Chapter 7 provides results of a preliminary resilience assessment using the original short version of

UNDRR's Disaster Resilience Scorecard for Cities. Chapter 8 concludes with a reflection on the information compiled for the review, identifying priorities for future work in the context of the ARCH project, as well as outlining relevant policies, strategies or projects that may be supported by the ARCH project.

IV. Relationship to other ARCH tasks and outputs

This report (D3.3) is the key output of Task 3.3 "Identify the baseline in each partner city" within Work Package 3 (WP3) "City Cases – Co-creating resilience and sustainable historic areas". WP3 is a cross-cutting package of tasks intended to shape and support the work of all other members of the research consortium. As such, the city baseline reviews are relevant to several other tasks and deliverables, however some in particular should be highlighted:

Deliverable D3.2 Local partnership and work plan

As part of WP3, city partners (supported by their local research partners) have mapped their local stakeholders and identified key stakeholders to engage as 'local partners' for the duration of the project (and ideally beyond). Together with these local partners, each city partner will develop a local work plan, defining an overarching aim, as well as key corresponding local actions and time frames. Key findings from the baselines established in this report will be summarised in the local work plan and contribute to the basis for defining local actions. Each city's local work plan should be read in conjunction with its baseline review.

Task T3.4 Co-create methods and tools for making historic areas more resilient (and all sub-tasks)

This task defines a set of methods and tools that ARCH scientific partners propose to develop in collaboration with city partners, including a *Hazard and Object Information Management System*, an *Impact and Risk Assessment Methodology*, a *Resilience Options Inventory* and *Resilience Pathways*, and a *Resilience Assessment Framework and Platform*. The content of the baseline reviews provides an important departure point for all scientific partners leading and contributing to these tasks.

Task T3.5 Co-create local measures in pilot cities for making historic areas more resilient (and all sub-tasks)

This task outlines a series of priorities and potential local activities, identified prior to commencement of the project, to be addressed in the context of the ARCH project. City partners should use the process of developing the baseline reviews – and the resulting content – to review, confirm and/or adjust these initial plans.

Task T3.7 Analyse experiences and lessons learnt

This task will be conducted towards the end of the ARCH project's duration and will involve reviewing the situation in the partner cities, as well as reflecting on the experience of engaging in the project. Discussion will include the status of the selected historic areas, the governance framework (including any changes), local partners or stakeholders involved, the local actions implemented, their direct and indirect results (including immediate impacts and potential longer

term ones), obstacles encountered and lessons learnt. This reflection will form the basis for recommendations on building the resilience of historic areas. The baseline reviews will serve as a key reference point in evaluating the situation in each partner city in future.

V. Methodology

This report was collaboratively and iteratively developed by several authors in order to establish a baseline review of the current status and resilience of the identified cultural heritage sites in the project cities to act as a basis for the activities and analyses planned within ARCH. ICLEI developed the overall structure, authored the content of this common introduction, as well as substantially reviewing iterative drafts from all contributors and editing the final version.

Chapters 1 through to 5, introducing the cities, their selected historic areas and overarching governance frameworks, were written by staff from the Cities of Bratislava, Camerino, Hamburg and Valencia, along with their local research partners University of Bratislava, University of Camerino, Fraunhofer and Tecnalia. The lead authors representing each city were instructed to seek input from colleagues in other departments as needed, to ensure an accurate and comprehensive review of the governance frameworks for cultural heritage management, disaster risk reduction and climate adaptation – as they relate to the selected cultural heritage sites.

Chapter 6, which provides an initial reflection on hazards affecting the selected sites and associated impacts, was designed and written by ENEA, based on the information provided by city partners in the Risk Profile Table at Part 6.2 (see Chapter 6 for a detailed description of the methodology used to interpret and classify this information). The template for the risk profile table that forms the basis for Chapter 6 was developed by ENEA, Fraunhofer, ICLEI and Tecnalia, with the content filled out by the city partners and their local research partners.

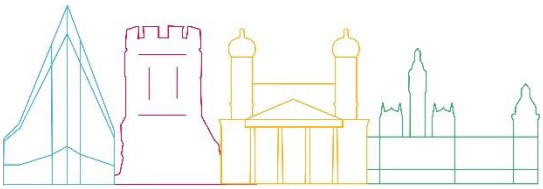
Chapter 7 includes results of preliminary resilience assessments conducted by Fraunhofer, the city partners, as well as the local research partners between December 2019 and February 2020. These resilience assessments employed the original short version of the UNDRR Disaster Resilience Scorecard for Cities.

Once all parts of the report were drafted, the conclusion, Chapter 8, was written by the city partners (again with support from local research partners), summarising the key local priorities and needs identified through the baseline review exercise, and their relevance for the ARCH project, as well as reflecting on the additional content introduced in Chapters 6 and 7.

ARCH

ARCH D3.3 City baseline report - Bratislava

29 April 2020



Deliverable No.	D3.3
Work Package	WP3
Dissemination Level	PU
Author(s)	Eva Streberova (Bratislava City)
Co-Author(s)	Simona Klacanova, Monika Steflovicova (Bratislava City) Margareta Musilova (MUOP) Eva Pauditsova (UNIBA) Serene Hanania (ICLEI) Daniel Lückerath, Katharina Milde (Fraunhofer) Sonia Giovinazzi, Ludovica Giordano (ENEA)
Due date	2020-03-31
Actual submission date	2020-04-30
Status	For submission
Revision	1
Reviewed by (if applicable)	Rene Lindner, Anne-Kathrin Schäfer (DIN); Eleanor Chapman, Iryna Novak (ICLEI); Artur Krukowski (RFSAT)

This document has been prepared in the framework of the European project ARCH – Advancing Resilience of historic areas against Climate-related and other Hazards. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820999.

Contact

arch@iais.fraunhofer.de

www.savingculturalheritage.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

Table of Contents

1. City Profile

The city of Bratislava has an overall territory of 367.66 km^2 and, by the end of 2018, the population of the city was 432 832. The city is administratively divided into 5 districts, which are the basic administrative units of the state administration. However, for self-government purposes, it is further divided into 17 city boroughs, each of which is governed by an elected local government and an elected Mayor. Bratislava City is governed by the City parliament and the elected Mayor – currently Matúš Vallo.

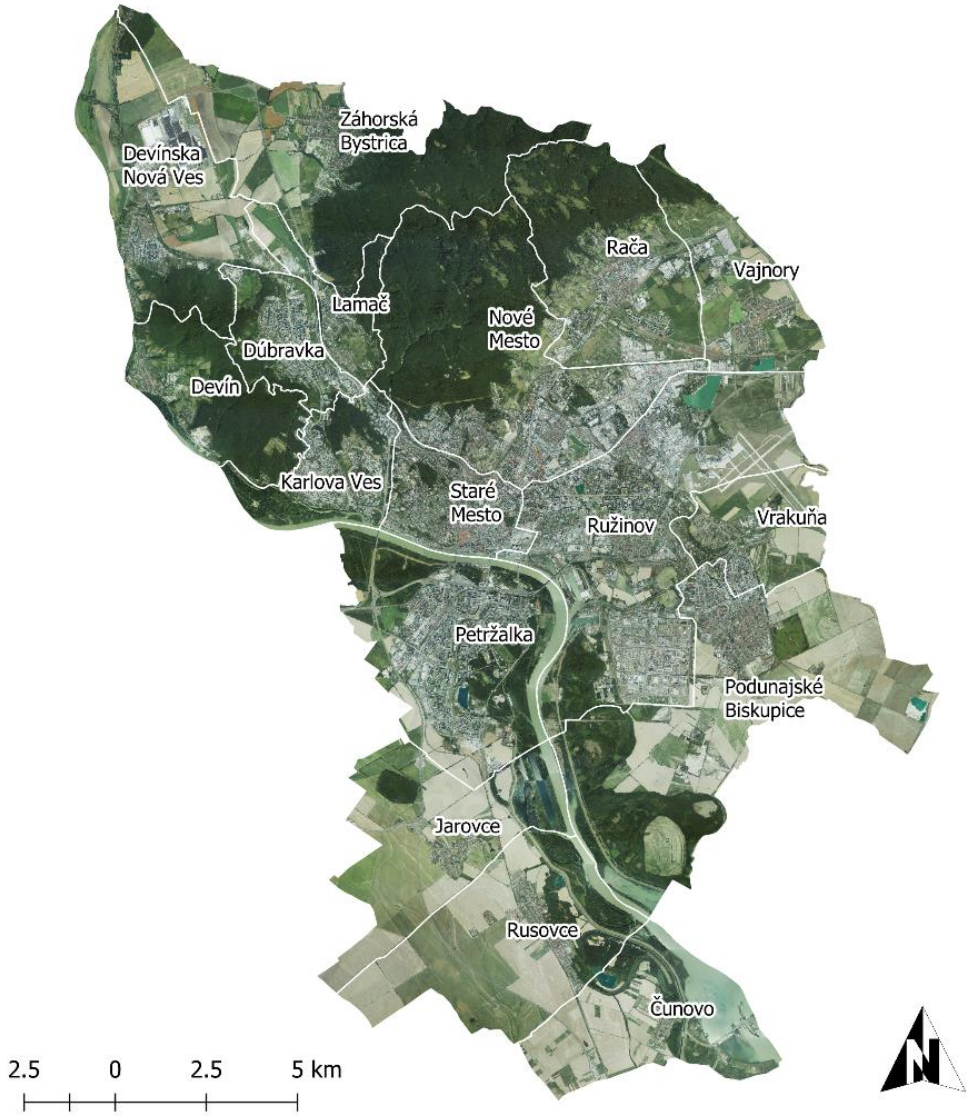


Figure 1.1. Bratislava City – divided by administrative borders into 17 city boroughs (municipalities).

The administrative organisation into districts and boroughs is as follows:

- District: Bratislava I – consists of City Borough Stare Mesto;

- District: Bratislava II – consists of City Boroughs Ruzinov, Vrakuna and Podunajske Biskupice;
- District: Bratislava III – consists of City Boroughs Nove Mesto, Raca and Vajnory;
- District: Bratislava IV – consists of City Boroughs Karlova Ves, Dubravka, Lamac, Devin, Devinska Nova Ves and Zahorska Bystrica;
- District: Bratislava V – consists of City Boroughs Petrzalka, Jarovce, Rusovce and Cunovo.

1.1. Population Growth

Table 1.1 shows the development of Bratislava's population in the period between 2008 and 2018. The population has been steadily increasing since 2008 with exceptions in the years 2010 and 2011 when there was a slight decrease in the number of men, and in 2016 and 2017 when there was a slight increase in the numbers. Bratislava's female population has remained mostly steady throughout this period.

Table 1.1. The population dynamics of Bratislava since 2008 by gender [1].

Year	Population	Men	Women
2018	432 832	203 658	229 174
2017	429 432	201 799	227 633
2016	425 883	199 767	226 116
2015	422 453	197 921	224 532
2014	419 788	196 271	223 517
2013	417 597	195 199	222 398
2012	415 405	194 198	221 207
2011	413 054	193 103	219 951
2010	433 077	203 440	229 637
2009	431 067	202 440	228 627
2008	428 530	201 049	227 481

In terms of population growth, a study conducted on Bratislava's demographic potential anticipates a natural decline shortly after 2020 according to all three scenarios considered. On the other hand, the migration prognosis varies: in the most conservative scenario it is on a decline, in the moderate scenario it remains steady, and in the optimistic case it is on the increase then remains steady. The highest natural population decline is expected just after 2030 in all three scenarios, where the number of deceased people is expected to exceed the number of new-born citizens. At this milestone, the annual values of natural population decline are estimated to be around 1 400 inhabitants/year. According to the moderate scenario of the forecast, by 2034, the annual natural population increase in Bratislava will be lower than present by more than 2 300 inhabitants. In the next period (years 2035-2050), it is expected that the natural decline in Bratislava's population will slightly decrease. Annual values of population decline in the middle of the 21st century will range from -600 (optimistic scenario)

to -1 750 persons (conservative scenario). In the case of less favourable demographic trends and lower immigration, Bratislava's population might decrease after 2025. It is expected that in 2050, the population will be from 420 000 to 490 000; most likely just below the limit of 460 000, which amounts to an increase of less than 8% compared to the current situation [2].

1.2. Age

The most accelerated population ageing in Bratislava is expected by 2035. In less than twenty years, the average age of the population will increase by more than four years, resp. 10%. Subsequently, the ageing will slow down, and shortly after 2040, the ageing of Bratislava's population should stop at values that are more than five years higher compared to the present. More intensive population ageing is not expected in Bratislava [2].

1.3. Population density

Bratislava's population density has not changed rapidly since 2008, which is, in fact, a positive indicator for the future development of the city. The lowest density was reached in the year 2011. Table 1.2 below shows Bratislava's population density per km^2 [1].

Table 1.2. The population density in Bratislava – persons per km^2 [1].

Year	Population density [per km^2]
2018	1172.97
2017	1163.53
2016	1154.51
2015	1146.01
2014	1138.47
2013	1132.91
2012	1127.2
2011	1120.17
2010	1175.16
2009	1168.72
2008	1163.49

1.4. Average age distribution and life expectancy

The ageing index compares the number of seniors (persons aged 65 and above) to the number of children, i.e. children under 15 years. It is one of the basic indicators for a population's ageing dynamics. In general, demographically young populations are characterized by the predominance of children, and the opposite is found in demographically ageing and old populations. According to the Study of Demographic Potential of Bratislava, despite the decline of the ageing population in the last ten years, the ageing index is the highest in the central

parts of Bratislava. Except for the fifth district, it is already possible to identify the prevalence of the number of seniors over children in all districts. There is a certain slowdown in the growth of the ageing index in some urban districts as a result of increased fertility, and thus a more dynamic increase in the weight of the child component in proportion to that of the seniors. This is usually the case of boroughs which offer new development areas. Also, Bratislava is the centre of economic activity in the country with many universities, which makes it appealing for people to migrate and settle there for work or studies.

From an economic point of view, the ratio of the productive and non-productive share of the population is the most relevant. The economic index is defined as the ratio of the number of children (0-14 years) and seniors (65+ years) per one or per one hundred people of working age (20-64 years). The total economic index was in decline in the 1990s and at the beginning of the new millennium. The cause was a sharp drop in the children component. Since then, the overall economic index has remained steady on average with a slight increase over the past five years in some of Bratislava's districts. In the long term, the lowest ratio between the unproductive and the productive component is foreseen to be in Bratislava's fifth district. In contrast, the highest is foreseen to be in the first district (Old Town) where the senior component is higher with a lower proportion of children [2].

As Table 1.3 below shows, the highest percentage of citizens in Bratislava is represented by the category "productive aged resident". The least number of citizens are aged 85 + years [1].

Table 1.3. The population of Bratislava by age categories (2019) [1].

Age	Population	%
(0-5)	32652	7.54
(6-17)	45647	10.55
(18-24)	20241	4.68
(25-34)	64266	14.85
(35-44)	82414	19.04
(45-64)	109270	25.24
(65-84)	70185	16.21
(85+)	8189	1.89

Life expectancy in the city of Bratislava between the years 2007 and 2018 is as seen in Table 1.4 below. The statistics also show a noticeable difference between men and women, with women in Bratislava having a slightly longer life expectancy than men. [3]

Table 1.4. Life expectancy for different sexes in the five administrative districts of Bratislava [4].

Life expectancy in male citizens	2007-2011	2008-2012	2009-2013	2010-2014	2011-2015	2012-2016	2013-2017	2014-2018
Bratislava I	75.37	75.47	75.51	76.34	76.66	76.85	77.19	77.41
Bratislava II	73.46	73.59	73.79	74.32	74.66	74.87	75.14	75.32
Bratislava III	73.36	73.47	73.74	74.17	74.50	75.10	75.24	75.64
Bratislava IV	75.34	75.39	75.76	75.92	76.28	76.52	76.85	76.96
Bratislava V	73.65	73.92	74.31	74.32	74.69	74.68	74.53	74.50
Life expectancy in female citizens	**2007-2011**	**2008-2012**	**2009-2013**	**2010-2014**	**2011-2015**	**2012-2016**	**2013-2017**	**2014-2018**
Bratislava I	81.37	81.95	82.12	82.30	82.41	82.26	82.29	82.34
Bratislava II	80.15	80.55	80.79	81.12	81.17	81.60	81.82	81.70
Bratislava III	80.46	80.98	81.41	81.39	81.60	81.45	81.32	81.22
Bratislava IV	80.45	80.64	80.97	81.44	81.89	82.23	82.46	82.75
Bratislava V	80.07	80.57	80.93	80.85	81.11	80.90	80.60	80.54

1.5. Poverty index

According to the publication of the Slovak Statistical Office on income and living conditions (EU-SILC), the number of people at risk of poverty living in the Slovak Republic has decreased over the last decade. The region of Bratislava remains the least vulnerable region in terms of poverty, where the at-risk-of-poverty rate was at 4.6 %, which is below the national level of the Slovak Republic (12.4 %). According to EUROSTAT, this indicator does not measure wealth or poverty, but low income in comparison to other residents in that country, which does not necessarily imply a low standard of living. Bratislava region also has the lowest percentage of people at-risk-of-poverty or social exclusion (8.6 %) in all Slovak Republic (average in the Slovak Republic is 16.3 %). This indicator corresponds to the sum of persons who are at risk of poverty or are severely materially deprived or living in households with very low work intensity [5] [6].

1.6. Population growth rate and vulnerable groups

Bratislava has seen steady population growth over the decades. Its position as the capital city and the fact that it is home to many corporations indicate that this growth pattern is likely to continue. The city's location, economic potential and favourable business conditions for entrepreneurs make it an ideal location for start-ups as well as international corporations. The number of legal persons has risen by 4% in the period 2014-2018. However, the number of self-employed persons has been on a steady decline (- 25% since 2014). The housing stock has increased astonishingly by 64.4 % (completed apartments 2014-2018), with new development projects densifying the city, but also spreading over what used to be agricultural areas, unused land or brownfields (e.g. in the city boroughs Petržalka, Devínska Nová Ves, Dúbravka, Ružinov, Nové Mesto, etc.) [3].

With the support of the Horizon2020 project RESIN, Bratislava was able to elaborate the results of the risk-based vulnerability assessment in a comprehensive Atlas of climate change impacts on Bratislava City with a particular emphasis on the impacts and risks to its population and critical infrastructure (road infrastructure and built areas). The assessment was done using the IVAVIA tool and had two stages – a qualitative and quantitative part, with the participation of local stakeholders in the assessment process. The assessment is used as a strategic planning tool, as well as a supporting document for different administrative tasks performed at the City Hall. For this assessment, several vulnerable population groups were identified by local stakeholders in the qualitative assessment workshops: In the case of heatwaves, it is mainly the elderly population over 65 years and the population under 14 years of age, people with cardiac and respiratory diseases, and hospitalised and homeless population groups. Age, health situation and overall capacity and means for responding to the negative impacts of heatwaves are all precursors for defining the vulnerable population groups in Bratislava. Since both case study areas represent famous monuments of national and even European importance, tourists need to be also included amongst the vulnerable populations in future assessments [7]. The level at which the assessment was undertaken was the city boroughs; however, the majority of the indicators were created first on a finer scale – developed based on existing data and information (object level which is finer than the borough level resolution) and then generalised to borough level.

1.7. Economic features

Gross value added (GVA) in current prices for the Slovak Republic was slightly over 76.43 billion EUR in 2017 of which 21.372 billion EUR was generated by the Bratislava region (NUTS 2) as seen in Table 1.5 below. Gross value added at basic prices (in USD billion) is shown in Table 1.6. Both Tables show a steadily increasing trend in Slovak Republic's economic productivity [1].

Table 1.5. Gross value added in current prices (in mil. EUR) [1].

	Slovak Republic	Region of Bratislava (NUTS 2)
2017	76 430.454	21 372.567
2016	73 436.195	20 716.842
2015	71 446.186	20 116.751
2014	68 907.405	19 120.993
2013	67 521.912	18 940.368
2012	66 410.254	18 150.194
2011	63 981.788	17 753.312
2010	61 368.250	17 245.925
2009	58 032.905	16 274.844
2008	62 121.709	16 322.383

Table 1.6. Gross value added at basic prices in USD billion [1]

2018	80.494
2017	75.786
2016	72.948
2015	71.776
2014	68.843
2013	67.264
2012	66.775
2011	64.088
2010	61.659
2009	57.993
2008	61.813

Gross domestic product in the Slovak Republic in 2018 was 3.9%. This constitutes an increase in comparison with the previous two years but is not the best result when considering a ten-year window. The highest rate of real GDP per capita occurred in 2010 as the peak reached 5.5%. On the contrary, the worst result was noticed in 2009 when the rate was negative (See Table 1.7 and Figure 1.2) [1].

Table 1.7. The annual growth rate of real GDP per capita [1].

2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
3.9 %	2.9 %	2.0 %	4.7 %	2.6 %	0.5 %	1.7%	3.5 %	5.5 %	-5.7 %	5.4%

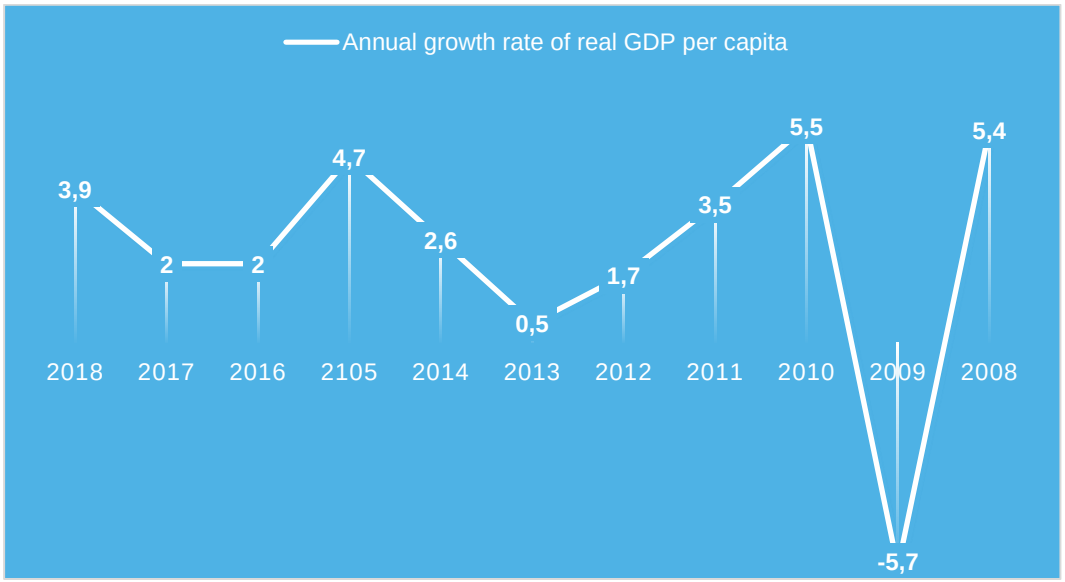


Figure 1.2. The annual growth rate of real GDP per capita in yearly % [1].

Table 1.8 below presents the gross domestic product by production divided into eleven economic sectors. The highest GDP in 2018 was reached in manufacturing, wholesale, automotive services and gastronomy as well as in public services, education, health and social work. The lowest GDP was reached in arts, entertainment and recreation [1].

Table 1.8. GDP by production at current prices in mil. EUR [1].

Sectors	2018**
Agriculture, forestry and fishing	2 119.88
Manufacturing total	20 661.03
of which Industrial production	17 653.49
Construction	6 374.75
Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; Accommodation and food service activities	15 684.99
Information and communication	3 786.20
Financial and insurance activities	2 508.01
Real estate activities	7 902.13
Professional, scientific and technical activities	8 166.85
Public administration and defence; compulsory social security; education; human health and social work activities	11 626.46
Arts, entertainment and recreation	1 664.61
Gross value added by economic activity total	80 494.91
Taxes on products except for subsidies on products	9 226.05
Gross domestic product	89 720.96

Table 1.9 below demonstrates the strongest areas of the service sector. The dominant area on the Slovak market is mainly real estate activities together with the commercial real estate market where retail and offices dominate. The second one is public administration and social security, followed by wholesale and retail trade which are related to the fact that, e.g. real estate activities play an important role in the Slovak market [1].

Table 1.9. Gross value added by industry at current prices in mil. EUR [1].

Type of industry, service	mil. EUR
Real estate activities	7902.13
Public administration and defence; compulsory social security	5581.18
Wholesale trade except for motor vehicles	4299.79
Retail trade except for motor vehicles	4119.74
Land transport and transport via pipelines	3066.49
Human health activities	2559.24
Electricity, gas, steam and air conditioning supply	1973.12
Financial service activities, except insurance and pension funding	1870.62
Warehousing and support activities for transportation	1682.85
Computer programming, consultancy	1664.34
Legal and accounting activities	1332.21
Activities of head offices; management consultancy	1329.80
Office administrative, office support	1243.47
Architectural and engineering activities	1195.77
Telecommunications	1140.11
Wholesale, retail trade and repair of motor vehicles	918.48
Civil engineering	895.72
Food and beverage service activities	877.87
Advertising and market research	716.43

1.8. Employment

The highest number of employed people is in the District of Bratislava I – Old Town with almost 6000 more than the District of Bratislava II – Ružinov, Vrakuňa, Podunajské Biskupice for example. The lowest number of registered employed people is in the District of Bratislava V – Petržalka, Jarovce, Rusovce, Čunovo. In the Slovak Republic, the sectors with the most employed people are manufacturing, wholesale and retail trade, repair of motor vehicles, and motorcycles. Manufacturing is essential mainly for the Districts II-IV. The wholesale and the

automotive services are important for all of Bratislava's Districts. See Table 1.10 below for employed people per economic activity [1].

Table 1.10. Employed people by economic activity collected through workplace method [1].

	Slovak Republic	District of Bratislava I	District of Bratislava II	District of Bratislava III	District of Bratislava IV	District of Bratislava V
Total	1 589 270	104 468	98 790	54 930	44 988	29 576
Agriculture, forestry and fishing	37 334	N/A	206	N/A	-	100
Manufacturing total	437 396	4 296	11 191	5 555	17 915	1 531
Mining and quarrying	6 221	N/A	-	-	N/A	N/A
Manufacturing	389 323	3 102	7 741	5 255	16 901	1 137
Electricity, gas, steam and air conditioning supply	16 462	981	1 269	N/A	N/A	N/A
Water supply; sewerage, waste management and remediation activities	25 390	N/A	2 181	N/A	158	258
Construction	71 288	1 158	6 866	2 544	571	1 654
Wholesale and retail trade; repair of motor vehicles and motorcycles	219 481	15 580	18 607	10 258	5 857	7 508
Transportation and storage	111 663	4 995	5 902	8 486	3 608	2 037
Accommodation and food service activities	31 257	3 434	1 300	1 001	617	657
Information and communication	44 082	3 391	11 480	3 083	2 805	3 929
Financial and insurance activities	30 348	11 676	5 607	2 463	695	1 033
Real estate activities	21 032	D	2 015	D	367	286
Professional, scientific and technical activities	76 931	19 760	8 875	4 278	3 274	2 659
Administrative and support service activities	68 001	6 797	5 825	1 704	1 122	2 620
Public administration and defence; compulsory social security	143 013	14 637	6 197	5 394	1 725	1 593

	Slovak Republic	District of Bratislava I	District of Bratislava II	District of Bratislava III	District of Bratislava IV	District of Bratislava V
Education	142 099	6 965	4 163	3 508	4 989	1 668
Human health and social work activities	113 099	4 240	8 093	3 699	996	1 347
Arts, entertainment and recreation	24 609	3 414	1 391	792	186	470
Other service activities	17 637	2 376	1 073	1 029	260	485

1.9. Unemployment

Over three years (2016-2018), a noticeable decrease in unemployment rates can be marked, registering the lowest rate over the last ten years. The highest unemployment rate was noticed in 2012 and can be connected to the European debt crisis. The highest unemployment rate in the District of Bratislava I-II was in 2014, District of Bratislava III-V in 2013 (see Table 1.11 below) [1].

Table 1.11. The registered unemployment rate in the Slovak Republic and in the districts of Bratislava City in % [1].

Year	Slovak Republic	District of Bratislava I	District of Bratislava II	District of Bratislava III	District of Bratislava IV	District of Bratislava V
2018	5.04	2.66	2.83	2.94	2.62	2.07
2017	5.94	2.91	3.39	3.40	3.12	2.51
2016	8.76	4.11	4.70	4.83	4.69	3.89
2015	10.63	4.81	5.63	5.69	5.14	4.67
2014	12.29	**4.99**	**6.67**	5.87	5.49	5.30
2013	13.50	4.93	6.08	**5.90**	**5.71**	**5.70**
2012	**14.44**	4.15	5.48	5.58	4.66	4.93
2011	13.59	3.53	5.60	4.65	4.36	4.98
2010	12.46	3.18	4.6	3.80	3.58	3.98
2009	12.66	2.71	4.00	3.39	3.39	3.84
2008	8.39	1.46	1.87	1.75	1.75	2.06

As can be seen in Table 1.11, the highest number of unemployed young people in 2017 was in District of Bratislava II. The highest unemployment rate in the age group from 15 to 24 was in 2012, coinciding with the highest unemployment registered for the overall population. One potential reason for this is the immigration of people in search of work due to the European debt crisis [1].

Table 1.12. The unemployment rate in the Slovak Republic in % [1].

	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
15-64	8.2	9.7	11.5	13.2	14.3	14.0	13.7	14.4	12.1	9.5
15-24	18.9	22.2	26.5	29.7	33.7	34.0	33.4	33.6	27.3	19.0
25-54	7.6	8.7	10.5	12.0	12.8	12.4	12.1	12.8	10.8	8.7

Table 1.13. Unemployed citizens by age in Districts of Bratislava I-V [1].

Age group	Total	District of Bratislava I	District of Bratislava II	District of Bratislava III	District of Bratislava IV	District of Bratislava V
Total	7 919	673	2 196	1 251	1 761	2 038
15 – 19	68	2	**28**	11	11	16
20 – 24	555	50	**162**	88	140	115
25 – 29	1 031	77	**302**	173	247	232
30 – 34	1 109	88	257	174	228	362
35 – 39	1 208	93	322	176	247	370
40 – 44	1 015	112	298	159	229	217
45 – 49	751	54	236	139	205	117

1.10. Old Town and Devin city boroughs

1.10.1. Overview

The Old Town City Borough (where the monument preservation reserve and preservation zone is located) is a historical centre of Bratislava City. It is the most visited part of Bratislava by tourists. In addition to historical monuments, there are many museums, galleries, embassies, consulates and governmental and state offices and institutions, newly built high-rise office buildings, restaurants and bars. The historic core of Old Town, which is partly surrounded by medieval fortification walls, is a pedestrian zone.

Figure 1.3. Aerial view of Bratislava in autumn time, on the photo we can observe most of the historical city centre, the Bratislava Castle on the southern tip of Male Karpaty mountain range and St. Martin´s Cathedral. Partly also the Hviezdoslavovo square and the Main square. Photo: P. Chromek, Foundation for Cultural Heritage Preservation.

The Devin city borough is a city borough of a rather rural character. The first settlements date back to 1800 AD. The city borough is located in the western part of the City territory (see Figure 1.1), between the Danube River and the Devínska Kobyla natural reserve, just several kilometres away from the Old Town City borough. It is known for Devin Castle; a national natural and cultural heritage site and for winemaking. Despite its rather small population, Devín is the fastest growing city borough with 32% newly build-up area since 2014 [3].

Figure 1.4 (left). Devin Castle from the air. Photo: P. Chromek, Foundation for Cultural Heritage Preservation. Figure 1.5 (right). Devin – the upper castle on the cliff, where the hazard of rockfall is monitored. Photo: M. Musilová, MUOP.

The Old Town City Borough has an uneven distribution of the different age categories, with the elderly population prevailing. During an ordinary working day, the Old Town receives a large number of people commuting there for work and education from other city boroughs as well as from satellite settlements located outside the city borders. In Devin, however, the age categories are more evenly distributed, and its citizens commute to work to other boroughs. Vulnerable population groups in both city boroughs are mainly the elderly (especially in the Old Town City borough), children and visitors (tourists). Another vulnerable group is the hospitalised people in many healthcare and hospital facilities in the Old Town.

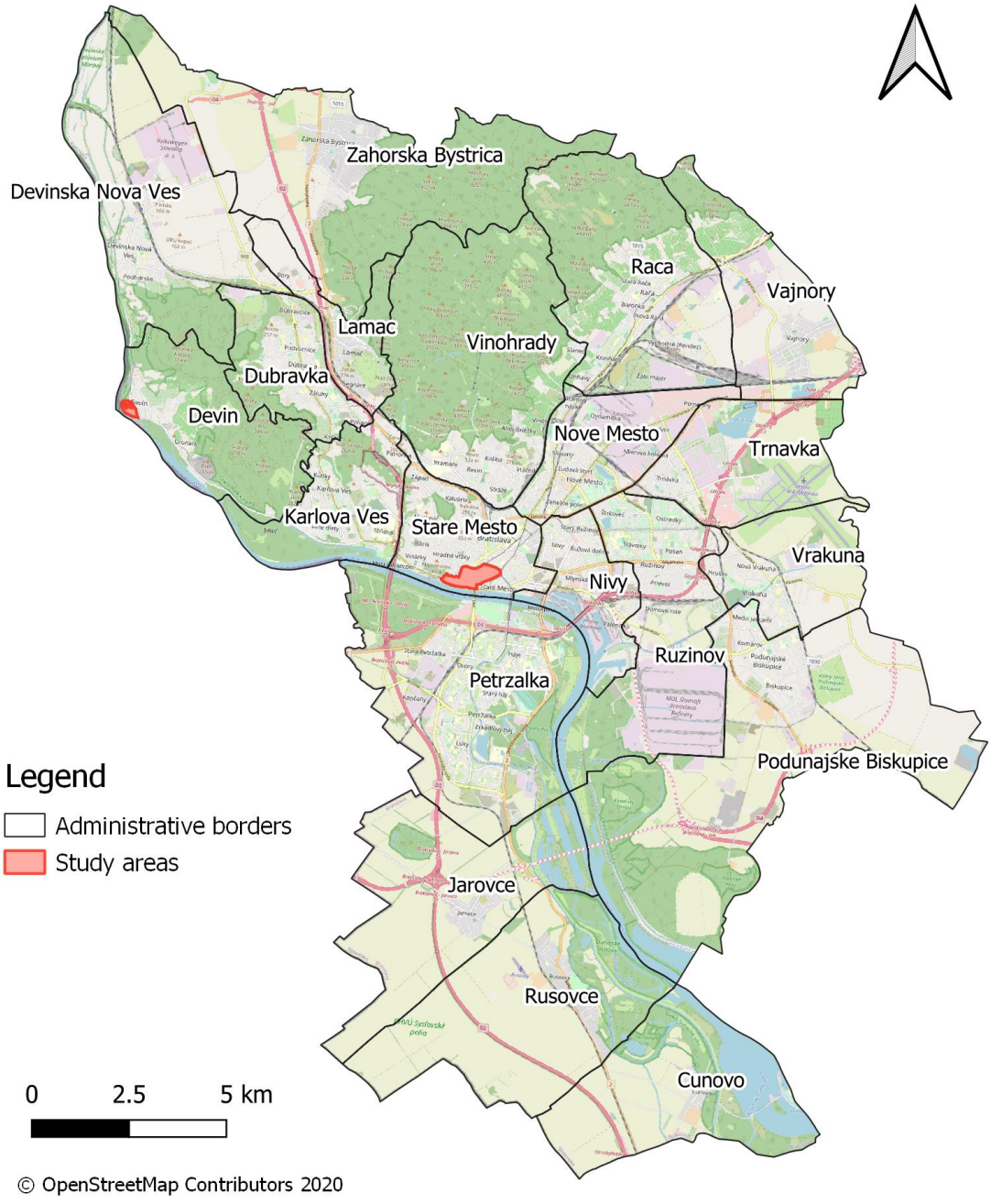


Figure 1.6. The focus sites in Devin City borough and Stare Mesto (meaning Old town in English).

1.10.2. Overview of the existing local frameworks for cultural heritage management, disaster risk reduction and climate adaptation

Both city boroughs – the Old Town and Devín, are of exceptionally high cultural importance, and monuments of national significance and many archaeological findings can be found here in large numbers. All heritage assets and their respective conditions are listed in the **Central List of Monuments Stock of the Slovak Republic**, maintained by the Monuments Board

(MB) of the Slovak Republic, which contains registers of immovable and movable cultural monuments, monument preservation zones and reserves. It is the primary groundwork for the performance of the state heritage administration. It applies to those assets that are considered national conservation monuments (NCM) and are subject to the highest legislative protection as governed by the **Act of the National Council of the SR No 49/2002 on the Protection of Monuments Stock** (as amended by the Act of the NC SR No 479/2005 Coll). The condition of heritage assets is also partially monitored by the **Principles of Protection of Conservation Sites (Zones, Reservations)** developed by the Monument Board of the Slovak Republic. The latter was established in 2002 and ensures the protection of the monuments stock of the Slovak Republic, following scientific findings and international conventions on the protection of cultural heritage. The Monument Board of the Slovak Republic has assumed decision-making power in legal terms, provided by the Monuments Act and the Statute.

The Municipal Monument Preservation Institute in Bratislava (MUOP) – a municipal research and preservation organisation, also runs a catalogue of city sights, which have lesser legislative protection.

Besides, information that has already been mapped out regarding disaster risk reduction, climate adaptation and cultural heritage management in the City of Bratislava is provided below. It will be expanded in Chapters 3, 4 and 5:

- Emergency response procedures and responsibilities in the city;
- Existing adaptation measures, strategies and key legislation in the city;
- Existing cultural heritage protection measures, strategies and key legislation in the city;
- Existing databases on climate risk information for the city;
- Decision-making structures in the city regarding adaptation;
- Decision-making structures in the city regarding cultural heritage protection;
- Inventory of heritage assets and their condition.

2. Target historic areas identified for ARCH

The target historical objects are in the historical city centre as well as at the City's outside border (see Figure 2.1 below).

Figure 2.1. Location of historical monuments selected for ARCH project. Source: UNIBA.

2.1. Historical monument preservation reserve (Old Town City Borough)

Bratislava's historical centre is situated within the ancient city walls in the Old Town city borough. Based on the terrain and the character of development, the Old Town can be divided into four areas: the western part, the northern part, the eastern part and the historical centre with the Bratislava riverfront (on the left bank of the Danube River). From monument preservation and historical perspectives, the area can be divided into a central historical monument zone and monument reservation (the medieval core of Bratislava). The monument preservation zone is further divided into smaller areas called sectors, based on the character of built-up area, architecture, terrain and landscape.

Figure 2.2. The Bratislava Castle with the St. Martin´s Cathedral in the background. Source: www.visitbratislava.com.

The western part of the Old Town is different from the other parts; it is situated on the Small Carpathian Mountain foothills, and mainly provides residential housing (villa houses). The western border of the Old town is the Mlynska valley – which was once a valley of watermills and its history translates into its current name (*mlyn* means *mill*). The Bratislava Castle is situated on the southernmost tip of the Small Carpathian Mountains and above the western side of the medieval fortification walls (with the northern and western sections of the walls still standing). The historical centre reaches to the left of the Danube (Dunaj) river bank. The northern and eastern borders of the historical centre are outlined by the Square of Slovak national uprising and Štúrová Street. The eastern and northern parts of Old town city borough are mostly residential with amenities and services as well as modern high-rise buildings (Mlynské Nivy, Eurovea, Landererova, Pribinova street), an international bus station and the river port (cargo and passenger). The northern border of the Old Town is outlined by the railway which connects Bratislava with the Czech Republic and Austria.

The surface area of the Old Town Borough is approximately 10 km^2 and has a population of 41 095 (population density is thus more than 4 000 inhabitants per km^2, 2018). During the day, around 70 000 commuters travel to the Old Town Borough. This makes it Bratislava's most crowded borough.

Bratislava's Old Town is known for St. Martins Cathedral and its many churches, the Bratislava riverfront and cultural landmarks (monuments). It is also the residence of most of the foreign states embassies and important Slovak institutions, including the National Council of the

Slovak Republic and Parliament building; the Summer Archbishop's Palace, the seat of the Government of Slovak Republic; and Grassalkovich Palace - the seat of the President of Slovak Republic and other important governmental institutions (such as the Ministry of Interior, the Ministry of Culture, Ministry of Foreign Affairs and the Ministry of Justice).

Figure 2.3. The Michael´s gate – the last standing of four gates of the city fortifications walls. The historical core of the city is a designated pedestrian zone called "Korzo". Photo: www.visitbratislava.com.

Other notable buildings, squares and streets include Trinity Church, Bratislava's Town Hall, Michael's Gate, the Primate's Palace, Comenius University, the Slovak National Theatre, National Uprising Square (Námestie SNP), the Main Square (Hlavné námestie), Hviezdoslav Square (Hviezdoslavovo námestie), Kamenné námestie ('Stone Square'), Obchodná Ulica ('Shop Street'), the building of the Pharmacy Salvator, Zochova Street from the 19th century and many other old churches and palaces. There are still some remnants of the medieval fortification walls (the northern and western section), currently closed to the public due to reconstruction.

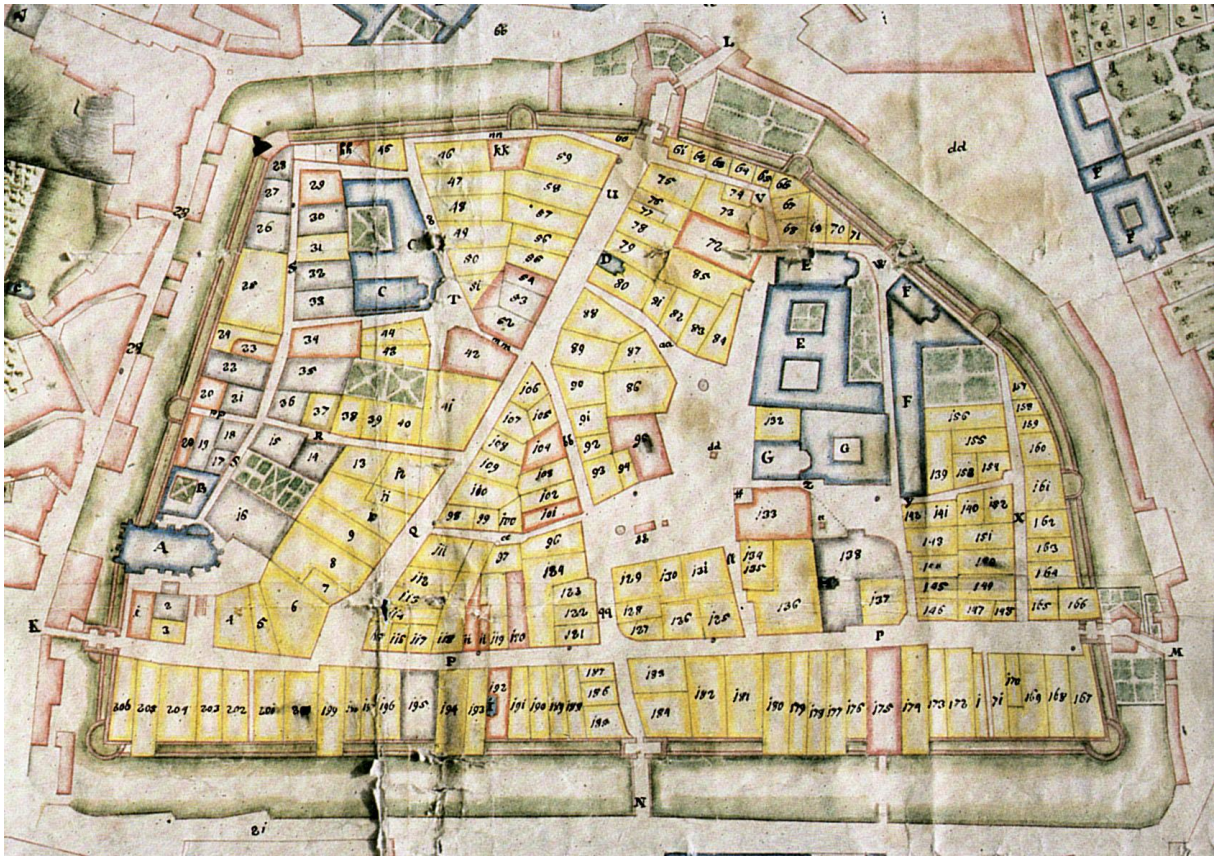


Figure 2.4. Bratislava plan of 1765, which was prepared by Michael Marquart, and therefore, we call it Marquart's plan. This plan is very valuable also as it shows the overall town fortification; shortly after its preparation, after 1775, significant changes occurred – by Maria Theresa's order the fortifications and gates (except the Michael's Gate) were torn down, many bastions were demolished, and embankments were refilled, on which new buildings were developed. Source: Archive of Bratislava City, inventory no. 1021.

There are several sites of Celtic specialised industry facilities in the territory of the historical monument preservation reserve in the Old Town dating back to the first century BC and the acropolis of a Celtic oppidum at the Bratislava castle hill. These include pottery kilns (Hlavné square, Uršulínska Street, Radničná Street 1), ironwork workshops (Ventúrska Street. 12/Zelená Street 10, Michalská Street 9), minting workshop (Panská Street 19) and an iron melting furnace on Rudnayovo square 4. These monuments, as well as other (unknown) underground monuments, are vulnerable to changes relating to surface permeability, intense precipitation and rising groundwater levels, which are driven by climate change and urban development in the surrounding areas**.**

Figure 2.5. A map showing the location of study sites in the historical monument reserve in Bratislava.

2.1.1. Celtic pottery kiln, Ápponyi House

In the western part of the Ápponyi House courtyard, a Celtic pottery kiln was found in 2007. The Ápponyi house belongs to the City Museum of Bratislava at Radničná Street 1. The twin chambered kiln of vertical type is on in situ display and is the best-preserved kiln. Its circular rack with evenly positioned air-holes had a diameter of 156 cm. One section of the rack had collapsed into the fire-pit, the other section remained intact.

Figure 2.6. The kiln in Ápponyi House (original) and its reconstruction. Authors: J. Minaroviech, J. Šimún, STUDIO 727. Source: MUOP.

Prints of the original twig structure which was burned in the course of firing are clearly visible on the reverse side of the rack. Hot air was drawn into the kiln from the pre-kiln pit via two heat ducts. The circular clay dome with a top opening which covered the upper chamber did not survive. Ceramic pottery shards were found in the fire chamber. Experiments have shown that depending on the dimensions of the kiln and its load, firing of a batch of pottery could take from 48 up to 72 hours. The kiln and the place around it were protected against the weather by simple roofing.

Figure 2.7. A 3D reconstruction of the original structure of the twin chambered kiln. Authors: J. Minaroviech, J. Šimún, Studio 727. Source: MUOP.

2.1.2. Celtic mint, Pálffy palace, City Galery Bratislava, Panská Street. 19, Bratislava

So far, the most extensive collection of technical ceramics comes from the Celtic workshop in Panská Street 19. The permanent exhibition of the Celtic minting is situated in the basement of the Pálffy palace. Besides the artefacts documenting the minting workshop (technical ceramics), there is also a pit with human bone remains on exhibition. The findings from the late 1980s consisted of dosage cups and fragments of clay plates used for dosing of coinage metals (silver, gold, lead and bronze); 75 casting cups and 22 fragments of dosages plates used for the production of coins on the site. The level of local metalworking is also attested to by an iron anvil, pieces of a clay mould, and smelting slag lumps. These findings are credible indications that a workshop of minting local coins was situated in this part of the Celtic *oppidum* of the *La Tene* period (140 – 1 BC). Possibly, there was more than one mint operating in the territory of Bratislava in the late *La Tene* period. The Celtic oppidum – a settlement of proto-urban character, was built around today's castle hill area.

Figure 2.8. The Celtic mint exposition inside the Pálffy palace. Photo: M. Musilová, MUOP.

2.1.3. Celto-Roman structures at the Bratislava Castle

Very recent archaeological research of the Bratislava castle, conducted by MUOP (Municipal Monument Preservation Institute in Bratislava) in the years 2008 – 2014, brought forth the discovery of precious Celto-roman architectures, built by Roman builders for the Celtic elite in the second third of the 1st century BC. The castle hill served as an acropolis of the Celtic city, the so-called *oppidum*. The stone architectures reveal the luxury of the Middle Danube region of that time. A structure with late Roman republican pavement of the *opus caementitium* type with floral patterns and meander was found under the palace courtyard. The *opus caementitium* pavement created part of a representative audience hall. Today, these finds are presented in situ. Similar types of such floors were found only in the Mediterranean area from the same period. Foundations of seven other buildings dating to the same period were found on the so-called Northern terrace of the castle. Three of them are also preserved *in situ.* The best preserved and presented is structure No. II - the Merchant´s House with luxurious imported goods and domestic Celtic wares. All Celto-Roman buildings are part of the so-called Celtic Path.

Figure 2.9. Details of the *opus caementitium* pavement and remains of Celto-Roman buildings found during the archaeological research lead by MUOP at the Bratislava the castle hill in 2008-9. Photo: B. Lesák, M. Musilová, MUOP.

2.1.4. Saint James's Chapel

Besides the above-ground historic buildings and monuments, there are many underground monuments preserved in situ within the monument preservation reserve in Bratislava. The Saint James's Chapel (Kaplnka sv. Jakuba) is the oldest sacral medieval structure and the only ossuary (charnel or bone house) in Bratislava. It is located underground next to the Old market hall (Stará tržnica) at the Slovak National Uprising square (Námestie SNP). Archaeological excavations in the late 1990s documented four structures from various times: a pre-Romanesque rotunda, a Romanesque charnel house and two construction stages of a Gothic charnel house. The rotunda was the oldest structure with the outer diameter of about 8.3 m, built around 1100. After its demolition around 1200, it was replaced by a Romanesque charnel house (a chapel with a circular floor plan, a semi-circular apsis, and an underground charnel house (bones house). The first record of the St. James´s Chapel dates to 1422; at that time, a Gothic chapel with rectangular aisle and polygonal apsis rebuilt around 1400, already stood there. The chapel was demolished during anti-Turkish actions around 1529.

Figure 2.10. A hypothetical reconstruction model of the different development stages of Saint James chapel and St. Laurence church. Authors: J. Minaroviech, B. Lesák, J. Hoššo. Source: MUOP.

Figure 2.11. Ossuary in the Saint James chapel. Photo: E. Pauditšová, UNIBA.

2.1.5. The fore-gate of the Fishermen`s Gate at Hviezdoslavovo square

The foregate of the Fishermen`s Gate is a uniquely preserved example of 15th-century Gothic fortification architecture in the Slovak Republic. The rectangular structure had two corner turrets and a drawbridge in the middle. It was built within the city's six-metre-deep moat. After infilling in the main carriage entrance, due to the threat of Ottoman invasion in 1529, only a small, lateral door for pedestrians survived. Also, a wooden bridge, the piles of which have been preserved, remained in use. In 1756 the Fishermen`s Gate and its foregate were restored and renamed after Empress Maria Theresa. The Empress later had it demolished in 1776. Today, visitors can observe the remaining walls of the gate through a glass plate at Hviezdoslavovo square. The walls on display were discovered by the archaeological research directed by PhDr. Margaréta Musilová from the Municipal Institute for Monument Protection in Bratislava (MUOP).

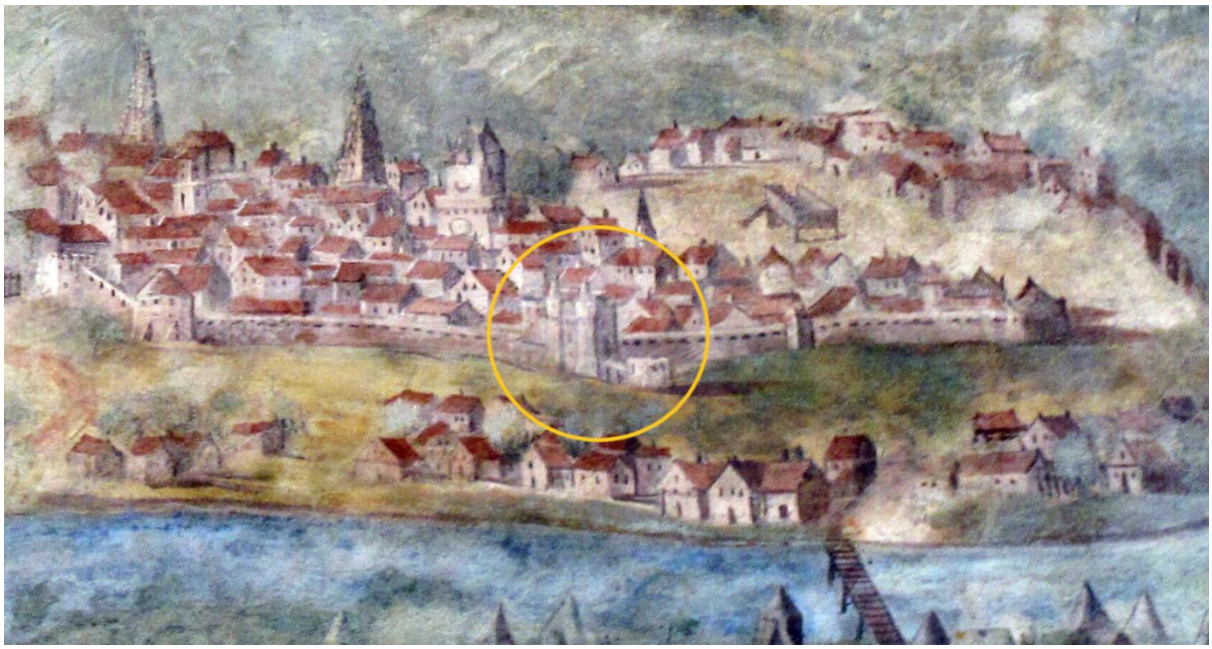


Figure 2.12. A fresco painting of Bratislava found on the Michelozzo courtyard in the Palazzo Vecchio in Florence. The yellow circle highlights the Fisherman´s Gate. Photo by: M. Musilová (MUOP).

Figure 2.13. The Fishermen`s Gate during and after excavation. Photo: M. Musilová, P. Horanský, MUOP.

2.2. Devín Castle (Devín city borough)

The Devín city borough is one of the smaller city boroughs in Bratislava. The population is 1 636 (2018), and the entire cadastral territory is roughly 14 km^2. The Devín city borough is situated in the western part of the cadastral territory of Bratislava City at the confluence of the rivers Morava and Danube. It is well known for the Devín Castle national monument, the ruins of which are one of the most visited monuments in Bratislava. Despite its small size, the Devín Castle Hill is surprisingly rich in rock variety and geological history starting from Early Paleozoic to Late Tertiary period. Twelve open fissures with narrow karst and pseudo-karst caves (16 – 13 million years old) are beneath the castle in the rock cliff, where a permanent exhibition was reopened in 2017. The castle is a historical monument of national as well as of European importance.

Figure 2.14. The Devin castle and its surroundings, before the recent reconstruction of the upper castle. Photo: P. Chromek, Foundation for Cultural Heritage Preservation.

Although located only several kilometres away from the city centre, the borough has a rural character with natural protected areas in its cadastral territory such as the Devínska kobyla national natural reserve (5th highest level of nature protection) and the alluvium of Morava river (4th level of nature protection). Above the confluence of the rivers Danube and Morava, a medieval castle's ruins are lying on the limestone promontorium (212 m a.s.l.) which belongs to the most important historical and archaeological sites of Central Europe. The cliff along with the castle offers charming natural scenery with a beautiful view. This National Cultural Monument is under the administration of the City Museum of Bratislava.

Figure 2.15. The Sandberg – at Devínska kobyla once used to be a sandpit. Today it is one of the most important paleontological sites in the country, protected with 5th (highest) level of nature protection. It is rich in fossil remains of marine coastal fauna and flora that lived the see that used to cover the area some 14 – 16 million years ago. Photo: www.visitbratislava.com.

Thanks to its strategic position, the Devín hill was settled by humans since the young Stone Age – Neolithic. The importance of the site rose with the significance of the crossroads of transcontinental Amber and Danube routes. The Celts built here a hillfort before the arrival of Germans. The Romans besieged the site at the turn of the ages. The significance of the site doubled after the Romans took permanent control of the Middle Danube and made the nearby town of Carnuntum (today in Austria) the capital of the Pannonia Superior Province in the 2nd century under Traianus.

The Germanic nobility adopted the Roman fashion of building stone residences, remains of which have been found on the Devín Castle hill too. The first written document about Devín is from the year 863 – in which the castle was referred to as Dowina. In the time of the Great Moravian Empire, Devín (Dowina) was an important fortification. A one-aisle church with a nearby cemetery was found on the castle hill, serving the local elite of the Slavs. After the fall of the Great Moravian Empire, the owners of the castle changed frequently and each gradually developed and extended it. The last noble family, which bought the castle, was the Pálffy family from 1635. The castle was hugely damaged in 1809, when the French army of Napoleon blew the castle up, and has not been restored to its original state since then In 1932 the Pálffy family sold the Devín castle to the Czechoslovak Republic for a symbolic 1000 crowns. Devín Castle became a symbol of the national awakening, and some of its fame was restored. Various sensitive reconstruction projects throughout the 20th century and very recent restorations of

the upper castle have helped to maintain the castle in better condition and make it accessible to the public.

In May 2017, the museum opened the upper part of Devín Castle with a new exposition in the caves in the cliff underneath the upper castle called “Devín Castle in the 13th - 20th Centuries”. Through more than 300 archaeological finds from Devín Castle, it presents the history and development of the castle, its owners and the most important events that took place in Devín.

The exposition is also complemented by the geological history of the castle and a unique presentation of the remains of the sea from the Tertiary period (16 million years ago), which are preserved here in the form of sea sand and also observable sea-level effects in the Devín rock cliff. Currently, there is ongoing archaeological and geological research in the area as well as plans for the reconstruction of ruins (the walls) and buildings on site.

Figure 2.15 and 2.16. New permanent exhibition “Devín Castle between the 13th and 20th centuries” in the cave of the upper castle (left), newly discovered structurally disturbed medieval fortification after removing of self-seeding trees (right). Photos: Bratislava City Museum, 2017.

2.3. Stakeholders

The following stakeholders are significant (in terms of direct monument protection competence) for the management and maintenance of both historical areas – the monument preservation reserve in the Old Town and the Devin Castle and its surroundings:

- Bratislava City Museum
- Bratislava City Gallery
- Old Town City Borough (municipality)
- Devín City Borough (municipality)
- Regional Monument Board of SR
- Slovak National Museum – Historical museum

The following stakeholders are considered relevant in terms of their competencies in different areas (not necessarily monument protection), which contribute to proper preservation of cultural monuments and historic areas:

- Bratislava-Old town city borough (municipality)
- Bratislava-Devín city borough (municipality)
- Metropolitan Institute of Bratislava (MIB)
- State Nature Conservancy
- Slovak Hydrometeorological Institute
- Bratislava Water Company
- Slovak Water Management Enterprise
- General Investor of Bratislava (GIB)
- Bratislava-self-governing region
- Bratislava Tourist Board

2.4. Challenges and hazards affecting the historical areas

The Old Town becomes increasingly crowded during the day as people commute to work or universities and visitors arrive either by buses or by ship cruises. Due to the high concentration of impermeable surfaces, high population density as well as the concentration of cultural heritage sites, the Old Town is especially vulnerable to climate change impacts such as pluvial flooding and heatwaves.

Figure 2.17. Model of the risk of pluvial flooding in the historical monument preservation reserve – the most vulnerable are the Laurinská, Panská street, Klariská as well as and Kapucínska street [7].

The high share of impermeable surfaces become quickly warmed up, and it gets very uncomfortable for pedestrians during the summer heatwaves. Paved roads and sidewalks, high building density, as well as topographical relief, increase the risks of pluvial flooding in the historical city centre. The Old Town is located at the foothills of Male Karpaty mountains, which are densely built-up with villa houses (see Figure 1.3.). During heavy rainfall, the rainwater comes rushing down into the lower parts of the historical centre. Underground historic buildings and monuments are at risk from pluvial flooding as a result of intensive rainfall periods, especially during summer months and augmented by aspects such as building density, surface permeability and terrain.

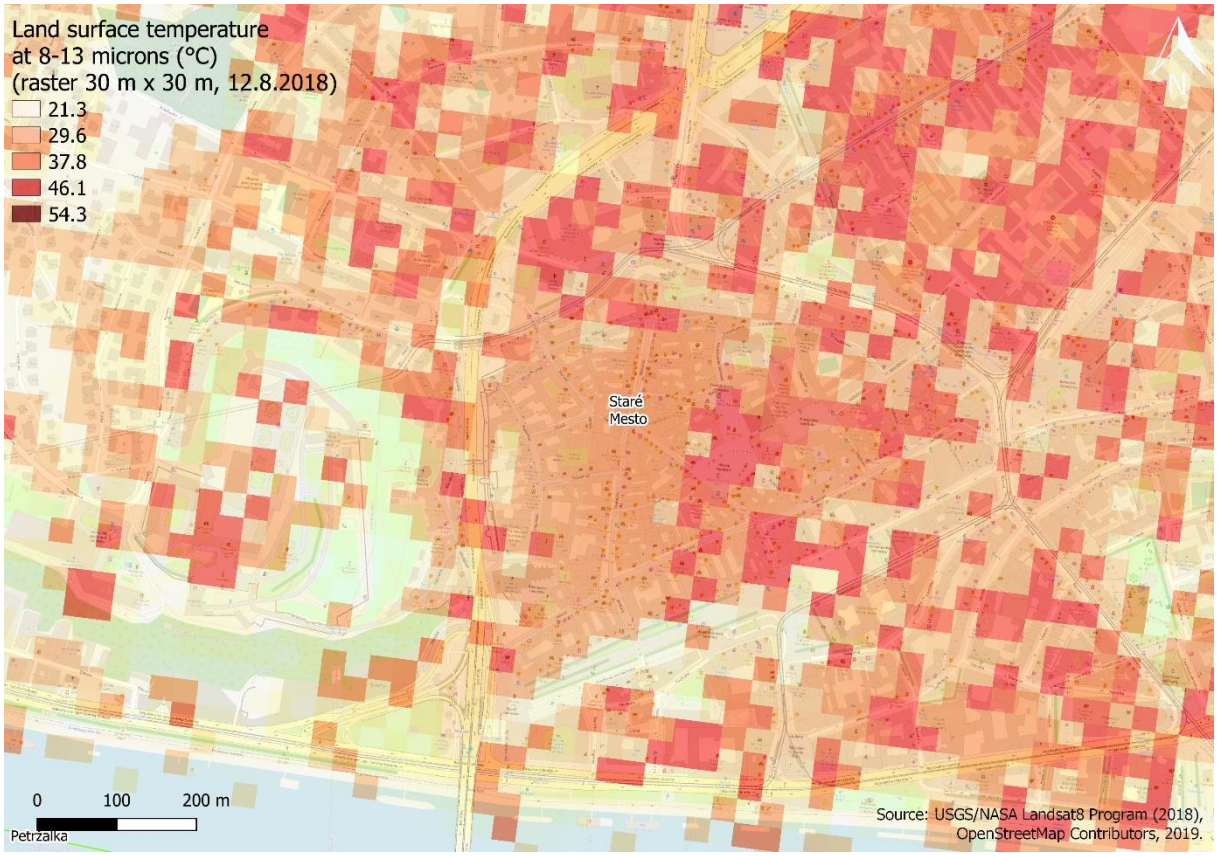


Figure 2.18. Land surface temperature model based on the evaluation of a multispectral satellite image of Landsat 8 [7]. The image shows the historical centre and the castle hill on the left.

Bratislava city is also planning the revitalisation of several squares, parks and courtyards as well as the reconstruction of medieval fortification walls so that they could be again accessible for the public. The public spaces which will be made greener and better suited to their functions also concerning the needs for adaptation to climate change are: the area of bus stops at Zochova street, Hodžovo sq., Freedom sq. (Námestie Slobody), Comenius sq., City hall sq., National Uprising sq., Suché mýto sq., Stone sq. (Kamenné nám.), Skatepark Nový Most and Park Dunajská street.

2.5. Gaps and needs for cultural heritage resilience

2.5.1. Old Town

The Old town itself has been evaluated as a borough with very high or high risk (compared to other boroughs) in all the areas of vulnerability assessment in the Atlas as follows: risk of extreme heat to the urban population, risk of pluvial flooding to the urban population, to buildings and to road infrastructure. The local stakeholders identified underground in situ archaeological objects and monuments as extremely vulnerable to intensive rainfall events, which are channelled through the narrow and paved streets into the historical city centre and some of the streets and buildings become flooded (especially their basements or lower levels). During summer, the accumulated heat from a series of tropical and supertropical days in

Bratislava makes walking in the city centre almost unbearable at noon and in the afternoons. The squares and paved public spaces with minimum shade, vegetation or breeze are the hottest surfaces.

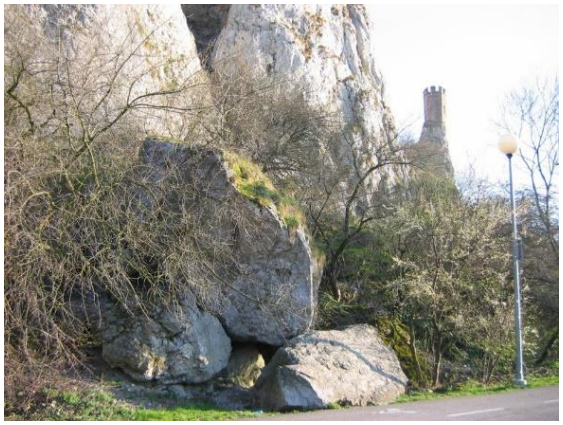
For the City to plan its implementation of adaptation measures and to its resilience to climate change impacts, there is a need to develop adaptation pathways for the historical monument reserve with possible additional applications in the Bratislava castle area or other areas adjacent to the historical monument reserve, where there are also buildings and monuments of great historical value. The measures need to be adapted to the current needs of multifunctional public space and to respect proper monument preservation practices and relevant regulations. Bratislava City has developed, with the support of H2020 RESIN project, a model of areas at most risk from pluvial flooding; however, this model is based only on above-ground hydrological models. What needs to be considered in more detail is the permeability of materials used on the surface, together with the dynamics of underground water, relief, buildings, and the capacity of the sewage system to name a few [7].

In terms of making the city more resilient to heat, Bratislava City has been relying mostly on the data from Landsat 8 on the land surface permeability and other information evaluated in the Atlas [7]. However, the Slovak Hydro-Meteorological Institute has been testing an urban heat model on the territory of Bratislava, and the results are already available for the public [8].

Figure 2.19. The Main square in Bratislava. In the second half of the 20th century, the park-like square was paved to match its origin from medieval times. In 2017 the City decided to plant mature trees on this square, and the adjacent Franciscan (Františkánske) square, to help ease the impact of summer heat on the pedestrian zone as can be seen in the picture. Photo: www.visitbratislava.com.

2.5.2. Devín Castle

The most significant hazard at Devín castle is most likely rockfall due to the erosion of cliffs and castle walls, thereby threatening the expositions in the caves and the safety of its visitors. In fact, the whole upper castle is going to be lost due to rockfall in the future; when this will occur is unknown. Climate change – especially droughts, extreme temperatures during summer and heatwaves – contributes to increased morbidity of vegetation and especially trees (as the vegetation becomes more prone to diseases), increased cost for maintenance and irrigation of natural assets as well as the built environment (castle walls, other service buildings present at castle site, etc.). This, however, is an overall condition relevant for urban vegetation in Bratislava, not just in Devín.



Figures 2.20 and 2.21. The danger of rockfall on the north-western side of the cliff (left), crack-gauge for monitoring rock displacement adapted specially for this Devin site using silica rods inert to temperature fluctuation (right). Photo: Bratislava City Museum, 2017.

The remaining castle walls are threatened by erosion due to the use of inappropriate materials for their reconstruction in the second half of the 20th century. The physical properties of the joining material used are different than those of the rocks which holds it together. This results in creating cracks and fissures in the castle walls when the temperature quickly changes, as well as during the winter months, where moisture and water enter the cracks and freezes which speeds up the process.

Within the subsystem 06 Stability of rock massifs under historical objects (which is a subsystem of the “Partial monitoring system of the Ministry of the Environment of the Slovak Republic” – see chapter 8), a complex continuous monitoring system was installed on Devín Castle (Bratislava) in November 2005, for monitoring static disturbances. The monitored sites are situated on a natural overhang in the central courtyard, by the staircase in the relic of the circular building with significant static failures and in the fortifications of the central castle. Based on the results of monitoring measurements, reconstruction work began at Devín Castle. Monitoring is currently suspended for technical reasons.

Restoration of the castle walls and the inner underground exhibitions, as well as the purchase of monitoring devices, was supported by previous projects funded by EEA Grants and Norway Grants. This included the monitoring of displacement of the most tectonically-disturbed parts of the rock cliff. The Bratislava City Museum oversees the implementation of active measures

as well, which include removing naturally seeded vegetation at the rock face (cliff), stabilisation of the loose parts, rainwater diversion in case of rock falls of smaller volume. Larger volume rock falls require stabilisation works – filling of the cracks, rock nailing and anchoring.

The Bratislava City museum together with the Bratislava City applied for external funds for the restoration of the remainder of most threatened walls. Another problem at the Devín castle seems to be rainwater and moisture that find their way into the caves and chambers, which are open to the public and used for expositions and the presentation of archaeological objects. Spreading of algae and fungi happens as a result of access humidity, which negatively impacts the condition of the exposed objects (see Figure 2.22). An air-drying system for reducing the humidity in the interiors has been installed; however, this measure is not as effective as needed.

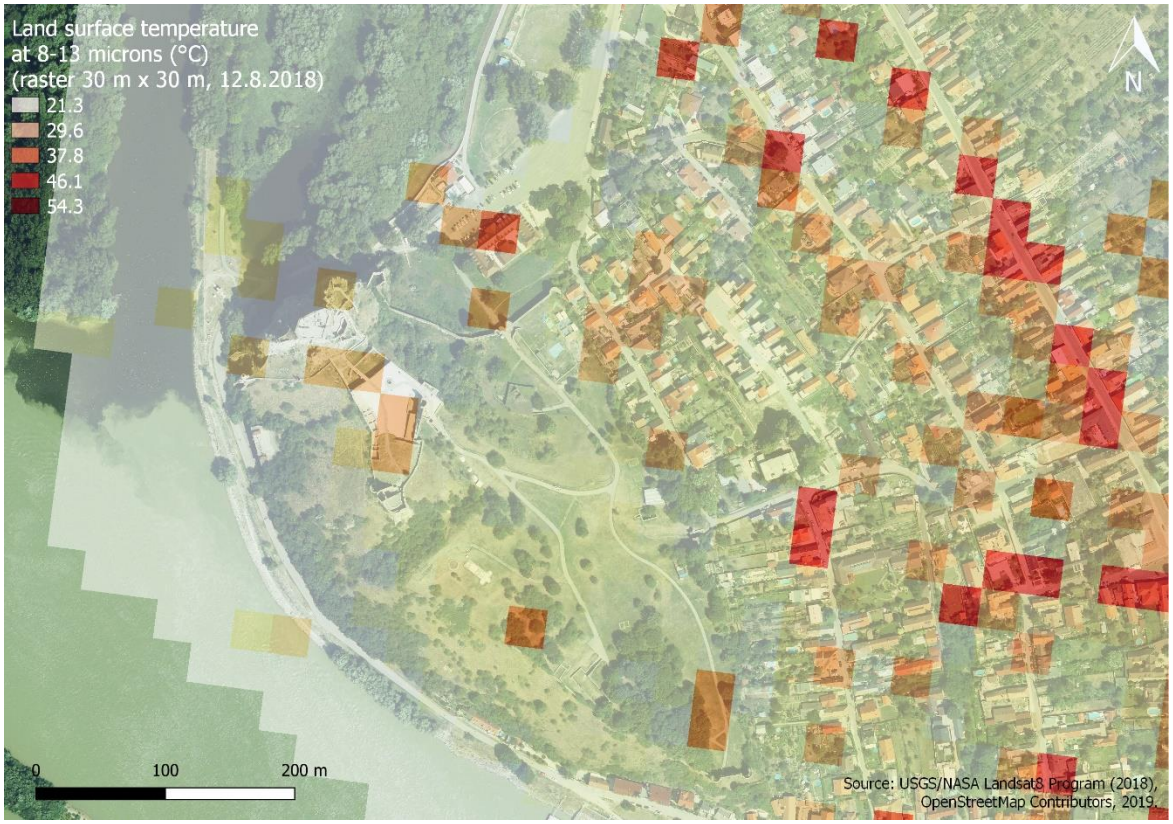


Figure 2.22. The land surface temperature model based on the evaluation of a multispectral satellite image of Landsat 8 [7]. The image shows the Devín Castle on the hill on the left.

Figure 2.23. Traces of moisture inside the caves in the upper castle (left), impact of the additional moisture can be seen on the remaining tertiary sands inside the cave (right), as green algae. Photo: E. Streberová.

Figures 2.24 and 2.25. Damage to the middle castle by rainwater (left), erosion in the castle walls in the upper castle (right). Photos: E. Streberová.

Another part of the Devín castle, the so-called middle castle, is covered partly in grass and party in a smaller fraction of gravel. Both these materials allow visitors to move freely and to explore. Planting of higher vegetation is not possible due to strong winds on the exposed castle hill and the possible damage that the roots could cause to the underlying chambers and caves. This makes it easy for the weather extremes to continue eroding the slightly sloped sections of the middle castle or to continue widening existing cracks or contribute to creating new ones in the castle walls.

3. Governance framework for cultural heritage management

This section looks at the governance framework for cultural heritage relevant to Bratislava's identified sites. It elaborates existing policies, strategies, visions and action plans for the management, protection and use of cultural heritage in Bratislava at the different governance levels.

3.1. International

The following international policies and declarations are relevant for the conservation of monuments in the Slovak Republic: the Convention for the Protection of Architectural Heritage of Europe, European Convention for the Protection of Archaeological Heritage or European Landscape Convention, Convention on the Underwater of Cultural Heritage Protection, and UNESCO Conventions concerning the Protection of the World Cultural and Natural Heritage and the Safeguarding of the Intangible Cultural Heritage. The Slovak Republic is a signatory to all of these internationally important declarations.

3.2. National

Declaration of the National Council of the Slovak Republic on the protection of cultural heritage (National Council of the Slovak Republic, 2001). This declaration of the National Council of the Slovak Republic recognises that irreplaceable cultural values created by previous generations are constantly threatened not only by the natural causes of deterioration and decay, but also by changes in lifestyle, the transformation of social and economic conditions, the decline and disappearance of traditional crafts and techniques, and the application of technologies which are often incompatible with the nature of these cultural assets. The declaration supports the implementation of principles enshrined in international treaties, conventions and recommendations of international organizations for the protection of cultural heritage in particular UNESCO and the Council of Europe. It documents and applies these for the development of the rights and obligations of everyone to protect cultural heritage under Article 44 of the Constitution of the Slovak Republic.

Strategy for the Conservation of Monuments (2017 – 2022). The Strategy aims to create such conditions and tools for the protection of monuments, which will guarantee their authenticity and integrity under current conditions, and which will contribute to improving the construction and technical condition of the heritage fund. In the area of territorial protection, it mainly promotes cultural heritage protection interests through spatial planning tools. The Strategy emphasises that the effectiveness of applying historical monuments protection strategies into land-use planning documents is dependent on how regulations are formulated and on their clear quantification. The Strategy is an opportunity to initiate the elaboration of a methodology focused on practical feasibility within territorial and construction proceedings.

Guideline of the Ministry of Culture of the Slovak Republic on the protection of national cultural monuments in crisis situations (Ministry of Culture of the Slovak Republic, 2008). This guideline regulates the procedure of legal entities and natural persons responsible

for the special protection of movable national cultural monuments referred to as 'special protection of cultural monuments' in the context of preparation for crisis situations and during crisis situations. The Regional Monument Board plays an important role in the area of special protection of cultural monuments and the fulfilment of tasks ensuing from providing special protection to cultural heritage. It provides legal entities and natural persons (owners or administrators) with professional and methodological assistance. The degree and method of special protection of cultural monuments shall be ensured depending on local sources of danger and the resulting categorization of the territory of the Slovak Republic, which is decisive for differentiating the scope of planning and implementation measures.

Last but not least, the Act on the protection of monuments and historic sites No. 49/2002 Coll. [9], governs the protection of cultural heritage monuments, historical sites, archaeological finds and archaeological sites. It is based on scientific knowledge and international conventions in the field of European and world cultural heritage to which the Slovak Republic is a signatory. According to Paragraph 1, this Act further regulates the organisation and competence of state administration authorities and territorial self-government authorities, as well as the rights and duties of owners and other legal entities and natural persons, and the imposition of fines for unlawful conduct in the field of the protection of monuments and historic sites which form an important part of cultural heritage and the conservation of which is in the public interest.

3.3. Regional

The framework of the future **Strategy for Development of Local and Regional Culture and Culture of National Minorities of the Slovak Republic by 2030 (Ministry of Culture of the SR, 2019).** The Concept serves as a basis for the creation of a comprehensive “Strategy for the Development of Local and Regional Culture and Culture of National Minorities of the Slovak Republic by 2030”, which the Government ordered the Ministry of Culture to submit by 31 December 2020. The main priorities of the strategy include improving the quality of public libraries, creating a legislative framework to ensure the support of cultures of national minorities, creating tools for coordinating and optimizing the performance of professional activities of regional cultural institutions, expanding regional activities of departmental organizations and intensifying the heritage. The strategic aim of the Ministry of Culture is to strengthen cultural centres to become a really attractive place for education, creating a cultural environment and awareness-raising.

Development Strategy for Culture in the Bratislava self-governing region for years 2015-2020. This strategy addresses the development of culture in the spirit of four priorities, which are consistent with those applied across Europe: promoting cultural identity, promoting cultural diversity, promoting creativity and promoting citizens' participation in culture.

3.4. Local

In 2016, Bratislava City initiated the preparation of a conceptual and strategic document named the **Framework for development of culture in Bratislava;** however, it has not yet been finalised. The City borough of Staré Mesto has a **Cultural policy concept of Bratislava-Staré Mesto** for the period of 2016-2020. The document emphasises support for the socio-economic use of the cultural potential of the Old Town as well as for public and cultural activities and

better involvement and cooperation among individual departments of the Office district and city district organizations. An action plan for implementation is part of the document to help implement the individual goals of the Framework.

4. Governance framework for disaster risk reduction

This section looks at the governance framework for disaster risk reduction with relevance to Bratislava's identified sites. It elaborates the relevant policies, strategies, visions and action plans for disaster risk management in Bratislava at the different governance levels.

4.1. National

The basic document for the identification of a potential threat in the territory of the Slovak Republic is **Analysis of the territory in terms of possible extraordinary events of the Slovak Republic**. The document is drawn up at all levels of state administration based on Act No. 42/1994 Coll [10]. on civil protection of the population, as amended, in accordance with Article 6 of Decision no. 1313/2013 / EU of 17 December 2013 on the European Union Civil Protection Mechanism. Under the Act, an emergency is defined as a natural disaster, accident, disaster or terrorist attack. A natural disaster is an extraordinary event in which the accumulated energies or masses are undesirably released as a result of the adverse effects of natural forces, in which hazardous substances may act or cause destructive factors that have a negative impact on life, health or property.

The Act also regulates the structure and content of the territorial analysis document in terms of possible extraordinary events of the Slovak Republic. The introductory part of the analysis focuses on geographical, demographic and economic characteristics of the territory. For the risk assessment the following structure is recommended: identification of the crisis phenomena and threatening factors, threat to the population, size of the hazard zone - area in km^2, anticipated secondary phenomena and possible overlap from territory to municipality / district / county / state. This analysis, however, does not directly assess the level of risk, but only identifies the risk and further identifies the resources and means available for managing the emergency in the analysed area. The list of risks to be assessed is included in the analysis, which modifies the structure and content of assessments on extraordinary events a document prepared at all levels of state administration [11].

In the Slovak Republic, flood risk is assessed in accordance with Directive 2007/60 / EC of the European Parliament and of the Council on the assessment and management of flood risks and **Act no. 7/2010 Coll. on flood protection** [12] [13]. This law was created as a consequence of the European Commission's Communication on Evaluation COM (2004) 472, Brussels, 12.7.2004 [14] and is in accordance with Directive 2007/60/EC [12]. When assessing the existing potential of significant flood risk in the Slovak Republic, the risk was considered potentially significant in those geographical areas where the flood in the past endangered health, the environment, cultural heritage or economic activity. In assessing the likely occurrence of a potentially significant flood risk, information on the current status of flood protection in individual geographical locations was used. The evaluation process was based on the available materials, and expert estimates were carried out to determine whether, within the expected flood range whose maximum flow rate can be reached or exceeded on average once every 100 years – such as buildings, infrastructure and industrial or agricultural estates [15].

Preliminary flood risk assessment in the Slovak Republic – update 2018 was prepared in accordance with the requirements of Directive 2007/60/EC. This document includes information about particular river basins in Slovakia. Preliminary assessment documents are publicly available on the website of the Ministry of the Environment SR [16]. Information about flood risk prediction is based on records of changes in the hydrological regime of Slovak rivers [17] [18]. This data is together with the proposal of adaptation measures part of the **National Climate Program of the Slovak Republic** [19].

Since 2002, Slovakia has the **Concept of sustainable exploitation of rock environment,** which implies to monitor geological environmental factors. The aim is to predict impending disasters. In 2006 the agreement on cooperation for the provision and use of geological information was signed between the Civil Protection Office of the Ministry of the Interior of the Slovak Republic (now the Crisis Management and Civil Protection Section) and the State Geological Institute of Dionýz Štúr (SGIDŠ). At the beginning of 2007, a working group for geological hazards so-called Geohazards Working Group as a part of **EuroGeoSurveys** (EGS) was created. One of the results of EGS activities is a strategic plan for assessment and prevention of geological hazards in European countries (including the Slovak Republic). In the Slovak Republic the plan includes eight subsystems:

01 – Landslides and other slope deformations;

02 – Tectonic and seismic activity of the territory;

03 – Anthropogenic sediments of environmental burden character;

04 – Impact of mining on the environment;

05 – Monitoring of radon volume activity in the geological environment;

06 – Stability of rock massifs under historical objects;

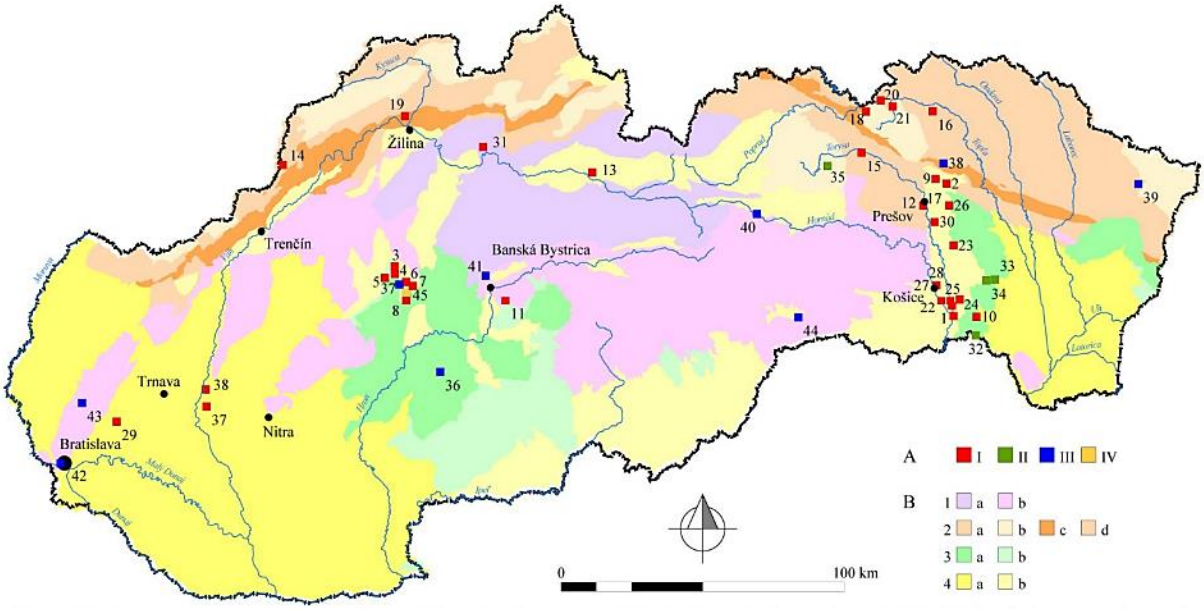
07 – Monitoring of river sediments;

08 – Volume unstable soils.

These partial information subsystems are continuously updated. The **Concept of Geological Research and Geological Survey of the Slovak Republic** is currently in force [20]. Monitoring of slope deformations is performed within the **Partial Monitoring System** (PMS) "Geological factors" in subsystem 01 - Landslides and other slope deformations. The PMS is part of the Monitoring System of the Environment of the Slovak Republic, which was approved by the Government Resolution no. 620 (September 7, 1993). Monitoring of geological factors is provided by the State Geological Institute of Dionýz Štúr. The PMS is focused on geological hazards, harmful natural or anthropogenic geological processes that endanger the natural environment. Monitoring of slope deformations is based on observation and subsequent evaluation of the state of activity or landslides, eventually control of slope deformations after implementation of remediation measures. Monitoring offers objective information necessary for decision-making, management, control, scientific research activities and for the public. Government administration and local/regional self-government and relevant legal and natural persons are being informed about monitoring results. The selection of monitored sites is

continually adjusted according to the current society-wide requirements as well as the monitoring of the assessed stability state of the observed sites.

In 2019 a total of 43 sites were monitored for various types of slope movements (Figure 4.1).



Legend:
I – sliding; II – earth creep; III – topple fall, rockfall (stability of rock cuts); IV – special sites,

Figure 4.1. The monitoring sites of slope deformations in the Slovak Republic. State Geological Institute of Dionýz Štúr [21].

Table 4.1. Violation of territory by slope deformations in Bratislava [22].

Number of deformations	District area [ha]	Area of violation territory [ha]				Failure [%]
		Total	Arable land	Forest soil	Other	
18	36 800	11.1	1.0	0.4	9.8	0.03

According to the Geological Act [23], the Ministry of the Environment of the Slovak Republic is obliged to ensure the carrying out of the engineering geological survey, monitoring of geological factors of the environment and remediation of the geological environment to avert, mitigate or eliminate the consequences of natural disasters. Therefore were issued recommended procedures to ensure the activities of the municipality in case of emergency or occurrence of an extraordinary event in connection with the occurrence of slope deformations in accordance with Act no. 42/1994 Coll. on Civil protection of the population [24], as amended and in accordance with the Geological Act.

In the period 1997-2006, the Ministry of the Environment of the Slovak Republic with the aim of comprehensive processing of data from the registration and mapping of slope deformations and surveys focused on slope deformations and their mapping provided a geological task – Compilation of Atlas of slopes stability maps of Slovakia at scale 1: 50 000 [22]. This atlas is

accessible on the geo server of the State Geological Institute of Dionýz Štúr. It contains the maps showing areas where there is a risk of slope deformation and provides detailed regional analyses of slope deformations in the Slovak republic in relation to the territorial units of so-called engineering geological regions and areas. For the needs of both the professional and laic public, it provides data on the area disruption by slope deformations in the form of passports and summary tables.

With the preparation of the Atlas of slope stability maps of the Slovak Republic, the Ministry of the Environment of SR initiated a project to compile **maps of geological environmental** factors for selected regions of Slovakia. Engineering-geological maps are the foundation of the maps of environmental geofactors, which include a map of susceptibility to slope movements. In these maps, the areas of interest are divided into stable, potentially unstable and unstable areas and evaluated in terms of the occurrence of slope deformations and the susceptibility of these areas to the development of slope movements. Maps of the area susceptibility to slope movements cover 73% of the territory of the Slovak Republic. The activation of slope deformations associated with extreme precipitation and floods in the Slovak Republic has recently caused significant damage in the affected areas.

4.2. Regional

The **Prevention Program of Landslide Risk Management (2014-2020) – update** [25] was approved by Government Resolution no. 738/2013 and represents a strategic document in the field of slope deformations. One of the objectives of this program is to support adaptation to climate change and mitigate the negative impacts of these changes by supporting the prevention, exploration and remediation of emergency landslides directly related to excessive rainfall. The program sets aims to improve the prevention and management of landslide risks. Landslides and slope streams represent 94.5% of the total number of registered slope deformations. Figure 4.2 shows the area (in hectares) disturbed by slope deformations on the territory of the Slovak Republic.

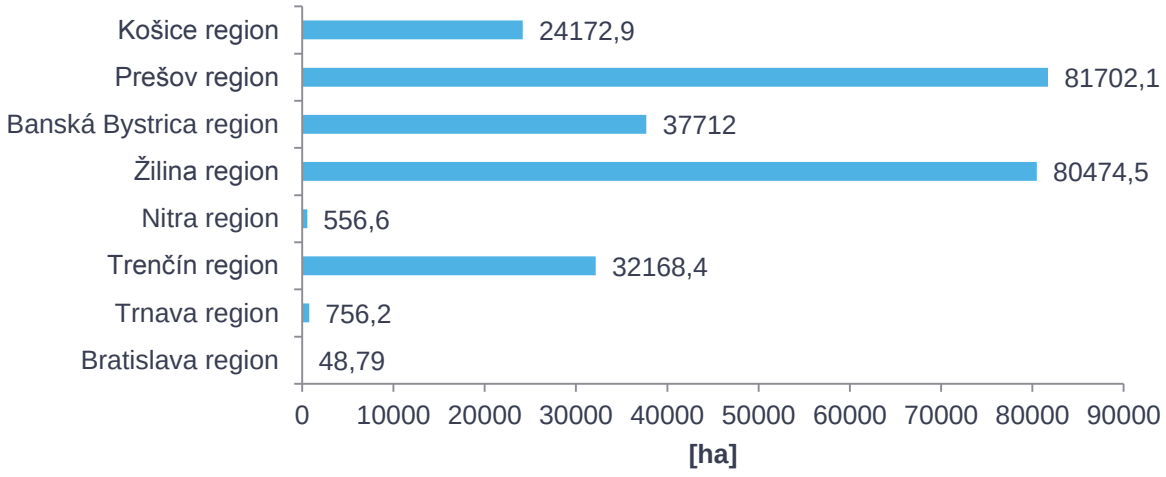


Figure 4.2. Violation of territory by slope deformations in Slovak regions. Ministry of the Environment of Slovak Republic [25].

In the Slovak Republic, there is no database focused on the damage caused by extraordinary events [11]. Vulnerability analysis is not carried out as part of the national level risk analyses. Some of its parts are part of the described assessment of the likely occurrence of potentially significant flood risk.

4.3. Local

In the Slovak Republic, there is no complex database focused on the damage caused by extraordinary events. Damages to the property of municipalities and towns are most often reimbursed by the state, either from the special reserve of the Prime Minister or from the relevant ministries. In order to approve the expended funds, a commission of the Regional Office, which is competent for the impacted municipality, is established. The municipality proves damages by invoices from suppliers, photo documentation, invoices for the rental of construction machinery and machines, etc. The reported amount of damage does not always correspond to reality, as in many cases, volunteers help in emergencies in municipalities [15]. Financial compensation may be requested by a natural person under the Civil Protection Act [24] when damage to property or dwellings, including equipment, has been incurred as a result of an emergency. Based on this application, the municipality shall, in cooperation with the relevant District Office, assess the extent of the damage and the social situation of the applicant. Citizens are indemnified by commercial insurance companies, of course, provided they have taken out insurance. Insurance companies keep own damage records and use the information to build own maps of risk areas [15].

5. Governance framework for climate change adaptation

This section looks at the governance framework for climate change adaptation of relevance to the City of Bratislava. It identifies the relevant policies, strategies, visions and action plans for climate change adaptation in Bratislava at the different governance levels. As Bratislava is a signatory of “Mayors Adapt” and the “Covenant of Mayors” the priority was to conduct a city level risk-based vulnerability assessment within two years of signing.

With support from the Horizon 2020 project RESIN, Bratislava City was able to elaborate on the results of the risk-based vulnerability assessment into a comprehensive Atlas of climate change impacts on Bratislava City. The document focuses on the impacts and risks of climate change to the City´s population and critical infrastructure (road infrastructure and built-up areas). Leading the working group for this assessment was the Office of the Chief City Architect. The group of experts included the Department of Landscape Ecology at the Faculty of Natural Sciences, the University of Comenius in Bratislava, Fraunhofer institute IAIS, different departments of the City Council (such as the Environmental and Spatial planning departments), Bratislava self-governing region, Bratislava Water Company, pilot city boroughs and many others.

The vulnerability and impact chain assessments were done in 2018, and the date from 2016 up to 2018, depending on availability. The method utilized the IVAVIA tool (IVAVIA – Impact and Vulnerability Analysis of Vital Infrastructures and Built-up Areas) which enables stakeholders to participate in the qualitative phase of the assessment for developing impact chains (see Figure 5.1.). Several stakeholder workshops were conducted throughout the qualitative phase (the first workshop focused on heatwaves, whereas the second focused on pluvial flooding, the third on droughts, and the last workshop focused on the weighting of indicators), where the most relevant impacts of climate change, drivers (also stressors not related to climate change), attributes of coping capacity and sensitivity were identified by the participants.

Before starting the indicator identification and data acquisition process in the quantitative phase, the various identified attributes nominated in the stakeholder workshops underwent a thorough review to filter out unsuitable and duplicated attributes, re-categorize attributes to correct for misunderstandings during the workshop (e.g. low awareness the participants listed “low implementation of building-level adaptation measures for reducing the impacts of rainfall” as a sensitivity indicator although it is a rather general observation with no specific spatial data supporting this claim), and reducing the number of attributes to a more manageable number in order to facilitate result validation. Following this process, initial indicators for each attribute and the required data were defined and identified, so that the final vulnerabilities and risks could be calculated. Furthermore, the assessment also included non-climatic stressors; however, these were not included in the qualitative part of the assessment done with the IVAVIA tool.

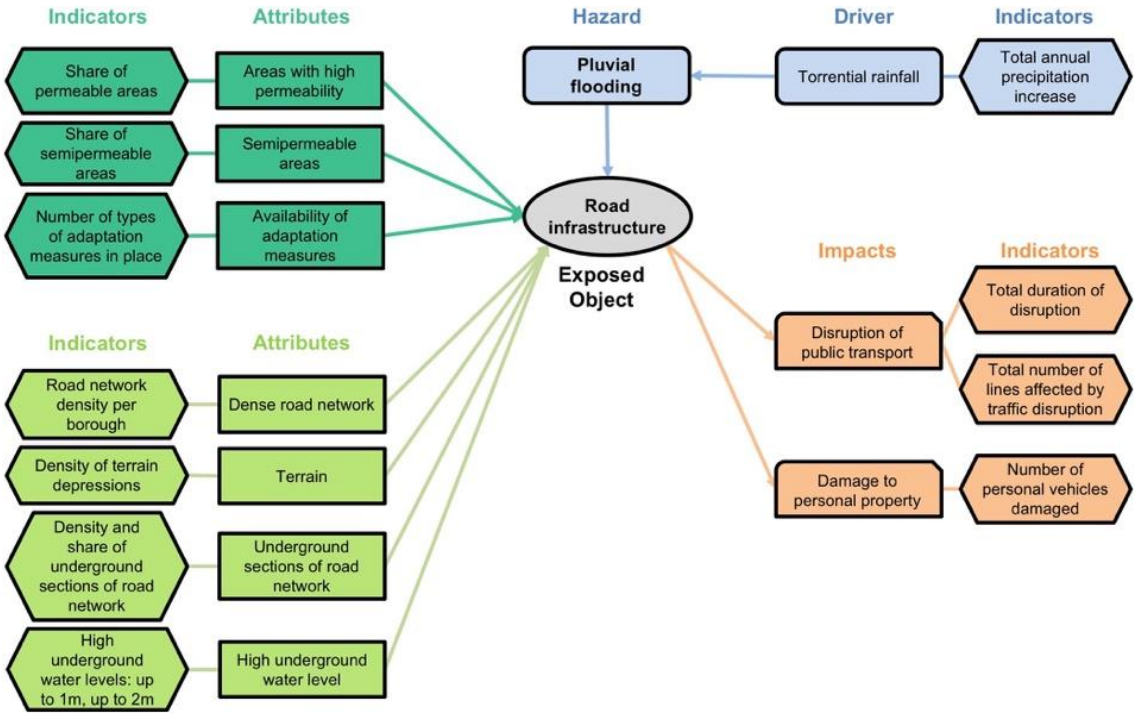


Figure 5.1. Simplified impact chain for the hazard-exposure combination "pluvial flooding on road infrastructure" in the city of Bratislava. Hazards and drivers in blue, exposed object in grey, coping capacity in green-blue, sensitivity in green, and impacts in orange. Rectangles: Attributes; Hexagons: indicators [26].

Several obstacles were identified in the process of conducting the vulnerability assessment, the most relevant being the availability (or lack) of data, as well as the capacity to conduct such assessment (both skill- and resource-wise). As the assessment focused mostly on vulnerable population and infrastructures, no specific attention was paid to cultural heritage, and the assessment did not differentiate between buildings in terms of their cultural or historical importance.

5.1. International

Under the **United Nations Framework Convention on Climate Change (1992),** 197 Parties to the Convention promised to take joint action to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the Earth's climate system. In accordance with Article 4 of the Convention, the signatory countries have also committed themselves to make every effort to develop adaptation strategies and to support climate change research and its consequences.

In 2013, the European Commission published the **"EU Strategy for Adaptation to Climate Change"**, along with several accompanying documents. The strategy was approved by the EU Environment Council on 18 June 2013. The strategy outlines a framework and mechanisms to increase EU preparedness to the impacts of climate change and to improve the coordination of adaptation activities. At the same time, it represents a long-term strategy to increase the EU's resilience to the adverse effects of climate change at all levels and in line with the Europe 2020 objectives. In 2018, the European Commission's Directorate-General for Climate Action

evaluated the implementation of the European adaptation strategy based on input from the Member States. The implementation evaluation report, together with the Member States' fact sheets, was published on the Commission's website, which will serve as a foundation for updating the strategy expected in 2020.

Regulation of European Parliament and of the Council 2018/1999 of the Energy Union and Climate Action. This Regulation sets out the necessary legislative foundation for reliable, inclusive, cost-efficient, transparent and predictable governance of the Energy Union and Climate Action (governance mechanism), which ensures the achievement of the 2030 and long-term objectives and targets of the Energy Union in line with the 2015 Paris Agreement on climate change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (the 'Paris Agreement'), through complementary, coherent and ambitious efforts by the Union and its Member States, while limiting administrative complexity. The goal of a resilient Energy Union with an ambitious climate policy at its core is to give Union consumers, including households and businesses, secure, sustainable, competitive and affordable energy, and to foster research and innovation by means of attracting investment, which requires a fundamental transformation of Europe's energy system. Such a transformation is also closely linked to the need to preserve, protect and improve the quality of the environment and to promote the prudent and rational utilisation of natural resources through the promotion of energy efficiency and energy savings and the development of new and renewable forms of energy.

5.2. National

The resolution of the Government of the Slovak Republic no. 148/2014 required the submission of an update of the national adaptation strategy to the Government's deliberations in light of the latest scientific knowledge in the field of climate change. In 2017, the Slovak Republic's Ministry of Environment started preparing a strategy update aimed at assessing the current state of adaptation and planned activities in key areas and sectors, defining a general vision for the adaptation of the selected areas and sectors and updating the set of adaptation measures and the framework for their implementation. The **Strategy of adaptation of the Slovak Republic to climate change – update** was approved on 17 October 2018 by the Government Resolution no. 478/2018 [27]. A vulnerability assessment is available on a national level from 2011 and needs to be updated [28].

The main objective of the updated adaptation strategy is to „increase resilience and improve the readiness of the Slovak Republic to face the adverse effects of climate change and to establish an institutional framework and coordination mechanism to ensure effective implementation of adaptation measures at all levels and in all areas". This is to be achieved by implementing partial objectives such as: implementing adaptation measures and monitoring their effectiveness, strengthening the trickle-down of objectives and recommendations of the adaptation strategy into other levels of governance, provision of incentives for entrepreneurship oriented at climate change adaptation/mitigation, promoting synergies between adaptation and mitigation measures while reflecting the objectives of the 2030 Agenda for Sustainable Development, the UN Framework Convention on Climate Change and the Paris Agreement.

The objectives of the Strategy should be put in practice by the forthcoming **Action Plan for adaptation,** which is to be submitted to the Government of the Slovak Republic by 31.12.2020 for approval. The preparation of the National **Adaptation Action Plan** began in 2018, with a public participation process where also municipalities were largely involved, and Bratislava participated in all its stages. The plan will include short-term measures for the period 2020-2022 and medium-term for the period 2022-2025 with a view to 2028 will be identified. The measures will be prioritized according to the importance, feasibility and availability of financial resources. The Action Plan should contribute to better translating adaptation measures into sectoral policies of the relevant sectors. It should also include a proposal for a monitoring system for vulnerability, a proposal for a system of the mid-term evaluation of the adaptation process in the Slovak Republic, including the monitoring of cost-benefit links, and a platform for publishing and sharing positive experiences [29].

Referring to the multi governance system in the Slovak Republic, it is mainly the cities and city boroughs which are responsible for implementing the objectives of the National Strategy on Adaptation in practice. However, there are currently still many obstacles preventing this, such as: inconsistencies in the legislature (the Strategy supports the implementation of sustainable urban drainage, but the legislation on water management prevents this), discrepancies between the permissions (and guidelines they contain) on this legislature to different investment activities (construction, reconstruction, etc.). These permissions are issued by the municipality as the competent authority in the first phase (to get what is called territorial permission – meaning the investment project is in-line with the current masterplan) and the city boroughs in the second stage (building permission) and heavy dependence on external funding for implementation of adaptation/ mitigation measures.

Another relevant policy for linking health and with climate change impacts is the Action Plan for the Environment and Health of the Population of the Slovak Republic no. V [30]. It reports that climate change is also likely to affect the spread of diseases in the future. In the Slovak Republic, we are increasingly confronted with restrictions on drinking water supplies due to droughts, torrential rains or floods. With increasing levels of knowledge about the presence of new contaminants and their potential health effects, new chemicals need to be included in the monitoring, and their implications for human health should be investigated.

A WHO / EURO questionnaire study [31] involving member states of the European region showed that countries consider the increase in temperature, heatwaves and prolongation of the pollen season by approximately 10-11 days as the greatest risk in terms of climate change. The results have shown that the most vulnerable groups, as perceived by EU countries in the poll, are the elderly, chronically ill and socially isolated and the urban population in general. In terms of health impacts, vector and rodent-borne diseases, water and food-borne diseases, as well as cardiovascular and respiratory diseases, were the most common (see Figure 5.2).

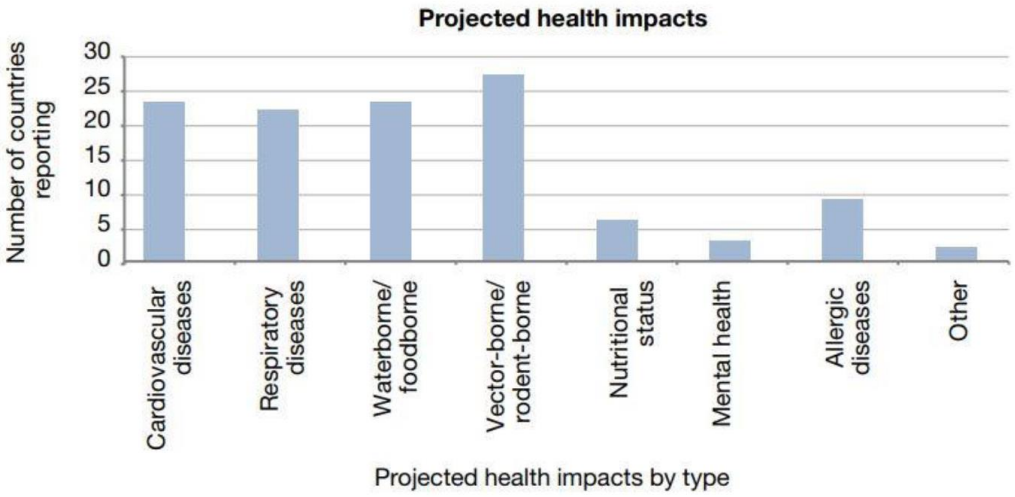


Figure 5.2. Results of the international questionnaire study by WHO – Projected health impact [36]

Another partially linked document to climate change adaptation is the **„Greener Slovakia" - a Strategy for Environmental Policy of the Slovak Republic until 2030** [32]. Adopted in 2019 with the Resolution no. 87/2019, this strategy paper defines a vision for 2030 considering possible, likely and desired future developments. The document identifies the underlying systemic problems, sets targets for 2030, proposes framework measures to improve the current situation, and also includes basic outcome indicators that allow the results to be verified. The basic vision is to achieve better environmental quality and a sustainable circular economy based on the consistent protection of environmental components, using as few non-renewable natural resources and hazardous substances as possible, leading to improved public health.

Action Plan for solving the consequences of drought and water scarcity [33] aims to prevent drought through preventive measures, eliminating the negative effects of climate change. Drought is a natural phenomenon; however, water shortage is strongly conditioned by anthropogenic activity. The Action Plan is a separate document that builds on Act No. 364/2004 Coll. on Waters, as amended. Drought and water scarcity is part of the update of the Water Plan of the Slovak Republic; although it is not currently classified as a significant impact that may have an impact on the status of surface and groundwater bodies. A separate chapter on drought is in the Greener Slovakia report (Strategy of Environmental Policy of the Slovak Republic 2030). **Slovak Water Policy Framework for 2015-2021** [34] does not include solutions to the impacts of climate change. This document represents a standard strategy, which was later replaced by the framework document **Orientation, Principles and Priorities of the Slovak Republic Water Management Policy by 2027** [35], see text below. Water policy currently applied in the Slovak Republic is based on Directive 2000/60 / EC of the European Parliament and of the Council of 23 October 2000, which established a framework for Community action in the field of water policy transposed into law no. 364/2004 Coll. on Waters, as amended. The water management policy of the Slovak Republic is drawn as a set of principles, priorities and instruments for the determination of effective measures, the correct application of which will lead to the achievement of environmental objectives for ensuring the

protection of water and its sustainable use by 2021, or by 2027. Another key document is the **Water plan of Slovakia** (update 2015) [36].

Regarding mitigation of negative climate change impacts, the Slovak Republic submitted a proposal of the I**ntegrated National Energy and Climate Plan 2021-2030** [37] to the European Commission, where the country proposed a contribution of 19.2% to the renewable energy target. The Ministry of Economy of the Slovak Republic will take all available steps to further accelerate the development of RES, especially in heat production, between 2021 and 2030, and in 2030 the Slovak Republic is to approach a higher share of the use of renewable energy sources.

5.3. Regional

River basin management plans, including programs of measures, are a tool to achieve the objectives set out in the national water policy. On a regional level, the water policy for Bratislava is implemented by the **Management Plan of the Danube River Basin** [38] with milestones for implementation by 2021, or by 2027 elaborated as part of the Water plan of Slovakia [36].

The framework document “Orientation, principles and priorities of the Slovak Republic water management policy by 2027” identified the need for creating a so-called **Timetable and factual and communication plan for the 3rd cycle of river basins’ management plan preparation** [39]. It is the key current document of water policy implementation in Bratislava.

Urban-landscape study for protection against torrential rain in the Small Carpathian region [40] deals with the issue of torrential rainfall in the Bratislava self-governing region. The document maps available adaptation measures and proposes the further implementation of measures based on the manifestations of climate change based on torrential rainfall and precipitation data from the Small Carpathian region. The study is the basis for territorial development and decision-making processes at the regional level.

Framework for protection and use of surface and groundwater sources in Bratislava self-governing region, 2017 [41] deals with issues of groundwater resources management and their pollution within the Bratislava self-governing region. The concept also marginally addresses the issue of climate change manifestations in relation to threats affecting the quantity and quality of groundwater resources. The concept is the basis for territorial development and decision-making processes at the regional level.

5.4. Local

Land-use plan for Bratislava, capital of the Slovak Republic (2007) and later amendments no.1-7. The aim of the land-use plan is to systematically and comprehensively address the spatial arrangement and functional use of land and lay down its principles. It proposes the material and chronological coordination of activities, which influence the environment, ecological stability, and cultural-historical values of land, land development and landscape in accordance with the principles of sustainable development [42].

Program of Economic and Social Development of the capital city Bratislava for the years 2010-2020 (2009, a binding document approved by the City Council Regulation No. 1020/2010 in July /2010). The city of Bratislava is committed to addressing the issue of climate change and related appropriate adaptation measures since 2010 in the approved Program of Economic and Social Development for the years 2010-2020 (City Hall of Bratislava, 2009). In 2015, the programme was updated in terms of its financial aspects in 2015 and a binding document approved by the City Council Regulation no. 351/2015 on 10 December 2015). Several measures approved in the financial part relate or directly support adaptation and mitigation measures to adverse effects of climate change as well as protection and enhancement of cultural heritage [43].

Strategy of Adaptation to Adverse Impacts of Climate Change on the territory of Bratislava, capital of Slovak Republic (elaborated by the members of the project Steering Committee, City Hall, 2014). The strategy was elaborated by a Project Steering Committee. It consisted of a chairman, (the chief architect), and a number of other members, who are employees of Bratislava City Hall, i.e. representatives from the departments of strategy project management and financial resources, the environment, territorial system coordination, social affairs, transport, infrastructure etc., as well as representatives of scientific organizations (i.e. Geographical Institute of the Slovak Academy of Sciences and Comenius University in Bratislava) and non-governmental organizations [44].

The Strategy of Adaptation summarises potential risks and gives guidance for the prevention/mitigation of the consequences of climate change risks. It was approved by the deputies of the City Assembly in Bratislava in September 2014. The objective of the Strategy of Adaptation is to ensure appropriate mechanisms are available for the city to counter the increased risk of climate change impacts, reduce vulnerability by appropriate adaptation measures within individual sectors (areas), and provide the necessary information and tools to facilitate the process of decision making and management. It was complemented by the **Action for adaptation to adverse impacts to climate change in Bratislava (2017),** which contains 27 adaptation measures that are to be implemented and monitored in the period between 2017-2020 to support the implementation of the vision and goals of the Strategy for adaptation to climate change in Bratislava. It defines competent departments, organisations of the city, boroughs, as well as competencies, timelines and available/estimated financial resources. The different sectors are: health and wellbeing, social care, green and blue infrastructure, rainwater and drinking water resources, transport, urbanised areas, and energetics [45]. Cultural heritage is not highlighted in the document; therefore, the new Action Plan for adaptation and mitigation should also for the first time put more focus on increasing the resilience of cultural heritage in addition to other sectors.

6. Expected impacts of climate change-related and natural hazards

The purpose of this section is to report and review the preliminary collection of relevant information about hazards, exposed elements, as well as impacts provided by ARCH city partners in collaboration with their local research partners, in order to offer an initial overview on the risks that might affect the selected historic areas and their communities. This section is structured as follows: a description of the methodology is provided, followed by a Risk Profile Table, outlining hazards, exposed elements, impacts, and corresponding resilience-building measures already planned or implemented to date. Next follows a review, interpretation, and validation of the information provided in the Risk Profile Table. Finally, an outlook is provided concerning further risk analysis work in the context of the ARCH project.

6.1. Methodology

In order to elicit relevant information for risk analyses from city partners, ENEA, Fraunhofer, ICLEI, and Tecnalia developed a Risk Profile Table template (see Part 6.2 below) based on the central risk components identified in the 5th Assessment Report of the Intergovernmental Panel on Climate Change: hazards, exposed elements, impacts (physical, societal, functional, economic, and intangible), as well as corresponding resilience-building measures already planned or implemented to date. This template was filled out by city partners and provides a starting point from which to conduct more detailed risk analyses. Furthermore, it serves as a starting point for the data, models, methods, and tools to be developed during the project.

The information provided in the Risk Profile Table was reviewed and harmonised by ENEA in order to provide a comparable description across all city cases and ensure relevance to (and validity for) similar on-going[1] and/or future initiatives and projects in the field of disaster risk reduction, climate change adaptation, and cultural heritage preservation.

The following standards, reference material, and tools were identified as most suitable for this exercise:

- The City Climate Hazard Taxonomy[2] for classification of hazards;
- The UNDRR QRE Tool[3] and ISO standard 37120 for the classification of exposed elements and impacts; and

[1] E.g. United Nations Office for Disaster Risk Reduction: *Words into Action guidelines: National disaster risk assessment*. UNDRR, 2017. Online: https://www.undrr.org/publication/words-action-guidelines-national-disaster-risk-assessment

[2] https://www.c40.org/researches/city-climate-hazard-taxonomy

[3] https://www.unisdr.org/campaign/resilientcities/toolkit/article/quick-risk-estimation-qre

- The ICOMOS CCHWG[4] classification and INSPIRE[5] directive for the classification of heritage assets.

Based on the harmonised information, initial proposals for risk analysis focus actions (e.g. which methods and tools to apply for which part/issue of a historic area) were formulated by ENEA. The initial proposals will be further defined during the co-creation process and in exchange with the relevant local stakeholders.

[4] https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

[5] INSPIRE, Infrastructure for Spatial Information in EuropeD2.8.III.2 Data Specification on Buildings – Technical Guidelines (5.3.1.1.4. Classification of buildings, pages 43-45).

6.2. Risk profile table

Heritage site (historical area)	Hazard[6]	Exposed element [7]	Impacts					Corresponding resilience-building measure	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible	Description (please indicate specific S or general G)	
Monument preservation reserve (location: area in the historical city centre)	Pluvial flooding Drought Heatwave	Buildings (and architecture) and other tangible cultural heritage Citizens and visitors Road network Urban greenery	Damage to buildings caused by flooding, moisture (especially underground levels) Increased morbidity of trees (drought/heatwave)	Loss of access to services such as transport Need to shorten working hours due to unsuitable working conditions inside (heatwave)	Disruption to services, e.g. transport services or sewage system Disruption to the operation of institutions,	Loss of tourism revenue due to a decrease in visitors Loss of business income due to damaged premises Loss of income due to shortened working hours	Loss of cultural heritage value resulting from physical damage Loss of heritage integrity of the area	Action plan for adaptation to climate change in Bratislava – in place. (S and G) Manual for public space – currently being developed at by MIB (Metropolitan Institute of Bratislava) (S and G)	[7] [46] [47] [48]
Celtic acropolis with roman architecture (location: Bratislava Castle area)	Pluvial flooding Drought Heatwave	Tangible cultural heritage – archaeological remains of the Celtic acropolis *in situ*	Damage to the archaeological remains	-	-	Disruption of tourism service provided on-site	Loss of cultural heritage value resulting from physical damage	limit the number of visitors allowed inside (to address humidity and resulting fungus growth caused by the breathing of many people)	[49] [50] [51]
Celtic kiln (location: in monumental reserve, underground)	Pluvial flooding – moisture entry and resulting fungal growth (interior)	Tangible cultural heritage (archaeological remains *in situ*)	Moisture/fungal damage to the kiln	-	-	Loss of tourism service provided on-site	Loss of cultural heritage value resulting from physical damage	Replacement of pavement on the courtyard above the kiln with a waterproof pavement with better spillway channels	[52] [53]

[6] Note: the UN Office for Disaster Risk Reduction (UNDRR)'s Resilience Scorecard defines 'hazard' as 'a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation'. Of these, the ARCH project is addressing natural and climatic hazards.

[7] Note: the UN Office for Disaster Risk Reduction's Resilience Scorecard defines 'exposure' as 'the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas'.

Heritage site (historical area)	Hazard[6]	Exposed element [7]	Impacts					Corresponding resilience-building measure	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible	Description (please indicate specific S or general G)	
Devín Castle (in Devin city borough – not the city centre)	Pluvial flooding Drought Heatwave Slope movements & landslides Erosion NW winds	Buildings (and architecture), excavations, finds of objects and other tangible cultural heritage Citizens and visitors Local natural habitats	Erosion of dolomite cliff threatening loss of the upper castle Erosion of dolomite cliff combined with extreme rain and heat worsen the erosion of the castle walls	-	Damage to castle walls, underground caves and expositions Dolomite cliff disruptions (fissures and cracks) Loss of biodiversity Disruption of tourism service provided on-site Disruption of archaeological research	Loss and disruption of tourism service provided on-site	Loss of cultural heritage value resulting from the fall of the cliff	Controls introduced on amount of visitors allowed Conservation of damaged masonry Protection against humidity, wind and deterioration	[54]
St. James´s chapel	Pluvial flooding – moisture entry (interior),	Tangible cultural heritage (archaeological remains in situ)	Moisture/fungal damage to the archaeological remains	-	-	-	Loss of cultural heritage value resulting from physical damage	Planned conservation activities after finishing archaeological research	[55] [56]
Celtic Metal casting and coin minting workshop, Panská Street 19	Pluvial flooding – moisture entry (interior),	Tangible cultural heritage (archaeological remains *in situ*)	Moisture/fungal damage to archaeological remains	The exhibition will be closed if there will be fungus	-	Disruption of tourism service provided on-site	Loss of cultural heritage value resulting from physical damage	Renovation of the wall plaster caused by the humidity- in the basement spaces, disinfection against fungus Planned activities from Bratislava City Gallery for the 2020 year, such as the reconstruction of the underground levels of buildings where the Celtic mint is being stored.	[57]
Fisherman´s gate	Pluvial flooding and underground water – moisture entry (interior),	Tangible cultural heritage (archaeological remains *in situ*)	Moisture/fungal damage to archaeological remains of fortification walls and tower can cause erosion	The site was designed Europa Nostra heritage 2003	Possible damage to upper layers of the pedestrian zone, loss of tourist sight	Disruption of tourism service provided on-site	Loss of cultural heritage value resulting from physical damage	Protection against humidity and deterioration, Functional protection, planning of yearly management control from the site of the Old City Borough	[58]

6.3. Preliminary classification of hazards, exposed elements and impacts

The purpose of this section is to review, interpret, validate, and harmonise the information provided in the Risk Profile Table as a sound basis for the project to address Bratislava's risks to cultural heritage induced by climate change and other hazards. The section provides a preliminary, qualitative screening of:

a) hazards;

b) elements exposed to those hazard; and

c) main impacts that the identified hazards might cause on the identified exposed elements.

The Risk Profile (Part 6.2 above) supported the identification of the elements mentioned above for different cultural heritage areas selected by Bratislava as a focus for the ARCH project, in two different boroughs, i.e. the **Old town city borough** and the **Devín city borough.**

Within the two selected boroughs, Bratislava City has a special interest in different cultural heritage areas, cultural landscapes, buildings and structures, as reported in Table 6.1 below:

Table 6.1. Cultural heritage areas, cultural landscapes, buildings and structures identified by Bratislava City as a focus for the ARCH project.

Old town city borough	Location
Monument preservation zone	Wider historical city centre, Old Town borough
Monument preservation reserve	Historical city centre, Old Town borough
Celtic acropolis with roman architecture	Bratislava Castle, Old Town borough
Celtic kiln	Monumental reserve, Old Town borough
St. James´s chapel and charnel house	Monument preservation zone, Old Town borough
Celtic Metal casting and coin minting workshop	Monumental reserve, Old Town borough
Fisherman´s Gate	Monument preservation zone. Old Town borough
Devin city borough	**Location**
Devín Castle	Devin borough

6.3.1. Hazards

Bratislava City is well aware of the hazards that are affecting the selected sites. Within the "Risk Profile Table" *pluvial flooding, droughts and heatwaves*, have been identified as the hazards affecting all the cultural heritage areas and elements of interest listed in Table 6.1 above.

The aforementioned extreme meteorological conditions are causing moisture to enter the buildings of interest (i.e. St. James´s chapel and the Celtic Metal casting and coin minting workshop). This can be regarded as an induced-hazard. Further than *pluvial flooding, droughts*

and heatwaves, the Devín Castle is affected by slope movements and landslides, erosion and wind.

The hazard clusters identified in Bratislava, for the cultural heritage sites of interest include: ***Meteorological, Geophysical, Biological*** (see Table 6.2 below). Although not specifically reported within the Risk Profile Table, human-induced pollution is also included in Table 6.2 as a possible hazard that Bratislava might like to consider (this possibility was mentioned by the City of Bratislava during the ARCH project 1st General Assembly in June 2019).

Table 6.2. Hazard clusters and manifestations identified in Bratislava. Italic characters are used to identify hazards that, although not included in the Risk Profile Table, Bratislava might be interested to analyse.

Hazard Cluster	Hazards	Manifestations
Meteorological	Extreme precipitation	Pluvial flooding, heavy rain, heavy snow, monsoons, blizzards, hail
	Wind	Tornados, cyclones, severe winds
	Extreme heat	Heatwaves, droughts
Geophysical	Mass movements	Landslides, avalanches, rockfalls, subsidence
Biological	Pests and plagues	Moths, mites
	Fungi action	Moisture, mould
Human-induced	Pollution	Soil pollution, water pollution, air pollution

6.3.2. Exposed Elements

The exposed elements identified by Bratislava City within the Risk Profile Table are herein reorganised according to the following categories:

- Natural Environment;
- Built Environment: critical Infrastructures and Buildings;
- Cultural heritage;
- Services (essential or basics and productive);
- Human and social aspects.

In Table 6.3, the cultural heritage category subsumes all exposed elements that are in themselves heritage, i.e. exposed elements declared as heritage are only categories as such and not as any of the other categories.

Table 6.3. Exposed elements identified in Bratislava.

Exposed Element Categories	Exposed Element Types
Natural Environment	Ecosystem
	Urban greenery
Built Environment	Buildings and architecture
	Road, railroad and other critical infrastructures
Cultural Heritage	Tangible cultural heritage
	Intangible elements
	Archaeological remains
Services, essential and productive	Essential and basics services
	Productive services
Human and Social Aspects	External people (e.g. tourists,)
	Local people

Table 6.4 reports in further detail the exposed elements categorised as cultural heritage. Here, reference has been made to the six categories identified by the ICOMOS Climate Change and Cultural Heritage Working Group, CCHWG (2019). In Bratislava, exposed cultural heritage elements include: archaeological resources, such as archaeological finds and archaeological sites (i.e. Celtic acropolis with Roman architecture, Celtic Metal casting and coin minting workshop, Celtic kiln); buildings and architectural structures (i.e. Devín Castle, St. James´s chapel) and groups of separate or connected buildings (i.e. Monument preservation zone); cultural landscapes, such as combined works of nature and humankind (i.e. Monument preservation reserve). Intangible heritage is also mentioned in the Risk Profile Table, however, the kinds of intangible heritage are not specified (see Table 6.4 for possible kinds).

Table 6.4. Exposed cultural heritage elements identified in Bratislava (highlighted in bold), and further cultural heritage categories and types identified in the ARCH project, that Bratislava City might like to consider.

Exposed Cultural Heritage Categories	Exposed Cultural Heritage Types
Moveable heritage	works of monumental sculpture and painting
Archaeological resources	archaeological finds
	archeological materials
	archaeological sites
	archeological monuments
	stratigraphic tests
	stratigraphic finds
Buildings and structures	architecture (castle, chapel, workshop)
	groups of separate or connected buildings
	historical nuclei
Cultural landscapes	parks/gardens
	combined works of nature and humankind
Associated and traditional communities	
Intangible heritage	oral traditions
	performing arts

	social practices
	rituals
	festive events
	knowledge and skills to produce traditional crafts
	knowledge and practices concerning nature and universe

6.3.3. Impacts

The identification of impacts in the Risk Profile Table for Bratislava is quite exhaustive.

Table 6.5 below reports, in a concise way, the different impacts identified for the five categories of impacts, included in the Risk Profile Table (i.e. Physical, Functional, Societal, Economic and Intangible) for the different exposed elements categorised according to the classification reported in Table 6.3.

Table 6.5. Physical, Functional, Societal, Economic and Intangible impacts identified in Bratislava for the different exposed elements.

Exposed Element		Physical	Functional	Societal	Economic	Intangible
Natural Environment	Ecosystem	Loss of biodiversity				
	Urban greenery	Increased morbidity of trees	Loss of protection against erosions			
Built Environment	Buildings and architecture	Damage to buildings due to flooding (especially underground levels)			Loss of business income due to damaged premises	
	Road and other critical infrastructures	Flooding of urban road and paths	Outage of critical services			
Cultural Heritage	Tangible cultural heritage	Moisture and fungus cause damage			Loss of tourism revenue due to decrease in visitors	Loss of cultural Values
	Archaeological remains					
	Intangible elements					
Services, essential and productive	Essential and basics services			Reduced /Loss of access to critical services		
	Productive services					
Human and Social Aspects	External people (e.g. tourists,)					
	Local people		Non-suitable	Fewer working hours due	Loss of income due to	

Exposed Element		Physical	Functional	Societal	Economic	Intangible
			working conditions in office and working buildings due to heatwaves	to not suitable working conditions	shortened working hours	

6.4. Outlook and implications for future ARCH work

As stated in Chapter 5 of this report, the "new action plan to adverse climate change-induced impacts in Bratislava" will put more focus on increasing the resilience of cultural heritage. The on-going and planned work within the ARCH project can provide critical and operative inputs to inform and support the implementation of such an action plan.

Towards that and following up on the information provided in the Risk Profile Table at Part 6.2 above, ARCH work for Bratislava City is envisaged to be conducted at different levels of analysis for the different exposed elements identified in Bratislava.

Table 6.6 below provides initial ideas of possible examples of the work that can be undertaken as part of the ARCH project. What is proposed in Table 6.6 will need, of course, to be discussed and agreed with Bratislava City and ARCH research partners; and will be subject to data availability[8].

Table 6.6. Possible analysis and possible tools to be implemented for ARCH work in Bratislava City.

Boundaries of Study Areas	Possible Analysis	Possible Tools
Bratislava City & Suburbs (including Old Town City, Devín city boroughs).	Impact Chain Analysis Thematic maps	IVAVIA impact chain creator (Adapted for ARCH) ARCH DSS (i.e. CIPCast)
Old Town City borough	Scenario simulations	ARCH DSS
- Monument preservation zone - Monument preservation reserve - Celtic acropolis with roman architecture	Scenario simulations with dynamic data integration from sensors and satellite images	ARCH DSS Satellite Images and Sensors

[8] In regard to the latter, some preliminary information has already been provided by Bratislava City, in response to a questionnaire developed by scientific partner INGV and distributed to all ARCH city partners in October 2019.

Boundaries of Study Areas	Possible Analysis	Possible Tools
- St. James´s Chapel, - Devín Castle - Celtic Kiln - Fisherman´s Gate	3D Building model with identified damage pattern and dynamic monitoring of damage Finite element analysis of the buildings to support retrofitting interventions	Sensors Photogrammetry 3D models

As for a large-scale territorial analysis (i.e. covering the whole Bratislava City & city boroughs), it may be possible to build on previous data collected as part of an earlier project RESIN[9], where Bratislava conducted risk analysis supported by ARCH consortium partner Fraunhofer, as well as to make use of the indexes defined in RESIN, which have been summarised for Bratislava into an ad-hoc Atlas. Also, starting from the Bratislava case study, that already used it, it would be great to adapt the IVAVIA risk-based vulnerability assessment methodology[10] that was conceived and defined as part of the RESIN project, to the proposed objectives of ARCH.

Towards that, it would be necessary to expand the hazards and the exposed elements that, currently, IVAVIA considers. As an example, for the implementation of IVAVIA in Bratislava mainly meteorological hazards were considered with special focus on precipitation and temperature; as far as the exposed elements and possible induced impact on them, main focus was on critical infrastructures and on vulnerable people.

For its use in Bratislava and more generally in the whole ARCH project, the possibility to analyse the impacts induced by further hazards (i.e. geophysical, biological and human-induced hazards as far as Bratislava is concerned) would need to be embedded into IVAVIA as well as the possibility to have a special focus on:

- further exposed elements and especially on cultural heritage exposed elements (both tangible and intangible, listed in Table 6.4) and
- direct and indirect/cascading impacts (both tangible and intangible) that climate change and other hazards might induce on cultural heritage exposed elements.

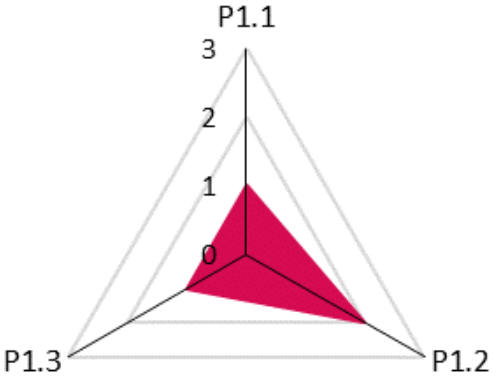
As a first step, of the adaptation process of IVAVIA to ARCH, a possibility could be to use Table 6.5 of this report as a reference to support a co-creation discussion with Bratislava stakeholders to expand on the possible expected impacts; information in several cells in Table 6.5 is still missing.

[9] See more at https://resin-cities.eu/home/
[10] See more at https://resin-cities.eu/resources/ivavia/

7. Preliminary resilience assessment

The following resilience assessment was developed using the preliminary version of the UNDRR Disaster Resilience Scorecard for Cities. The preliminary assessment was conducted within the framework of a webinar between the municipality of Bratislava, MÚOP, and Fraunhofer on January 28, 2020. As the original Scorecard is aimed at city-level, not all questions were immediately applicable on the level of historic areas or single heritage assets. Wherever possible, answers were provided for the historic areas under examination (e.g. with regard to hazard scenarios). For all other questions, answers were provided on city-level (e.g. with regard to city masterplans). The results give a first indication of the overall resilience of the city with some – but not exclusive – focus on the historic areas examined by ARCH. In addition, the application of the Scorecard will be used as input for the development of the ARCH Resilience Assessment Framework specifically focused on historic areas. Lastly, the preliminary resilience assessment results presented in the baseline reports should not be employed to develop resilience action plans, as not all necessary stakeholder groups were involved in the assessment process.

7.1. Essential 01: Organize for resilience



P1.1	Does the City master plan (or relevant strategy/plan) adopt the Sendai Framework?	1
P1.2	Is there a multi-agency/sectoral mechanism with appropriate authority and resources to address disaster risk reduction?	2
P1.3	Is resilience properly integrated with other key city functions / portfolios?	1

Figure 7.1. Results Essential 01.

Regarding Essential 01, Bratislava achieves a resilience score of 3/9. While the city has a master plan, it is not compliant with the Sendai Framework. Instead, there is an additional regional DRR plan for Bratislava consisting of emergency instructions, which is - as all Slovak Republic DRM plans - compliant with Decision No. 1313/2013/EU of the European Parliament (score of 1 for P1.1). Organisation and coordination for DRR is well addressed; all lead agency teams are well established, properly resourced and with authority to act, but there is no consistency in the resourcing of the main DRR stages (score of 2 for P1.2). Lastly, resilience is only integrated into other key city functions on an ad hoc basis during or after a disastrous event (score of 1 for P1.3).

7.2. Essential 02: Identify, understand and use current and future risk scenarios

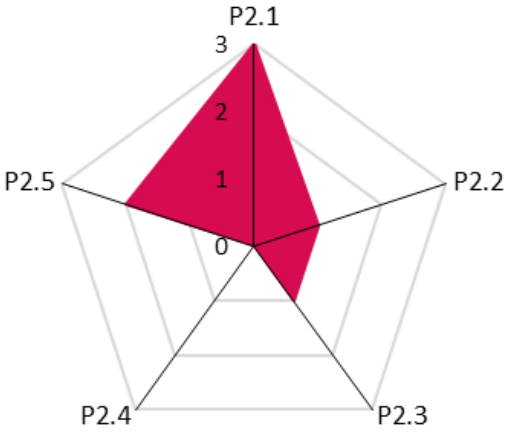
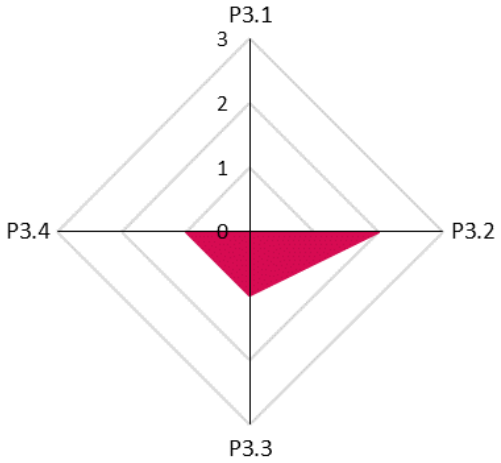


Figure 7.2. Results Essential 02.

P2.1	Does the city have knowledge of the key hazards that the city faces, and their likelihood of occurrence?	3
P2.2	Is there a shared understanding of risks between the city and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks?	1
P2.3	Are their agreed scenarios setting out city-wide exposure and vulnerability from each hazard, or groups of hazards (see above)?	1
P2.4	Is there a collective understanding of potentially cascading failures between different city and infrastructure systems, under different scenarios?	0
P2.5	Do clear hazard maps and data on risk exist? Are these regularly updated?	2

For Essential 02, Bratislava achieves a resilience score of 7/15. The city understands its main hazards and has a well-established monitoring network. Depending on the hazard, related data are periodically updated and maintained by related industries / stakeholders. For example, the city's air pollution data is monitored every hour. The data is monitored and published by the Slovak Hydrometeorological Institute, and large and medium-sized polluters, like oil refinery and car manufactures, regularly share their pollution data with the city. Furthermore, climate change impact data will be available this year (score of 3 for P2.1). Individual system risks are known by the respective utility providers, but not systematically shared in a forum among relevant stakeholder groups in order to understand cascading effects. Furthermore, risks are not defined for heritage sites (score of 1 for P2.2). Due to the application of the IVAVIA assessment in the H2020 RESIN project, single disaster scenario information are available for some hazards. In general, for heritage sites, Slovak Republic recommends procedures in case of emergencies (score of 1 for P2.3). There is no general analysis and understanding of cascading effects and impacts (score of 0 for P2.4). Hazard maps will be published in a risk atlas and shall be updated regularly afterwards (score of 2 for P2.5).

7.3. Essential 03: Strengthen financial capacity for resilience

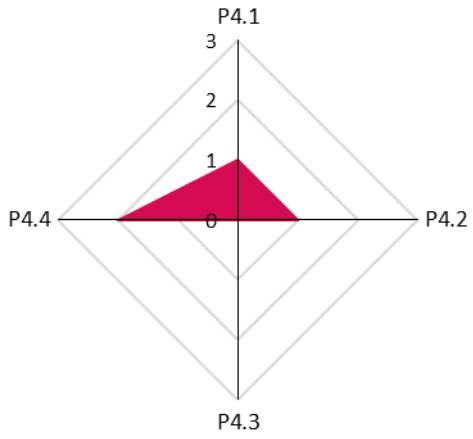


P3.1	The city / lead agencies understand all sources of funding, and the "resilience dividends", are well connected, understand all available routes to attract external funding and are actively pursuing funds for major resilience investments.	0
P3.2	Does the city have in place a specific 'ring fenced' (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)?	2
P3.3	What level of insurance cover exists in the city, across all sectors – business and community?	1
P3.4	What incentives exist for different sectors and segments of business and society to support resilience building?	1

Figure 7.3. Results Essential 03.

For Essential 03 Bratislava achieves a resilience score of 4/12, which indicates room for improvement. Currently, there is little knowledge about available funding approaches for resilience measures. While there is a multi-level DRM structure (national, regional, and municipal), any resources for funding are usually only pursued on the national level with the local agencies having only a limited awareness of additional funding opportunities (score of 0 for P3.1). The city financial plan allows for DRR activities. Enough budget is available for civil protection and crisis management coordination, supported by finance measures of the state for reconstruction (score of 2 for P3.2). The level of insurance coverage varies significantly by sector (score of 1 for P3.3). Only a limited number of incentives for the support of resilience-building exist, such as small grants for sustainable drainage systems for private households (up to 1000 € per applicant) or the environmental grant programmes of the Bratislava regional authority (up to 12 000€ per application) (score of 1 for P3.4).

7.4. Essential 04: Pursue resilient urban development

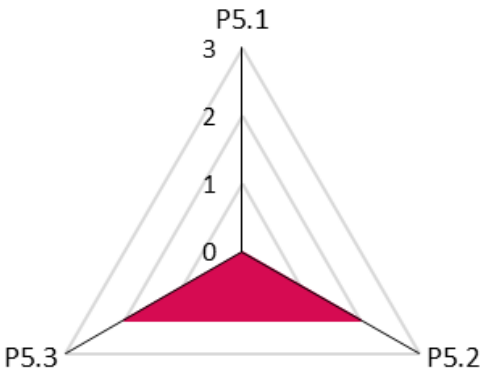


P4.1	Is the city appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres?	1
P4.2	Are approaches promoted through the design and development of new urban development to promote resilience?	1
P4.3	Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?	0
P4.4	Are zoning rules, building codes and standards widely applied, properly enforced and verified?	2

Figure 7.4. Results Essential 04.

Regarding Essential 04, Bratislava achieves a resilience score of 4/12, which leaves room for improvement. Zoning plans exist for the city and the boroughs; hazard and risk analysis is conducted by the Ministry of Interior as well as regional authorities for the municipalities. However, a more detailed and small-scale land-use zoning plan is needed for the heritage sites (score of 1 for P4.1). Resilience approaches for new urban developments are promoted, but only in an inconsistent way. Since the law on building codes does not support actions for resilience against climate change, the city is only able to give recommendations for appropriate urban development approaches. For the development of heritage sites, a different law, the law of heritage protection is applied (Act 49/2002 Coll. By the National Council of the Slovak Republic) (score of 1 for P4.2). There are no relevant building codes and standards that address any specific hazards of the city, which is furthermore a state-wide problem (score of 0 for P4.3). Zoning rules and building codes and standards are applied and enforced in more than half of the occurring cases in the city, but these are often not properly enforced (score of 2 for P4.4).

7.5. Essential 05: Safeguard natural buffers to enhance the protective functions offered by natural ecosystems



P5.1	Beyond just an awareness of the natural assets, does the city understand the functions (or services) that this natural capital provides for the city?	0
P5.2	Is green and blue infrastructure being promoted on major urban development and infrastructure projects through policy?	2
P5.3	Is the city aware of ecosystem services being provided to the city from natural capital beyond its administrative borders? Are agreements in place with neighbouring administrations to support the protection and management of these assets?	2

Figure 7.5. Results Essential 05.

For Essential 05 Bratislava reaches a score of 4/9. The city has showcased until recently little awareness and understanding of the functions and services that natural capital provides for it (score of 0 for P5.1), amongst topics such as mobility and development. However, green and blue infrastructure are getting more and more integrated and promoted through city policy for the past two years; for example, a report on urban greenery was developed, and a manual for greenery is currently under development as well as an Action plan for adaptation to climate change was adopted in 2017 (score of 2 for P5.2). The city is aware of the functions provided by natural capital beyond the city administrative border, and it cooperates well with neighbouring administrations such as the Bratislava regional authority, regional office of state nature conservancy and the transboundary national park protection (SK-AT-HU) (score of 2 for P5.3).

7.6. Essential 06: Strengthen institutional capacity for resilience

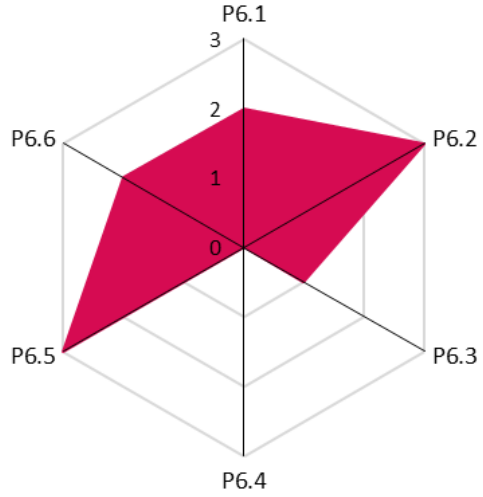


Figure 7.6. Results Essential 06.

P6.1	Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?	2
P6.2	Does a co-ordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public?	3
P6.3	Extent to which data on the city's resilience context is shared with other organizations involved with the city's resilience.	1
P6.4	Are there training courses covering risk and resilience issues offered to all sectors of the city including government, business, NGOs and community?	0
P6.5	Are training materials available in the majority of languages in common use in the city?	3
P6.6	Is the city proactively seeking to exchange knowledge and learn from other cities facing similar challenges?	2

Regarding Essential 06, Bratislava achieves a score of 11/18. The city can quickly access most of the skills required to identify and respond to identified disaster scenarios. In general, the coordination and organisation of risk responses is designed in a multi-level governance fashion; from state ministries and regional authorities to municipalities and city boroughs (score of 2 for P6.1). This also ensures proper dissemination of hazard, risk, and disaster information via fully co-ordinated campaigns (score of 3 for P6.2). Up to now, some of the city's data layers are shared, e.g. via the risk atlas. A department for data management & policy was created mid-2019 and is in charge of creating a data portal and providing interpretations (score of 1 for P6.3). Training materials are available in the common language Slovak for all city hall employees (score of 3 for P6.5). Bratislava understands the importance of sharing knowledge with other cities and is involved in regional networks (score of 2 for P6.6).

7.7. Essential 07: Understand and strengthen societal capacity for resilience

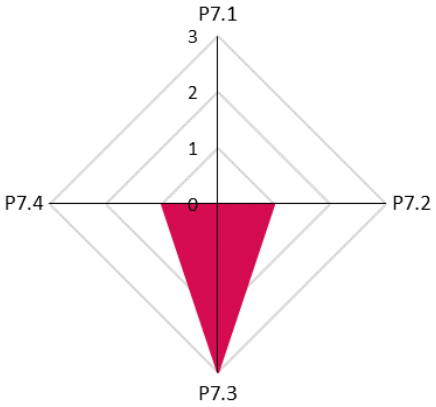


Figure 7.7. Results Essential 07.

P7.1	Are "grassroots" or community organizations participating in risk reduction and post-event response for each neighbourhood in the city?	0
P7.2	Are there regular training programmes provided to the most vulnerable populations in the city?	1
P7.3	What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months?	3
P7.4	How effective is the city at citizen engagement and communications in relation to DRR?	1

Bratislava achieves a score of 5/12 for Essential 07, which partly offers space for improvement. There is very little involvement from grassroots organisations in the city for risk reduction and post-event responses due to the low number of severe disasters in the last years (score of 0 for P7.1). However, there are NGOs taking care of climate change adaptation and decarbonisation. There are no training programs provided to the most vulnerable populations in the city (score of 1 for P7.2). A large share (60 – 100%) of mostly larger corporations and businesses have documented and usually very comprehensive business continuity plans (score 3 for P7.3). The city engages citizens and communicates DRR via some channels such as the National Integrated Rescue System (IRS), which provides information in the event of threats to life, property, or the environment (score of 1 for P7.4).

7.8. Essential 08: Increase infrastructure resilience

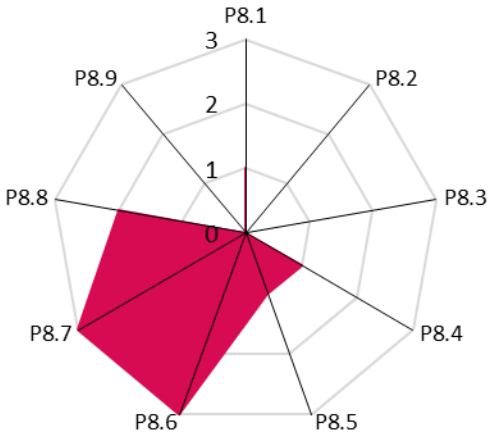


Figure 7.8. Results Essential 08.

P8.1	Is critical infrastructure resilience a city priority, does the city own and implement a critical infrastructure plan or strategy?	1
P8.2	Is existing protective infrastructure well-designed and well-built based on risk information?	0
P8.3	Would a significant loss of service for these two essential services be expected for a significant proportion of the city under the agreed disaster scenarios?	-
P8.4	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)?	1
P8.5	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would transport infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc.) and passable?	1
P8.6	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event?	3
P8.7	Would there be sufficient acute healthcare capabilities to deal with expected major injuries in 'worst case' scenario?	3
P8.8	% of education structures at risk of damage from "most probable" and "most severe" scenarios	3
P8.9	Will there be sufficient first responder equipment, with military or civilian back up as required?	0

For Essential 08, Bratislava reached a score of 10/27 leaving major room for improvement. The city understands the risks for some major infrastructure types; however, CI operators use only their forums to exchange on risks and cascading effects (score of 1 for P8.1). Significant parts of the city are unprotected from known risks and hazards, e.g. there is no protection from pluvial flooding (score of 0 for P8.2).

For the preliminary assessment, there was no available information with regard to loss of service for the water (potable and sanitation) infrastructure (score of - for P8.3) and only very

limited information with regard to the loss of service for the energy infrastructure (score of 1 for P8.4). These areas will need to be revisited during a more detailed assessment.

From the most probable scenario, pluvial flooding, some loss of service would be expected for the transport infrastructure (score of 1 for P8.5), but no loss of service for communication infrastructure (score of 3 for P8.6). The healthcare and education systems of Bratislava are well-positioned to deal with the hazards faced by the municipality as more than 90% of major injuries can be treated within six hours under the “most severe” scenario (score of 3 for P8.7), and no teaching facilities would be at risk under the “most probable” scenario (score of 2 for P8.8). Lastly, Bratislava’s first responders are not well equipped to deal with the “most probable” scenario (score of 0 for P8.9). This is contrary to the national rescue system that is very well prepared and equipped.

7.9. Essential 09: Ensure effective disaster response

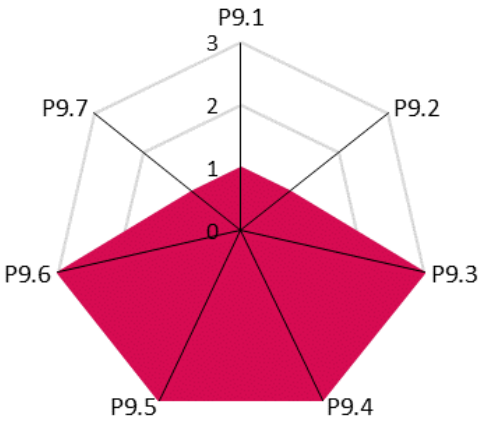
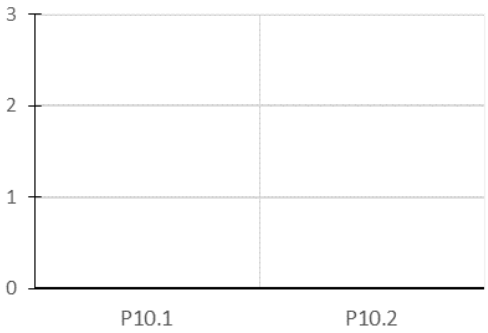


Figure 7.9. Results Essential 09.

P9.1	Does the city have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?	1
P9.2	Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies?	1
P9.3	Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?	3
P9.4	Are equipment and supply needs, as well as the availability of equipment, clearly defined?	3
P9.5	Would the city be able to continue to feed and shelter its population post-event?	3
P9.6	Is there an emergency operation centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with “most probable” and “most severe” scenarios?	3
P9.7	Do practices and drills involve both the public and professionals?	1

For Essential 09 Bratislava achieves a resilience score of 15/21. The early warning systems of the city can reach over half of the population via different channels such as sirens, smartphone applications, radio stations, TV, websites (score of 1 for P9.1). The Slovak state legislation provides acts on, e.g. protection of civilians, management of the state in conflicts etc. Furthermore, the Ministry of Interior of the Slovak Republic provides an emergency response handbook. However, the acts and plans are not joined up (score of 1 for P9.2). The responsible disaster management authorities have sufficient staffing capacity, on the national as well as the regional level (score of 3 for P9.3). In addition, the equipment and relief supply needs are clearly defined (score of 3 for P9.4), and the necessary supplies of food and basic relief items exceeds estimated needs under the “most severe” scenario. These are provided by city boroughs – via general and special shelters – which are coordinated on city level (score of 3 for P9.5). The city boroughs are coordinated by city crisis committees that are able to deal with the “most severe” scenario (score of 3 for P9.6). Lastly, according to Act 42/1994, several practices and drills are designed and performed for a few scenarios (score of 1 for P9.7).

7.10. Essential 10: Expedite recovery and build back better



P10.1	Is there a strategy or process in place for post-event recovery and reconstruction, including economic reboot, societal aspects, etc.?	0
P10.2	Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects?	0

Figure 7.10. Results Essential 10.

For Essential 10, Bratislava achieves a score of 0/6 leaving a lot of room for improvement. There are no processes or strategies in place for post-event recovery and reconstruction; solutions and lessons-learnt are unplanned and are usually on an ad-hoc basis (score 0 for P10.1 and P10.2).

7.11. Overall resilience of Bratislava

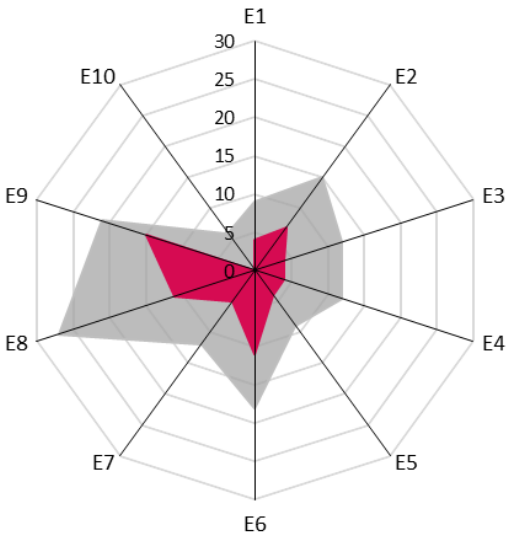


Figure 7.11. Combined results for Essential 01-10 for Bratislava.

Overall, Bratislava achieves a resilience score of 66/141 with significant room for improvement in all Essentials, except for Essential 06 and Essential 09.

Bratislava has good institutional capacity for supporting in case of emergencies. Due to the national and regional institutional structures, an emergency response is provided in a fast manner and with sufficient resources. However, there is potential for using available data for planning future scenarios and evaluating cascading effects. There are several legislative acts for disaster response and existing emergency plans, but these could be combined to plan and structure emergency responses in a more comprehensive way. There is room for further evaluation and application of resilience actions for the city and its infrastructure. Especially for the heritage sites, there is a great potential for defining, planning and incorporating resilience actions.

8. Conclusions

The tangible and intangible heritage of Bratislava covers architectural, monumental, archaeological, and natural heritage. It is characterized by complex settlement arrangements with a high density of cultural monuments, which are mainly at risk from pluvial flooding, erosion, heatwaves and other extreme weather events. For the ARCH project, Bratislava City has proposed the following study sites: the medieval town centre which gained the status of monument preservation reserve in 1995, the unique Devin Castle on the dolomite cliff above the Danube River, and Celto-Roman structures on the Bratislava Castle hill. Findings from the research that will be undertaken at the monument preservation reserve (protecting the wider city core since 1992) and findings from the Devin Castle can be transferred to other outdoor tangible heritage sites such as the antique Gerulata castellum. The research sites are impacted by different hazards and represent different categories of exposed objects (not only in terms of size): Natural Environment, Built Environment: critical Infrastructures and Buildings; Cultural heritage; Services (essential or basics and productive); local population and visitors to Bratislava.

The historical monument preservation reserve is greatly threatened by pluvial flooding, as the majority of objects are preserved in situ. Additional threats come from moisture and humidity, and there is a risk of closing the sights to the public as it could pose danger visitors in addition to the monuments. At Devín castle, it is unknown how much time is left for the cliff to finally erode to the extent that the castle will have to be closed for visitors. The remaining castle walls are also threatened by the cliff movement as well as by the rapidly changing temperatures. It would be useful for the Bratislava City Museum, Bratislava City, and the Devín city borough to know the trends of rock erosion and how they may be affected by different climate change scenarios. This helps the stakeholders determine which adaptation measures are most suitable and to what extent they need to be implemented. Therefore, developing adaptation pathways for the mitigation of the currently non-ideal situation at the historical monument reserve and the mitigation of erosion at the Devín Castle are priorities for the City and its stakeholders. (Municipal Monument Preservation Institute, Bratislava City Gallery and Bratislava City Museum).

After carrying out a first vulnerability assessment in 2018 to prioritise the most vulnerable sectors and population groups, a second risk-oriented vulnerability assessment was undertaken as part of a previous Horizon 2020 project (RESIN), which analysed the impacts of recent heatwaves and pluvial flooding on the population and selected critical infrastructure. Bratislava would like to take a further step and focus on additional sectors, such as cultural heritage protection, to be able to adapt the historical centre and other valuable tangible cultural heritage sites to the impacts of future scenarios of climate change. The current Action Plan for Climate Change Adaptation reaches the end of its term in 2020, and a new Action Plan is already under preparation. The preparation phase of the Action Plan provides a good opportunity for testing and co-creating the tools of the ARCH project.

This report has identified gaps between the governance frameworks reviewed, such as the absence of direct links between cultural heritage and climate change adaptation. The updated national strategy for adaptation to climate change and the forthcoming Action Plan for adaptation raise the topic of cultural heritage protection as well as the absence of relevant

legal tools for enforcing adaptation measures by local authorities. One possible solution to this would be a new act on climate change adaptation and the mitigation of impacts. This would also, to a certain extent, amend existing legislation on building and construction, spatial planning, cultural heritage protection and others.

As Bratislava has been growing along the banks of the Danube River for centuries, it has sometimes had a “troubled relationship” with this international river. The City has often been threatened by floods from the Danube, which led to the fortification of flooding barriers against a 100-year flood in Devin city borough and against a 1000-year flood in the historical centre. The overall topic of fluvial flooding and the resulting disaster risk management is very well elaborated in the existing governance frameworks on all levels of governance (also including compensation mechanisms). However, similar policies should be developed to help prevent and deal with other hazards caused by climate change – especially pluvial flooding from intensive rainfall and heatwaves. There is room for further evaluation and application of resilience actions for the city, its population, cultural heritage and infrastructure.

In the field of adaptation to negative impacts of climate change, the first meetings with local stakeholders launched under the umbrella of the ARCH project identified a future need for a paradigm shift in cultural heritage protection. This is because adaptation measures need to be implemented in order to ensure and make historical centres places worth living, working and visiting even during very hot days and nights. Suitable adaptation measures can also help preserve cultural heritage and increase its resilience to climate change impacts of greater intensity in the future.

Bratislava City, together with its municipal organisations and its local stakeholders, have a reasonable amount of knowledge, experience and data that can be provided to facilitate the process of evaluating the cascading effects of climate change impacts on (not only) cultural heritage sites, planning adaptation pathways and choosing the appropriate resilience actions.

9. Bibliography

[1] “DATAcube (in Slovak),” Statistical office of the Slovak Republic, 2019. [Online]. Available: http://datacube.statistics.sk. [Accessed 30 January 2020].

[2] B. Bleha, B. Šprocha and B. Vaňo, “Study of demographic potential of the Bratislava the Capital City of the Slovak Republic (in Slovak),” 2017. [Online]. Available: https://bratislava.blob.core.windows.net/media/Default/Dokumenty/Str%C3%A1nky/Chcem%20vediet/%C5%A0t%C3%BAdia%20demografick%C3%A9ho%20potenci%C3%A1lu%20Bratislavy.PDF. [Accessed 2 April 2020].

[3] “Bratislava in numbers (in Slovak),” Statistical institute of the Slovak Republic, Bratislava, 2019.

[4] Infostat - Demographic Research Centre, “http://www.infostat.sk/,” [Online]. Available: http://www.infostat.sk/vdc/en/index.php?option=com_wrapper&view=wrapper&Itemid=46. [Accessed 22 April 2020].

[5] R. Vlačuha and Y. Kováčová, “EU SILC 2017/ EU SILC 2017 Poverty indicators (in Slovak, in English),” Statistical office of the Slovak Republic, 2018.

[6] EUROSTAT, “ec.euroba.eu/eurostat,” [Online]. Available: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:At-risk-of-poverty_rate. [Accessed 22 April 2020].

[7] E. Streberová, D. Lückerath, M. Šteflovičová, M. Šteflovičová, J. Pecho, M. Bogen, M. Kozová, E. Pauditšová, I. Konrad and V. Kasala, Atlas of risk-based vulnerability assessment of the impacts of climate change in Bratislava (in Slovak), Bratislava: Hlavné mesto SR Bratislava, 2020 (forthcoming).

[8] J. Holec, M. Garaj and J. Pecho, “Effects of the character of bulit-up area on the air temperature regimes in Bratislava (in Slovak),” Slovak hydrometeorological institute, Bratislava, 2018.

[9] “Act on the protection of monuments and historic sites No. 49/2002 Coll, amendments made by Act No. 479/2005, Act No. 208/2009, Act No. 262/2011, Act No. 180/2013 Act No. 38/2014 Z. z. and Act No. 104/2014,” National Council of the Slovak Republic, 2002.

[10] “ Act No. 42/1994 Coll. on civil protection of the population (in Slovak),” National Council of the Slovak Republic.

[11] M. Blišťanová, “Analysis of Natural Hazard Assessments in the Context of the National Strategy for Adaptation to Climate Change (in Slovak),” Journal of Global Science, vol. 2, no. 4, 2017.

[12] “Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks,” European Parliament and European Concil.

[13] “Act No. 7/2010 Coll. as amended by later regulations on the prevention of floods (in Slovak),” National Council of the Slovak Republic.

[14] European Commission´s Communication on flood prevention, protection and mitigation, Brussels: European Commission, 2004.

[15] L. Mahdoň, “Compensation of financial costs of municipalities and citzens during extra ordinary events (in Slovak),” in "Solving crisis situations in specific environments" - 21. international conference, 25-26.5.2016, Žilina, 2016.

[16] “Preliminary flood risk assessment in the Slovak Republic – update 2018 (in Slovak),” Ministry of the Slovak Republic, Bratislava, 2018.

[17] D. Lešková and et al, “Report on the floods in 2018,” Slovak Hydrometeorological Institute, Hydrological information and forecasting service, Bratislava, 2019.

[18] K. Hlavčová, J. Szolgay, D. Halmová, J. Parajka and S. Kohnová, “Changes in the hydrological regime of Slovak rivers and basic adaptation measures to climate change in water management,” in National Climate Program of the Slovak Republic 12/08: Consequeqences of climate change and adaptation measures., Bratislava, 2008.

[19] K. Mikulová, P. P. Šťastný, J. Pecho and et al., National Climate Program of the Slovak Republic. Climatological norms for the period 1981-2010 in Slovakia (in Slovak), Bratislava: Ministry of the Environment SR, Slovak Hydrometeorological Institute, 2019.

[20] Concept of Geological Research and Geological Survey of the Slovak Republic (in Slovak), Ministry of the Environment of the Slovak Republic, 2017.

[21] Partial monitoring system "Geological factors" - Subsystem 01 – Landslides and other slope deformations (in Slovak), Bratislava: State Geological Institute of Dionýz Štúr - Ministry of the Environment of the Slovak Republic, 2016.

[22] J. Šimeková und e. a. al., Atlas of Slope Stability Maps SR (scale 1:50 000) (in Slovak), State Geological Institute of Dionýz Štúr, 2017.

[23] Act No. 569/2007 Coll. on Geological Works (Geological Act) as amended by futher regulations (in Slovak), National Council of the Slovak Republic, 2007.

[24] “Act No. 42/1994 Coll. on Civil protection of the population as amended by futher regulations (in Slovak),” National Council of the Slovak Republic, 1994.

[25] Prevention program of landslide risk management (2014-2020) – update (in Slovak), Ministry of the Environment of the Slovak Republic, 2018.

[26] D. Lückerath, S. E. M. Bogen, E. Rome, O. Ullrich and E. Pauditšová, “Climate Change Impact and Vulnerability Analysis in the City of Bratisalva: Application and Lessons Learned,” In: Nadjm-Tehrani S. (eds) Critical Information Infrastructures Security. CRITIS 2019. Lecture Notes in Computer Science, vol. 11777, 2020.

[27] “Strategy of adaptation of the Slovak Republic to climate change - update (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2018.

[28] J. Minďaš, V. Páleník and P. Nejedlík, “Impacts of climate change and possible adaptation options for different sectors (in Slovak),” EFRA, Zvolen, Bratislava, 2011.

[29] “Adaptation to climate change,” Ministry of the Environment of the Slovak Republic, [Online]. Available: https://www.minzp.sk/klima/politika-zmeny-klimy/adaptacia-zmenu-klimy/. [Accessed 7 April 2020].

[30] “Action Plan for the Environment and Health of the Population of the Slovak Republic no. V (in Slovak),” Ministry of healthcare of the Slovak Republic, Bratislava, 2018.

[31] “Public health and climate change adaptation policies - final report,” World health organisation, Copenhagen, 2018.

[32] “Greener Slovakia: Strategy for Environmental Policy of the Slovak Republic until 2030 (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2019.

[33] “Action Plan for solving the consequences of drought and water scarcity (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2018.

[34] “Slovak Water Policy Framework for 2015 (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2006.

[35] “Proposal of Orientation, Principles and Priorities of the Slovak Water Policy until 2027 (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2015.

[36] “Water plan of Slovakia (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2015.

[37] “31] Integrated National Energy and Climate Plan 2021-2030 (in Slovak),” Ministry of Economy of the Slovak Republic, Bratislava, 2019.

[38] “Management plan of the Danube river basin - an update (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2015.

[39] “Timetable and factual and communication plan for the 3rd cycle of river basins management plan preparation (in Slovak),” Ministry of the Environment of the Slovak Republic, Bratislava, 2019.

[40] “Urban-landscape study to protect against storm rainfall in the Small Carpathian region (in Slovak),” Bratislava self – governing region, Bratislava, 2014.

[41] “Concept of protection and utilization of surface and ground water sources in Bratislava self – governing region (in Slovak),” Bratislava-selfgoverning region, Bratislava, 2017.

[42] ''Land-use plan for the territory of Bratislava the Capital City of the Slovak Republic (in Slovak),'' Bratislava the Capital City of the Slovak Republic, Bratislava, 2007.

[43] „Programme of social and economic development in Bratislava City (in Slovak),“ Bratislava the Capital City of the Slovak Republic, Bratislava, 2010.

[44] “Strategy for Adaptation to Adverse Impacts of Climate Change in the Territory of Bratislava City (in Slovak),” Bratislava the Capital of the Slovak Republic, Bratislava, 2014.

[45] “Action plan for adaptation to adverse impact of climate change in the territory of Bratislava City (in Slovak),” Bratislava the Capital City of the Slovak Republic, Bratislava, 2017.

[46] D. Výberči, J. Pecho, Faško and O. Bochníček, “Warm and cool spells in Slovakia, in the period 2017-1951, in the context of climate change (in Slovak),” Meteorological journal, vol. 21, p. 101 – 108.

[47] D. VÝBERČI, M. ŠVEC, P. FAŠKO, H. SAVINOVÁ, M. TRIZNA und M. E., „The effects of the 1996–2012 summer heat events on human mortality in Slovakia (in Slovak),“ Moravian Geographical Reports, Bd. 23, Nr. 3, pp. 101-108, 2015.

[48] D. Výbeči und J. Pecho, „Longterm changes in selected variables of excessive heat stress in summer in Slovakia (in Slovak),“ GEOGRAPHIA CASSOVIENSIS, Bd. X, Nr. 2, pp. 193-203, 2016.

[49] M. Musilová and M. J., “3D Reconstruction of Roman buildings from the 1st century BC on the Celtic Hillfort in Bratislava, Urban Archaeology,” in Proceedings of the 20th International Conference on Cultural Heritage and New Technologies, Vienna, 2015.

[50] M. Musilová, “Structural analysis of the Celto-Roman Masonry Building on Bratislava Castle Hill -A preliminary study. In: M. Karwowski, P. C. Ramsl (Hg.),,” in Boii - Taurisci, Materialien des internationalen Seminars 14-15. Juni, 2011, Oberleis-Klemen, 2016.

[51] M. Musilová, „Keltská akropola na Bratislavskom hrade/L´acropoli celtica nel castello di Bratislava (in Slovak and Italian),“ pp. 77-94, 2016.

[52] B. Lesák and A. Vrtel, “Archeologický výskum v Áponnyiho paláci v Bratislave (in Slovak),” Pamiatky a múzeá, p. 43–48, 2009.

[53] M. Musilová, “Výsledky archeologického výskumu Starej radnice v Bratislave v rokoch 2008-2010 (in Slovak),” Zborník k životnému jubileu PhDr. V. Plachej: Devín Veroniky Plachej, pp. 197-212, 2017.

[54] M. Illáš, “Vzťah predrománskeho kostola na Devíne k dalmátskej architektúre - Relation of the pre-Romanesque Church at Devín to Dalmatian Architecture (in Slovak),” in KONŠTANTÍNOVE LISTY , vol. 2, 2018, pp. 14-34.

[55] P. Šimončičová Koóšová, “Farnosť sv. Vavrinca v kontexte stredovekej Bratislavy, Parish of St. Lawrence in the Context of medieval Bratislava (in Slovak),” Harmadyova, K. ed. Devín veroniky Plachej, pp. 213-225, 2017.

[56] J. Hoššo, B. Lesák and M. Musilová, “Výskum cintorínovej kaplnky sv. Jakuba v Bratislave (in Slovak),” in Avans v roku 1994, Nitra, 1996, pp. 90-92.

[57] D. Rexa, “Výskum Pálffyho paláca na Nálepkovej ulici v Bratislave.,” in AVANS v roku 1984, Nitra, 1985, p. 204–205.

[58] M. Musilová, “Znovuobjavená Rybárska brána a jej gotické predbránie na freske Possonia vo Florencii (in Slovak),” ARS 49 - Časopis Ústavu dejín umenia SAV, pp. 50-67.

10. Annex

10.1. Key documents governing cultural heritage management (See Chapter 3)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention for the Protection of the Architectural Heritage of Europe	Agreement	International	Binding	Council of Europe	1987		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/121	Legally binding instrument which sets the framework for an accurate conservation approach within Europe. The main purpose of the Convention is to reinforce and promote policies for the conservation and enhancement of Europe's heritage.
European Landscape Convention	Agreement	International	Binding	Council of Europe	2000		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	Promotes the protection, management and planning of the landscapes and organizes international co-operation on landscape issues. Aware that the landscape contributes to the formation of local cultures and that it is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
European Convention on the Protection of the Archaeological Heritage (Revised)	Agreement	International	Binding	Council of Europe	1995		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	This revised Convention updates the provisions of a previous Convention adopted by the Council of Europe in 1969. The new text makes the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies. It is concerned in particular with arrangements to be made for co-operation among archaeologists and town and regional planners in order to ensure optimum conservation of archaeological heritage.
Convention on the Protection of the Underwater Cultural Heritage	Agreement	International	Binding	UNESCO	2001		https://unesdoc.unesco.org/ark:/48223/pf0000126065	Intended to enable States to better protect their submerged cultural heritage. provides widely recognised practical rules for the treatment and research of underwater cultural heritage.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention Concerning the Protection of the World Cultural and Natural Heritage	Agreement	International	Binding	UNESCO	1972		https://whc.unesco.org/en/conventiontext/	Provides a permanent framework – legal, administrative and financial – for international cooperation in safeguarding humankind´s cultural and natural heritage and introduces the specific notion of a “world heritage” whose importance transcends all political and geographic boundaries.
Convention for the Safeguarding of the Intangible Cultural Heritage	Agreement	International	Non-binding	UNESCO	2003		https://ich.unesco.org/en/convention	Considers the importance of intangible cultural heritage as a mainspring of cultural diversity and a guarantee of sustainable development. It recognizes that the processes of globalization and social transformation, alongside the conditions they create for renewed dialogue among communities, also give rise to grave threats of deterioration, disappearance and destruction of the intangible cultural heritage, in particular owing to a lack of resources for safeguarding such heritage

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Declaration of the National Council of the Slovak Republic on the protection of cultural heritage	Policy/regulation	National	Binding	The National Council of the Slovak Republic	2001		https://www.nrsr.sk/web/?sid=nrsr/dokumenty/vyhlasenia	Recognizes that cultural values created by previous generations are threatened by natural causes of deterioration and decay, changes in lifestyle, transformation of social and economic conditions, decline and disappearance of traditional crafts and techniques, and the application of technologies which are often incompatible with the nature of these cultural assets.
Strategy for the Conservation of Monuments	strategy	national	binding	Ministry of Culture of the Slovak Republic	2017	2023	http://www.culture.gov.sk/extdoc/7244/Strategia_ochrany_pamiatkoveho_fondu_2017-2022	aims to create such conditions and tools for the protection of monuments, which will guarantee their authenticity and integrity under current conditions, and which will contribute to improving the construction and technical condition of the heritage fund. In the area of territorial protection, it mainly promotes cultural heritage protection interests through spatial planning tools.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Guideline of the Ministry of Culture of the Slovak Republic on the protection of national cultural monuments in crisis situations	guideline/regulation	national	binding	Ministry of Culture of the Slovak Republic	2008		https://www.pamiatky.sk/Content/Data/File/pamiatkovy_vyskum/MK-30102008-1011546.pdf	Regulates the procedure of legal entities and natural persons responsible for the special protection of movable national cultural monuments in the context of preparation for crisis situations; and during crisis situations.
Strategy for Development of Local and Regional Culture and Culture of National Minorities of the Slovak Republic by 2030	strategy/policy	regional	binding	Ministry of Culture of the Slovak Republic	2019	2030	https://www.slov-lex.sk/legislativne-procesy/SK/LP/2019/471	The main priorities include improving the quality of public libraries, creating a legislative framework to ensure the support of cultures of national minorities, creating tools for coordinating and optimizing the performance of professional activities of regional cultural institutions, expanding regional activities of departmental organizations and intensifying the heritage.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Development Strategy for Culture in the Bratislava self-governing region for years 2015-2020	strategy	regional	binding	The Bratislava self-governing region	2015	2020	https://portal.egov.region-bsk.sk/c/document_library/get_file?groupId=20182&fileEntryId=94896	
Framework for development of culture in Bratislava	strategy/policy	local	non-binding	Bratislava	2016			
Cultural policy concept of Bratislava-Staré Mesto	strategy/policy	local	binding	Bratislava-Staré Mesto	2016	2020	https://www.staremesto.sk/data/MediaLibrary/32/32119/Koncepcia_kultura_2016.pdf	Cultural policy concept of Bratislava-Staré Mesto document emphasises support for the socio-economic use of cultural potential of the Old Town as well as for public and cultural activities and better involvement and cooperation among individual departments of the Office district and city district organizations.

10.2. Key documents governing climate adaptation (See Chapter 4)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Paris Agreement	Agreement	International	Binding	UNFCC	2015-2016		https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement	The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
United Nations Framework Convention on Climate Change	Agreement	international	binding	The United Nations	1992		https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change	The ultimate objective of the Convention is to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system. It states that such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.
EU Climate Change Adaptation Strategy	Strategy	International (Europe)	Non-binding	European Commission	2013	Framework and mechanisms for improving the EU's preparedness for current and future climate impacts.	Last evaluated in 2018. Update likely 2021.	https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Evaluation of the EU strategy on adaptation to climate change	Report	European Community	Non-binding	European Commission	2018		https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1	This report examines the process and the results of the evaluation of the strategy COM/2018/738, including the lessons learned from its implementation.
Vulnerability and impact chain assessments	guideline	local	non-binding	The Office of the Chief City Architect	2018			The vulnerability and impact chain assessments is based on a qualitative as well as a quantitative analysis and assessment. It focuses mainly on the topics of extremely hot days and nights, heatwaves, extreme precipitation and periods of drought. The assessment also included non-climatic stressors
Resolution of the Government of the Slovak Republic no. 148/2014	regulation	national	binding	The Slovak Republic's Ministry of Environment	2014		https://rokovania.gov.sk/download.dat?id=D20E6A6330264DAC9318C4430DFD570B-9788FA292E5DD18CE9C181288B0A8535	The resolution of the Government of the Slovak Republic no. 148/2014 required the submission of an update of the national adaptation strategy to the Government's deliberations in light of the latest scientific knowledge in the field of climate change.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Strategy of adaptation of the Slovak Republic to climate change	strategy/policy	national	binding	The Slovak Republic's Ministry of Environment	2018		https://www.minzp.sk/files/odbor-politiky-zmeny-klimy/strategia-adaptacie-sr-zmenu-klimy-aktualizacia.pdf	The main objectives of The Strategy of adaptation of the Slovak Republic to climate change – update is to „increase resilience and improve the readiness of the Slovak Republic to face the adverse effects of climate change and to establish an institutional framework and coordination mechanism to ensure effective implementation of adaptation measures at all levels and in all areas". This is to be achieved by implementing partial objectives.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
National Action Plan for adaptation	strategy/policy	national	binding	The Slovak Republic's Ministry of Environment	2022	2026	https://www.minzp.sk/klima/politika-zmeny-klimy/adaptacia-zmenu-klimy/	The National Action Plan for adaptation should contribute to better translating adaptation measures into sectoral policies of the relevant sectors. It should also include a proposal for a monitoring system for vulnerability, a proposal for a system of mid-term evaluation of the adaptation process in the Slovak Republic, including the monitoring of cost-benefit links, and a platform for publishing and sharing positive experiences.
Conception of the Slovak Water Policy for 2015	strategy	national	binding	Ministry of the Environment of the Slovak Republic	2006	2015	https://www.minzp.sk/voda/koncepcne-aplanovacie-dokumenty/koncepcia-vodohospodarskej-politiky-slovenskej-republiky-do-roku-2015.html	

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Proposal of Orientation, Principles and Priorities of the Slovak Water Policy until 2027	policy	national	binding	Ministry of the Environment of the Slovak Republic	2015	2027	https://www.minzp.sk/files/sekcia-vod/orientacia-zasady-priority-vodohosp-politiky-sr-do-r-2027_po-oprave-tlacovej-chyby.pdf	
Integrated National Energy and Climate Plan 2021-2030 (2019)	strategy	national	binding	Ministry of Economy of the Slovak Republic	2019	2030	https://www.economy.gov.sk/uploads/files/IjkPMQAc.pdf	
Greener Slovakia: Strategy for Environmental Policy of the Slovak Republic until 2030	Strategy	national	binding	Ministry of the Environment of the Slovak Republic	2019	2030	https://www.minzp.sk/files/iep/03_vlastny_material_envirostrategia2030_povlade.pdf	

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Action Plan for solving the consequences of drought and water scarcity	strategy	national	binding	Ministry of Economy SR	2018		https://www.minzp.sk/voda/koncepcne-aplanovacie-dokumenty/h2odnotaje-voda-akcny-plan-riesenie-dosledkov-sucha-nedostatku-vody.html	
Water Plan of the Slovak Republic for 2022-2027	Strategy	national	binding	Ministry of the Environment of the Slovak Republic	2015	2027	https://www.minzp.sk/voda/koncepcne-aplanovacie-dokumenty/vodny-plan-slovenska-aktualizacia-2015.html	
Timetable and factual and communication plan for the 3rd cycle of river basins management plan	Guideline	national	binding	Ministry of the Environment of the Slovak Republic	2019	2027	https://www.minzp.sk/files/oblasti/voda/koncepcne-a-planovacie-dokumenty/casovy-vecny-harmonogram.pdf	

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Action Plan for the Environment and Health of the Population of the Slovak Republic V	Strategy	national	binding	Ministry of the Environment of the SR, Ministry of Agriculture and Rural Development of the SR, Ministry of Economy of the SR, Ministry of Transport and Construction of the SR, Ministry of Education, Science, Research and Sport of the SR	2019		http://www.uvzsr.sk/docs/org/ohzp/ap_sr_4.pdf	

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Concept of protection and utilization of surface and ground water sources in Bratislava self - governing region	guideline	regional	non-binding	Bratislava self - governing region	2017	-	http://www.region-bsk.sk/uzemne-planovanie-a-zivotne-prostredie-koncepcne-materialy.aspx	
Land-use plan for Bratislava, capital of the Slovak Republic	strategy/policy/regulation	local	binding	City Hall of Bratislava	2007		https://bratislava.sk/sk/uzemny-plan	The aim of The Land-use plan for Bratislava, capital of the Slovak Republic is to systematically and comprehensively address the spatial arrangement and functional use of land and lay down its principles.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Program of Economic and Social Development of the capital city Bratislava for the years 2010-2020	strategy/policy	local	binding	City Hall of Bratislava	2010	2021	https://bratislava.blob.core.windows.net/media/Default/Dokumenty/Str%C3%A1nky/Chcem%20vediet/Strategick%C3%A9%20dokumenty/Program%20hospod%C3%A1rskeho%20a%20soci%C3%A1lneho%20rozvoja.pdf	Program of Economic and Social Development of the capital city Bratislava for the years 2010-2020 creates an organizationally and financially viable development program with the maximum support of all interested partners, including municipalities of each city districts.
Strategy of Adaptation to Adverse Impacts of Climate Change on the territory of Bratislava	strategy/policy	local	binding	City Hall of Bratislava	2014		https://bratislava.blob.core.windows.net/media/Default/Dokumenty/Str%C3%A1nky/Chcem%20vediet/064_Adaptacne%20strategie.pdf	Strategy of Adaptation to Adverse Impacts of Climate Change on the territory of Bratislava summarises potential risks and gives guidance for the prevention/mitigation of the consequences of climate change risks.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Action for adaptation to adverse impacts to climate change in Bratislava	strategy	local	binding	City Hall of Bratislava	2017	2021	https://zastupitelstvo.bratislava.sk/data/att/14595.pdf	Action for adaptation to adverse impacts to climate change in Bratislava (2017), which contains 27 adaptation measures that are to be implemented and monitored in the period between 2017-2020 to support the implementation of the vision and goals of the Strategy for adaptation to climate change in Bratislava.

10.3. Key documents governing disaster risk reduction (See Chapter 5)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Sendai Framework	Agreement	International	Non-binding	United Nations Office for Disaster Risk Reduction (UNDRR)	2015	Valid until 2030. UNDRR is in charge of follow-up and review of the Sendai Framework by preparing periodic reviews on progress, among other actions.	http://www.unisdr.org/we/inform/publications/43291	Establishment of a global framework for action to prevent new and reduce existing disaster risks, based on 7 targets, 4 priorities for action with supporting rationale and 13 guiding principles.
EU law (Decision 1313/2013/EU)	Law	International (Europe)	Binding	European Parliament	2013		https://eur-lex.europa.eu/homepage.html	Decision No 1313/2013/EU of the European Parliament and of the Council on a Union Civil Protection Mechanism. It defines the activities to assist with the response to immediate adverse consequences of a disaster inside or outside the Union.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
EU law (Decision 420/2019/EU)	Law	International (Europe)	Binding	European Parliament	2019		https://eur-lex.europa.eu/homepage.html	This decision defines an effective and coherent approach to the prevention of and preparedness for disasters and to promote the exchange of best practices within the Union Mechanism.
Directive 2007/60/EU	Guideline	International (Europe)	Binding	The European Parliament and The Council of The European Union	2007		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060	The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community. It should be read together with Act no. 7/2010 Coll. on flood protection,

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Instruction of the Director General of the Crisis Management Section of the Ministry of the Interior of the Slovak Republic	regulation	national	binding	Ministry of the Interior of the Slovak Republic	2007		https://www.minv.sk/?Dokumenty_na_stiahnutie_CO	Instruction of the Director General of the Crisis Management Section of the Ministry of the Interior of the Slovak Republic
Act No. 42/1994 Coll. on civil protection of the population	law	national	binding	The National Council of the Slovak Republic	1994		https://ec.europa.eu/echo/sites/echo-site/files/42-1994_civil_protection_act.pdf	Act No. 42/1994 Coll. on civil protection of the population define a natural disaster, analysis and identifies vulnerable areas as well as regulates the structure and content of the Territorial Analyses document in terms of possible extraordinary events of the Slovak Republic. The introductory part of the analysis focuses on geographical, demographic and economic characteristics of the territory.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Concept of sustainable exploitation of rock environment.	strategy	national	binding	Ministry of the Environment	2017	2020	https://www.minzp.sk/files/sekcia-geologie-prirodnych-zdrojov/koncepcia-geologickeho-vyskumu-geologickeho-prieskumu.pdf	The aim is to predict impending disasters. Summary of measures from engineering geological survey, monitoring of geological factors of the environment and remediation of geological environment to avert, mitigate or eliminate the consequences of natural disasters, including emergency landslides.
Landslides and slope deformations", Partial monitoring system "Geological factors", Subsystem 01 – Landslides and other slope deformations.	policy	national	non-binding	Ministry of the Environment	Every year from 1993	2020	https://apl.geology.sk/geofond/zosuvy/	The aim is to identify slope deformation and to predict impending disasters.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Prevention program of landslide risk management (2014-2020) – updating	strategy	national	non-binding	Ministry of the Environment	2014	2020	https://www.minzp.sk/files/sekcia-geologie-prirodnych-zdrojov/program-prevencie-manazmentu-zosuvnych-rizik-2014-2020-aktualizacia.pdf	
National Climate Program of the Slovak Republic	policy	national	non-binding	Ministry of the Environment SR, Slovak Hydrometeorological Institute	2019		-	
Preliminary flood risk assessment in the Slovak Republic – update 2018	policy	national	non-binding	Ministry of the Environment SR, Slovak	2018		http://www.minzp.sk/sekcie/temy-oblasti/voda/ochrana-pred-povodnami/manazmentpovodnovych-rizik/predbezne-hodnotenie-povodneho-rizika-2011.html	

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Slope deformation and slope deformation susceptibility maps	guideline	national	non-binding	The State Geological Institute of Dionýz Štúr	2006		https://www.geology.sk/2018/03/01/zosuvy-na-slovensku/	These are maps showing areas where there is a risk of slope deformation, but there is no indication of the risk. However, the timeliness of the available data on slope deformations is critical, as the information in question has not been updated regularly since 2013.

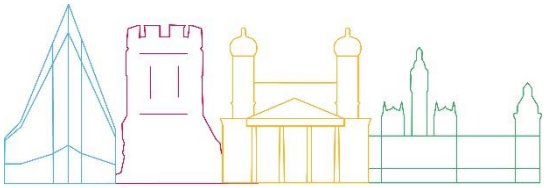
Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Analysis of the territory of Bratislava Region	guideline	regional	non-binding	City Hall of Bratislava				Analysis of the territory of Bratislava Region assesses the territory in terms of possible risks of emergencies, exposure to exceptional weather and climatic events, areas of possible danger of slope deformations and seismic activity, areas of potential flood risk, areas of potential risk in case of water structure violation (including tailings ponds), areas of potential fire and explosion hazard, areas of potential danger to all modes of transport and areas of the potential risk of leakage of hazardous substance resulting from the characteristics of hazardous substances.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Urban-landscape study to protect against storm rainfall in the Small Carpathian region	guideline	regional	non-binding	Bratislava self-governing region	2014	-	http://www.region-bsk.sk/urbanisticko-krajinarska-studia-na-ochranu-pred-privalovymi-dazdami-v-malokarp-oblasti.aspx	
Atlas of climate change impacts on Bratislava City	guideline	local	non-binding	The Office of the Chief City Architect				Atlas of climate change impacts on Bratislava City focuses on impacts and risks of climate change to the City´s population and critical infrastructure (road infrastructure and built-up areas).

ARCH

ARCH D3.3 City baseline report - Camerino

29 April 2020



Deliverable No.	D3.3
Work Package	WP3
Dissemination Level	PU
Author(s)	Barbara Mastrocola, Matteo Iommi, Quintilio Piattoni, Riccardo Pennesi (municipality of Camerino); Sonia Giovinazzi (ENEA)
Co-Author(s)	Andrea Dall'Asta, Alessandro Zona, Michele Morici, Enrica Petrucci, Graziella Roselli, Marco Materazzi (Unicam), Serene Hanania (ICLEI), Daniel Lückerath, Katharina Milde (Fraunhofer)
Due date	2020-03-31
Actual submission date	2020-04-30
Status	For submission
Revision	1
Reviewed by (if applicable)	Eleanor Chapman, Iryna Novak (ICLEI), Saskia Maresch (DIN), Vittorio Rosato, Ludovica Giordano (ENEA)

This document has been prepared in the framework of the European project ARCH – Advancing Resilience of Historic Areas against Climate-related and other Hazards. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820999.

Contact

arch@iais.fraunhofer.de

www.savingculturalheritage.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

Table of Contents

1. City profile

The municipality of Camerino (Figure 1) has a total surface area of 128km^2 with the Old Town accounting for 0.15km^2. The municipality is located at an altitude of 600m and dominates the surrounding hilly landscape. It includes a hospital and the headquarters of the University of Camerino which are considered important institutions for the interior territory of the Marche Region between the Apennines (Italian mountains) and the coastal areas near the Adriatic Sea.

After a major earthquake occurred in Central-Italy Earthquake in 2016, the entire population of Camerino's Old Town was temporarily displaced as a consequence of housing and other property lost or rendered uninhabitable. Some people were relocated to housing in other towns with national funds allocated to support the payment of residential rent. Others were temporarily re-housed in pre-cast buildings located in emergency reception areas.

The Old Town is the focus for the ARCH project. This area is situated at the top of a hilly ridge and enclosed within the city's medieval defensive walls. The Old Town of Camerino contains a very large number of historic buildings, churches and artworks, with considerable artistic, architectural and historical value, which could benefit from methods and tools to improve their management and preservation. Thus, the overall aim for the ARCH project is to mitigate the impact of natural hazards on the Old Town by developing knowledge and tools for monitoring and preserving these significant cultural heritage assets.

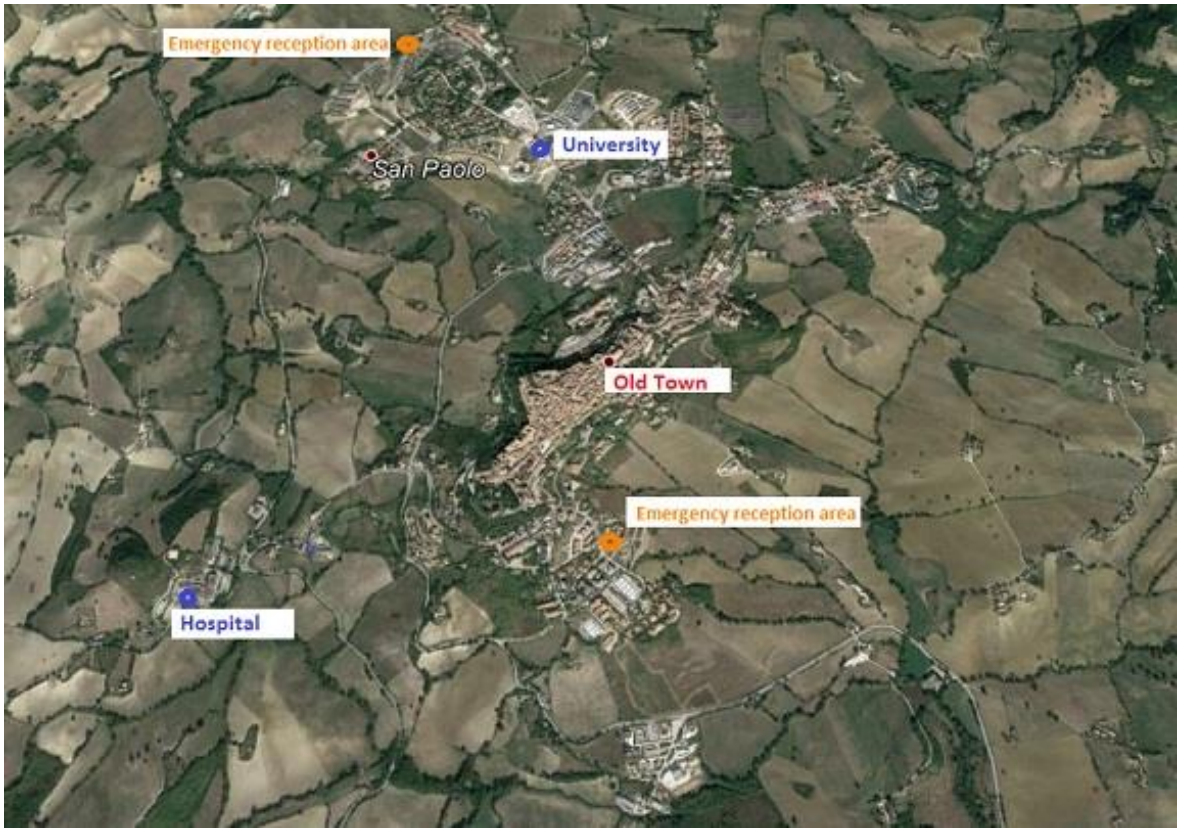


Figure 1. Camerino municipality area [1].

1.1. Demographic features

The population of Camerino's municipality stands at 6,852 (2018) with similar numbers of male and female inhabitants (Table 1). The Old Town had a total of 760 inhabitants up to the last seismic event in 2016. Camerino's population trends are reflected in Table 2. The municipality has noted a population decline, especially after the 2016 earthquake (Figure 2).

Gender	Before Earthquake (September 2016)	After Earthquake (November 2016)	2018
Male	-	-	3,360
Female	-	-	3,492
Total	7,016	6,991	6,852

Table 1. Data of population (Camerino) after the last earthquake of 2016 (2018) [2].

Year	Population
1971	8,499
1981	7,975
1991	7,320
2001	6,858
2011	6,897

Table 2. Demographic development of Camerino from 1971 to 2011 (2018) [2].

The demographic development of the municipality of Camerino was impacted by a depopulation trend, related to a mass relocation process from the internal areas of the Marche Region to coastal areas and to other bigger cities (Figure 3). In general, due to economic and social reasons, the population growth rate can be considered negative for the municipality. In fact, several migrant flows can be identified both for Camerino and the area near the Apennines. The first occurred during the first decades of the twentieth century as a result of economic conditions in the rural areas. The second migration flow happened after the Second

World War; away from the rural areas and towards the valleys, the industrialised areas of the big towns and the coastal areas that offer greater job opportunities and better services.

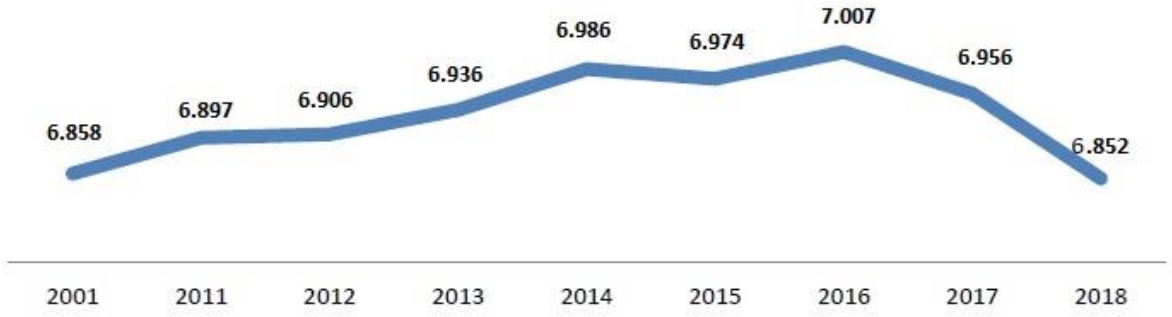


Figure 2. Population trend of Camerino (2001-2018) [3].

These phenomena resulted in a progressive aging of the population; a phenomenon reflected both in Camerino and the Apennine area of the Marche Region. The data concerning population density for the Marche Region (Figure 3) highlights the high density (orange and red colour) for the biggest cities in the coastal areas and for the industrialised zones; low population density characterises the internal zones (pink and yellow colour).

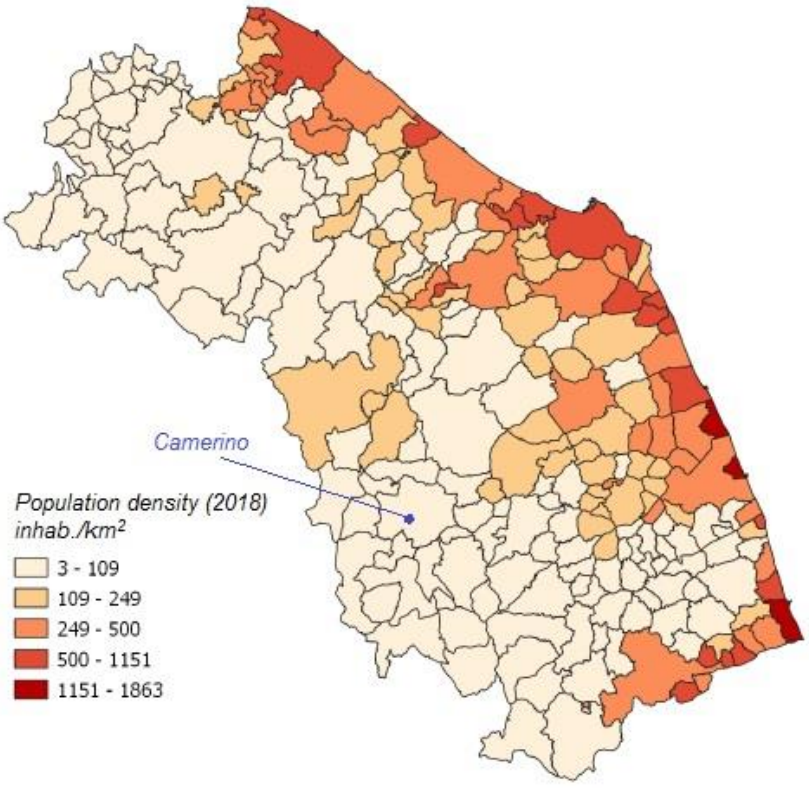


Figure 3. Population density (2018) of Marche Region [4].

After the 2016 Central-Italy earthquake, the entire population of the Old Town was temporarily displaced due to property/housing lost or rendered uninhabitable.

An analysis conducted on 25th September 2019 [5] highlights that a large number of people, approximately equal to 2,242 inhabitants, had obtained funds to support rental payments in temporary residences. As previously mentioned, approximately 1,179 inhabitants were relocated to other towns with national funds to support residential rent, whereas others were temporarily relocated to emergency reception areas. The result has been a low population density in the municipalities inside the earthquake-stricken areas (Figure 4).

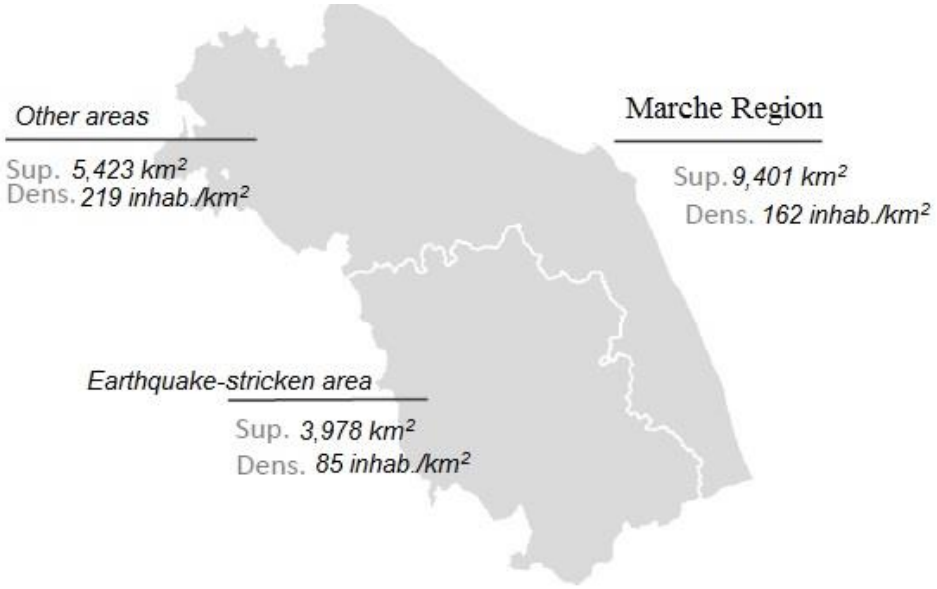


Figure 4. Population density (2018) of Marche Region [3].

The natural growth rate of Camerino's population (Table 3) is negative (-8.10%) and it is lower than the average value for the Marche Region; the internal migration rate is negative (-11.6%) principally due to the economic and social effects of the last earthquake event.

Growth rate	Municipality of Camerino	Marche Region
Natural growth rate (‰)	-8.1	-4.6
Internal migrant rate (‰)	-11.6	-0.1
Foreign migrant rate (‰)	6.8	2.4
Total growth rate (‰)	-15.1	-4.2

Table 3. Population growth rate (2018) of Camerino and of Marche Region [3].

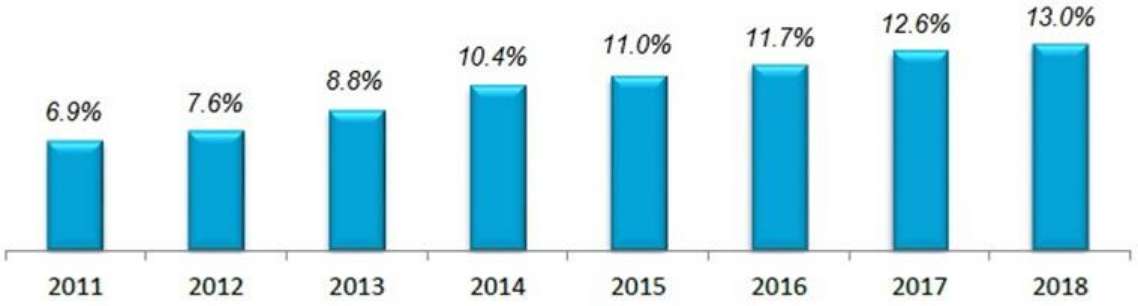


Figure 5. Foreign inhabitants (2018) of Camerino [3].

The collected data (Figure 5) highlights the increment of foreign inhabitants in Camerino who principally come from Europe, Africa and Asia (Table 4). The total growth rate of Camerino's population is negative (Table 3) and it is higher than the average value for the Marche Region.

Approximately, half of the population is in the age range 45-84 with a life expectancy of about 83 years (see Table 5). The percentage of inhabitants in the age range (0-14) is equivalent to 9.7% (Figure 6). The old age indicator is equal to 280.1 (Figure 7); a high value that is similar to other municipalities of the earthquake-stricken areas in the southern part of the Marche Region. Additional data on Camerino's population is shown in Figure 8.

Native land	Municipality of Camerino	Marche Region
Europe	41.1%	53.7%
Africa	24.6%	19.9%
Asia	30.0%	20.9%
America	4.0%	5.5%
Oceania and stateless persons	0.22%	0.04%

Table 4. Native land of foreign inhabitants (2018) of Camerino [3].

Age Range	Number of people	Percentage
0-5	232	3.41 %
6-17	609	8.97%
18-24	358	5.27%
25-34	957	14.10%
35-44	839	12.36%
45-64	1,921	28.31%
65-84	1,526	22.49%
+ 85	342	5.04%

Table 5. Average age distribution, excluding university students (2020) [2].

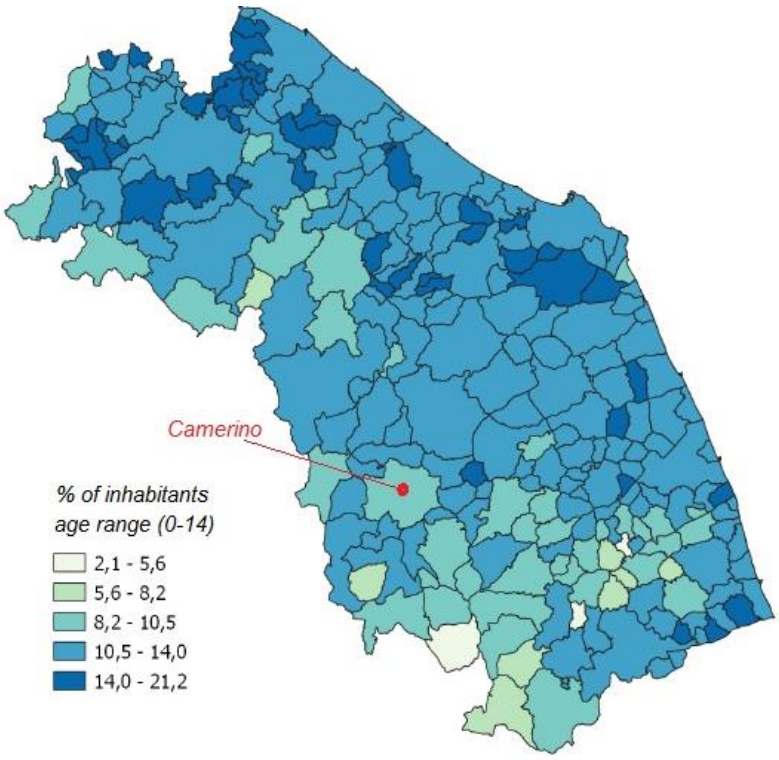


Figure 6. Percentages of inhabitants of Marche Region (2019) for the age range (0-14) [4].

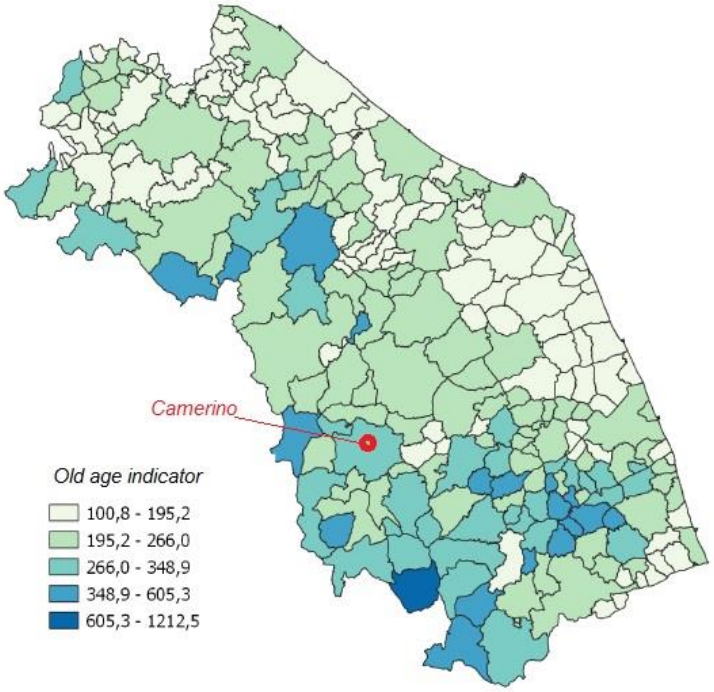


Figure 7. Old age indicators of Marche Region (2019). This indicator is equal to the number of inhabitants with age higher than 65 years respect to 100 inhabitants of age lower than 14 years [4].

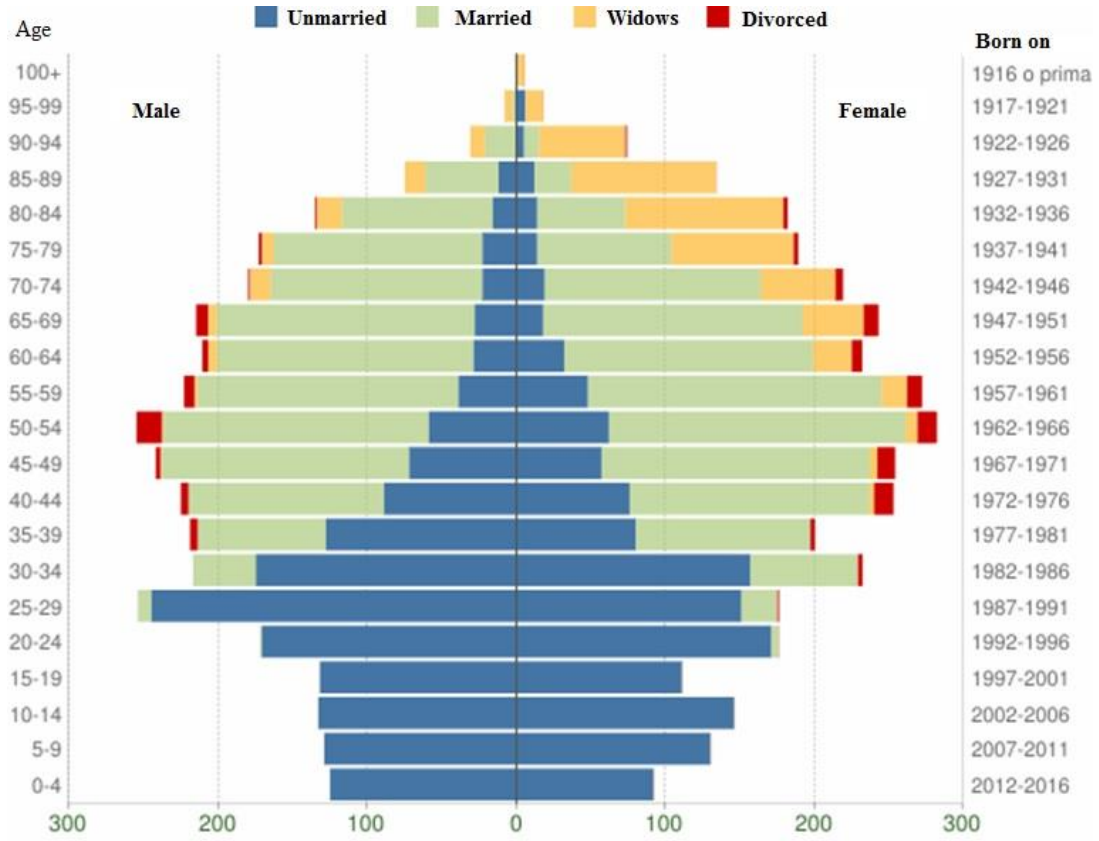


Figure 8. Population of Camerino (2016) divided for age, male and female, unmarried, married, widows and divorced [6].

1.2. Economic features

Figures 9 and 10 below show the development of enterprises and the corresponding sectors in Camerino. The number of enterprises reflected a light decrease since 2010 (Figure 9) both due to the international financial crisis (2008) and to local reasons. Small companies, often family-run, are responsible for most commercial activity in Camerino. Following the 2016 seismic event, several stores located in the Old Town closed and were relocated to new sites financed by national funds. According to statistics, the most prevalent service sectors in Camerino's municipality in 2018 were agriculture and silviculture, followed by commerce, construction, and lodging and food services (Figure 10). The size of the rural area is a significant determinant of the rate of activities in agriculture and forestry. The increment of the average age of the farmers employed in this sector is due to both demographic and cultural reasons. The economic vitality of the urban area is closely linked to the University: the presence of numerous students is very important for local economic activities. Tourism is a developing sector that is focused both on cultural heritage from the Renaissance period, and on the preservation of the natural landscape. The industrial sector, comprising only a few small companies, is very modest. On the other hand, the number of handcraft enterprises (manufacturing activities in Figure 10) is relevant. The distribution of Camerino's enterprises has a similar trend to those of other earthquake-stricken areas in the region (Figure 11).

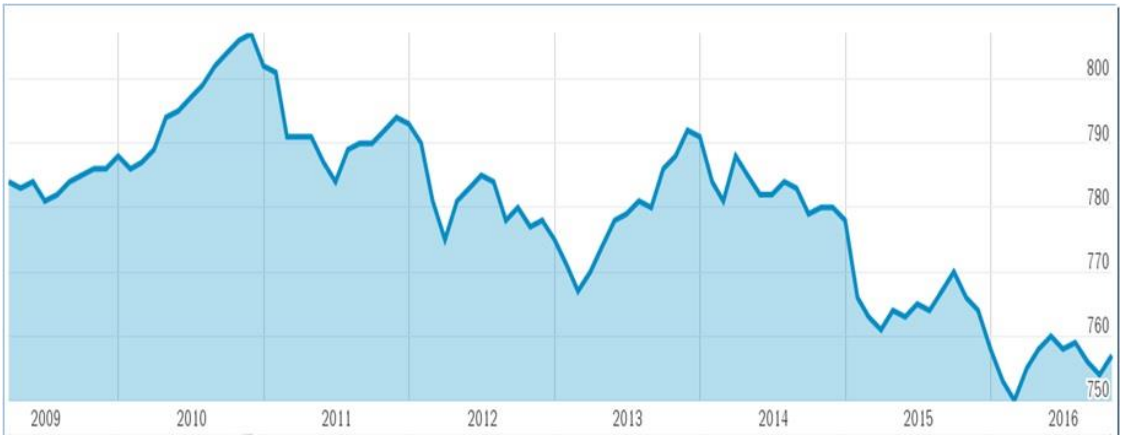


Figure 9. Number of enterprises from 2009 to 2016 for the municipality of Camerino [7].

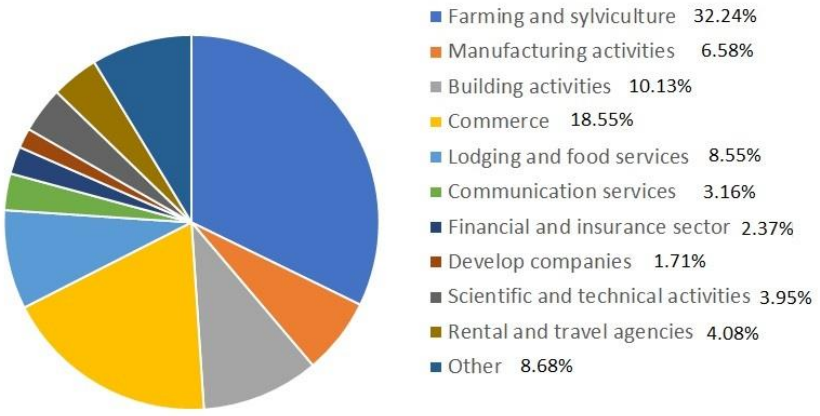


Figure 10. Distribution of Camerino's enterprises (2018) [3].

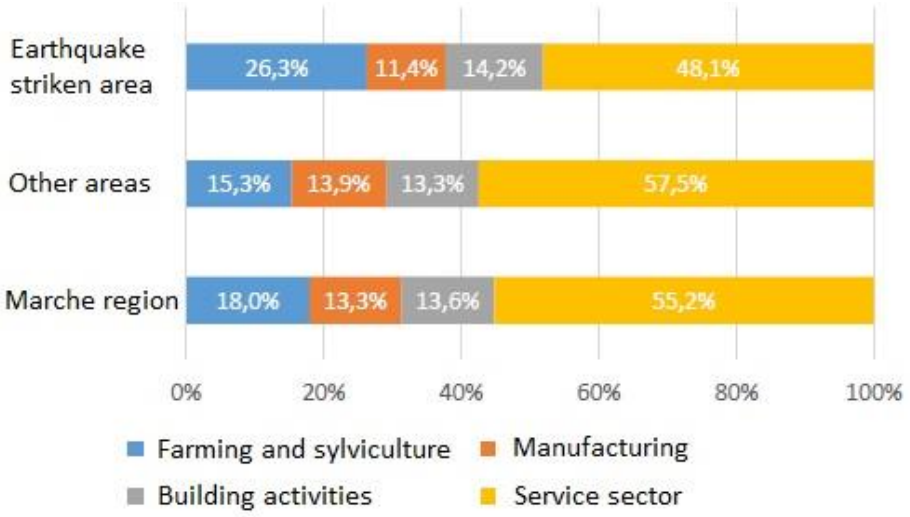


Figure 11. Distribution of enterprises of the Marche Region (2018) [3].

After the decrease in the number of enterprises due to the 2016 earthquake, the growth rate (Figure 12) displays substantial equilibrium for the year 2018. Commercial and manufacturing centres have been built with national financial funds in order to allow the relocation of some activities. The taxable income of Camerino (Table 6) includes activities related to the tertiary sector, as a direct result of the presence of the local University which is important for a small municipality like Camerino.

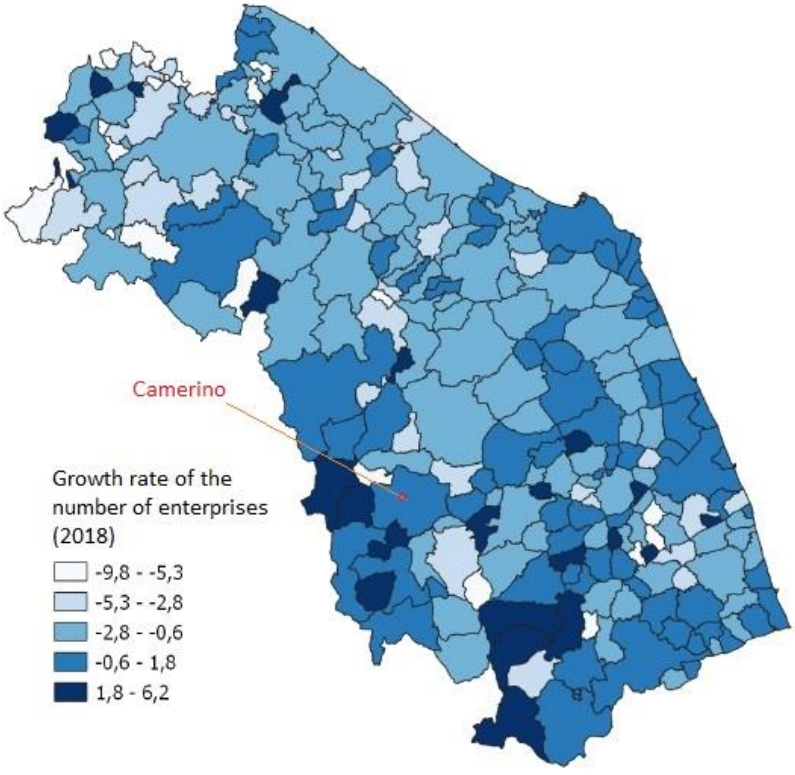


Figure 12. Growth rate (%) concerning the number of enterprises for the Marche Region (2018) [4].

Taxable income for contributor	Taxable income for inhabitants
21,502 €	14,621 €

Table 6. Taxable income (2017) for the municipality of Camerino [3].

1.3. Vulnerabilities and risks

The municipality of Camerino identifies the elderly as the most socially vulnerable population group (adults over 65). Prior to the Central-Italy earthquake of 2016, many such elderly people lived in Camerino's historical centre, and were hence part of the relocation to temporary housing or to other towns mentioned earlier. Older adults may be most vulnerable to natural disasters and emergency events, such as the 2016 Central-Italy earthquake. Since then, the municipality of Camerino has supported initiatives to improve the psychological health of inhabitants, especially for younger persons. Furthermore, the local University has provided funds to support students through online courses. There is not a significant number of homeless people due to the limited parameters of the urban area; furthermore, access to the Old Town has been prohibited since the last earthquake. Inhabitants with economic difficulties are supported by municipal and ecclesiastical institutions, while families and small companies that were relocated after the 2016 seismic events are supported by national funds (as mentioned earlier). However, a spatial mapping/analysis of vulnerable population groups/areas in the municipality currently does not exist.

In terms of the built fabric of Camerino, many buildings located in Camerino's historic centre pre-date 1974 (Table 7) when seismic standards became obligatory. The time needed to complete the post-earthquake rebuilding process will influence the future possibility of people returning to Camerino's urban area. This issue will also influence the social and economic profile of Camerino in coming years.

In response to the risk of seismic activity, the municipality of Camerino has mapped the following:

- Emergency response procedures and responsibilities in the city;
- Preliminary cultural heritage protection strategies and key legislation.

Additional mapping activities that could be useful to the municipality in building its resilience include the mapping of:

a) existing cultural heritage protection measures, strategies and key legislation in the city;

b) existing databases on natural risk information for the city; and

c) decision-making structures in the city regarding cultural heritage protection.

Construction age	% of residential buildings
< 1918	43.0%
1919-1945	13.4%
1946-1960	6.2%
1961-1970	6.7%
1971-1980	9.2%
1981-1990	6.5%
1991-2000	7.6%
2001-2005	3.7%
> 2006	3.7%

Table 7. Construction age of residential building (2011) of Camerino [3].

2. Target historic areas identified for ARCH

2.1. Overview

The municipality of Camerino's territory (Province of Macerata, Marche Region, Italy) is centrally located between the rivers Potenza and Chienti (Figure 13). The territory of Camerino is characterised by large areas with high naturalistic and environmental value.

Figure 13. Camerino's geographic location [1].

For the purposes of the ARCH project, the city case of Camerino will focus on the entire Old Town (Figure 14). The Old Town is well defined by its physical area; it is situated at the top of a hilly ridge and enclosed within the ancient walls which represent the town's medieval defensive perimeter. The old town of Camerino is a historical urban centre (300 B.C.) that was expanded during the Roman Age. The current road network design is essentially based on the medieval pattern. The urban morphology of the Old Town features a compact and continuous urban context, characterised by a high building density and irregular, jagged road network of medieval origin. The Old Town has a surface area of 150,000 m^2 and contains a very large number of buildings, churches and monuments, some of them of considerable artistic, architectural and historical value. Figure 15 illustrates the location of key buildings within the

Old Town, among them the Ducal Palace and Santa Maria in Via Church, which are discussed in detail later in this chapter.

Figure 14. Urban centre of Camerino (MC, Italy) [8].

Figure 15. City map of the old town, showing locations of key buildings St. Maria in Via's Church and the Ducal Palace [1, 9, 10, 11].

2.2. Key stakeholders

Local stakeholders relevant to the ARCH project's focus on cultural heritage, disaster risk reduction and climate adaptation have been separately mapped, and more information can be found in related ARCH deliverable D3.2: local partnership and work plan. Table 8 below

presents the different entities involved in the management and maintenance of cultural heritage, as well as civil protection and disaster recovery in the municipality of Camerino.

No.	Institution	Description
1	Civil Protection Office of Camerino (COC) [8]	First authority that organises, under the supervision of the mayor, disaster or emergency response, before the successive and possible interventions of the regional and national civil protection departments. The COC is divided into nine offices that have several supportive tasks: a. Technical and planning tasks; b. Health and veterinary assistance; c. Local voluntary organisations; d. Material resources and logistics; e. Main networks (electric, hydric, etc.) and school services; f. Preliminary damage evaluation; g.Operability of the main roads; h. Telecommunication networks; i. Preliminary assistance to population.
2	Civil Protection Office of Marche Region [12]	Authority that organises emergency response at regional level concerning health assistance, material resources and logistics, assistance to the population, etc.
3	Episcopate (diocese) of Camerino [13]	Manages local churches, some artwork museums and local refuges.
4	Superintendence of Architectural and Landscape Heritage of Marche Region [14]	Manages, at regional level, architectural heritage, museums andnatural reserves. This authority approves private and public activities that involve cultural heritage.
5	Office for Reconstruction [15]	Manages, at regional level, urban planning and related financing, and authorises technical design and funds for the reconstruction of private and public buildings (as for the last earthquake).
6	Ministry of Cultural Heritage and Activities, and Tourism (MIBACT) [16]	Coordinates the activities of the regional secretariats that supervise the management of cultural heritage. The MIBACT regulates the management of architectural heritage, museums, landscape preservation, etc.

Table 8. Entities that are involved in the management and maintenance of cultural heritage.

Two buildings have been selected as case studies for the ARCH project due to their historical and representative values: the Ducal Palace and Santa Maria in via Church. These are described next.

2.2.1. Ducal Palace

The Ducal Palace (Figure 16) is an example of the evolution of different Italian architectural styles from the 13th to 15th century, and was built in three periods: the Case di Gentile (13th century), the Palazzo di Venanzio (14th to 15th century) and the Case Nove or 'Palazzo di Giulio' (15th century). Camerino's Ducal Palace is among the notable buildings of civil architecture built by the Da Varano family and it is now home to the local University. It has an original section, which was rebuilt in the late fourteenth century, and was extended and completed in the mid-to-late fifteenth century in the Renaissance style. The whole building is centred on a square-portico courtyard (Figure 17) possibly designed by Baccio Pontelli, a Renaissance architect, and can be accessed via several rooms, including the "*Sala degli Stemmi" a room with coats* (Figure 18).

Figure 16. The Ducal Palace [9].

Figure 17. The square-portico courtyard of the Ducal Palace [17].

Figure 18. The "Sala degli Stemmi", a room with coats inside the Ducal Palace.

With the fall of the duchy (1545), the palace became the seat of the papal governors and, from 1749 onwards, of the University. Some semi-buried tunnels bridge the slope of the hill and emerge onto the main cathedral square. The interior of the Ducal palace is characterised by cellars, dungeons, a monumental spiral staircase, an enormous cistern, rooms dating back to various epochs (some of which are richly frescoed) and a viewing platform. The palace was damaged by the 2016 seismic event (Figure 19).


(a)

(b)

Figure 19. External (a) and internal (b) damage to and collapse of masonry (Ducal Palace) [9].

2.2.2. Santa Maria in Via Church

The Santa Maria in Via Church (Figure 20) was originally a little chapel, like many others along the pilgrimage's road of Via Romea, offering protection and viaticum to pilgrims who were leaving or passing through. The current church was built between 1639 and 1624 based on a design by Camillo Arcucci da Sigillo, in response to the wish of Cardinal Angelo Giori, secretary of Pope Urbano VIII Barberini. The simple brickwork facade with triangular pediment and two superimposed floors is vertically decorated with pilasters. The perimeter walls of the interior elliptical plant, which draws inspiration from Bernini, are enriched by semi-circular chapels, each of which houses three canvases (17th century). The main altar has the venerated picture of Saint Maria in Via; a canvas in Byzantine style painted on wood from the Umbria and Marche school dating back to the 18th century. Among its most prestigious works, the Church keeps two canvases (vestries) of Valentin de Boulogne who was a 17th century disciple of Caravaggio: they represent Saint Giovanni Battista and Saint Girolamo.


(a)

(b)

Figure 20. (a) Facade of St. Maria in Via Church and (b) the provisional steel structures that were put up in order to reinforce the remaining structures [9].

An earthquake in 1799 destroyed the brickwork vault, which was then replaced by one made of “camorcanna” (thin vaults usually made by mats of reeds nailed to an upper wooden framework) with historical plasters decorated by Giuseppe Rinaldi. The oratory has preserved a copy of the Sacra Sindone (Holy Shroud) realized in 1658. Due to the earthquake of 1997, the church suffered much damage, among which was the detachment of the facade. After careful restoration works, it was opened again to the public in 2007. The latest earthquake in 2016 resulted in new, severe damage (Figure 21 and Figure 22).

Figure 21. Collapse of the bell-tower of St. Maria in Via Church [9].

Figure 22. Collapse of the roof and of the decorated thin vault of St. Maria in Via Church [9].

2.3. Particular challenges and climatic hazards affecting the sites

Relevant climatic hazards include the impact of snow precipitation in the winter seasons on the effectiveness of the main networks (electricity, communications, etc.). Furthermore, two major earthquakes in a little over two decades (most recently in 2016, as already highlighted, but also earlier in 1997) have highlighted the weakness of the urban area and its valuable cultural heritage to seismic hazards, and related geomorphological hazards (e.g. landslides). In order to address these hazards, the municipality of Camerino has developed a preliminary civil emergency plan [19] that roughly defines the general tasks of officials in emergency events and the main reception areas for citizens. In such circumstances, the role of the mayor, within the municipal territory, is as follows:

- assumes the direction and coordination of the assistance services to the population affected by the emergency;
- organises the necessary interventions immediately communicating them to the President of the Regional Council and to the President of the Province and to the Prefect;
- informs the population on the evolution of ongoing events and on the procedures foreseen in the emergency plan.

Municipal staff of Camerino have improved their knowledge of some natural hazards such as seismic hazards and geomorphological hazards (particularly landslides). As an example, a Seismic Microzonation [28] was carried out in 2018 for the historical centre. Despite this progress, some gaps and challenges remain. For example, the Municipality has the need:

- to develop a database with information about relevant hazards in order to inform civil protection strategies;
- to use a system that helps detect the historical buildings or monuments most exposed to risks;
- to prepare a list of priorities for historical buildings and artwork in order to identify repair strategies.

3. Governance framework for cultural heritage management

3.1. International[1]

At the international level, it is possible to consider the policy decisions and the main directives that are adopted by national laws. The Italian laws are promulgated by the Italian Parliament and they are mandatory. Some international commitments recognised by Italian law include:

- Recommendation concerning the Protection, at national level, of the Cultural and Natural Heritage of the General Conference of UNESCO adopted in 1972 and recognised by the Italian Law No. 184 of 6th April 1977;
- Convention for the Protection of the Architectural Heritage of Europe, European Treaty Series (ETS) No.121, Granada, 3rd October 1985, recognized by the Italian Law No. 93 of 15th February 1989.

There are also European Conventions that are references for archaeological heritage and heritage landscapes:

- European Convention on the Protection of the Archaeological Heritage (Revised) ETS No.143 La Valletta, 16th January 1992;
- European Landscape Convention European Treaty Series (ETS) No.176 Florence, 20th October 2000.

Some principles are reported in the following proceedings of international and European conferences:

- Convention on the Protection and Promotion of the Diversity of Cultural Expressions, General Conference of UNESCO, Paris, 2005;
- Recommendation on the historic urban landscape, General Conference of UNESCO, Paris, 2011;
- Davos declaration 2018 - Towards a high-quality Baukultur for Europe, Conference of European Ministers of Culture, Davos, 2018.

Finally, general principles for the conservation of cultural heritage are shown in the following International Charters:

[1] References (See Annex 11.1):
- Italian Law n. 184 of 6th April 1977, Ratifica ed esecuzione della convenzione sulla protezione del patrimonio culturale e naturale mondiale, firmata a Parigi il 23 novembre 1972 (in Italian);
- Italian Law n. 93 of 15th February 1989, Ratifica ed esecuzione della convenzione europea per la salvaguardia del patrimonio architettonico in Europa, firmata a Granada il 3 ottobre 1985 (in Italian).

- European Charter of Architectural Heritage, Amsterdam, 1975;
- Charter for the conservation of historic towns and urban areas, Washington, 1987;
- The Charter of Krakow - Principle for conservation and restoration of built heritage, Krakow, 2000.

3.2. National[2]

The *Ministry for Cultural Heritage and Activities, and Tourism* (MIBACT) regulates the management of archaeological and architectural heritage, museums, landscape preservation, etc. Different levels of government (state, regions and municipalities) share responsibilities for cultural heritage, according to the Italian Constitution. Cultural heritage preservation is listed among the cultural responsibilities to be retained by the state, with a few exceptions listed in article 5 of the Cultural Heritage and Landscape Code (Legislative Decree No. 42, issued 22nd January 2004, modified by Legislative Decree No. 62 of 26th March 2008). According to the Cultural Heritage and Landscape Code, MIBACT developed a specific directive in order to manage the protection and safeguarding of cultural heritage in case of disasters. Regions, municipalities and local authorities shall cooperate with the ministry in performing its protection tasks. The ministry has a superintendent role and ensures through its peripheral offices the proper surveillance and inspection of national cultural heritage. The system for landscape protection has been balanced by giving responsibility back to the state, in cooperation with regional authorities, by the Legislative Decree No. 63 of 26th March 2008. Furthermore, there are voluntary technical standards for the management of cultural heritage that are promulgated by UNI (Ente italiano di Normazione) [18]. These apply, for example, to chemical, physical and mechanical analyses of cultural heritage materials, to defining preservation and restoration methods for architectural heritage and artworks, and managing the cultural heritage and recovery area for artworks.

3.3. Regional[3]

The Council of the Marche Region developed the regional law no. 4 of 09th February 2010 for the preservation of the regional cultural heritage. This law has the objective of regulating cultural heritage assets and related activities according to the articles no. 117 and no. 118 of the Italian Constitution and in compliance with the legislative decree no. 42 of 22nd January, 2004. With this law, the Marche Region has the task of carrying out actions to protect cultural heritage in accordance with the Cultural Heritage and Landscape Code (see Section 3.2), and

[2] References (see Annex 11.1):
- Legislative Decree n. 42 of 22nd January,2004, Cultural Heritage and Landscape Code (in Italian).
- Legislative Decree n. 62 of 26th March 2006, Changes on Legislative Decree n. 42/2004 concerning Cultural Heritage (in Italian).
- Legislative Decree n. 63 of 26th March 2006, Changes on Legislative Decree n. 42/2004 concerning Landscape (in Italian).

[3] References (see Annex 11.1):
- Regional Law n. 4 of 09th February, 2004, Laws concerning cultural heritage and activities (in Italian).

to support and promote the conservation of cultural heritage by restoration, prevention and recovery actions. The superintendence of architectural and landscape heritage of the Marche Region manages, at regional level, architectural heritage and museums, and it approves private and public activities that involve cultural heritage according to national and regional laws. The seismic design of any refurbishment of architectural heritage damaged by the last earthquake in 2016 needs to be approved by the regional office for reconstruction [15]. For religious buildings, the regional episcopate is also involved in management [13].

3.4. Local

Camerino's council has the responsibility for planning, managing and conducting the ordinary maintenance of historical buildings and cultural heritage landscapes. Camerino's municipality has no specific plan, programmes or guidelines for disaster risk management of cultural heritage in spite of the various local museums, historical palaces and churches in its inner urban area. Post-disaster management is mainly entrusted to the Civil Protection Office of the Camerino (COC) [19].

At present, the municipality of Camerino lacks a system that identifies the historical buildings or monuments most exposed to risks. Such a system could help to prioritise historical buildings and artworks in order to define preservation and intervention strategies and implement them where most needed.

4. Governance framework for disaster risk reduction

4.1. International[4]

The *Italian Civil Protection Office* works together with the *European Civil Protection Mechanism through the Emergency Response Coordination Centre* (ECCR) that coordinates the delivery of assistance to stricken countries, such as civil protection teams and specialised equipment. The guidelines coming from these activities may be accepted also by the national and local civil protection authorities. The *United Nations Office for Disaster Risk Reduction* (UNDRR) [20] supports coordination mechanisms like the National Platforms for Disaster Risk Reduction and other institutions (e.g. governments, science and technology, civil society). UNDRR [20] supports the implementation of the *Sendai Framework for Disaster Risk Reduction 2015-2030*. The *Sendai Framework [21]* is a tool adopted in order to manage the transition from "disaster management" to "disaster risk management". The UNDRR [22] and the *Directorate-General for European Civil Protection and Humanitarian Aid Operations* (DG ECHO) [23] define criteria for the disaster management. The DG ECHO is composed of two units: the first has the task of emergency and disaster response based on international collaborations between member states; the second unit develops frameworks in order to prevent disasters and emergency situations (e.g. training courses, exchange of knowledge and expertise, the development of new training solutions, the management of prevention projects, the coordination of public information activities and the financial planning for the two units). This system facilities cooperation between the European member states and all the activities are based on the principle of subsidiarity, i.e. several actions are undertaken through the supervision of the member state interested by natural disasters.

4.2. National[5]

The *Italian Civil Protection Office* [24] is an agency of the Presidency of the Council of Ministers. The office coordinates responses to natural disasters, drafts legislation on risk

[4] References (see Annex 11.2):
- Decision 1313/2013/EU of the European Parliament and of the Council on a Union Civil Protection Mechanism;
- Decision (EU) 2019/420 of the European Parliament and of the Council of 13 March 2019 amending Decision 1313/2013/EU on a Union Civil Protection Mechanism.

[5] References (see Annex 11.2):
- Decreto Legislativo n.1 del 02/01/2018 (Italian National Law): Codice della protezione civile (in Italian);
- D.P.C.M. 09/08/2016 (Decree of the President of the Council of Minister): organizzazione del Dipartimento della Protezione Civile (in Italian);
- Decreto del Segretario Generale della Presidenza del Consiglio dei Ministri del 10/08/2016 (Decree of the General Secretary of the Presidency of the Council of Ministers): organizzazione interna del Dipartimento della Protezione Civile (in Italian);
- D.P.C.M. 20/02/2012 (Decree of the President of the Council of Minister): componenti del comitato paritetico (in Italian);
- D.P.C.M. 21/11/2006 (Decree of the President of the Council of Minister): Costituzione e modalita' di funzionamento del Comitato operativo della protezione civile (in Italian);
- Legge n. 286 del 27/12/2002 (Italian National Law), Conversione in legge, con modificazioni, del D.L. 4 novembre 2002, n. 245, recante interventi urgenti a favore delle popolazioni colpite dalle calamità naturali nelle regioni Molise e Sicilia, nonché ulteriori disposizioni in materia di protezione civile (in Italian)

prevention and promotes training projects. The latest modification to the internal organisation of the Civil Protection Office occurred with the Decree of the President of the Council of Minister of August 9, 2016. The functions and services of the offices according to the current organisational chart (see Figure 23 below) have been assigned by Decree of the General Secretary of the Presidency of the Council of Ministers of August 10, 2016. The Office of the Operational Director is divided into different departments: Emergency Planning and Drills, Operational Support in Emergency, Italia Situation Room and Operations Centre for Maritime Emergencies (COEMM), Joint Air Operations Centre (COAU) and Mobility and Essential Services. In particular, the COEMM elaborates models and procedures for the National Civil Protection Service, shares information on emergency situations, evaluates the situation post-disaster, and supports in case of the declaration of a state of emergency. The COEMM department also has the task of coordinating first response activities after disasters, catastrophes or other events which, due to their intensity and extent, must be handled with immediate intervention and with special capacities and means.

With the declaration of a state of national emergency by the Council of Ministers, the Head of the Office of Civil Protection decides on the first intervention activities to implement (see Figure 23). The National Civil Protection Office consists of: State administrations, Provincial councils, Municipalities and local authorities for the management of the mountain areas. Its operating structures include: scientific research groups (including I.N.G.V. and other research institutes), technical services, voluntary organisations, the Italian Fire Brigade, the Armed Forces, the Police Force, the National Forestry Commission, the Italian Red Cross, the structures of the Italian Health Service and the National Mountain Rescue and Speleological Corps (C.N.S.A.S.). In ordinary situations, the operative structures with the departments perform the monitoring, forecasting and risk prevention activities as well as the operative interventions, each with its own specific technical skills. In situations of national emergency or when natural calamities occur, after the declaration of the state of emergency by the Council of Ministers, the Prime Minister may avail of delegated commissioners and operative structures for the necessary interventions. The management of the operative structures is assigned to the Head of the Civil Protection Office.

Furthermore, there are national technical standards for buildings and infrastructures also in order to assess vulnerability and to reduce seismic risks [25].

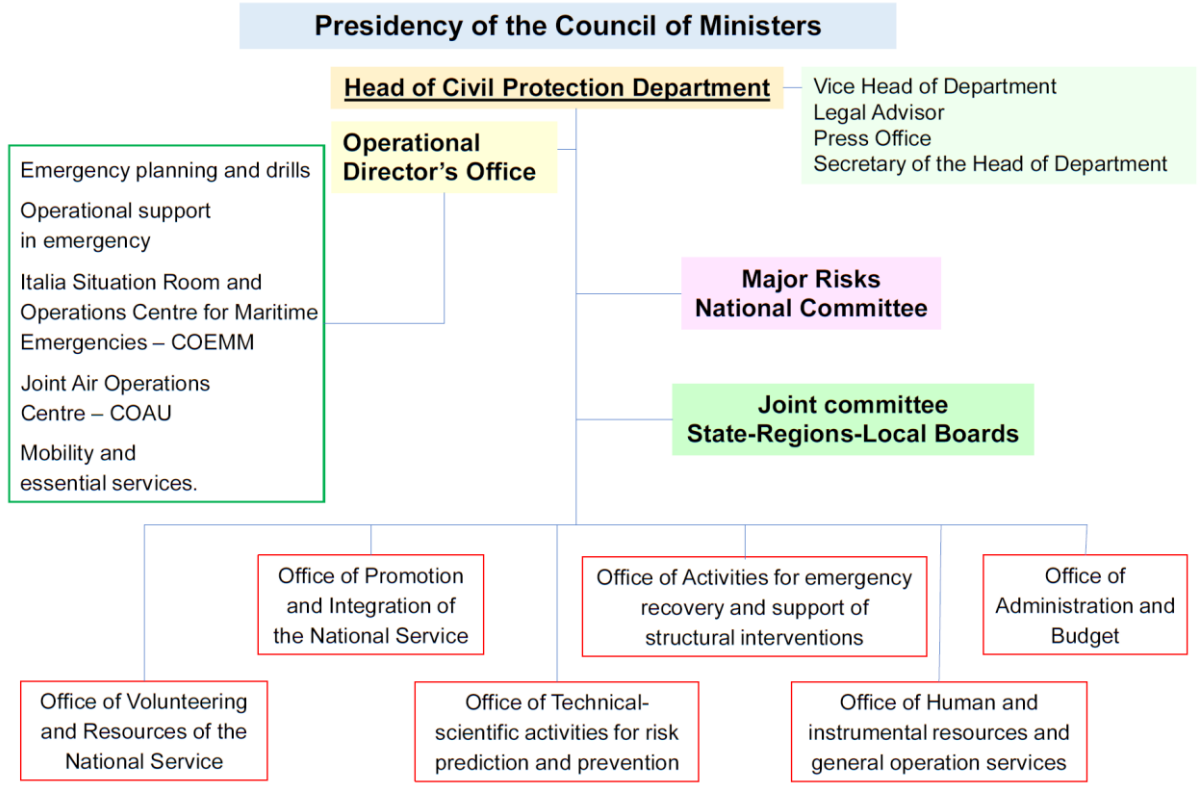


Figure 23. Organisational chart of the Civil Protection Office.

4.3. Regional[6]

The Civil Protection Office of the Marche Region is influenced by some laws, such as the regional law no. 32/2001 that defines both the tasks of the local authorities and the operative procedures for emergency management. The main tasks of the Civil Protection Office of the Marche Region concern programming of civil protection activities, risk prevention and rescue. Regional skills, concerning local security, are entrusted to the civil protection system. When emergencies occur, the Civil Protection Office of the Marche Region defines the tasks of the local authorities and coordinates their activities. The Civil Protection Office of the Marche Region has three main boards: Multi-risks Office, Regional Operative Office (SOUP) and the Emergency Service Centre (CAPI) (see Figure 24 for organisational structure).

4.3.1. Multi-risks Office

This Office contributes to ensuring the management of the national alert system for weather, hydrogeological and hydraulic risk. Its main task is to support the decisions of civil protection

[6] References (see Annex 11.2):

- Legge Regionale n. 32 del 11/12/2001, Sistema regionale di protezione civile, B.U.R. n. 146 del 20/12/2001, (in Italian).
- Legge Regionale n. 13 del 03/04/2015, Disposizioni per il riordino delle funzioni amministrative esercitate dalle Province, B.U.R. n. 33 del 16/04/2015, (in Italian).
- Decreto del Presidente della Giunta Regionale n° 41 del 01/02/2005, (in Italian).

authorities. The primary functions of the Office are the monitoring and surveillance of events, as well as weather-hydrogeological-hydraulic risk assessment.

The monitoring activities of the Office are based on local and national networks, such as the seismic events recorded by the monitoring network of the National Institute of Geophysics and Volcanology (INGV).

4.3.2. Regional Operative Office (SOUP)

The Regional Operative Office (SOUP) consists of officials from the Civil Protection Department, Fire-Department, State Forestry Commission, Italian Red Cross, and the National Health Service. The SOUP holds networks for the remote control of the area (hydrology, seismic) and databases necessary for the management of civil protection emergencies.

4.3.3. Emergency Service Centre (CAPI)

The Emergency Service Centre (CAPI) of the Marche Region is a permanent operating structure that has warehouses for the storage of emergency supplies to be used when calamitous events occur. The main aims of the centre are the acquisition, storage, and protection of supplies and equipment for civil protection.

Figure 24. Organisational chart of the Civil Protection Department at regional level.

Furthermore, the Prefect of Macerata (the province that includes Camerino municipality) has civil protection tasks within the provincial territory. When a calamity occurs, the Prefect – together with different authorities of the Civil Protection Department – guarantees first aid services and emergency management also by firefighters and law enforcement. If the emergency is more complex, a Coordination Centre (CCS) is activated at the Prefecture; this centre is a temporary structure for the duration of the emergency, and aims to coordinate and connect the measures that are adopted by different local authorities. Finally, the Prefect prepares emergency plans for factories susceptible to high risk levels.

In the Marche Region there are eight local authorities for the management of the mountain areas. These are institutions made up of some municipalities that share funds for guaranteeing the main social and economic services to the population, managing land use zoning and planning, and preserving landscapes and ecosystems (see Figure 25).

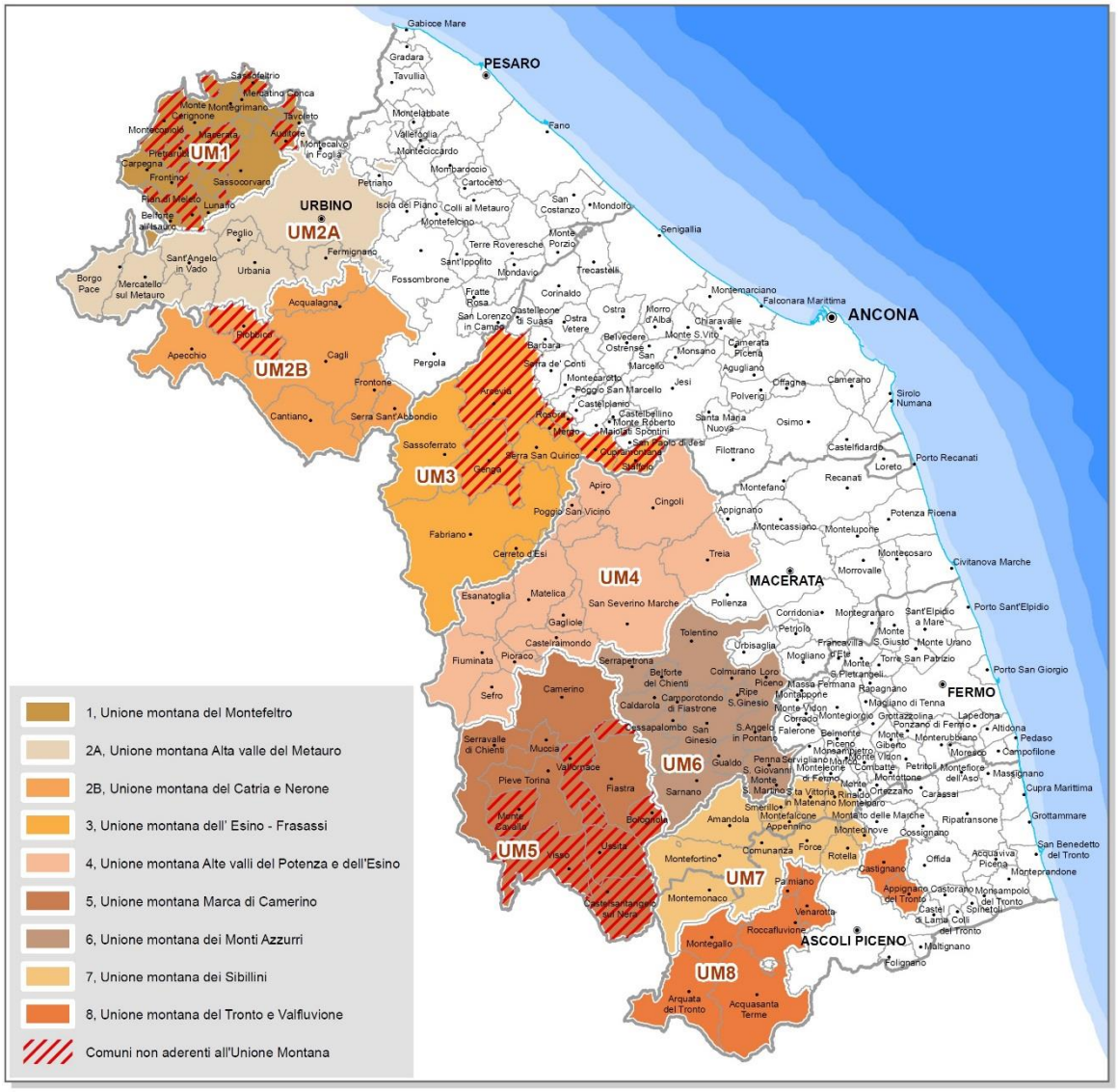


Figure 25. Local authorities for the management of the mountain areas (Marche Region) [26].

4.4. Local[7]

The *Civil Protection Office of Camerino (COC)* is the first authority that organises the response to a disaster or to an emergency, before successive possible interventions of regional and

[7] References (see Annex 11.2):

- Civil protection plan, approved by council's deliberation n. 61 of 22nd December, 2008, according to Italian Law n. 225 of 24th February, 1992.

national civil protection departments. When an emergency occurs, the COC activates the different support operation structures. The mayor is the head of COC within the municipality.

4.5. Gaps and needs

Considering the objectives of the ARCH project, it would be essential to conduct new geological and geomorphological surveys in order to more accurately identify hazard scenarios. The same data would then be indispensable for the construction of a “geological model” of extreme detail, functional also for future studies on local seismic response and in order to define a risk map for the historical urban area. The municipality has the need to develop a database with this information for its civil protection strategies.

5. Governance framework for climate change adaptation

5.1. International

At the international level, it is possible to highlight some fundamental strategies and visions, which helped drive climate action. These documents are accepted and recognised by Italy, as a member of the United Nations (U.N.) and the European Community. They affect the national level and should be taken into account in local actions as well. Two international levels can be defined: a global level with the Kyoto Protocol and its successive processes and meetings and a European level with some fundamental directives: EU Directive 2003/87, EU Directive 2012/27, EU Directive 2018/844 and more specific regulations provided by the European Energy Agency like documents relevant to environmental policy in Europe which set out the environmental objectives, targets and reporting obligations with data and indicators. Of particular relevance is the EU Adaptation Strategy (2013). The evaluation package comprises a report on the implementation of the EU Strategy on adaptation to climate change COM (2018)738, the Evaluation of the EU Strategy on adaptation to climate change SWD (2018)461, and the Adaptation preparedness scoreboard Country fiches SWD (2018)460. The evaluation found that the EU Adaptation Strategy has been a reference point to prepare Europe for the climate impacts to come, at all levels. It emphasised that EU policy must seek to create synergies between climate change adaptation, disaster risk reduction efforts and sustainable development to avoid future damage and provide for long-term economic and social welfare in Europe and in partner countries.

5.2. National

In Italy, the protection of the environment, ecosystems and cultural resources is under the exclusive competency of the central government. The *Ministry for Environment, Landscape and Sea* (IMELS) carries out activities on climate change at the national and international level.

The Italian governance framework for adaptation to climate change can be considered as very fragmented with several laws and regulations in which actions, strategies and regulations have been partially provided for different aspects (mobility and transportation, energy use, energy production, waste management, marine cost management, greenhouse gas emissions, etc.) and in different ways without an overall and comprehensive vision. Specifically related to climate change are the Legislative Decree 216/2006 and the National Adaptation Strategy (NAS).

The NAS from 2014 includes the following:

- The state of scientific knowledge on impacts, vulnerability and adaptation to climate change in Italy;
- Analysis of the EU and national legislation relevant to impacts, vulnerability and adaptation to climate change;

- Elements for a National Strategy for Adaptation to Climate Change.

The NAS is a tool for encouraging adaptation actions in planning activities at national, regional and local levels. After approval from the "State-Regions Unified Conference" on 30th October 2014, the NAS was finally adopted in June 2015 by a Directorial Decree of the Climate and Energy General Directorate, establishing specific objectives to be reached by 31st December 2016.

Based on the NAS, the Ministry of Environment started in 2017 to provide an Italian National Adaptation Plan for Climate Change (NAP). The Directorate General for Climate and Energy of IMELS is currently working on the implementation of the NAS through the NAP, developed with the support of the *Euro-Mediterranean Centre on Climate Change* (CMCC). The NAP was drafted in December 2016. During 2017 and the first half of 2018, IMELS carried out a check on the draft NAP by a consultative process involving national, regional and local authorities, universities, research centers and other stakeholders. The approval of the NAP is occurring through an Agreement with the State-Regions Conference. The NAP provides some preliminary institutional guidelines [27] to national and local authorities for the elaboration of regional strategies or plans and for the integration of climate change adaptation within spatial and sectorial planning.

5.3. Regional

For the Marche Region, it is possible to cite two guidelines related to the management of and adaptation to climatic changes: the Regional *Environmental and Energy Plan* from 2016 and the *Regional Plan for Climate* from 2007. The *Regional Environmental Energy Plan* identifies the guidelines for environmental energy policy in the regional territory:

- to respect the "burden sharing" legislation (Ministerial Decree 15th March 2012 and Ministerial Decree 11th May 2015)[8;]
- to respect the "ex ante conditionality" for the use of the structural funds - energy sector, as established by the regional operative program (POR)9 and the Rural Development Plan (RDP) 2014-2020.

The *Regional Plan for Climate*, made in 2007 but still in draft, intends to systemise and make more effective the climate change mitigation policies. Targets of the plan are:

- energy efficiency to direct the construction market towards the design and construction of zero-emission buildings and favours the use of cogeneration and smart systems in the industrial, civil and tertiary sector;

[8] These laws implemented the legislation of the European Strategy 20.20.20 on climate and energy and Legislative Decree 28/2011 on the promotion of the use of the energy from renewable sources.
[9] http://www.regione.marche.it/Entra-in-Regione/Fondi-Europei/FESR/Programma-Operativo-Por-FESR

- renewable sources to improve the biofuels, micro-wind and geothermal sectors applied to the civil sector and the recovery of energy contained in the organic waste fraction biogas;
- sustainable mobility and urban development to reduce the need for travel by private transport and favours the transition from the use of private transport to public transport by supporting mobility plans, surface metros and carpooling;
- efficient use of resources to minimize the consumption of resources and energy per unit of product and service, supporting Life Cycle Analysis (LCA), green public procurement, separate waste collection at home and a green tax reform;
- other measures to increase the knowledge culture and awareness of the importance of individual political choices and behaviours in facing the climate challenge.

5.4. Local

At the local level, there are no direct laws or regulations for climate change adaptation. The municipality of Camerino has no specific department dedicated to climate change adaption and related aspects. The *Office for Environment and Public Works* can be considered as the local public service most suited to manage possible activities about climate change adaptation. Considering the local land use policy and the management of natural areas as part of the governance for climate change adaptation, it is possible to cite the Forest Fire Emergency Plan (2018) through which the municipality of Camerino plans and manages risks from forest fires. It is a local program for protecting the integrity of life, property, settlements and the environment from damage or from dangers resulting from natural disasters, catastrophes and other events. The mayor and the city council are able to propose, draft and enforce possible actions and plans within the municipality's territory, as long as they do not contradict regional and national plans and laws.

5.5. Gaps and needs

There are no specific studies, surveys, or risks and vulnerability assessments related to climate change impacts for the territorial area of the municipality of Camerino. Existing records about the status and condition of cultural heritage assets, such as historical buildings, monuments, landscapes, ecosystems and environment have to date not considered the impacts and effects of climate change. Reasons for the lack of assessments on climate change impacts could be economic as well as the (possibly related) absence of effective monitoring systems.

6. Expected impacts of climate change-related and natural hazards

The purpose of this section is to report and review the preliminary collection of relevant information about hazards, exposed elements, as well as impacts provided by the municipality of Camerino in collaboration with the University of Camerino as their local research partner, in order to offer an initial overview of the risks that might affect the selected historic areas and their communities. It should be noted that the content in this section is not exhaustive, but rather should be understood as a departure point to serve as a basis for future work.

This section is structured as follows: a description of the methodology is provided, followed by a Risk Profile Table, outlining hazards, exposed elements, impacts, and corresponding resilience-building measures already planned or implemented to date. Next follows a review, interpretation, and validation of the information provided in the Risk Profile Table. Finally, an outlook is provided concerning further risk analysis work in the context of the ARCH project.

6.1. Methodology

In order to elicit relevant information for risk analyses from the municipality of Camerino, ENEA, Fraunhofer, ICLEI, and Tecnalia developed a Risk Profile Table template (see Section 6.2) based on the central risk components identified in the 5th Assessment Report of the Intergovernmental Panel on Climate Change: hazards, exposed elements, impacts (physical, societal, functional, economic, and intangible), as well as corresponding resilience-building measures already planned or implemented to date.

This template was filled out by the Camerino city partners and it provides a starting point from which to conduct more detailed risk analyses. Furthermore, it allows to provide a useful starting point for the data, models, methods, and tools to be developed during the ARCH project. The information provided in the Risk Profile Table was reviewed and harmonised by ENEA in order to provide a comparable description across all city cases and ensure relevance to (and validity for) similar on-going and/or future initiatives[10] and projects in the field of disaster risk reduction, climate change adaptation, and cultural heritage preservation.

The following standards, reference material, and tools were identified as most suitable for this exercise:

- The City Climate Hazard Taxonomy[11] for classification of hazards;
- The UNDRR QRE Tool[12] and ISO standard 37120[13] for the classification of exposed elements and impacts;

[11] https://www.c40.org/researches/city-climate-hazard-taxonomy
[12] https://www.unisdr.org/campaign/resilientcities/toolkit/article/quick-risk-estimation-qre
[13] https://www.iso.org/standard/68498.html

- The ICOMOS CCHWG[14] classification and INSPIRE[15] directive for the classification of heritage assets.

Based on the harmonised information, initial proposals for risk analysis focus actions (e.g. which methods and tools to apply for which part/issue of a historic area) were formulated by ENEA. The initial proposals will be further defined during the co-creation process and in exchange with the relevant local stakeholders.

[14] https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

[15] INSPIRE, Infrastructure for Spatial Information in EuropeD2.8.III.2 Data Specification on Buildings – Technical Guidelines (5.3.1.1.4. Classification of buildings, pages 43-45).

6.2. Risk Profile Table for Camerino

Heritage site (historic area)	Hazard[16]	Exposed element [17]	Impacts					Corresponding resilience-building measure undertaken	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible	Description (please indicate specific S or general G)	
Old town (Camerino)	Seismic hazards	Cultural heritage (churches, historical buildings, palaces etc.). Intangible cultural heritage. Private and public buildings. People. Transportation systems (road and railroad networks). Infrastructure systems (electrical, gas, and waterworks networks etc.). Natural environment (groundwater level and earthquake-induced landslides).	Damage to cultural heritage assets (churches, historical buildings, palaces etc.) and private buildings. Damage to transportation systems (road and railroad networks). Damage to infrastructure systems (electrical, gas, and waterworks networks etc.). Degradation of natural environment.	Injury and death. Possible effects on mental health (depression due to lifestyle modification). Loss of personal effects. Loss of access to key services.	Functionality loss of transportation systems (road and railroad networks). Functionality loss of infrastructure systems (electrical, gas, and waterworks networks etc.). Reduced functionality of school and other public services.	Loss of tourism revenue due to service disruptions. Interruption of commerce and tertiary sector.	Loss of cultural and artistic values and traditions (also related to loss of artworks and cultural heritage).	Civil emergency management plan (G). Seismic Microzonation (S). Funding for retrofit and seismic upgrade of buildings (G).	[19], [28], [29]
Old town (Camerino)	Geomorphological hazards	Natural environment.	Loss of natural environment.	Loss of access to key services.	Damage to ecosystems.	Loss of tourism revenue due to	Damage or loss of area with cultural value	Land use zoning plan (S).	[30], [31]

[16] Note: the UN Office for Disaster Risk Reduction (UNDRR)'s Resilience Scorecard defines 'hazard' as 'a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation'. Of these, the ARCH project is addressing natural and climatic hazards.

[17] Note: the UN Office for Disaster Risk Reduction's Resilience Scorecard defines 'exposure' as 'the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas'.

Heritage site (historic area)	Hazard[16]	Exposed element [17]	Impacts					Corresponding resilience-building measure undertaken	Notes/Evidence
			Physical	Societal	Functional	Economic	Intangible	Description (please indicate specific S or general G)	
		Cultural heritage (churches, historical buildings, palaces etc.). Intangible cultural heritage. Private buildings. People. Transportation systems (road and railroad networks). Infrastructure systems (electrical, gas, and waterworks networks etc.).	Damage to cultural heritage (churches, historical buildings, palaces etc.) and private buildings. Transportation systems (road and railroad networks). Infrastructure systems (electrical, gas, and waterworks networks etc.).		Functionality loss of transportation systems (road and railroad networks). Functionality loss of infrastructure systems (electrical, gas, and waterworks networks etc.). Damage and flooding of sewerage systems.	decrease in visitors.	(also related to loss of artworks and cultural heritage). Damage to natural environment.	Geological map at regional level (S). Protective infrastructure in place for landslides that are well maintained and monitored (S).	
Old town (Camerino)	Heavy snowfalls	Cultural heritage (churches, historical buildings, palaces etc.). Infrastructure systems (electrical, gas, and waterworks networks etc.).	Damage to cultural heritage (churches, historical buildings, palaces etc.) and private buildings. Infrastructure systems (electrical, gas, and waterworks networks etc.). Damage to public green areas (breaking old trees).	Loss of access to key services.	Reduction functionality of transportation systems (road and railroad networks). Reduction functionality of infrastructure systems (electrical, gas, and waterworks networks etc.).	Loss of tourism revenue due to service disruption.	Loss of cultural and artistic values (also related to loss of artworks and cultural heritage).	Civil emergency management plan (G).	[19]

6.3. Preliminary classification of hazards, exposed elements and impacts

The purpose of this section is to review, interpret, validate, and harmonise the information provided in the Risk Profile Table (part 6.2) as a sound basis for the project to address Camerino's risks to cultural heritage induced by climate change and other hazards. This preliminary analysis covers:

a) hazards;

b) elements exposed to those hazards; and

c) main impacts that the identified hazards might cause on the identified exposed elements.

6.3.1. Hazards

The identified hazards for the municipality of Camerino are recorded in Table 9 below and have been identified based on the hazard classification C40 *City Climate Hazard Taxonomy*[18] which is broken down into main hazard types and hazard subtypes. These are also highlighted in the preliminary resilience assessment presented in Section 7 of this report. According to this classification system, two main hazard clusters were identified in Camerino, namely: meteorological and geophysical (Table 9). As far as meteorological events are concerned, heavy snow was identified by the city as one of the main hazards in Camerino. Whereas for geophysical hazards, earthquakes are the main concern, followed by mass movements of different nature, such as landslides and rock falls (see Table 9).

Hazard categories	Hazard types	Hazard sub-type
Meteorological	Extreme precipitation	Heavy rain, heavy snow, monsoon, blizzard, hail
	Storm surges	Convective storms, (Thunderstorm, rainstorm)
Geophysical	Mass movements	Landslide, avalanche, rockfall, subsidence
	Tectonic activity	Earthquakes, *earthquake-induced landslides, rockfalls and subsidence*

Table 9. Hazard categories, types and sub-types identified for Camerino based on the city Risk Profile Table; in italics earthquake-induces hazard sub-types, not included in the C40 "City Climate Hazard Taxonomy".

[18] https://www.c40.org/researches/city-climate-hazard-taxonomy

Mass movements can also be induced by tectonic activity (as also observed in Camerino after the 2016-2017, Central-Italy earthquake sequence) therefore hazard sub-types such as earthquake-induced landslides, rockfalls and subsidence have been included in Table 9.

6.3.2. Exposed elements

The elements exposed to the hazards and identified in the Risk Profile Table (part 6.2 above) for Camerino have been reorganised in Table 10 below.

Exposed Element Categories	Exposed Element Types
Natural Environment	Ecosystem
	Agricultural soil
	Natural parks and public green areas
Built Environment	Private and public buildings
	Transportation system
	Further critical infrastructure systems (electrical, gas, and waterworks networks etc.).
Cultural Heritage	Tangible and intangible elements (see Table 11)
Services	Tertiary sector (education and university)
	Agriculture
	Commerce
	Tourism
Human and Social Aspects	External people (e.g. tourists)
	Local people

Table 10. Exposed elements identified in Camerino.

The cultural heritage category subsumes all exposed elements (Table 10) that are in themselves heritage, i.e. exposed elements declared as heritage are only categories as such

and not as any of the other categories. Table 11 reports the exposed elements categorised as cultural heritage. Here, reference has been made to the six categories identified by the *Climate Change and Cultural Heritage Working Group* (CCHWG) in 2019. Thanks to data provided by the *Italian Ministry of Cultural Heritage, Cultural Activities and Tourism* (MIBACT), cultural heritage assets were identified in Camerino for all the six typologies identified by CCHWG[19], as reported in Table 12. However, among the six CCHWG categories the following three are of particular relevance for Camerino: Movable Heritage, Building and Structures, and Cultural Landscapes**.** For the aforementioned cultural heritage, categories cultural heritage sub-types have been identified to provide a more detailed picture (Table 11).

Exposed Cultural Heritage Categories	**Exposed Cultural Heritage Types**
Moveable Heritage	Works of monumental sculpture and painting
Archaeological Resources	Archaeological sites
	Archaeological monuments
Buildings and Structures	Architecture: churches, castles, palaces, towers, etc.
	Groups of separate or connected buildings
	Historical nuclei in surrounding villages
Cultural Landscapes	Parks/gardens
Associated and Traditional Communities	Local authorities for the management of the mountain areas and congregations
Intangible Heritage	Oral traditions
	Performing arts
	social practices
	Rituals
	Festive events
	Knowledge and skills to produce traditional crafts

Table 11. Categories and types of the cultural heritage exposed elements identified in Camerino.

[19] https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

As far as ***Movable Heritage*** is concerned, there is a strong interest in Camerino to find viable operational procedures and location (depots) to ensure the preservation and security of the works of monumental sculpture and paintings that were dislocated from the damaged churches and palaces in Camerino following the recent seismic events.

As for ***Buildings and Structures***, the interest is both in groups of separate or connected buildings as well as in historical nuclei. For groups of separate buildings, the following sub-categories have so far been identified in Camerino: churches, castles, palaces, triumphal arches, masonry bridges, towers and obelisks. For connected buildings, as far as earthquake hazard is concerned, a peculiar analysis (from a strictly technical point of view) needs to be performed. These "building aggregates" are very typical in Italian historical centers. With regard to historical nuclei, in addition to Camerino, small surrounding villages (e.g. Ussita and Visso) will also be investigated.

As concerns ***Cultural Landscape***, attention will be placed on natural capital (parks and gardens and on any heritage green and blue infrastructure included there) that go beyond Camerino's administrative borders and that are governed, as far as their preservation is concerned, by local authorities for the management of the mountain areas.

6.3.3. Impacts

Table 13 reports the different impacts identified in Camerino for the five categories of impacts included in the Risk Profile Table (part 6.2 above) for the different exposed elements categorised according to the classification reported in Table 11 reports in a succinct way.

<table>
<tr><th>Exposed Element Categories</th><th>Exposed Element Types</th><th>Physical</th><th>Functional</th><th>Societal</th><th>Economic</th><th>Intangible</th></tr>
<tr><td rowspan="3">Natural Environment</td><td>Ecosystem</td><td>Damage to ecosystems</td><td></td><td></td><td rowspan="2">Loss of tourism revenue due to decrease in visitors</td><td></td></tr>
<tr><td>Natural parks and public green areas</td><td rowspan="2">Degradation and damage to natural environment
Damage to old trees</td><td></td><td></td><td></td></tr>
<tr><td>Agricultural soil</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2"></td><td>Private and public buildings</td><td>Damage</td><td></td><td rowspan="2">Loss of access to residential houses, offices, schools</td><td></td><td></td></tr>
<tr><td>Transportation system</td><td>Damage</td><td></td><td></td><td></td></tr>
</table>

Exposed Element Categories	Exposed Element Types	Physical	Functional	Societal	Economic	Intangible
Built environment	Critical infrastructure systems	Damage of sewerage systems		and key services		
Cultural Heritage	Tangible and intangible elements	Damage	Service disruption		Loss of tourism revenue	Loss of cultural values and traditions
Services	Tertiary (education, university)				Loss of revenue	
	Agriculture					
	Commerce					
	Tourism					
Human and Social Aspect	External people (e.g. tourists)					
	Local people	Injury and death		Loss of personal effects		Possible effects on mental health, PTSD[20]

Table 12. Physical, Functional, Societal, Economic and Intangible impacts identified for the different exposed elements in Camerino.

Further to the impacts identified by Camerino in the Risk Profile Table (part 6.2 above), it is suggested to consider additional impacts. In particular, and as far as societal impacts are concerned, it would be important to consider all the people directly and indirectly affected by a disaster (e.g. people whose livelihoods and/or family and traditional craft businesses were

[20] *Post-traumatic stress disorder (PTSD), e.g. in Camerino due to the experienced trauma, lifestyle modifications, lack of reference points including loss of access to houses, personal effects and religious and cultural heritage buildings.

disrupted or destroyed) as well as long-term effects (e.g. the sudden post-disaster increase in depopulation of the territory already in act since a long time in all the rural territories of central Italy). Furthermore, Camerino's Risk Profile Table currently encompasses only indirect economic losses (i.e. loss of revenue), whereas direct economic losses should also be accounted for (e.g. direct economic losses resulting from damaged or destroyed buildings, cultural heritage and critical infrastructures). Additionally, as far as loss of revenue is concerned, it would be important to further disaggregate them by economic sector, according to the standard classification adopted in Italy (ATECO 2007[21]).

6.3.4. Outlook and implications for the ARCH project

Based on the information provided in the Risk Profile Table (part 6.2 above) and building on the joint meetings between Camerino and the research partners, ARCH's work for the municipality of Camerino is envisaged to be conducted at different levels of analysis (Table 13).

Study Areas/Buildings	Possible Analysis	Possible Tools
District scale - beyond the municipality's borders	• Impact chain analysis; • Thematic maps.	• IVAVIA impact chain creator (adapted for ARCH); • ARCH DSS (i.e. CIPCast).
Municipality scale - Camerino's old town	Scenario simulations	• ARCH DSS; • Satellite images and and/or survey supported by drones.
Prototypical building scale - identified within Camerino old town	Scenario simulations with dynamic data integration from sensors and satellite images	• ARCH DSS; • Survey supported by drones; • Chemical and mechanical characterisation of constructive materials;

[21] ATECO 2007 classification is the Italian national version of the Nace Rev. 2 (the statistical classification of economic activities in the European community, https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF). From 2008, not only the Italian National Institute of Statistics (ISTAT) adopted the so called ATECO 2007, but also multiple institutional governance body (e.g. the Ministry of Economy, business enterprise associations, and internal revenue agencies) .

Study Areas/Buildings	Possible Analysis	Possible Tools
		• Sensors.
Two buildings of interest (See Section 2): 1) Palazzo Ducale; 2) Santa Maria in Via Church.	• 3D building model with identified damage pattern; • Dynamic monitoring of damage; • Finite element analysis of the buildings to support retrofitting interventions.	• Sensors installation of low-cost and traditional structural health monitoring sensors (e.g. MEMS, optic fibre and accelerometers); • Chemical and mechanical characterisation of constructive materials; • Photogrammetry laser scanner and/or survey supported by drones; • 3D models.

Table 13. Possible analysis and possible tools to be implemented for ARCH work in Camerino.

Table 13 provides initial ideas of possible examples for the work that can be undertaken as part of the ARCH project. The proposed content in Table 13 was discussed with the municipality of Camerino and the research partners.

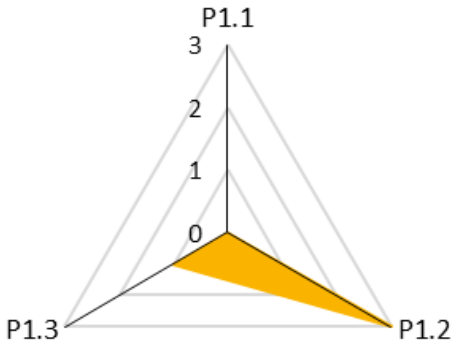
For the different study areas/buildings, identified in Table 13, the idea is to conduct damage and impact assessments, with particular focus on earthquake events and heavy snow falls, both at the “status quo” and after the implementation of resilience strategies that might encompass both physical interventions (such as seismic retrofitting of buildings, critical infrastructure and cultural heritage), as well as strategies to improve the current best practices and frameworks for governance and management.

The idea is to allow the municipality to assess the effectiveness of alternative resilience strategies not only in terms of tangible and measurable costs and benefits (e.g. reduction of physical damage to the built environment, including cultural heritage asset, reduction of physical and social impacts on communities, depopulation of the territory, direct and indirect economic losses), but also in terms of reduction of intangible losses related to the loss of cultural and artistic value and to the loss of social practices such as festive events and the know-how for producing traditional crafts.

7. Preliminary resilience assessment

The following resilience assessment was developed using the preliminary version of the *UNDRR Disaster Resilience Scorecard for Cities*. The preliminary assessment was conducted within the framework of a workshop between the municipality of Camerino, the University of Camerino, ENEA, and Fraunhofer on 9th December 2019. As the original Scorecard is aimed at city-level, not all questions were immediately applicable on the level of historic areas or single heritage assets. Wherever possible, answers were provided for the historic areas under examination (e.g. with regard to hazard scenarios). For all other questions, answers were provided on city-level (e.g. with regard to city masterplans). The results give a first indication of the overall resilience of the city with some – but not exclusive – focus on the historic areas examined by ARCH. In addition, the application of the Scorecard will be used as input for the development of the ARCH Resilience Assessment Framework specifically focused on historic areas. Lastly, the preliminary resilience assessment results presented in the baseline reports should not be employed to develop resilience action plans, as not all necessary stakeholder groups were involved in the assessment process.

7.1. Essential 01: Organise for resilience



P1.1	Does the city master plan (or relevant strategy/plan) adopt the Sendai Framework?	0
P1.2	Is there a multi-agency/sectoral mechanism with appropriate authority and resources to address disaster risk reduction?	3
P1.3	Is resilience properly integrated with other key city functions / portfolios?	1

Figure 26. Results Essential 01.

For Essential 01, Camerino achieves an overall resilience score of 4/9, with room for improvements in planning and resilience integration. There exists no city master plan in order to improve resilience, and the *Sendai Framework for Disaster Risk Reduction* is not well known in Camerino (score of 0 for P1.1). Urban planning takes into account the geomorphological features of the municipal area. Camerino's municipality has a preliminary civil emergency plan that roughly defines the general tasks of officials in case of emergency events, and the main reception areas for people. The Civil Protection Office of the Camerino municipality (COC) is the first authority that organizes disaster and emergency response, before the successive and possible interventions of the regional and national civil protection offices. At the same time, the local, regional, and national offices for civil protection are well coordinated and resourced, enabling a multi-agency mechanism for addressing disaster risk reduction to be applied (score of 3 for P1.2). Lastly, disaster resilience is only integrated with key city functions (e.g. planning or community engagement) on an ad hoc basis (score of 1 for P1.3).

7.2. Essential 02: Identify, understand and use current and future risk scenarios

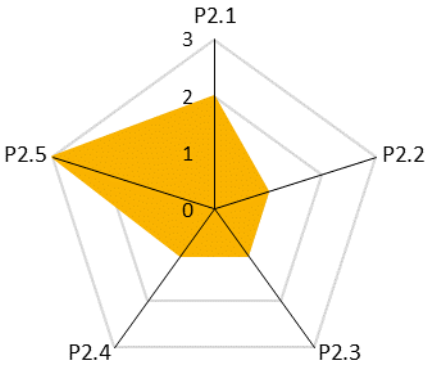


Figure 27. Results Essential 02.

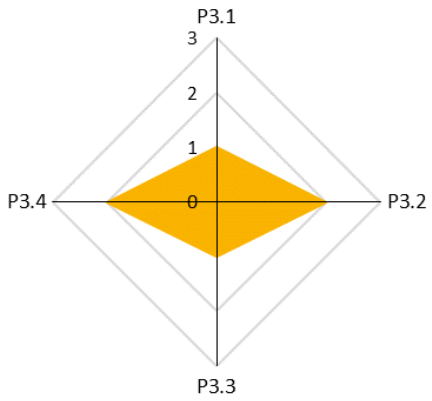
P2.1	Does the city have knowledge of the key hazards that the city faces, and their likelihood of occurrence?	2
P2.2	Is there a shared understanding of risks between the city and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks?	1
P2.3	Are their agreed scenarios setting out city-wide exposure and vulnerability from each hazard, or groups of hazards (see above)?	1
P2.4	Is there a collective understanding of potentially cascading failures between different city and infrastructure systems, under different scenarios?	1
P2.5	Do clear hazard maps and data on risk exist? Are these regularly updated?	3

For Essential 02, Camerino achieves an overall resilience score of 8/15. The municipality understands the main hazards affecting it and there are currently some processes for updating information concerning seismic and landslide hazard maps. Geomorphological features of the municipal area are taken into account in the urban planning choices (land use zoning plan). There are no risk scenarios for the main natural hazards, however some issues are roughly defined in the civil emergency plan (score of 2 for P2.1). At the same time, individual system risks are not shared among utility providers and regional/ national agencies proactively in order to understand cascading effects; these risks are only shared after a hazard occurred as part of post-disaster discussions (score of 1 in P2.2). Hazard scenarios for vulnerability and exposure only exist for some disasters. Specifically, the municipality of Camerino has historical data on earthquakes available, but not enough data for other hazard scenarios (score of 1 for P2.3). As a result from P2.2 and P2.3, there is only a limited understanding of cascading impacts under a limited amount of disaster scenarios (score of 1 for P2.4). However, for most hazards (i.e. earthquakes and hydrogeological risks) there exist regularly updated hazard maps provided by national agencies (score of 3 for P2.5).

7.3. Essential 03: Strengthen financial capacity for resilience

For Essential 03, Camerino achieves an overall resilience score of 5/12. While the municipality employs crowdfunding and participates in national/European (research) projects, not enough information about other funding opportunities is available (score of 1 for P3.1).

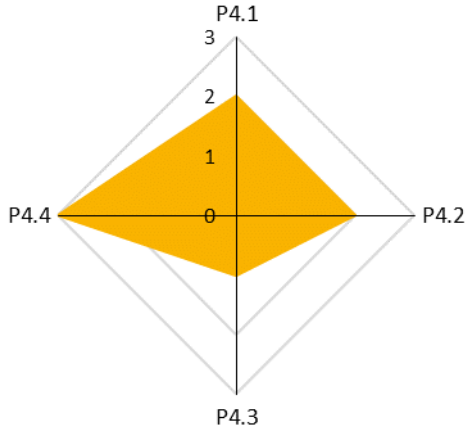
At the same time, the municipality's financial plan allows for DRR activities and the associated budgets are reserved (score of 2 for P3.2). An area where room for improvement exists is insurance coverage, which varies significantly per sector and is not actively promoted by the municipality (score of 1 for P3.4). Whereas public infrastructure is often covered by insurance, cultural heritage assets are not. Lastly, there exists a sufficient number of incentives to support resilience building on national and regional level, with gaps remaining in some sectors (score of 2 for P3.4).



P3.1	The city/ lead agencies understand all sources of funding, and the "resilience dividends", are well connected, understand all available routes to attract external funding and are actively pursuing funds for major resilience investments.	1
P3.2	Does the city have in place a specific 'ring fenced' (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)?	2
P3.3	What level of insurance cover exists in the city, across all sectors – business and community?	1
P3.4	What incentives exist for different sectors and segments of business and society to support resilience building?	2

Figure 28. Results Essential 03.

7.4. Essential 04: Pursue resilient urban development

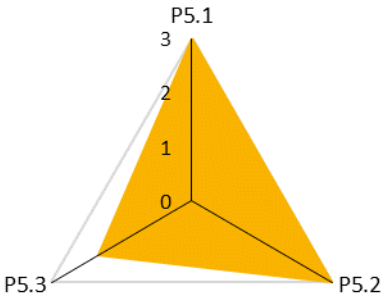


P4.1	Is the city appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres?	2
P4.2	Are approaches promoted through the design and development of new urban development to promote resilience?	2
P4.3	Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?	1
P4.4	Are zoning rules, building codes and standards widely applied, properly enforced and verified?	3

Figure 29. Results Essential 04.

For Essential 04 Camerino achieves a resilience score of 8/12 with minor room for improvement. The municipality employs a land use zoning plan loosely based on known hazards and risks (score of 2 for P4.1) and promotes resilience in new urban developments (guidance for this can be improved) (score of 2 for P4.2). Regulations exist on national level and have to be implemented on local level but in general there is no clear planning for updating the codes (score of 1 for P4.3). Most importantly, where zoning plans and building codes are available these are enforced, although not always verified (score of 3 in P4.4).

7.5. Essential 05: Safeguard natural buffers to enhance the protective functions offered by natural ecosystems



P5.1	Beyond just an awareness of the natural assets, does the city understand the functions (or services) that this natural capital provides for the city?	3
P5.2	Is green and blue infrastructure being promoted on major urban development and infrastructure projects through policy?	3
P5.3	Is the city aware of ecosystem services being provided to the city from natural capital beyond its administrative borders? Are agreements in place with neighbouring administrations to support the protection and management of these assets?	2

Figure 30. Results Essential 05.

For Essential 05, Camerino achieves a high resilience score of 8/9. Both the municipality and key stakeholders are familiar with the term ecosystem services and understand the economic value of all the functions provided by key local natural assets (score of 3 for P5.1).

In addition, green and blue infrastructure is being promoted in major urban development and infrastructure projects through policy and supporting guidance material (score of 3 for P5.2). Lastly, the municipality is aware of the importance of the functions provided by natural capital beyond its administrative borders and there has been some exchange with neighbouring administrators (score of 2 for P5.3). As an example, the municipality is part of an association of mountain communities[22] sharing ecosystem services.

In the Marche Region there are eight local authorities for the management of the mountain areas (see Section 7.3); these are local institutions made up of some municipalities which share financial funds in order to guarantee the essential social and economic services to the population and in order to manage the land use zoning and planning, and to preserve landscapes and ecosystems.

7.6. Essential 06: Strengthen institutional capacity for resilience

For Essential 06 Camerino achieves a resilience score of 5/18 with significant room for improvement. While the municipality can access most of the skills and resources necessary to respond to identified disaster scenarios, gaps still exist. This is especially the case for pre-disaster planning as well as coordination with utility providers (score of 1 for P6.1). Through the dissemination activities of schools and the local university on hazards and risks as well as through civil protection meetings, the municipality is able to reach more than 50% of its

[22] The local authorities for the management of the mountain areas were established by D.Lgs 267/2000 and L.R. 35/2013 with the aim of supporting and maintaining partnerships between single local municipalities into a wider governance of internal territories, focused on the protection, conservation and the enhancement of the natural environment. The local authorities for the management of the mountain areas are local entities set up for the enhancement and development of mountain areas and for associated functions and services between municipalities. The municipality of Camerino is part of the “Unione Montana Marca di Camerino” with other neighboring municipalities. The “Unione Montana Marca di Camerino” provides a support to plan and develop green and blue infrastructures, forest management, etc. on and beyond the territory of Camerino.

population with targeted education and awareness raising campaigns (score of 2 for P6.2). However, only some of the municipality's data layers about hazards and risks are shared with other organisations, and the information that is shared requires further interpretation due to the raw format of the data (score of 1 for P6.3).

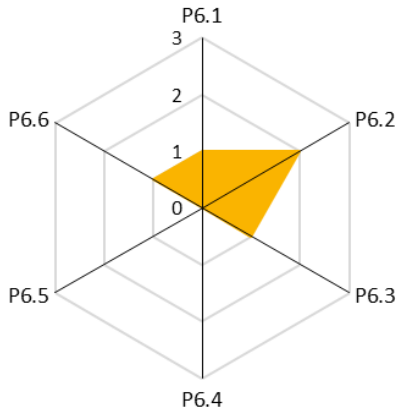


Figure 31. Results Essential 06.

P6.1	Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?	1
P6.2	Does a coordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public?	2
P6.3	Extent to which data on the city's resilience context is shared with other organizations involved with the city's resilience.	1
P6.4	Are there training courses covering risk and resilience issues offered to all sectors of the city including government, business, NGOs and community?	0
P6.5	Are training materials available in the majority of languages in common use in the city?	0
P6.6	Is the city proactively seeking to exchange knowledge and learn from other cities facing similar challenges?	1

While schools and the university disseminate hazard information, there exist no training courses covering risks and resilience issues on the local level, only some civil protection courses on national level exists (score of 0 for P6.4).

Similarly, as no training material exists, it is not translated into other languages. However, if training material would exist, it would be provided in Italian, which is the majority language in Camerino (score of 0 for P6.5). Lastly, knowledge exchange with other municipalities facing similar challenges is limited to local networks and via participation in (research) projects.

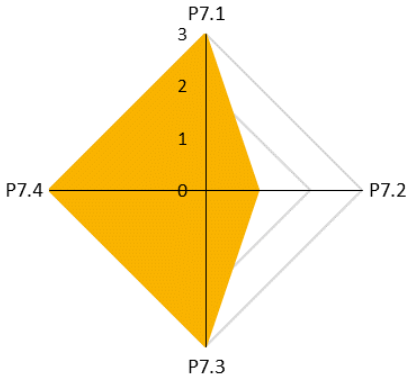
As such, the exchange is more ad hoc than systematic (score of 1 for P6.6). Improving resilience is principally dependent on the availability of financial funds which may be limited for a small town such as Camerino.

7.7. Essential 07: Understand and strengthen societal capacity for resilience

For Essential 07, Camerino achieves a resilience score of 10/12. The municipality actively engages community organizations (e.g. the Concentrico committee – a committee of private citizens) in risk reduction actions and pre-event planning (score of 3 for P7.1).

However, vulnerable population groups do not receive any specific disaster training (score of 1 for P7.2). Of the few businesses in Camerino that employ more than 10 employees – which

are not very many – all have a business continuity plan (score of 3 for P7.3). Lastly, multiple multimedia channels are used for communicating with citizens (score of 3 for P7.4).

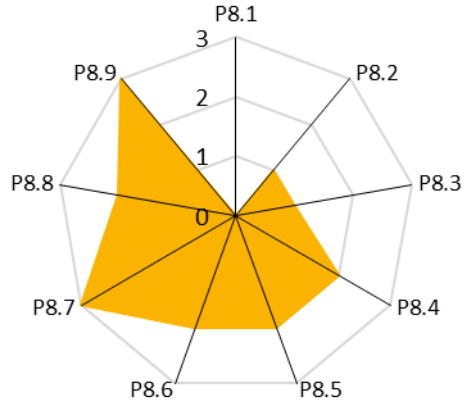


P7.1	Are “grassroots” or community organizations participating in risk reduction and post-event response for each neighbourhood in the city?	3
P7.2	Are there regular training programmes provided to the most vulnerable populations in the city?	1
P7.3	What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months?	3
P7.4	How effective is the city at citizen engagement and communications in relation to DRR?	3

Figure 32. Results Essential 07.

7.8. Essential 08: Increase infrastructure resilience

For Essential 08, Camerino achieves a resilience score of 16/27. There are no plans or forums to tackle critical infrastructure resilience, as critical infrastructure providers manage these risks on their own (score of 0 for P8.1). For some hazards, such as seismic events and landslides, studies are carried out by the civil protection department or by the Marche Region in order to highlight possible critical issues.



P8.1	Is critical infrastructure resilience a city priority, does the city own and implement a critical infrastructure plan or strategy?	0
P8.2	Is existing protective infrastructure well-designed and well-built based on risk information?	1
P8.3	Would a significant loss of service for these two essential services be expected for a significant proportion of the city under the agreed disaster scenarios?	1
P8.4	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)?	2
P8.5	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event? In the event of failure would transport infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc) and passable?	2
P8.6	Would a significant loss of service be expected for a significant proportion of the city in the ‘worst case’ scenario event?	2
P8.7	Would there be sufficient acute healthcare capabilities to deal with expected major injuries in ‘worst case’ scenario?	3
P8.8	% of education structures at risk of damage from “most probable” and “most severe” scenarios	2
P8.9	Will there be sufficient first responder equipment, with military or civilian back up as required?	3

Figure 33. Results Essential 08.

However, the healthcare and education systems of Camerino are well suited to deal with the hazards faced by the municipality as more than 90% of major injuries could be treated within six hours under the “most severe” scenario (score of 3 for P8.7), and no teaching facilities would be at risk under the “most probable” scenario (score of 2 for

P8.8). Lastly, first responders in Camerino are well equipped to deal with the “most severe” scenario (score of 3 for P8.9). While there is protective infrastructure in place for landslides that are well maintained and monitored, protective infrastructure for other hazards is missing and the design of existing infrastructure may not be consistent with best practices (score of 1 for P8.2). As for loss of service, there would be some loss of services under the “most severe” scenario (i.e. an earthquake of similar intensity as the ones in 2016) for the energy, transport, and communications systems (scores of 2 for P8.4, P8.5, and P8.6), while some loss of service would be expected for the water system even under the “most probable” scenario (i.e. heavy snowfalls; score of 1 for P8.3).

7.9. Essential 09: Ensure effective disaster response

For Essential 09, Camerino achieves a resilience score of 14/21. The early warning systems can reach more than 75% of the population; however 30% of the population is not reachable, e.g. due to no possession of mobile phone such as is the case for the elderly (score of 2 for P9.1). In addition, Camerino’s municipality has a preliminary civil emergency plan that roughly defines the general tasks of the officials for emergency events and the main reception areas for people (score of 1 for P9.2).

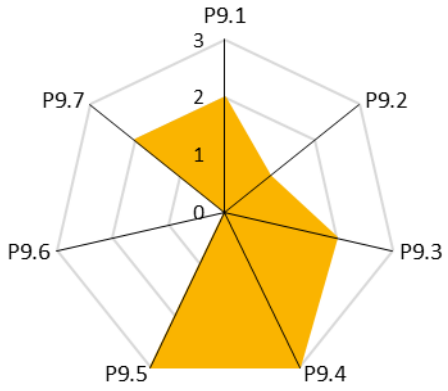


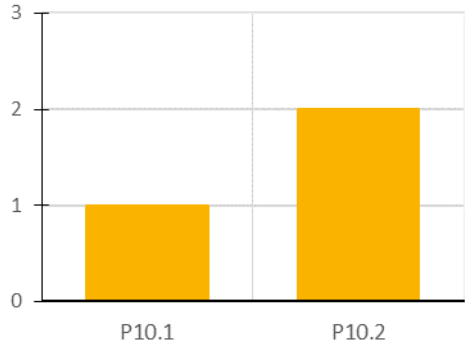
Figure 34. Results Essential 09.

P9.1	Does the city have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?	2
P9.2	Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies?	1
P9.3	Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?	2
P9.4	Are equipment and supply needs, as well as the availability of equipment, clearly defined?	3
P9.5	Would the city be able to continue to feed and shelter its population post-event?	3
P9.6	Is there an emergency operations centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with “most probable” and “most severe” scenarios?	0
P9.7	Do practices and drills involve both the public and professionals?	2

The responsible disaster management authority has enough staff and is able to cover all the neighbourhoods within 24-48 hours in case of an emergency scenario (score of 2 for P9.3). In addition, the equipment and relief supply needs are defined at national level (score of 3 for P9.4) and the necessary supplies of food and basic relief items exceeds estimated needs in the “most severe” scenario (score of 3 for P9.5).

The local civil protection office of Camerino (C.O.C.) is the first authority to organize disaster and emergency response before the successive and possible interventions of the regional and national civil protection departments (score of 3 for P9.6). Lastly, schools, the university and public offices conduct annual drills for disaster response, which are validated by professionals, but are not based on the “most severe” or “most probable” scenario (score of 2 for P9.7).

7.10. Essential 10: Expedite recovery and build back better



P10.1	Is there a strategy or process in place for post-event recovery and reconstruction, including economic reboot, societal aspects etc.?	1
P10.2	Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects?	2

Figure 35. Results Essential 10.

For Essential 10, Camerino achieves a resilience score of 3/6., The current plans for post-event recovery and rebuilding may be improved, especially in terms of economic reboot (score of 1 for P10.1).

The commissioner responsible for rebuilding of the real estate damaged by the last earthquake (2016) issues several ordinances that define criteria for the repair and financing of different types of buildings and of cultural. In terms of lessons learnt, there are clear processes in place to capture lessons from previous difficulties for coping post-event, but the mechanism to transfer these lessons into the design and delivery of rebuilding projects needs improvement. Methods, procedures and funds, which are updated and renewed for each new disaster event, do not always allow for addressing the best and more resilient solutions. (score of 2 for P10.2).

A general issue is the need to combine the preservation of the construction and cultural features of the old town area with the retrofitting works in order to ensure a suitable safety level for the population. Furthermore, there are social and economic issues that have to be tackled in order to avoid the depopulation of the old town.

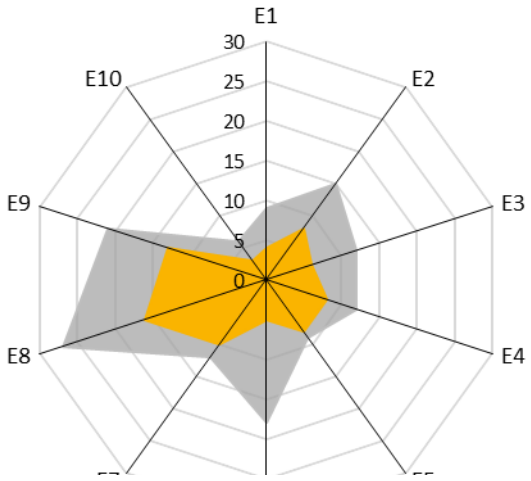


Figure 36. Combined results of Essentials 1 to 10 for Camerino.

7.11. Overall resilience of Camerino

Overall, Camerino achieves a resilience score of 81/141.

The highest scores for resilience were achieved for Essentials 02, 04, 05, 07 and 08 and 09. Camerino offers well established warning systems as well as organisations for risk reduction within the population. The city is a member of a local authority for the management of the mountain areas and it gives great value to its surrounding natural ecosystem and its protection. A zoning plan for hazardous areas and building codes for

urban development exists. The incorporation of these in the development plan of the city will be improved in the next years.

Most room for improvement of the resilience was found in Essential 01, 03, 06, and 10. High quality maps and information about hazards, in particular about earthquakes and geomorphological hazards, are available, but the sharing of these information may be improved and these data are not currently implemented in order to carry out future risk scenarios. The local and regional civil protection offices have defined procedures for post-disaster management. The lack of detailed risk scenarios for emergencies does not currently allow for the development of suitable pre-disaster planning. The critical infrastructure providers do not have a specific agreement with the municipality for resilience improvement, but they support the municipality when disasters occur.

Furthermore, there are minor deficits in the Essentials 01, 03, 10. The Municipality of Camerino employs a general land use zoning plan and it has a civil protection plan for population reception and rebuilding after seismic events. Risk scenarios are not available for the main natural hazards, and thus there is no plan for improving resilience. However, regional and national civil protection services do function well. In contrast to the well-insured public infrastructure, there is no dedicated financial support for resilience and investment actions, different form the ordinary maintenance, for heritage sites. The municipality of Camerino, when disasters occur, establishes a local civil protection office. The emergency warning service and support systems offer sufficient functions. Up to now, there are some difficulties in order to learn from previous events due to financial and social reasons and the need to preserve the original construction features of the old town. For new buildings built in the peripheral areas, after the last earthquake, innovative construction techniques are used such as base-isolated buildings.

8. Conclusion

The preliminary analysis of the main hazards, exposed elements and the possible impacts in section 6 allows an initial assessment of the resilience of different features of the municipality of Camerino. This resulted in the identification of preliminary priorities corresponding to the findings of the baseline review and useful for defining the municipality's detailed needs and objectives within the ARCH project. The main aspects for the improvement of Camerino's resilience (chapter 7) were found to be the identification and use of the risk scenarios, and the planning of institutional strategies to improve the resilience of the urban areas as well as the infrastructure.

Generally, maps and information about earthquakes and geomorphological hazards are available, but these are currently not utilised to define future risk scenarios. The local civil protection office has defined procedures for post-disaster management, however, pre-disaster planning is hindered by a lack of detailed risk scenarios for future emergencies. Furthermore, critical infrastructure providers currently have no specific agreement with the municipality for resilience improvement, but rather support the municipality on ad-hoc basis when disasters occur. There are also some difficulties in making use of the lessons learned from previous events due to financial and social reasons. Another challenge derives from the need to preserve the historical construction techniques as well as the cultural features of the Old Town despite the necessity for seismic retrofitting.

Based on this, the specific objectives for the ARCH Project for Camerino include:

1) to improve the predictive models and risk assessment methods to lead future actions for current post-earthquake reconstruction, mitigate the effects of future events and enhance the preparedness for natural hazards;

2) to increase the knowledge base on the geological-structural setting of the "Camerino hill" and the geomorphological processes, thereby determining the hydrogeological hazard scenarios for the historical centre;

3) to increase the knowledge of the vulnerability of historical buildings with reference to construction materials and techniques;

4) to monitor cultural heritage of significant value in order to provide alerts and real-time information about damage resultant from natural hazards and degradation due to environmental conditions;

5) to develop guidelines for managing and securing artefacts and artwork after seismic events.

It is therefore planned to conduct the analyses of the risks due to natural hazards at different urban scales; from the district scale to that of the case study buildings (the Ducal Palace and Santa Maria in Via's Church). Furthermore, extreme precipitation can influence the risk scenario concerning landslides and service networks (communication, electric, etc.). Thus, enacting measures for increasing urban resilience leads to disaster risk reduction.

These strategies can be supported by the assessment of tangible costs and benefits (e.g. reduction of physical damage to the built environment, direct and indirect economic losses),

and intangible losses related to the loss of cultural and artistic value. The planned activities will also allow the definition of risk scenarios via the use of tools [32] that are able to support the planning of resilience improvement and the identification of emergency strategies for the urban area.

9. Bibliography

[1] GoogleMaps 2020 [Online]. Available: https://www.google.com/maps.

[2] City's registry Office, municipality of Camerino.

[3] Office of Statistics, Marche Region [Online]. Available: http://statistica.regione.marche.it/

[4] Statistical volume of the Marche Region, 2019 [Online]. Available: http://statistica.regione.marche.it/

[5] Report of Technical Office of Camerino [Online]. Available: https://www.comune.camerino.mc.it/avvisi-cms/i-numeri-del-sisma-al-25-settembre-2019/?a=

[6] Data on Camerino's enterprises [Online]. Available: https://www.tuttitalia.it/

[7] Infocamera, Camera di Commercio of Macerata (2016) [Online]. Available: http://www.mc.camcom.it/

[8] Municipality of Camerino [Online]. Available: https://www.comune.camerino.mc.it/

[9] A. Dall'Asta, G. Leoni, M. Morici, L. Dezi, F. Gara, S. Carbonari, "Camerino: report fotografico di edifici in zona rossa" (in Italian), 2016 [Online]. Available: http://www.reluis.it.

[10] S. Carbonari, A. Dall'Asta, L. Dezi, F. Gara, G. Leoni, M. Morici, A. Prota, A. Zona, "First analysis of data concerning damage occurred to churches of the Marche region following the 2016 central Italy earthquakes", Bollettino di Geofisica Teorica ed Applicata, Vol. 60, n. 2, pp. 183-196, 2019.

[11] Rocca Borgesca, Wikipedia [Online]. Available: https://it.wikipedia.org/wiki/Rocca_Borgesca

[12] Civil Protection Office of the Marche Region [Online]. Available: http://www.regione.marche.it/Regione-Utile/Protezione-Civile

[13] Diocese of Camerino [Online]. Available: http://www.arcidiocesicamerino.it/

[14] Superintendence of Architectural and Landscape Heritage of Marche Region [Online]. Available: http://sabapmarche.beniculturali.it/

[15] Special Office for Reconstruction, Marche Region [Online]. Available: http://www.regione.marche.it/Regione-Utile/Ricostruzione-Marche/Ufficio-speciale-ricostruzione-Marche

[16] Ministry for Cultural Heritage and Activities and Tourism (MIBACT), [Online]. Available: https://www.beniculturali.it/

[17] Ducal Palace of Camerino, Wikipedia [Online]. Available: https://it.wikipedia.org/wiki/Palazzo_Ducale_(Camerino)

[18] Italian Institute for technical standards (UNI) [Online]. Available: https://www.uni.com/

[19] Civil protection plan, municipality of Camerino, approved by council's deliberation n. 61 of 22th December, 2008 [Online]. Available: https://www.comune.camerino.mc.it/documenti-cms/relazione-piano-di-protezione-civile/

[20] United Nations Office for Disaster Risk Reduction [Online]. Available: https://www.undrr.org/

[21] The Sendai Framework [Online]. Available: https://www.preventionweb.net/sendai-framework/sendai-framework-for-drr

[22] United Nations Office for Disaster Risk Reduction, Regional Office for Europe [Online], Available: https://www.unisdr.org/europe

[23] Directorate-General for European Civil Protection and Humanitarian Aid Operations [Online]. Available: https://ec.europa.eu/echo/

[24] The Italian Civil Protection Office [Online]. Available: http://www.protezionecivile.gov.it/department

[25] Italian building code "Norme tecniche per le costruzioni, D.M. 17/01/2018", [Online]. Available: https://www.gazzettaufficiale.it/eli/gu/2018/02/20/42/so/8/sg/pdf

[26] Marche Region [Online]. Available: http://www.regione.marche.it/

[27] Italian Ministry for the. Environment, Land and Sea [Online]. Available: https://www.minambiente.it/

[28] Seismic Microzonation of municipality of Camerino [Online]. Available: https://www.comune.camerino.mc.it/documenti-cms/microzonazione-sismica-di-livello-3-del-comune-di-camerino-ai-sensi-dellordinanza-del-commissario-straordinario-n-24/?a=

[29] Funding for retrofit and seismic upgrade of buildings "Sismabonus" [Online]. Available: https://www.agenziaentrate.gov.it/portale/web/guest/aree-tematiche/casa/agevolazioni/sisma-bonus

[30] Land use zoning plan of Camerino [Online]. Available: https://www.comune.camerino.mc.it/documenti-cms/piano-regolatore/;

[31] Geological map of Marche Region [Online]. Available: http://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica/Cartografia/Repertorio/Cartageologicaregionale10000.

[32] CIPCast [Online]. Available: http://sue.enea.it/product/citta-sicure-e-sostenibili/sistema-di-supporto-alle-decisioni-cipcast/

Additional key documents and laws are described in the Annex (part 11).

10. List of abbreviations

Term	Meaning
CAPI	Emergency Service Centre
CCS	Coordination Centre
CCHWG	Climate Change and Cultural Heritage Working Group
CMCC	Euro Mediterranean Centre on Climate Change
CNSAS	National Mountain Rescue and Speleological Corps
COAU	Joint Air Operations Centre
COEMM	Operations Centre for Maritime Emergencies
COM	European Commission documents
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
DSS	Decision support system
ECCR	Emergency Response Coordination Centre
ETS	European Treaty Series
ICOMOS	International Council on Monuments and Sites
IMELS	Italian Ministry for the. Environment, Land and Sea
INGV	National Institute of Geophysics and Volcanology
INSPIRE	Infrastructure for Spatial Information in Europe

IVAVIA	Impact and Vulnerability Analysis of Vital Infrastructures and Built-up Areas
LCA	Life Cycle Analysis
MIBACT	Ministry of Cultural Heritage and Activities, and Tourism
MEMS	Micro Electro-Mechanical Systems
NAP	Italian National Adaptation Plan for Climate Change
NAS	National Adaptation Strategy
POR	Regional operative program
PTSD	Post-traumatic stress disorder
RDP	Rural Development Plan
SOUP	Regional Operative Office
SWD	European commission staff working document
UNDRR	United Nations Office for Disaster Risk Reduction

11. Annex

11.1. Key documents governing cultural heritage management (see Section 3)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention for the Safeguarding of the Intangible Cultural Heritage	Agreement	International	Non-binding	United Nations Educational, Scientific and Cultural Organization (UNESCO)	2003	No relevant timelines for the Convention itself have been identified. The created list of intangible heritage elements is annually updated.	Convention: https://ich.unesco.org/en/convention List of Intangible Cultural Heritage: https://ich.unesco.org/en/00011?type=00002#tabs	The Convention established (Article 16) a Representative List of Intangible Cultural Heritage of Humanity.
European Framework for Action on Cultural Heritage	Commission staff working document	International	Non-binding	European Commission	2018	Implementation of the Framework will be monitored by the Cultural Heritage Forum, an informal Commission expert group meeting at least annually since 2019.	https://ec.europa.eu/culture/content/european-framework-action-cultural-heritage_en	Framework of continued action for Europe's cultural heritage based on a holistic, mainstreaming and integrated approach, multi-stakeholder cooperation.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Convention for the Protection of the Architectural Heritage of Europe	Agreement	International	Binding	Council of Europe	1987		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/121	Legally binding instrument which sets the framework for an accurate conservation approach within Europe. Aims to reinforce and promote policies for the conservation and enhancement of Europe's heritage.
European Landscape Convention	Agreement	International	Binding	Council of Europe	2000		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	Promotes the protection, management and planning of the landscapes and organizes international co-operation on landscape issues.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
European Convention on the Protection of the Archaeological Heritage (Revised)	Agreement	International	Binding	Council of Europe	1995		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143	This revised Convention updates the provisions of a previous Convention adopted by the Council of Europe in 1969. The new text makes the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies.
Italian law no. 184, 6th April 1977	Law	National (I)	Binding	Italian Parliament	1977		https://www.gazzettaufficiale.it/	Ratification and implementation of the convention on the protection of the world's cultural and natural heritage, Paris, 23th November 1972.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Italian Law no. 93 of 15th February 1989	Law	National (I)	Binding	Italian Parliament	1989		https://www.gazzettaufficiale.it/	Ratification and execution of the European Convention for the Protection of the Architectural Heritage in Europe, Granada, 3rd October 1985.
Legislative Decree no. 42, 22nd January, 2004	Law	National (I)	Binding	Italian Parliament	2004		https://www.gazzettaufficiale.it/	Legislative Decree no. 42, 22/01/2004 (Cultural Heritage and Landscape Code). The Legislative Decree describes the standards for the cultural heritage i.e. architectural heritage, museums, artwork. Furthermore, this code defines the criteria for the planning of protection, use and the enhancement of the cultural heritage. Standards for the landscape planning are shown.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future revision/update	Link (if available)	Summary of content
Legislative Decree no. 62, 26th March, 2006	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Legislative Decree no. 62, 26/03/2006 (changes on Legislative decree n. 42/2004).
Legislative Decree no. 63, 26th March, 2006	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Legislative Decree no. 63, 26/03/2006 (changes on Legislative Decree n. 42/2004).
Marche Region Law no. 04, 09/02/2010	Law	Regional	Binding	Regional Council	2010		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional law no. 04, 09/02/2010, Laws on cultural heritage and activities. This law defines the tasks of the Region, of the municipalities and of the local authorities and the types of activities in order to enhance both the cultural heritage and the landscapes.

11.2. Key documents governing disaster risk reduction (see Section 4)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Sendai Framework	Agreement	International	Non-binding	United Nations Office for Disaster Risk Reduction (UNDRR)	2015	Valid until 2030. UNDRR is in charge of follow-up and review of the Sendai Framework by preparing periodic reviews on progress, among other actions.	http://www.unisdr.org/we/inform/publications/43291	Establishment of a global framework for action to prevent new and reduce existing disaster risks, based on 7 targets, 4 priorities for action with supporting rationale and 13 guiding principles.
EU law (Decision 1313/2013/EU)	Law	International (Europe)	Binding	European Parliament	2013		https://eur-lex.europa.eu/homepage.html	Decision No 1313/2013/EU of the European Parliament and of the Council on a Union Civil Protection Mechanism. It defines the activities to assist with the response to immediate adverse consequences of a disaster inside or outside the Union.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
EU law (Decision 420/2019/EU)	Law	International (Europe)	Binding	European Parliament	2019		https://eur-lex.europa.eu/homepage.html	This decision defines an effective and coherent approach to the prevention of and preparedness for disasters and to promote the exchange of best practices within the Union Mechanism.
Directive 2007/60/EU	Guideline	International	Binding	The European Parliament and The Council of The European Union	2007		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060	The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community. It should be read together with Act no. 7/2010 Coll. on flood protection,

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law. Legislative Decree no. 1, 02/01/2018)	Law	National (I)	Binding	Italian Parliament	2018		https://www.normattiva.it/	Legislative Decree no.1 02/01/2018: Civil Protection Code (in Italian). This law defines the organisation of the National Civil Protection office and the tasks of the offices at regional and local levels. Furthermore, it defines the tasks of the scientific committee and the planning of the activities to prevent disasters and to manage the rebuilding.
Italian law (Decree of the Prime Minister of 09/08/2016)	Law	National (I)	Binding	Italian Parliament	2016		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 09/08/2016: this decree describes the organization of the Civil Protection Office (in Italian).

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law (Decree of the General Secretary of the Presidency of the Council of Ministers, 10/08/2016)	Law	National (I)	Binding	Italian Parliament	2016		http://www.protezionecivile.gov.it	Decree of the General Secretary of the Presidency of the Council of Ministers 10/08/2016: this Decree describes some activities concerning the Civil Protection Office (in Italian)
Italian law (Decree of the Prime Minister of 20/02/2012)	Law	National (I)	Binding	Italian Parliament	2012		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 20/02/2012: this Decree describes both the components and the tasks of the committee that supports the civil protection office (in Italian)
Italian law (Decree of the Prime Minister of 21/11/2006)	Law	National (I)	Binding	Italian Parliament	2006		https://www.gazzettaufficiale.it/	Decree of the Prime Minister D.P.C.M. 21/11/2006: this Decree shows the activities and the tasks of the Civil Protection Operational Committee (in Italian)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Italian law no. 286, 27/12/2002	Law	National (I)	Binding	Italian Parliament	2002		https://www.normattiva.it/	Law no. 286 27/12/2002, modification of the Legislative Decree no. 245 04/11/2002, concerning urgent interventions in favour of populations affected by natural disasters in the Molise and Sicily regions, as well as further provisions on civil protection (in Italian).
Marche Region Law no. 32, 11/12/2001	Law	Regional	Binding	Regional Council	2001		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional Law no. 32,11/12/2001, B.U.R. n. 146 del 20/12/2001, (in Italian). This law defines the tasks of the civil protection offices at regional levels and the organisation of the civil protection authorities.
Marche Region Law no. 13, 03/04/2015	Law	Regional	Binding	Regional Council	2015		https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/	Regional Law no. 13, 03/04/2015, B.U.R. no. 33 del 16/04/2015, (in Italian). This regional law shows the organization of the administrative functions of the Provinces.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation /update)	Link (if available)	Summary of content
Council's deliberation no. 61, 22/12/2008		Local	Binding	Council of Camerino municipality	2008		https://www.comune.camerino.mc.it/documenti-cms/relazione-piano-di-protezione-civile/	Civil protection plan, approved by council's deliberation n. 61 of 22th Dec., 2008, according to Italian Law n. 225 of 24th Feb., 1992. The municipal civil protection plan defines the preliminary activities and tasks of the local civil protection office (COC) and the emergency reception areas.

11.3. Key documents governing climate adaptation (see Section 5)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Paris Agreement	Agreement	International	Binding	UNFCC	2015-2016		https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement	The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.
EU Directive 2018/844		European Community	Binding	European Parliament	2018		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0844	Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
EU Directive 2012/27		European Community	Binding	European Parliament	2012		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0027	Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance
EU Directive 2003/87		European Community	Binding	European Parliament	2003		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32003L0087	Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
COM/2018/738 Report on the implementation of the EU adaptation strategy	Report	European Community	No binding	European Commission	2018		https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a52018dc0738	Report from the commission to the European parliament and the council on the implementation of the EU strategy on adaptation to climate change. Impacts of weather and climate extremes

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
EU Climate Change Adaptation Strategy	Strategy	International (Europe)	Non-binding	European Commission	2013	Last evaluated in 2018. Update likely 2021.	https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1	Framework and mechanisms for improving the EU's preparedness for current and future climate impacts.
Evaluation of the EU strategy on adaptation to climate change	Report	European Community	Non-binding	European Commission	2018		https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1	This report examines the process and the results of the evaluation of the strategy COM/2018/738, including the lessons learned from its implementation.
SWD/2018/ 460 Adaptation preparedness scoreboard – Country Fiches	Report	European Community	Non-binding	European Commission	2018		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:460:FIN	Commission Staff Working Document/Adaptation preparedness scoreboard Country fiches/Accompanying the document Report from the Commission to the European Parliament and the Council on the implementation of the EU Strategy on adaptation to climate change

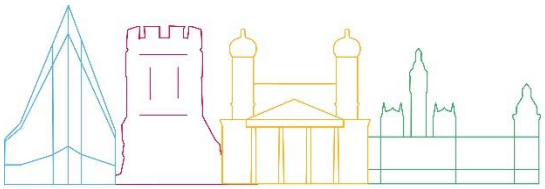
Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Legislative Decree no. 111/2019	Law	National	Binding	Italian Parliament	2019		https://www.gazzettaufficiale.it/eli/id/2019/10/14/19G00125/sg	This law is aimed primarily at adopting urgent measures for the definition of a national strategic policy to combat climate change and improve air quality. Urgent interventions are also introduced to resolve certain environmental infringement procedures
Legislative Decree no. 216/2006	Law	National	Binding	Ministry for the Environment	2006		https://www.minambiente.it/sites/default/files/archivio/allegati/emission_trading/Dlgs_216-06.pdf	National execution of he EU Directives 2003/87, 2004/101/CE and Kyoto Protocol on greenhouse emissions
National Adaptation Strategy	Strategy	National	No binding	Ministry for the Environment	2014		https://www.minambiente.it/notizie/strategia-nazionale-di-adattamento-ai-cambiamenti-climatici-0	The NAS provides a “State of the art on scientific knowledge of impacts vulnerabilities and adaptation of climate” that illustrate in a depth, for national territory, sectors which are affected on future impact of climate change

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
National Plan on adaptation to climate changes	Plan	National	Non- binding draft	Ministry for the Environment	2017		https://www.minambiente.it/sites/default/files/archivio_immagini/adattamenti_climatici/allegato_2_impatti_e_azioni.pdf	Report on the state of scientific knowledge on impacts, vulnerability and adaptation to climate change in Italy. Analysis of the EU and national legislation relevant to impacts, vulnerability and the 'adaptation to climate change. Elements for a National Strategy for Adaptation to Climate Change
PEAR 2020 Regional, environmental and energy plan	Plan	Regional	Non- binding	Marche Region	2016		https://www.regione.marche.it/Regione-Utile/Energia/Piano-Energetico-Ambientale-Regionale	The Regional Environmental Energy Plan (PEAR) identifies the planning and guidelines for environmental energy policy in the regional territory

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year published	Timeline for future evaluation/update	Link (if available)	Summary of content
Regional Plan for climate	Plan	Regional	Non- binding draft	Marche Region	2007		http://www.sinanet.isprambiente.it/gelso/banca-dati/regione/regione-marche/schema-di-piano-regionale-per-il-clima-della-regione-marche	The Plan intends to systemise and make climate change mitigation policies more effective
Forest fire emergency plan	Plan	Local	Binding	Municipality of Camerino	2018		https://www.comune.camerino.mc.it/documenti-cms/piano-incendi-boschivi/	Local law to protect the integrity of life, property, settlements and the environment from damages or from dangers deriving from natural disasters, catastrophes and other events

ARCH D3.3 City baseline report - Valencia

30 April 2020



Deliverable No.	D3.3
Work Package	WP3
Dissemination Level	PU
Author(s)	Lidia García, Gemma Roig, Emilio Servera (LNV) Saioa Zorita (Tecnalia)
Co-Author(s)	Eleanor Chapman (ICLEI) Daniel Lückerath, Kilian Nickel, Oliver Ulrich (Fraunhofer) Sonia Giovinazzi, Ludovica Giordano (ENEA)
Due date	2020-03-31
Actual submission date	2020-04-30
Status	For submission
Revision	1
Reviewed by (if applicable)	Anne-Kathrin Schäfer (DIN), Erich Rome (Fraunhofer), Iryna Novak (ICLEI)

This document has been prepared in the framework of the European project ARCH – Advancing Resilience of historic areas against Climate-related and other Hazards. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820999.

Contact

arch@iais.fraunhofer.de

www.savingculturalheritage.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

Table of Contents

1. City profile

This section profiles the city of Valencia in general terms, and introduces the local areas where the ARCH focus sites are located. Information is provided at a city-wide level, in terms of land use, population demographics and economy, followed by a closer look at the area(s) in the immediate vicinity of the focus sites.

The sites in focus for the ARCH project in Valencia city are the Huerta and the Albufera. Both sites are cultural landscapes, located in the metropolitan area of Valencia, and essential elements of its long agricultural history. They are also considered as two of its key landscape features, together with the Turia river and the Mediterranean Sea [1], and major components of the city green and blue infrastructure. As shown in Figure 1, the Huerta surrounds the city, while the Albufera is located to the South of it. Both areas stretch into neighbouring municipalities. The Huerta is an agricultural area (mainly covered by arable crops), whose size has decreased considerably over the last decades as a result of urban and infrastructure development. Its irrigation system is a heritage artefact from the Arab tradition, based on eight major irrigation ditches, distributed throughout the municipalities. Since its creation, seven of those irrigation diches have been governed by the Water Tribunal, an institution that regulates the use of the flows and has been declared Intangible Heritage of Humanity due to its unique character. While the Huerta and other northern agriculture sites are known for oranges, artichokes and tiger nuts, among other arable crops, the southern agricultural sites which extend into the Albufera Natural Park cultivate centuries-old local rice varieties. The Albufera is one of the most important wetland areas in Spain, designated as a protected area under several international, national and regional agreements, as it brings food and other benefits to both fishers and rice farmers and it has a high ecological value.

Figure 1. Key landscape elements in the Valencia metropolitan area [1].

1.1. Land use

The total area of the municipality of Valencia is 138.35 km^2 [2]. In 2019, this area included 30.01 km^2 of cropland, 6.67 km^2 of forest (mainly in the “Devesa del Saler“ public woodland, within the Albufera Natural Park), and 102.48 km^2 classified as “Other land“ [2]. Representing about 22% of the total area, cropland is particularly important for the people of Valencia since in the municipality it is located either in the Huerta or the Albufera historic areas, and it is considered a key part of its historical, cultural and natural heritage [1]. The area made up of forest is only a small fraction of the total area, but likewise important not only because of its environmental value, but also because it is highly appreciated by Valencian people as a landmark for recreation and outdoor activities.

Cultivated land in the Valencia municipality has experienced little variation in the Albufera area during the last decades. However, the Huerta area decreased dramatically in the second half of the last century, not only in Valencia but also in the neighbouring municipalities, due to urban and infrastructure expansion. It is estimated that around 62% of the Huerta area irrigated by the historic seven hydraulic systems under the Water Court (“Tribunal de las Aguas”) has been lost since the 1950-71 period [1], despite its agricultural and historical value. Since 2003 there have been no major reductions in cultivated land (as shown in Figure 2), apart from slight declines in 2014 and 2018 [3]. However, urban development is currently planned on agricultural land in the Benimaclet district (a former village that has been incorporated into the Valencia municipality, located north-east of the city centre), which has caused high levels of public controversy and even academic discussion [4].

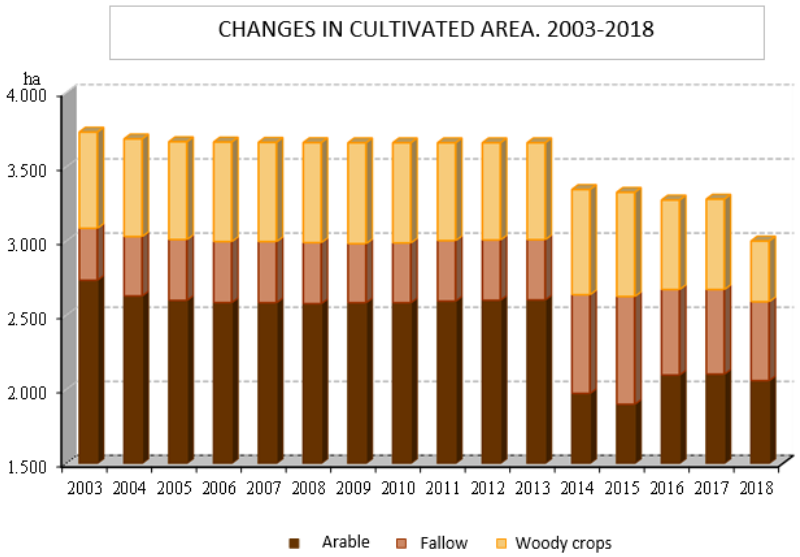


Figure 2. Valencia cultivated area. 2003-2018. Modified from [3].

1.2. Demographic features

1.2.1. Population density

Population density in Valencia is on average 8,055 inhabitants/km^2 [2]. The spatial distribution of the population in terms of place of residence is shown according to inhabitants per hectare in Figure 3 below.

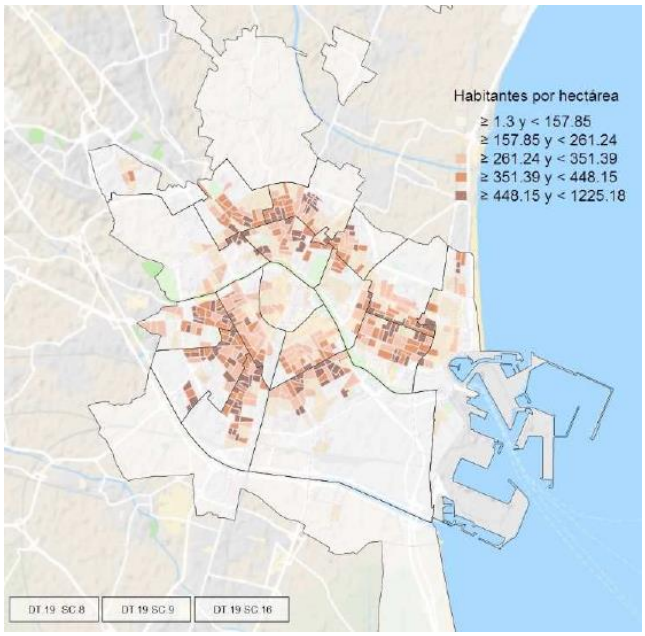


Figure 3. Population density in the city of Valencia [2].

1.2.2. Age and sex

Valencia has a population of 795,736 people (1/1/2019), with the majority female (417,305 females, 378,431 males) [2]. The evolution of the age demographic pyramid during the last century has changed radically as can be seen in Figure 4. The age pyramid has been reversed, as is the case in much of contemporary society. The majority of the population is aged 40-45 years old.

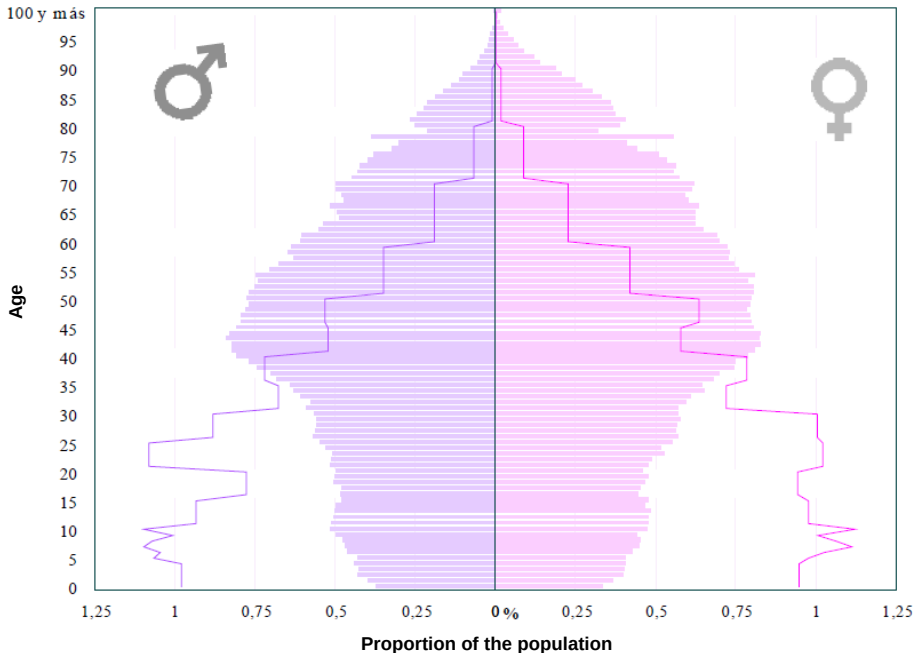


Figure 4. Population pyramid. Comparison 1900-2019 (1900: outline; 2019: solid) [2].

In the last seventy years the population has been growing overall in the city of Valencia, from half a million inhabitants to the current nearly 800,000 (see Figure 5 above).

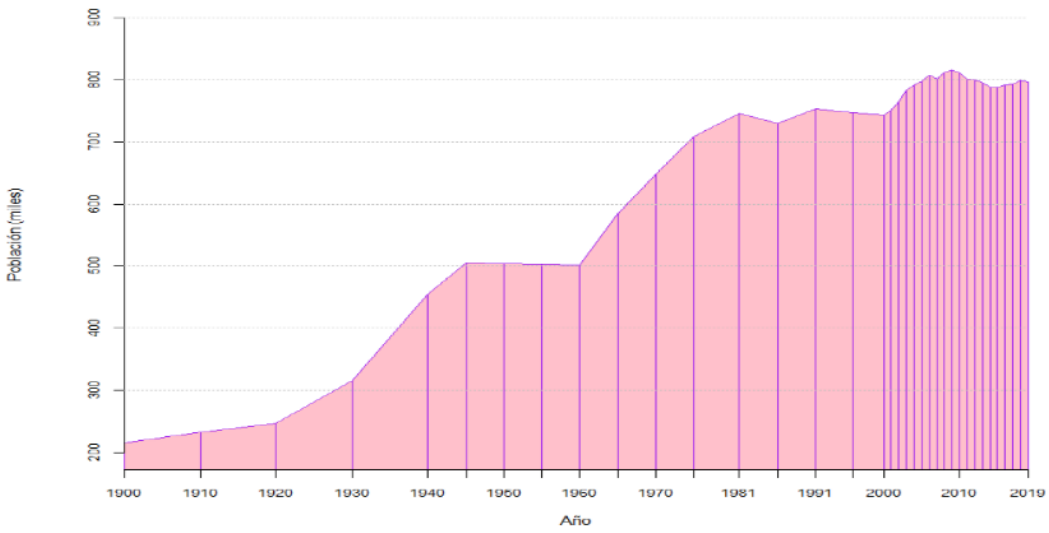


Figure 5. Census. 1900-2019 [2]

The population projection for the next years (2021, 2026 and 2031) by age and sex is shown in Figure 6. The portion of the population dependent on pensions is projected to increase, i.e. an increase of people no longer participating in the workforce (simultaneously reducing the city's economic growth potential), who will at the same time likely need care and special services. Since elderly people are likely to be vulnerable to the impacts of climate change, such as the effects of a heatwave, this projected demographic change is particularly relevant to the City's efforts to adapt to climate change.

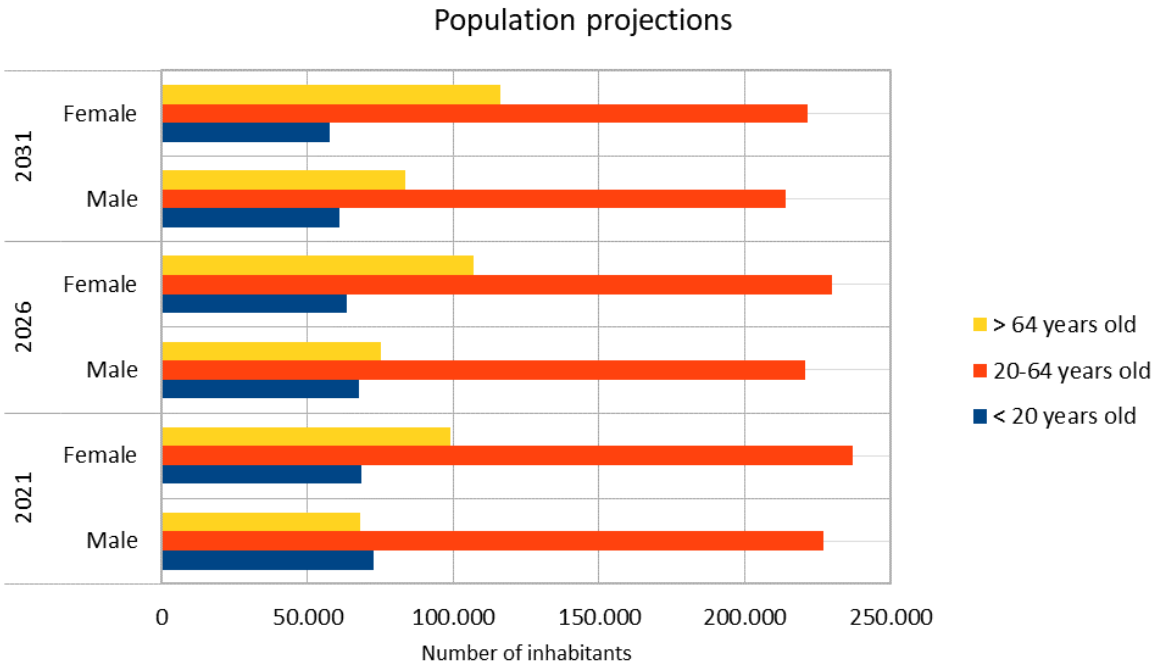


Figure 6. Population forecasts by sex and age in the city of Valencia. (Own elaboration from [3]).

The 2019 age distribution in the city of Valencia is shown in Figure 7 below, where percentages are always stated in relation to the total population size (795,736 inhabitants). Within the specified ranges, most of the population lies within the 45-64 interval. Males are in the majority within the 0-24 range, while females are more predominant at every other interval. The difference between genders is highest (2.75%) in the 65-84 range, i.e. there are over 21,000 more elderly women than men.

Age range	Total	Male	Female
0-5	4.85%	2.49%	2.35%
6-17	11.47%	5.88%	5.60%
18-24	7.02%	3.56%	3.46%
25-34	11.65%	5.76%	5.89%
35-44	15.31%	7.65%	7.66%
45-64	28.86%	13.78%	15.08%
65-84	17.62%	7.44%	10.18%
85+	3.22%	0.99%	2.23%

Figure 7. Valencia age distribution. 2019. Modified from [3].

The life expectancy (2015-2018 data) in Valencia is, as usual, higher for females (86.3) than for males (80.5) [2].

1.2.3. Population growth

Population change in the city of Valencia in recent years is summarised in Figure 8 and Figure 9 below. In the last 14 years, natural growth has decreased and even became negative since around 2013 [3] (-1,147 in 2018). No clear trend in net migration can be seen in Figure 9 for the period analysed, although net migration has increased from 2004 (from 10,538 up to 12,923 in 2018) [3] [5]. Total population change has been affected by these previous trends, alternating rises and falls, above and below the zero line. The last data available (2018) show a net population decrease (-2,763), taking into account not only natural change and net migration, but also other movements.

Population change (2018)	
Births	5,789
Deaths	6,936
Immigrants	40,231
Emigrants	27,308

Figure 8. Population change in the city of Valencia (2018). Modified from [2].

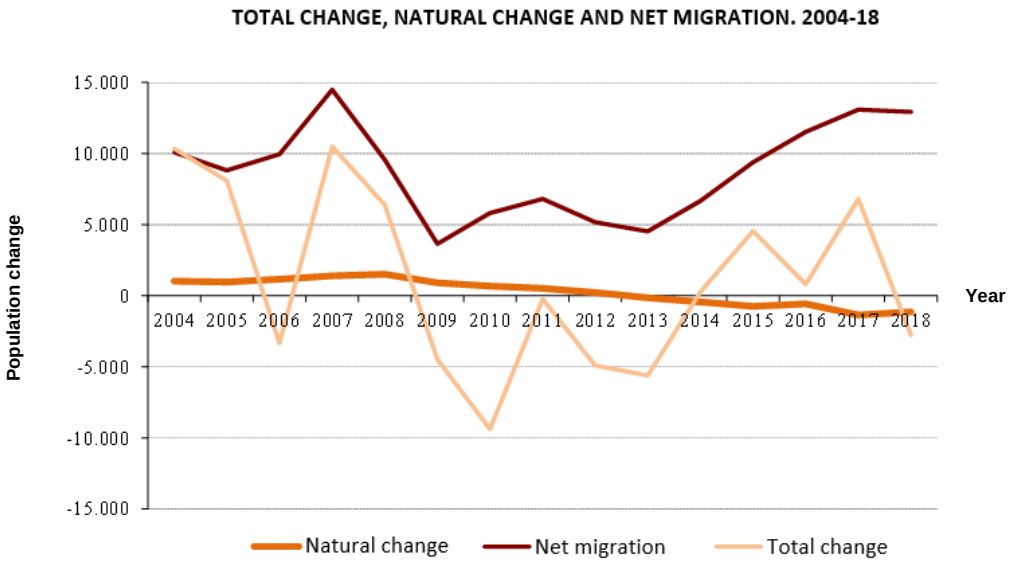


Figure 9. Population change in the city of Valencia (2004-2018). Modified from [3].

1.2.4. Vulnerable groups

Valencia uses the AROPE (at risk of poverty or exclusion) index to measure the risk of poverty and/or social exclusion, based on the sum of persons "either at risk of poverty, or severely materially deprived or living in a household with a very low work intensity" [6]. According to this measure, 29.8% of the population were at risk. This figure is higher than the average AROPE index calculated in the same year (2018) for both the whole Valencia province (26%) and the Valencia region (27.6%) [3], as well as higher than the national results for Spain (26.1%) [7]. Risk was higher within the male population (30%) than within the female population (29%), while 34.5% of the population under 16 was also found to be at risk [3].

Aside from use of the AROPE index, there is not a single valid definition of "vulnerable population groups" in the city of Valencia. On the contrary, several criteria are applied, such as those mentioned below, depending on the objective of the analysis or the organisation involved.

For instance, the Social Welfare Department of the city considers the following as priority beneficiary groups for their social intervention programs [8]:

- Immigrants, refugees and asylum seekers
- Homeless people or those suffering poor housing conditions
- Minor ethnic groups
- Prisoners and former prisoners
- People under addiction treatment
- Unemployed people
- Old people

- Women
- Infants, young people and families
- Young people with integration problems
- People with disabilities and dependent
- People with chronic and/or long-term diseases
- Other vulnerable groups and communities

In terms of vulnerability to climate impacts, the only vulnerable groups officially identified in Valencia found are those vulnerable to heat. At a regional level, an annual prevention and care programme (designed to prevent, minimise and otherwise address health problems related to extreme temperatures in the Comunitat Valenciana) was established in 2004 by the Regional Department of Universal Healthcare and Public Health. This programme is active between June and October every year [9]. While the programme is active, forecast temperatures for each area in the region are made available via web, together with advice, recommendations, and other information aimed to minimise the impacts on people from extreme heat.

The last programme, from 2019 [10], identified older people as the most sensitive group. Several other risk factors during a heatwave were also identified within four main groups: personal, local, environmental risk factors, and those concerning existing health problems. Some examples of those risk factors which define vulnerability to a heatwave from the programme perspective are shown in Figure 10.

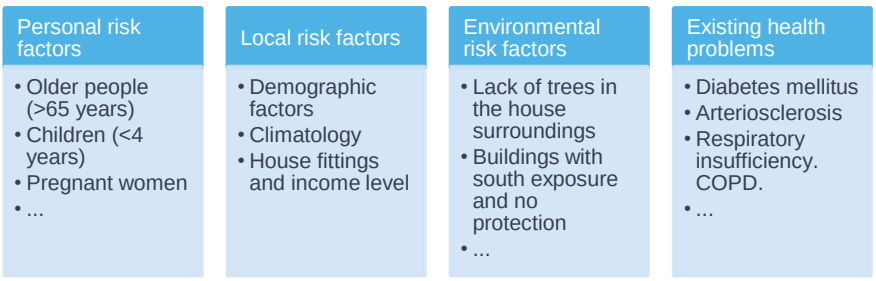


Figure 10. Main risk factors during a heatwave (excerpt) [10].

Several vulnerability maps have been developed and/or related analysis undertaken in Valencia. There are too many and, in some cases, they are also too extensive, to be added as annexes to this document. However, an overview is provided below, and the full references are freely available to download. Additional documents are provided by the city's Statistical Office [11] and Social Welfare Department [12], among others.

The main vulnerability mapping and analysis was released in 2018 based on data from 2016 [13], and is intended to be updated every three years. It includes not only a comprehensive report, but also the statistical data on which it is based, available as a spreadsheet file. Vulnerability was analysed and mapped based on several indicators, which are grouped on

three main topics, each one of them made up of several sub-sections: access to public facilities (including health, transport, education, population at risk and others), demographics (including population density, population increase, dependent population, population from outside the EU, population aged 65 or over living alone, population aged 80 or over and population under 18) and socio-economics (including educational level, cars, housing and economic status). This analysis was performed at census section level. A Global Vulnerability Index was also defined in order to summarise in a single Index the results from the sectoral indicators considered for each topic and sub-section. Figure 11 summarises the results of the Global Vulnerability Index aggregated at district level, and indicates the number and percentage of census sections and people living within them, which were identified as "Vulnerable"[1] or "Potentially vulnerable"[2].

			Vulnerable			Potentially Vulnerable		
District	Population	# of census sections	# of census sections	Population	% Population	# of census sections	Population	% Population
València	**787.266**	**599**	**60**	**71.137**	**9,0**	**60**	**71.530**	**9,1**
1. Ciutat Vella	26.472	25	0	-	-	0	-	-
2. l'Eixample	42.180	42	0	-	-	0	-	-
3. Extramurs	48.208	39	0	-	-	0	-	-
4. Campanar	37.084	27	3	3.919	10,6	1	877	2,4
5. la Saïdia	46.718	36	3	3.340	7,1	4	4.447	9,5
6. el Pla del Real	30.124	25	1	902	3,0	0	-	-
7. l'Olivereta	48.105	36	7	8.543	17,8	4	4.560	9,5
8. Patraix	57.356	41	0	-	-	2	1.758	3,1
9. Jesús	51.943	38	3	4.143	8,0	5	5.939	11,4
10. Quatre Carreres	73.067	51	2	2.767	3,8	7	8.612	11,8
11. Poblats Marítims	57.710	46	14	15.324	26,6	8	9.376	16,2
12. Camins al Grau	64.536	43	1	1.163	1,8	9	10.605	16,4
13. Algirós	37.210	28	1	1.284	3,5	1	910	2,4
14. Benimaclet	28.868	22	0	-	-	0	-	-
15. Rascanya	52.210	39	9	10.269	19,7	10	12.440	23,8
16. Benicalap	44.931	31	10	12.465	27,7	4	6.285	14,0
17. Pobles del Nord	6.478	5	2	1.545	23,8	1	1.419	21,9
18. Pobles de l'Oest	13.969	10	2	3.162	22,6	2	2.139	15,3
19. Pobles del Sud	20.097	15	2	2.311	11,5	2	2.163	10,8

Figure 11. Global Vulnerability Index. Modified from [13].

The location of every district in Valencia city is shown in Figure 12. Of particular relevance to this current report are the districts where the ARCH focus sites are situated, which will be introduced later in Chapter 6. These districts are District no 19 "Pobles del Sud" (where the

[1] A census section (and therefore, the population living within) was considered "Vulnerable" if its Global Vulnerability Index was equal to or less than the 10th percentile.

[2] A census section (and therefore, the population living within) was considered "Potentially Vulnerable" if its Global Vulnerability Index lay within the 10th to 20th percentile range.

Albufera estuary is located) as well as. Districts no. 17 “Pobles del Nord”, 4 “Campanar”, 10 “Quatre Carreres”, 19 “Pobles del Sud”, 15 “Rascanya”, 14 “Benimaclet” and 13 “Algirós” (where parts of the Huerta are located). See Figure 12 below for the full extent of the Huerta.

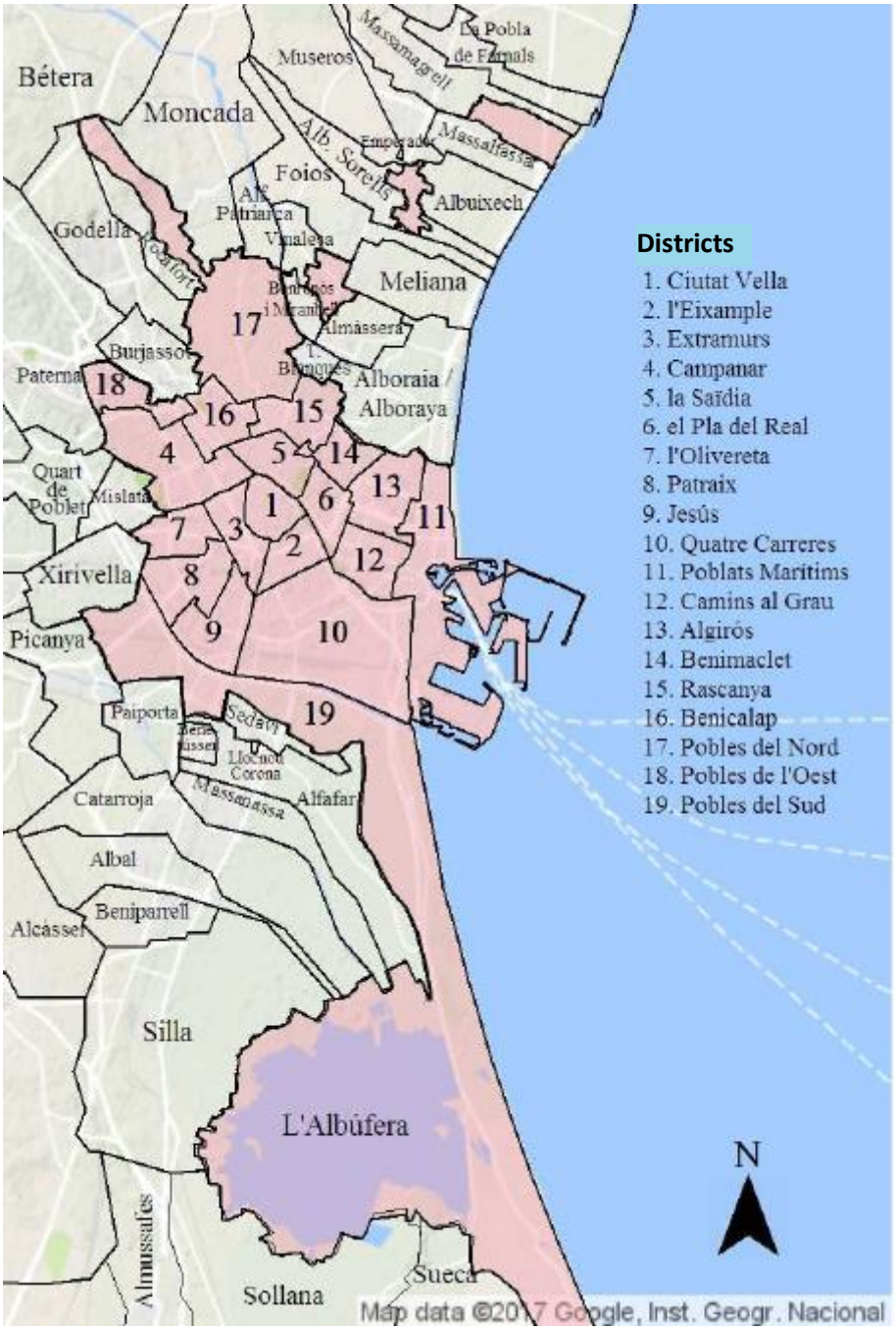


Figure 12. Valencia districts. Modified from [2].

Figure 13. Valencia green areas. Modified from [2].

Detailed analyses are also made available every year for some of the city neighbourhoods or districts [14], including some of the areas mentioned above, such as the Pobles del Sud [15] and Pobles del Nord [16] districts. A 2017 report prepared by the municipality [17] also spatially analysed vulnerability in the city, in the context of the recent economic crisis. In that case, the analysis was based on the social services structure of the city, and vulnerability indicators were disaggregated for each of the eleven municipal social services departments (each of whom provides services to certain neighbourhoods). For instance, Figure 14 shows the rate of households in risk of poverty and/or social exclusion per municipal social services department, according to the AROPE index previously described.

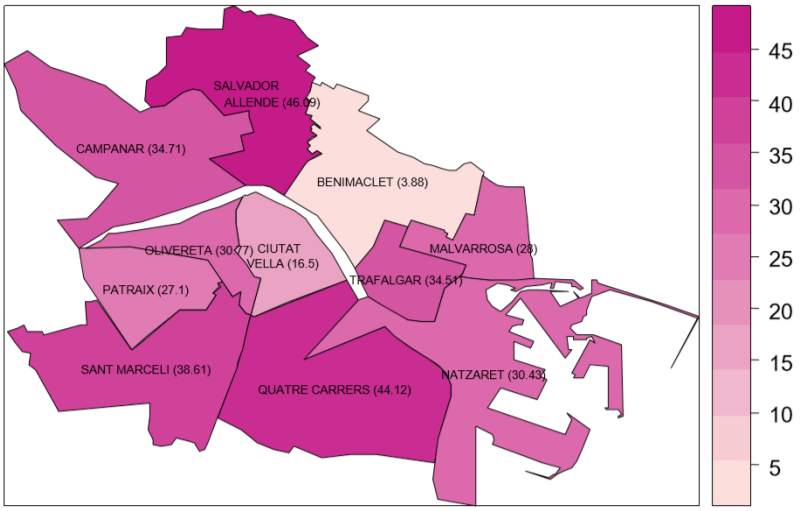


Figure 14. Arope Index (2017) per Valencia municipal social services department [17].

1.3. Economic features

Gross Value Added per capita in Valencia city in 2017 was 24,090.69 € [2]. Average economic growth rate was 2.3-2.4% (2019). See Figure 15 for recent trends at regional level.

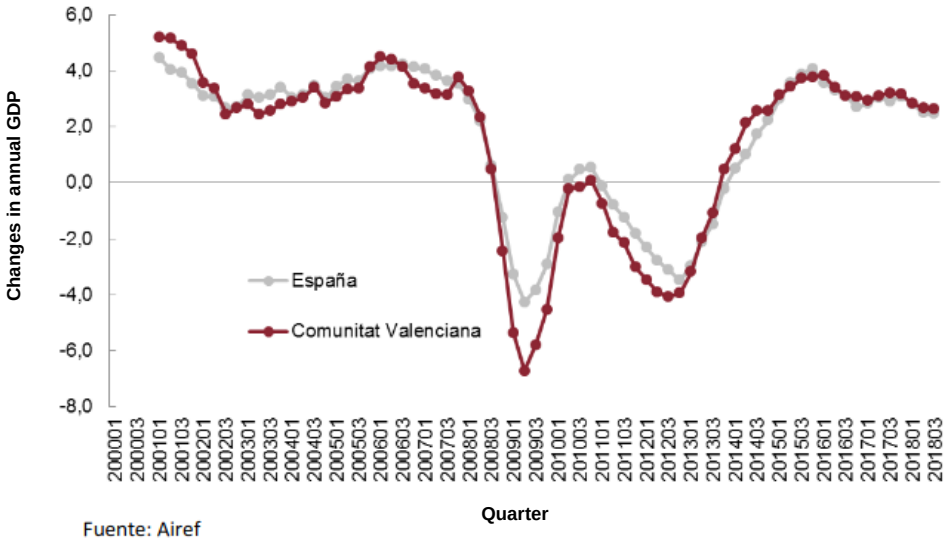


Figure 15. Evolution of the annual GDP (Gross Domestic Product) growth rate by quarter. Source: Comunidad Valenciana (regional government) [18].

The most important economic sector in Valencia city is “Trade and Services”, according to available data shown in Figure 16 [3], based on data from the economic activities tax. The next sector in terms of importance would be “Professional”, followed by “Construction”, “Industrial”, “Artistic” and, finally, “Livestock”.

	Total	Livestock	Industrial	Construction	Trade and Services	Professional	Artistic
2019	128,562	39	4,330	8,586	85,857	28,828	922
%	100.0	0.0	3.4	6.7	66.8	22.4	0.7

Figure 16. Economic activities by economic activities tax (2019) [3].

The city of Valencia is fundamentally a service area whose influence reaches far beyond the limits of its municipal district. The population currently employed in the services sector accounts for 83% of the total, with a large proportion of final demand activities (i.e. goods or services for consumption, public or private investment, or for export), retail and wholesale trade, specialised services for companies and professional activities.

Nevertheless, the city also maintains an important industrial base, with an employed population of 11%, made up of small and medium-sized companies, among which the paper and graphic arts, wood and furniture, metal products, and the footwear and clothing sectors stand out.

The city's dynamism as an economic centre and reference point for many economic activities is reflected in the strength of key institutions for economic development such as Feria Valencia, the Autonomous Port, the Stock Exchange, the Conference Centre and its universities.

Valencia also has cultural institutions that are increasingly important in its development: the Palau de les Arts, the IVAM, the Palau de la Música or the City of Arts and Sciences bring undeniable added value to the city and its metropolitan environment as a cultural and leisure centre.

Agricultural activities are of relatively minor importance in terms of employment (see Figure 17), however agricultural land accounts for a relatively large share of land use: total of 3,348 hectares, about one fifth of the total area of the municipality, mostly made up of horticultural crops. Agriculture is also important for the city in terms of cultural heritage, due for instance to the existence of the "Tribunal de las Aguas de la Vega de Valencia" ("Water Court of the Plain of Valencia"), considered the oldest European existing justice institution, which was recognised as Intangible Cultural Heritage by UNESCO in 2009 [19]. The "Paella", a rice dish, is the most traditional and typical dish in Valencia, with great cultural importance. Traditionally, it is made from rice grown in the Albufera Natural Park. It is also traditional to eat it on the weekends, often in one of the many restaurants in the Huerta surrounding Valencia or the Albufera. Agro-tourism activities are also increasingly important, with new companies offering several tours and other agro-food tourism activities in the Huerta [20]. Ornithological tourism is also developing, and the Albufera Natural Park, including its agricultural zones, is one of the best areas around Valencia for birdwatching [21]. Therefore, the influence of the agriculture sector on the services sector in the city of Valencia must also be acknowledged and appreciated.

	Annual average	1st quarter	2nd quarter	3rd quarter	4th quarter
Total	**276K**	**268,1**	**276.3K**	**278.6K**	**280.9K**
Agriculture	2.2K	1.8K	1.8K	1.9K	3.2K
Industry	33.8K	31.1K	33.6K	37.6K	32.9K
Building industry	11.1K	11.2K	12.6K	10.9K	9.6K
Services	228.9K	224.0K	228.3K	228.2K	235.2K

Figure 17. Number of gainfully employees by economic sector (2018) [3].

The average unemployment rate in Valencia city during 2018 was 14.5% (based on [3]), slightly lower than the national average during the same period (15.25%) [22]. The monthly evolution of the unemployment rate during that year is shown in Figure 18. The highest unemployment was recorded in January, while the lowest rate corresponds to June data.

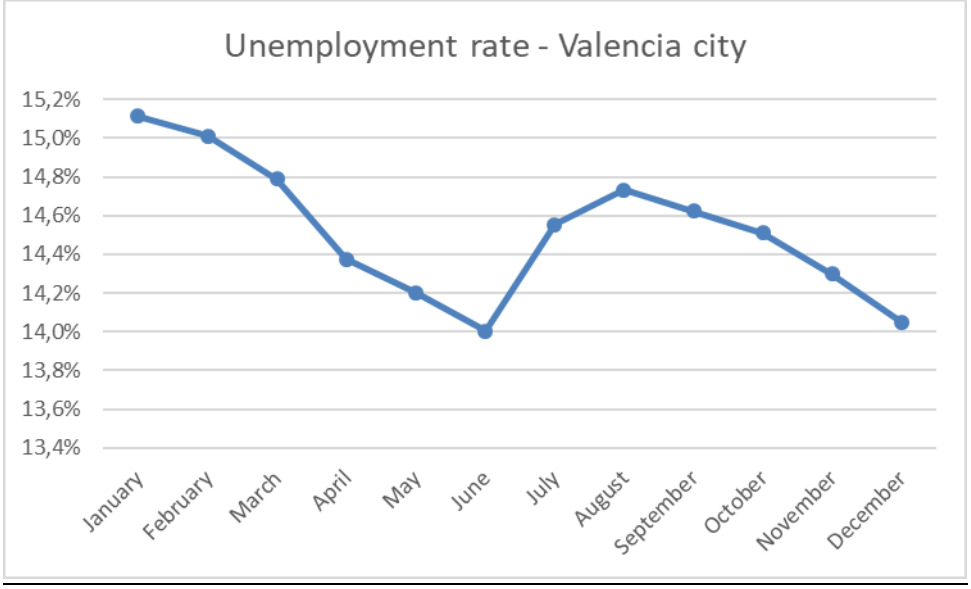


Figure 18. Unemployment rate. 2018. Based on data from [3].

The youth unemployment rate in Valencia city was 20.8% in the fourth quarter of 2018 (slightly higher for young women at 22.0%, compared to 20.0% for young men) [23].

1.4. Around the focus sites: the Huerta and the Albufera

1.4.1. Overview

While the Huerta is originally an agricultural landscape (mainly dominated by arable and woody crops), the Albufera Natural Park combines agricultural areas (mainly rice paddies) with large

areas with natural character, such as the Albufera lagoon, or the “Devesa del Saler” forest and other highly valuable ecosystems located in the sandbar between the lagoon and the sea. Some Huerta areas in the southern part of the municipality are also located within the Albufera Natural Park boundaries, and were classified in a particular category (“Espacios de Valor Natural”, Areas of Natural Value) within the Huerta Land Use Plan [1]. The overlapping area between both sites is shown in Figure 19.

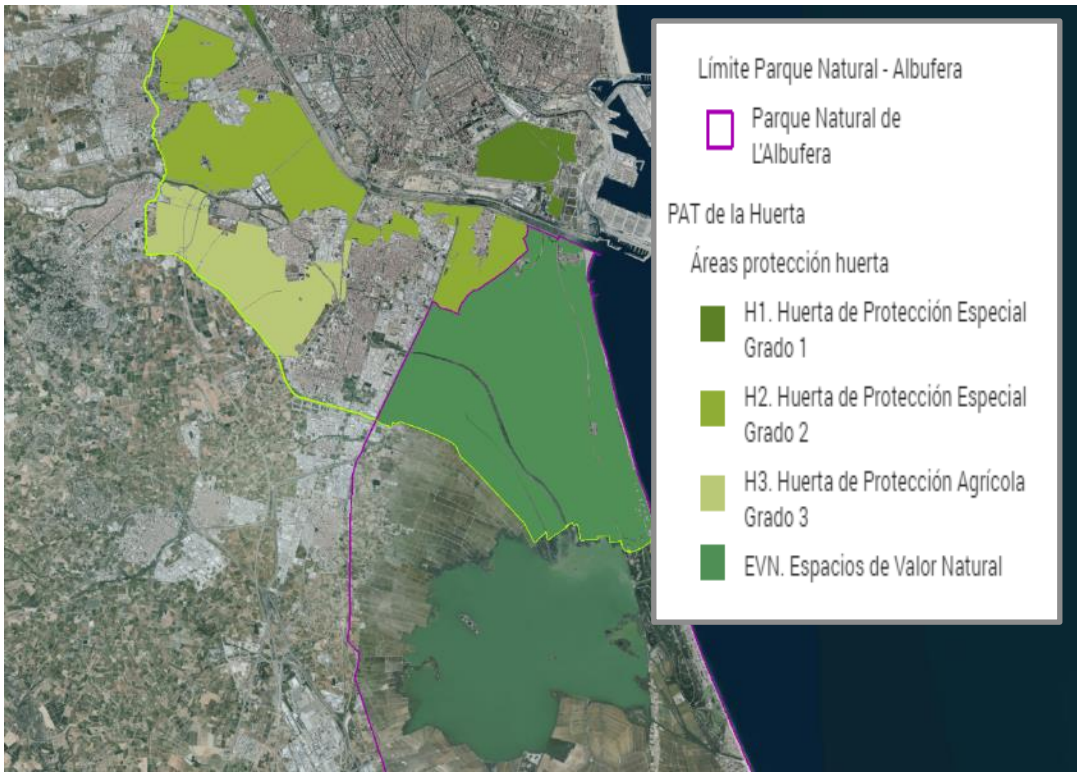


Figure 19. Areas of Natural Value (“EVN. Espacios de Valor Natural”), in the overlapping area within both Huerta (“Áreas protección huerta”)(outlined in green) and Albufera (“Límite Parque Natural-Albufera”)(outlined in purple) protected sites [24].

1.4.2. Employment

The districts adjacent to the Huerta and Albufera have been identified in previous sections (see part 5.2.3 above). These are peripheral districts of the city of Valencia with a socio-economic rank lower than the average of the city. These neighbourhoods occupy land that was previously farmland, meaning many older people are still engaged in agricultural employment and activities, while young people are more disconnected [25]. Initiatives are emerging that try to reverse this loss of connection with traditional agricultural livelihoods, such as farmers and local markets, or direct sales from producers to neighbours. As seen in Figure 12 and Figure 13, the “Pobles del Sud” district includes some Huerta areas, as well as the Albufera Natural Park sections that belong to the Valencia municipality, including the own Lagoon.

1.4.3. Vulnerable groups

There are vulnerable groups living within the vicinity of the Huerta and Albufera areas, as described in previous sections and references (see Figure 11 and subsequent comments for

some estimates of the number of vulnerable and potentially vulnerable people living in the districts adjacent to Huerta and Albufera). More detail on the prevalence per district of the main causes of vulnerability and potential vulnerability previously identified (access to public facilities, demographics and socio-economics) can be found in [13].

As will be mentioned in Chapter 6, both the Huerta and the Albufera are large and complex, and therefore smaller pilot areas could be established within them for the project purposes. In that case, additional, more detailed information regarding vulnerable groups in such areas could be extracted from the already identified sources or additional ones. For instance, it has already been mentioned that the "Pobles del Sud" district includes areas within both the Huerta and the Albufera. In addition to the previously identified sources of information, detailed vulnerability data could also be found if needed in the "Pobles del Sud" district analysis [26], which includes a thorough review on vulnerability, energy poverty or poverty, among other issues. Some of this information is extracted from the previously mentioned references. As an example of the available information, Figure 20 shows the total and relative vulnerable population in each of the population nuclei in the Pobles del Sud district.

Pobles del Sud	Population (2016)	Total Vulnerable Population (2016)	% Vulnerable Population (2016)
PINEDO	2.607	0	0,00%
EL SALER	1.704	0	0,00%
EL PALMAR	769	0	0,00%
EL PERELLONET	1.430	0	0,00%
EL FORN D'ALCEDO	1.215	1.207	99,30%
EL CASTELLAR-EL OLIVERAL	6.881	703	10,20%
LA TORRE	4.643	2.473	53,30%
FAITANAR	979	979	100,00%
Total CMSS	20.228	5.362	26,51%

Figure 20. Vulnerability per population nucleus in the "Pobles del Sud" district. Modified from [26].

Following is a detail of additional available spatial information regarding the Benicalap district, one of the Huerta neighbouring districts previously mentioned. Its vulnerable and potentially vulnerable census sections are described and mapped in [13], as seen in Figure 21.

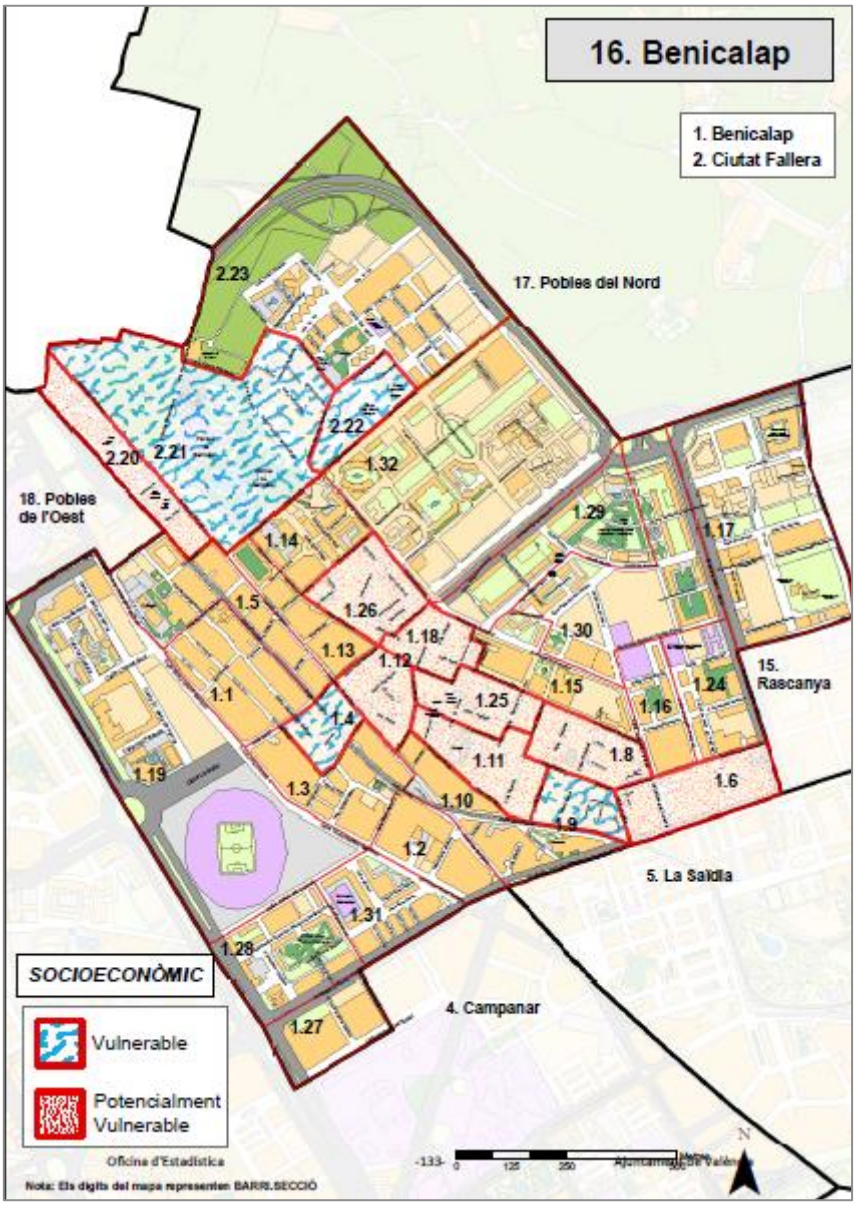


Figure 21. Socio-economic vulnerability mapping – Benicalap (*Huerta areas shown in green, in the census section coded 2.23*) [13].

Additional data, for instance regarding the aging index or the dependence index, are also available at neighbourhood level in [17]. See Figure 22 and Figure 23 for some examples of the information available in relation to Benicalap and other nearby neighbourhoods which are also close to the northern part of the Huerta, and which are all dependent on the Campanar Social Services Department.

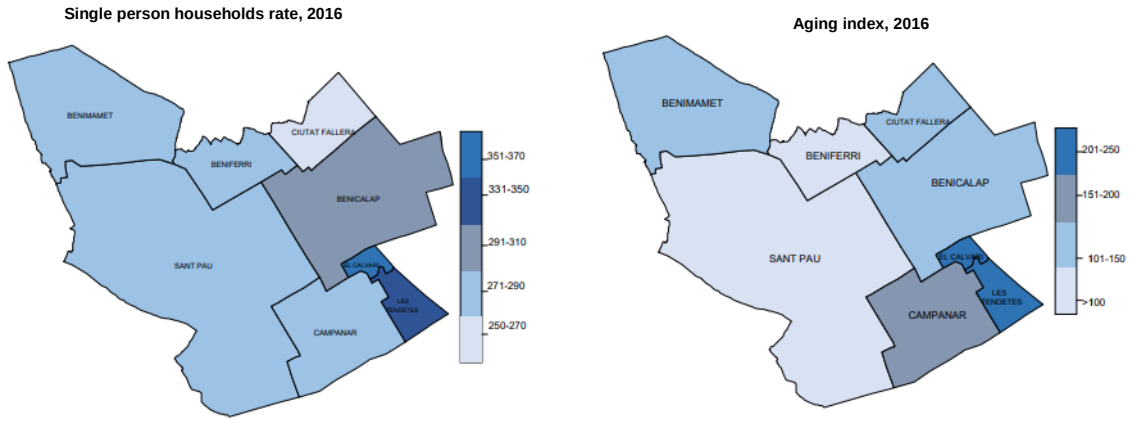


Figure 22. Single person households rate (left) and aging index (right) at neighbourhood level. 2016 data from the Campanar Social Services Department. Modified from [17].

	Female rate*	Male rate**	Aging Index	Dependency ratio	Single person households rate
Campanar	115,9	86,3	183,3	55,0	285,5
les Tendetes	113,5	88,1	228,4	53,2	339,6
el Calvari	108,0	92,6	216,4	58,8	363,2
Sant Pau	104,9	95,4	53,2	54,6	273,5
Benicalap	106,3	94,1	102,7	50,9	296,0
Ciutat Fallera	102,1	97,9	122,3	50,9	259,1
Benimàmet	105,3	95,0	106,4	52,0	284,3
Beniferri	101,5	98,6	60,4	38,8	271,7
Total CMSS	107,2	93,3	108,1	52,5	293,5
Ciudad de València	109,0	91,5	136,2	53,4	324,7

Figure 23. Neighbourhood level data from the Campanar Social Services Department [17] (*Female rate is defined as the number of females per 100 males at 1 January of year t; **Male rate is defined as the number of males per 100 females at 1 January of year t).

1.5. Overview of existing local framework for disaster risk reduction, climate adaptation and cultural heritage management

The boxes ticked below provides a preliminary overview of the local policy framework in regard to disaster risk reduction, climate adaptation and cultural heritage management (specifically, which information has already been mapped), which will be expanded on in Chapters 3, 4 and 5.

☐ *Emergency response procedures and responsibilities in the city*

☒ *Existing adaptation measures, strategies and key legislation in the city*

☐ *Existing cultural heritage protection measures, strategies and key legislation in the city*

☐ *Existing databases on climate risk information for the city*

☐ *Decision-making structures in the city regarding adaptation*

☐ *Decision-making structures in the city regarding cultural heritage protection*

☒ *Inventory of heritage assets and their condition*

2. Target cultural heritage landscapes identified for ARCH

The information below concerns the Huerta and Albufera at a general level. In discussion with stakeholders, the focus may still be refined in future to focus on selected districts, zones or ecosystems, due to the complexity and size of both cultural heritage landscapes.

2.1. La Huerta de València

2.1.1. Overview

The “Huerta” has been defined by Meeus as one of 30 main European landscapes, consisting of “Irrigated*, fertile valleys on Mediterranean coast*”, characterised by the presence of intensive horticulture and permanent crops such as fruit trees [27]. The “Huerta de València” is one of the last six landscapes of such type remaining in Europe (see Figure 24).

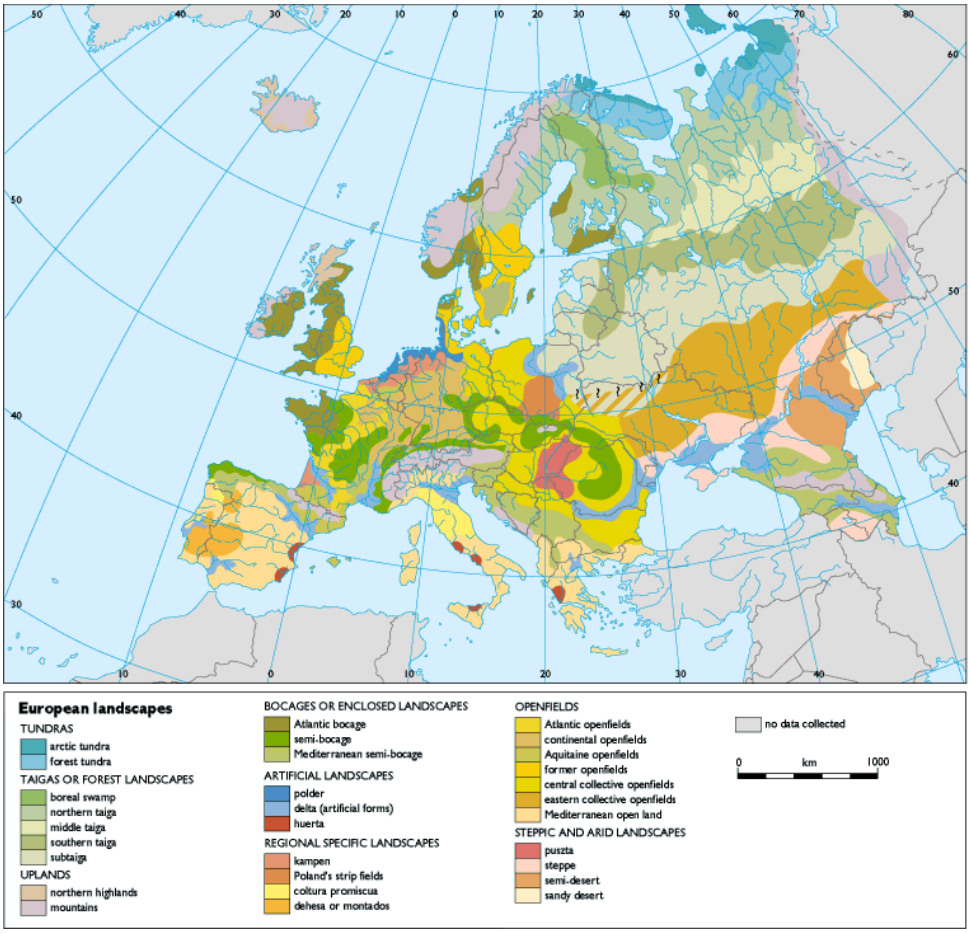


Figure 24. European landscapes [27].

The term “Huerta” is a specific, definable and recognisable historical concept that corresponds to an irrigation model created in medieval times. In this way, the Huerta de València is the territory delimited by the maximum perimeters of the irrigation ditches of medieval Islamic origin that captured the water in the district of València. That is, the seven hydraulic systems that

have formed part of the Water Court (“Tribunal de las Aguas”) for centuries, plus the Royal Acequia of Moncada.

The planning, establishment and development of the space of the Huerta was marked by three fundamental spatial elements:

- The network of irrigation ditches (“acequias”).
- The location of settlements: protected rural areas and goods.
- The road network.

The Huerta area is extremely large, well beyond the municipal boundaries of València city. The part of the Huerta within the “detailed” planning area alone (in dark green in Figure 25) has been estimated at nearly 11,393 ha [1] spans a total of 40 municipalities, of which València is only one, alone with: Albuixech, Aldaia, Alfafar, Alfara del Patriarca, Almàssera, Benetússer, Bonrepòs i Mirambell, Burjassot, Catarroja, Emperador, Foios, Godella, Lugar Nuevo de la Corona, Manises, Massalfassar, Massamagrell, Massanassa, Meliana, Mislata, Moncada, Museros, Paiporta, Paterna, Picanya, La Pobla de Farnals, Puçol, El Puig, Quart de Poblet, Rafelbunyol, Rocafort, Sedaví, Tavernes Blanques, Torrent, Vinalesa and Xirivella. The “extended planning area” (also shown in Figure 25 in lighter green), considered in the same land use plan, covers the whole of “L’Horta” county, including, for historical reasons, four additional municipalities (Albal, Alcàsser, Beniparrell and Picassent), where the Huerta can in fact no longer be found, at least according to the criteria considered in regional regulations [1] [28].

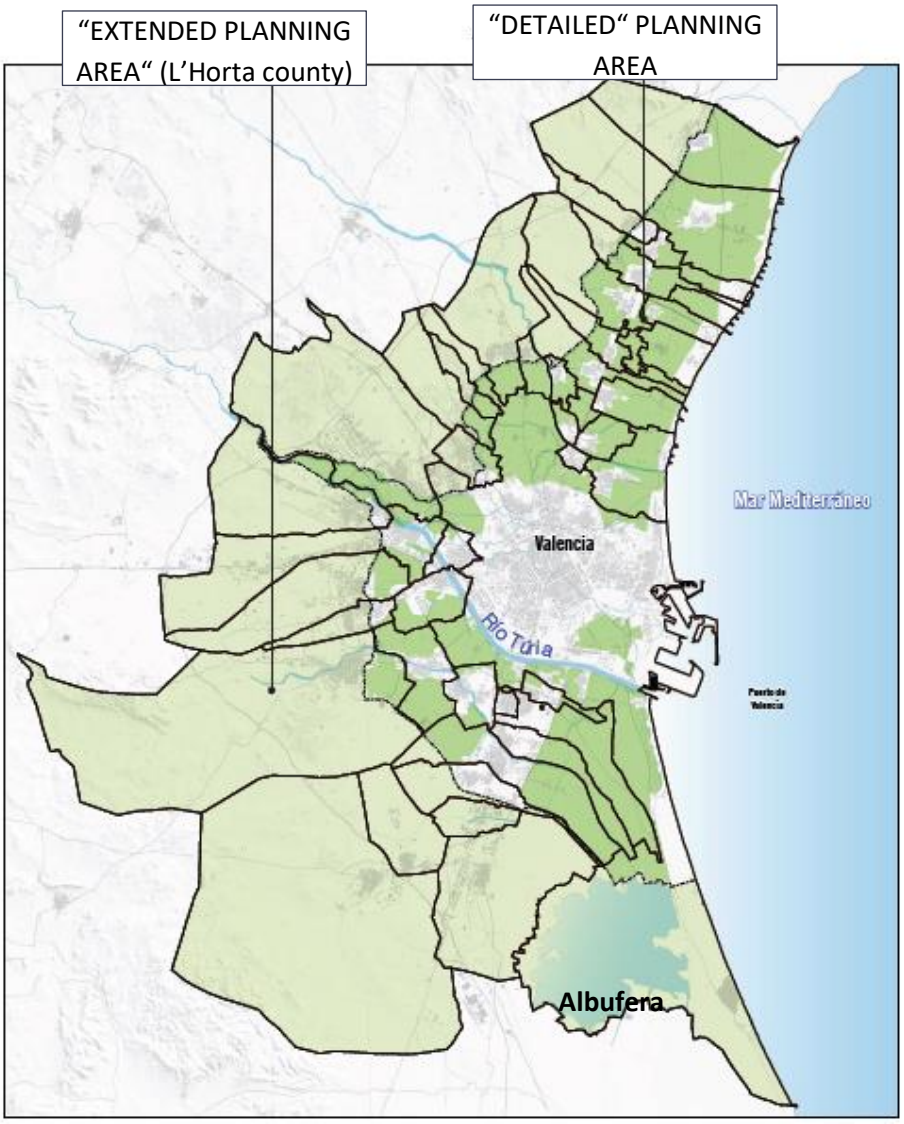


Figure 25. Planning Areas. Huerta de València Regional Plan (municipal boundaries shown in black). Modified from [1].

The Huerta de València is considered "*historic, cultural, natural and agricultural heritage of the Valencian people*" [1]. Relevant international cultural heritage designations are listed in section 3.1. Its social and public functions are recognised by regional law (Article 4, Law 5/2018 [28]: "*The agricultural activity and the natural, cultural and landscape heritage of the Huerta de València fulfils a relevant* social *function, since it favours the development of the agricultural sector, food sovereignty, human welfare, sustainable development and climate change mitigation*". However, other functions, such as its potential role regarding the adaptation of the city of València to climate change, have not yet been fully assessed.

In November 2019, the historical irrigation system and its "Horta" have been recognised on the register of Globally Important Agricultural Heritage Systems (GIAHS), managed by the UN Food and Agriculture Organization (FAO). According to the FAO's Yoshihide Endo who coordinates the GIAHS programme:

> *"The Horta of Valencia is invaluable. Half of the crops grown here are at risk of disappearing in the region. It provides for both farmers and fishers. Its citrus fruits have a Geographical Indication (GI) label due to their high quality and variety. The site is also home to a wide range of birds, fish and plants, many classified as rare, endemic or endangered,"*[3]

2.1.2. Stakeholders

The map of actors involved in managing, planning for and working within the Huerta is very diverse, but of particular importance is the role of the newly-created **Consell de l'Horta** (kick-off in February 2020) thanks to the recently-established Law of the Huerta in 2018. The Council's objective [28] is:

> *"to guarantee the survival and promote the revitalisation of agricultural activities in the Huerta, promoting an agriculture that is more respectful of the environment as well as the possibility of allowing complementary uses and activities compatible with agricultural activities, as well as encouraging citizen participation in the taking of decisions that affect the Huerta, food sovereignty, the reconnection between the countryside and the city, and promoting a local agri-food system"*
>
> *(art. 39 of the Law of the Huerta de València).*

At the time of writing, the Council is made up of members from the Agriculture Department (regional government), the Provincial Government of Valencia and the Municipality of València. The rest of the municipalities that form part of the Huerta area will join later.

There are also other public actors involved in the management of the Huerta. The current structure of the municipal government [29] includes the following areas relevant to the ARCH project:

- "Urban Ecology, Climate Emergency and Energy Transition",
- "Education, Culture and Sports" (which holds, among others, local competencies on cultural heritage and resources) and
- "Innovative Development of Economic Sectors and Employment" (which holds, among others, local competencies on agriculture, sustainable food and Huerta).

Three departments of the regional government are also relevant:

[3] for further information: http://www.fao.org/news/story/en/item/1252906/icode/

- “Agriculture, Rural Development, Climate Emergency and Ecological Transition”,
- “Territorial Policy, Public Works and Mobility” and
- “Education, Culture and Sport”.

The private sector is very important to the Huerta, especially farmers cultivating agricultural land there, such as the SME Terra I Xufa. Other relevant private companies include agritourism company Horta Viva and startup Green Urban Data which develops software to promote the use of remote sensing and other open data for climate change adaptation..

In terms of civil society, social movements have had a long tradition of protecting and supporting the territory in the Huerta, such as Per L'Horta, CERAI and the Assut Foundation. Universities and agricultural research centres are also present in the territory. In the figure below you can see a map of actors according to influence and interest, undertaken by the authors (for more detail on the stakeholder mapping exercise, see forthcoming ARCH report *D3.2 Local partnership and work plan*).

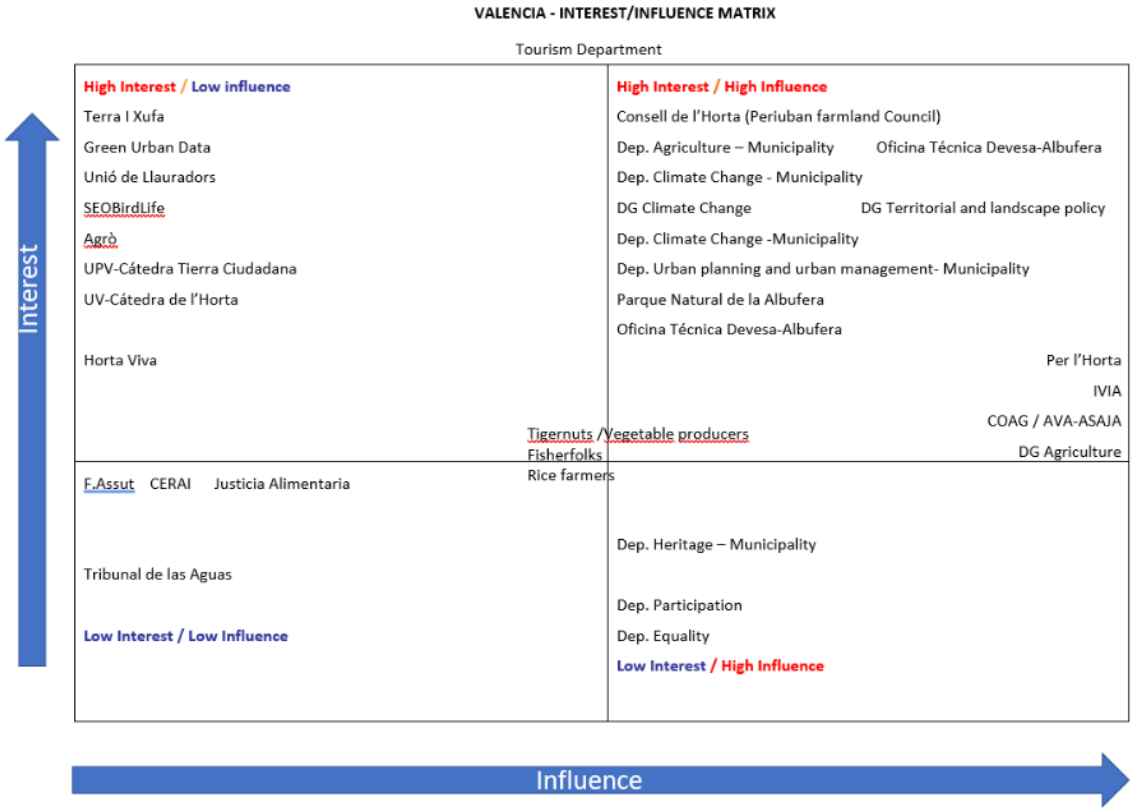


Figure 26. Stakeholder mapping, current as of February 2020. For latest version and more information, refer to *Local partnership and work plan for Valencia* (D3.2).

2.1.3. Hazards affecting the site

The following section briefly introduces the hazards potentially affecting the Huerta, which have been classified and named based on the hazard classification system from UNDRR’s Quick Risk Estimation (QRE) Tool [30]. More detail on hazards is provided in Chapter 10. No relevant **geophysical** hazards were identified. Flood risk is the main **hydrological** hazard for the

Huerta, although wave action could be considered as well in some very specific locations close to the coastline. Within the **meteorological** group of hazards, convective storms and extreme temperature are considered the main risks. Drought is the only relevant **climatological** hazard identified and could become highly significant considering the key influence of irrigation in the agricultural character of the Huerta landscape. Insect infestation is the only **biological** hazard identified according to the QRE Tool, since the tool's definition of "Disease" seems to focus on human diseases. However, as with pests, diseases affecting crops could also change in incidence and prevalence in the Huerta due to climatic changes.

The City developed a *Sustainable Energy and Climate Action Plan (SECAP)* in 2019, [31] including a vulnerability analysis (VA) [32] based on previous climate projections [33], both published in 2015. These VAs also provided the basis for Valencia's *Climate Adaptation Plan 2050* [34] published in 2017[4]. However, they are not spatially explicit, since they are solely based on data from one weather station, which moreover is located in the Valencia airport (outside the Valencia municipal boundaries, and more than 13 km from the coastline). Climate projections were calculated for the RCP4.5 and RCP8.5 scenarios in relation to several descriptive variables of future temperature and rainfall patterns. It should be noted that they are based on statistical downscaling methods, and not on the more advanced regional climate models such as EURO-CORDEX [35] and other derived and gridded data which are currently available. Therefore, assumptions made in the past VAs are of limited use, since they are mainly qualitative and based on data on which faces certain limitations.

The VA [32] was structured around five priority sectors (selected based on strategic and historical importance: water ("Agua"), biodiversity ("Biodiversidad"), coastal zones ("Zonas costeras"), health ("Salud"), and transport and land use planning ("Transporte y ordenación urbana"). Although the sectors agriculture and energy were not addressed in this first study, they were included in a further expansion of the report [36], and also in the analysis that forms part of *Climate Adaptation Plan 2050* [34]. Graphs below show how the level of vulnerability (ranging from "Despreciable" or negligible to "Muy alta" or very high) of each of the sectors in the first VA [32] is expected to evolve in the future (from 2014 up to 2100) in relation to the following expected changes due to climate change: temperature rise (Figure 27), decreasing precipitation (Figure 28), heavy rains (Figure 29), other extreme events (heatwaves and droughts) (Figure 30) and sea level rise (Figure 31). Heavy rains are considered in the analysis as the less dangerous impact driver, as the maximum vulnerability identified to their impacts is just low ("Baja"). Impacts due to sea level rise were also not considered especially worrying, since only coastal areas were considered to have a high vulnerability to it ("Alta"), and the rest of the sectors were considered, at most, to have a low vulnerability. The VA considered indeed that health was not vulnerable to sea level rise at all. The health and water sectors were assessed as highly vulnerable to heatwaves and droughts after 2040, while the rest of the sectors only scored medium ("Media") vulnerability to such extreme events, at most. Higher

[4] It is worth noting that the C*limate Adaptation Plan 2050* also includes results from an updated VA that also addressed the energy and agriculture sectors (see also Figures 32 and 33 below). This updated version, dated March 2016, is apparently not referenced or linked in any of the key documents consulted by the authors, but can be found online: https://www.valencia.es/ayuntamiento/Energias.nsf/0/57AABB553B187CC8C1257F8700396AD6/$FILE/An%C3%A1lisis_vulnerabilidad.pdf?OpenElement&lang=1

levels of vulnerability were linked to temperature rise and decreasing precipitation. In the case of temperature rise, water, biodiversity, coastal areas and health were considered highly vulnerable to temperature rise by 2070, at latest. Water, biodiversity and health were also assessed as highly vulnerable to decreasing precipitation from 2070, or in some cases earlier. No sector was considered to show a very high vulnerability to any of the climate change impact drivers analysed, for any of the time horizons considered.

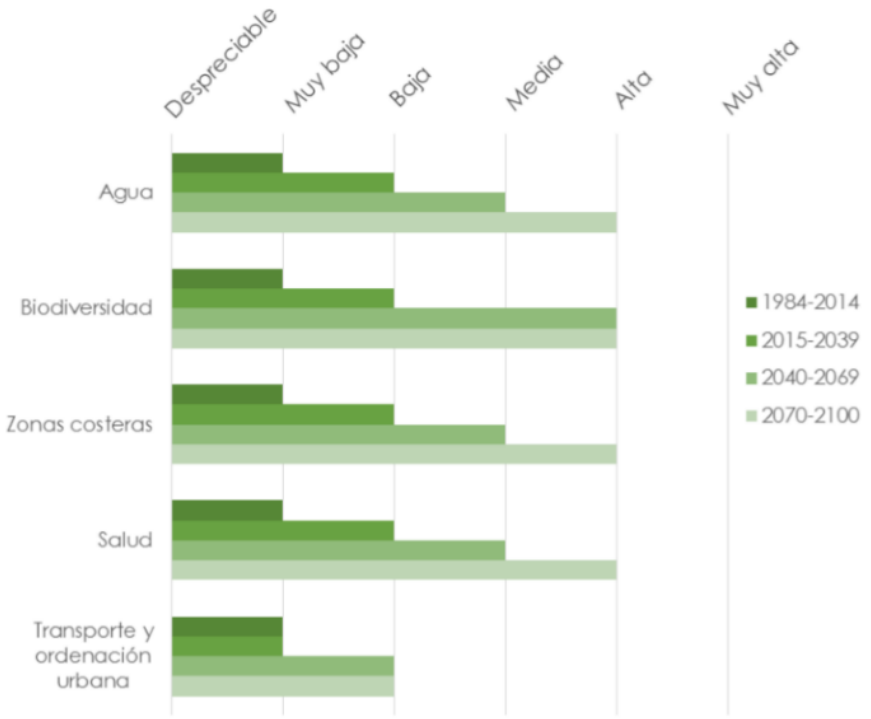


Figure 27. Levels of vulnerability to temperature rise [32].

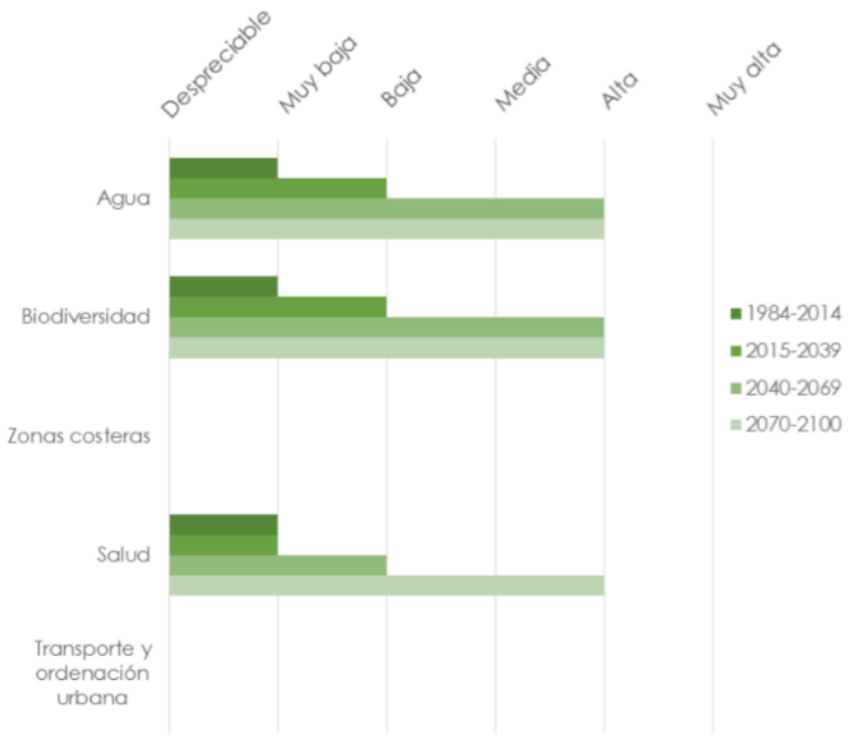


Figure 28. Levels of vulnerability to decreasing precipitation [32].

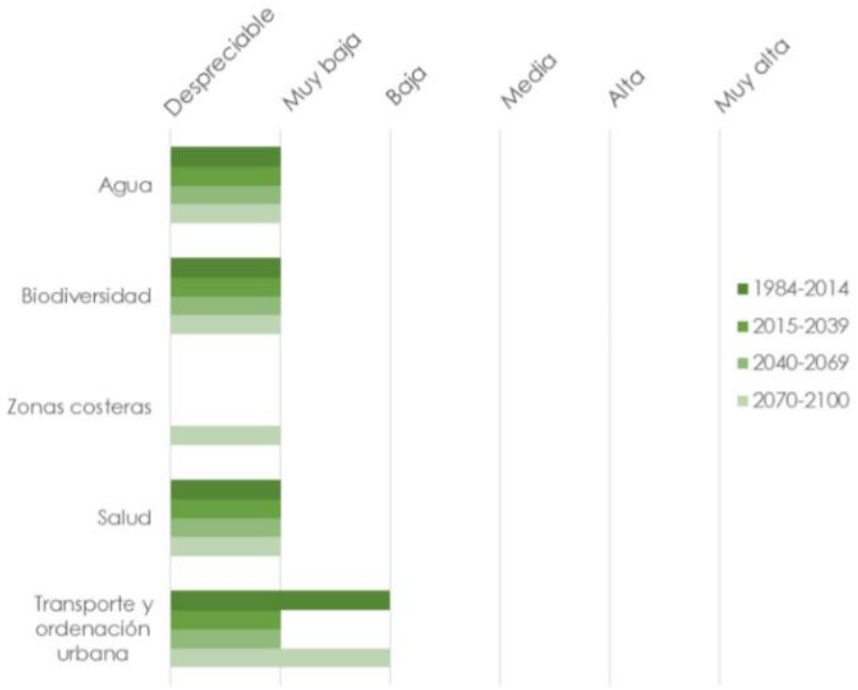


Figure 29. Levels of vulnerability to heavy rains [32].

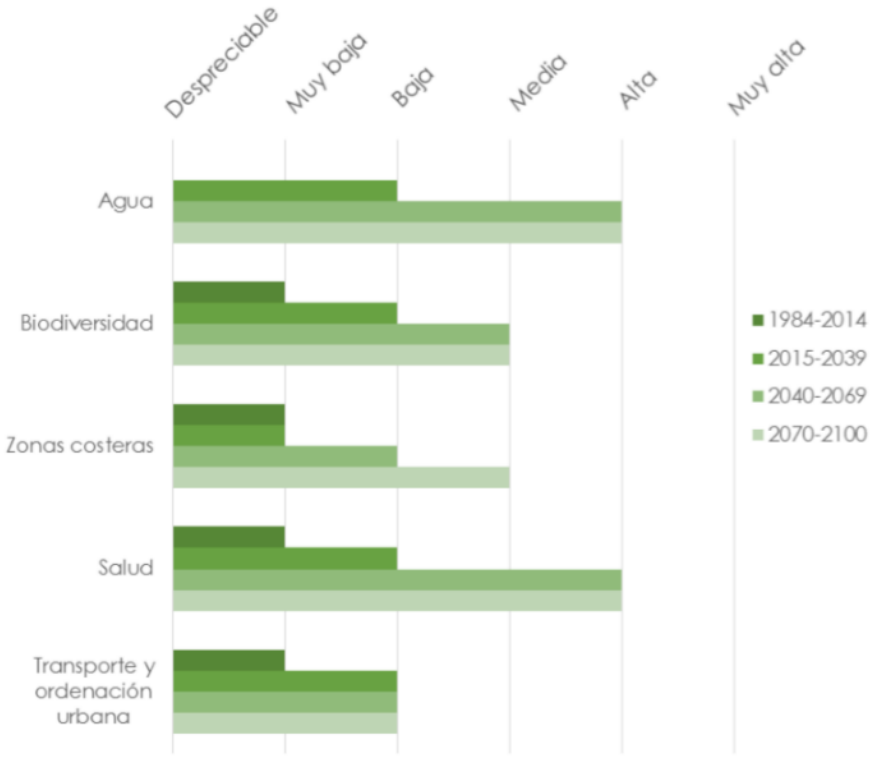


Figure 30. Levels of vulnerability to other extreme events (heatwaves and droughts) [32].

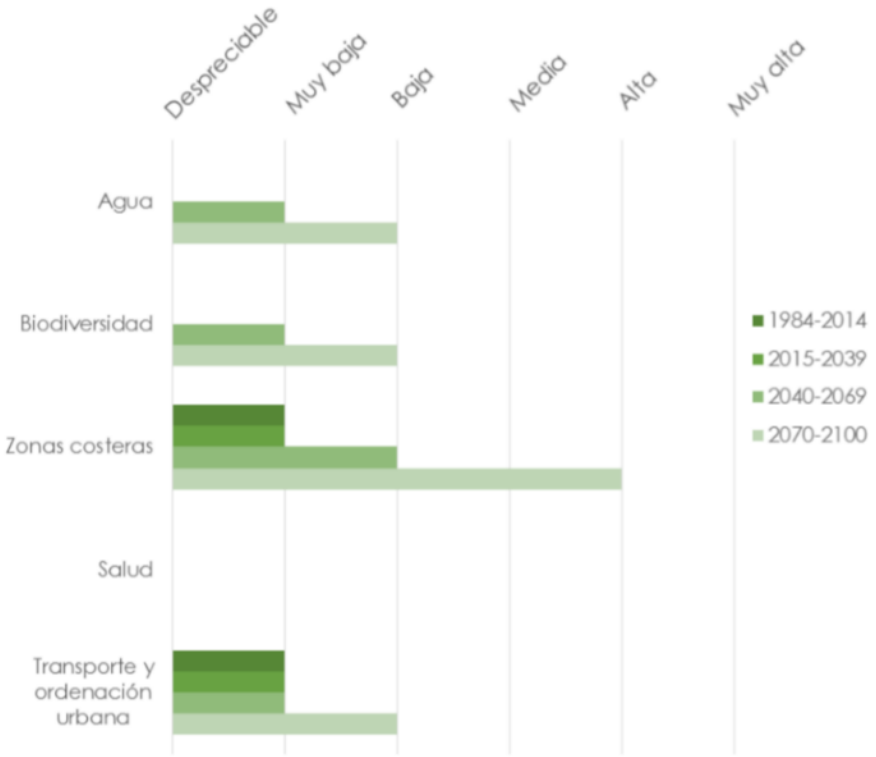


Figure 31. Levels of vulnerability to sea level rise [32].

Climate change hazards in the agriculture (Figure 32) and energy (Figure 33) sectors were presented in a slightly different way in the subsequent expansion of the VA [36]. The impacts likelihood ("Probabilidad") was assessed from unlikely ("Improbable") to highly likely ("Muy Probable"). Consequence from such impacts was ranked, from minimal ("Mínima") to catastrophic ("Catastrófica"). Drivers of impacts are then shown in the table according to their likelihood and consequence, for four different timeframes (T=average temperature, P= average annual rainfall, LT= heavy rainfall, REE= other extreme events, NM=sea level rise, (0=1984-2014, 1=2015-39, 2=2040-69, 3=2070-2100)).

	2. CONSECUENCIA						
	Despreciable	Mínima	Menor	Significativa	Importante	Crítica	Catastrófica
1. PROBABILIDAD	Improbable	NM0; NM1	LLT3	LLT2			
	Muy poco Probable		REE0		LLT1		
	Poco Probable		NM2	T0; P0	LLT0		
	Probable			T1; REE1	P1		
	Bastante probable			NM3	T2; REE2; REE3	P2; T3	
	Muy Probable					P3	

Figure 32. Risks of climate impacts in the agricultural sector, with magnitude of risk ranging from minimal to catastrophic, and probability ranging from unlikely to high likely [32].

	2. CONSECUENCIA						
	Despreciable	Mínima	Menor	Significativa	Importante	Crítica	Catastrófica
1. PROBABILIDAD	Improbable	NM0; NM1; LLT3			REE0		
	Muy poco Probable		LLT1; LLT2				
	Poco Probable	T0; P0	NM2	LLT0	V0		
	Probable		T1; P1			REE1; V1; V2	
	Bastante probable		T2	P2; T3; NM3		REE2; REE3	V3
	Muy Probable				P3		

Figure 33. Risks of climate impacts in the energy sector, with magnitude of risk ranging from minimal to catastrophic, and probability ranging from unlikely to high likely [32].

Climate change impacts and economic sectors in Valencia were also ranked in relation to four time horizons in [32], according to the levels of vulnerability above, although the difficulty in comparing "different impacts, affecting very different stakeholders" was explicitly recognised.

Figure 34 classifies, in decreasing order of importance, the five aforementioned groups of expected changes in relation to the level of risk associated with the sectors considered in the document. Furthermore, Figure 35 classifies seven economic sectors, in decreasing order too, in relation to their assessed level of vulnerability to the climate impacts considered.

	1984-2014	2015-2039	2040-2069	2070-2100
1	Torrential rain	Heat waves and drought	Heat waves and drought	Heat waves and drought
2	Increasing temperatures	Increasing temperatures	Increasing temperatures	Increasing temperatures
3	Decreasing precipitation	Decreasing precipitation	Decreasing precipitation	Decreasing precipitation
4	Heat waves and drought	Torrential rain	Rising sea level	Rising sea level
5	Rising sea level	Rising sea level	Torrential rain	Torrential rain

Figure 34. Impact classification according to their level of risk associated. Modified from [32].

	1984-2014	2015-2039	2040-2069	2070-2100
1	Agriculture	Biodiversity	Water	Water
2	Biodiversity	Agriculture	Biodiversity	Biodiversity
3	Energy	Water	Health	Health
4	Transport and urban planning	Health	Agriculture	Coast
5	Health	Energy	Coast	Agriculture
6	Water	Transport and urban planning	Energy	Energy
7	Coast	Coast	Transport and urban planning	Transport and urban planning

Figure 35. Sector classification according to their level of vulnerability. Modified from [32].

The VA does not analyse in detail the expected impacts of climate change in the Huerta areas of the municipality. The text only contains very brief generic information in relation to the expected impacts on agriculture of the considered changes in climate conditions. Agriculture was addressed in more detail in the subsequent expansion of the VA [31], but still no details are given in relation to issues such as which crops or which areas would be likely more affected, beyond a reference to sea level rise as a threat to some agricultural areas. There is no reference either to the potential role of the existence of Huerta areas surrounding the city in relation to the expected impacts on the urban environment, i.e. as contributing to coping capacity.

2.1.4. Measures proposed to address hazards and build resilience

Some measures to address these forecast climate impacts have already been proposed, but not implemented yet, for instance in the Valencia's *SECAP* [31]. The Annex to the *SECAP* includes many adaptation actions related to the Huerta (planned for implementation between 2019 and 2030), some of them are especially relevant for the aims of the ARCH project. For instance, Measure A.5.2.1 (Figure 36) is particularly interesting in that it explicitly links cultural heritage and adaptation, aiming to disseminate the values of the Huerta and Albufera, and comprising both the Huerta and Albufera areas together. Figure 37 shows a measure aimed at increasing public engagement in relation to the preservation of the Huerta as an adaptation measure for the city itself. Increasing resilience of urban and natural ecosystems is considered an interesting co-benefit which could be obtained. Figure 38. Measure A.4.1.4 Extension of reserved and protected areas for agricultural use which aims at increasing the protection of land for agricultural use in the city, even if it is already considered as available for development. Additionally, Figure 39. Measure A.4.2.2 Acknowledgement of the containment function of the rural territory which aims at identifying, assessing, and even monetising the Huerta's role as an element of green infrastructure, capable of absorbing rainfall (thereby mitigating flood impacts) and attenuating heatwaves. Finally, Measure A.11.2.1 (Figure 40) is focused on the recovery and protection of existing peri-urban Huerta areas, mentioning as a co-benefit the increased infiltration rate for rainfall.

<table>
<tr><th colspan="2">TRANSMISIÓN DE LOS VALORES DE LA HUERTA Y EL ENTRONO DEL PARQUE DE LA ALBUFERA COMO ELEMENTO DE AUTENTICIDAD</th></tr>
<tr><td colspan="2">Agentes implicados: Ayuntamiento de València</td></tr>
<tr><td>Adaptación</td><td>Prioridad a medio plazo</td></tr>
<tr><td colspan="2"><u>Descripción de la acción:</u>
Desarrollo de una cultura ligada al territorio. Perfeccionamiento de la oferta actual y difusión para dar a conocer los itinerarios e iniciativas existentes.
Código Plan de Adaptación: A.5.2.1

<u>Ayudas:</u> Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas:
• Generalitat.
• Programa LIFE.
<u>Periodo de actuación:</u> 2022-2025
<u>Indicadores:</u>
• Desarrollo de soportes de comunicación e información.</td></tr>
<tr><td>Beneficios asociados</td><td>Preservación del entorno natural.
Valoración de la imagen de la huerta y del territorio.</td></tr>
</table>

Figure 36. Measure A.5.2.1: Transmission of the values of the Huerta and the surroundings of the Albufera Natural Park as an element of authenticity [31].

FOMENTAR LA IMPLICACIÓN DE LA CIUDADANÍA EN LA PRESERVACIÓN DE LA HUERTA COMO ESTRUCTURA ADAPTATIVA FRENTE AL CAMBIO CLIMÁTICO	
Agentes implicados: Ayuntamiento de València y Generalitat	
Adaptación	Prioridad a corto plazo
Descripción de la acción: Fomentar la implicación de la ciudadanía en la preservación de la huerta como estructura adaptativa frente al cambio climático. Código Plan de Adaptación: **A.3.1.7** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • Programa LIFE. • Convocatorias de la Fundación Biodiversidad. **Periodo de actuación:** 2017-2021 **Indicadores:** • Iniciativas participativas en torno a problemáticas como la huerta, los recursos energéticos, etc. • Participantes a las iniciativas participativas en torno a problemáticas como la huerta, los recursos energéticos, etc. • Iniciativas de huertos urbanos compartidos.	
Beneficios asociados	Contribuir al incremento de la resiliencia de los ecosistemas urbanos y naturales.

Figure 37. Measure A.3.1.7 To promote the involvement of citizens in the preservation of the Huerta as an adaptive structure in the face of climate change [31].

AMPLIACIÓN DE ZONAS RESERVADAS Y PROTEGIDAS PARA EL USO AGRARIO	
Agentes implicados: Ayuntamiento de València, Consejo agrario, alcaldes pedáneos y Asociación Per l'Horta	
Adaptación	Prioridad a medio plazo
Descripción de la acción: Ampliación de zonas reservadas y protegidas para el uso agrario en el PGOU y revertir la calificación de suelo urbanizable a no urbanizable de determinados terrenos usados como agrícolas o abandonados. Código Plan de Adaptación: **A.4.1.4** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • FEADER. • Generalitat **Periodo de actuación:** 2022-2025 **Indicadores:** • Zonas calificadas para uso agrícola.	
Beneficios asociados	Preservación de nidos de biodiversidad. Dinamización del sector e incremento de los ingresos generados a nivel local.

Figure 38. Measure A.4.1.4 Extension of reserved and protected areas for agricultural use [31].

RECONOCIMIENTO DE LA FUNCIÓN DE CONTENCIÓN DEL TERRITORIO RURAL	
Agentes implicados: Ayuntamiento de València, Consejo agrario, alcaldes pedáneos y Asociación Per l'Horta	
Adaptación	Prioridad a medio plazo
Descripción de la acción: Reconocimiento de la función de contención del territorio rural – espacios de huerta- su alto índice de permeabilidad y de recarga freática. Reconocimiento del papel de la huerta urbana como elemento mitigador del efecto de ola de calor. Monetización de los servicios ambientales ofrecidos por la huerta y valoración de la oportunidad de la creación de un pago. Revalorizar el trabajo del agricultor. Código Plan de Adaptación: **A.4.2.2** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • FEADER. • Programa LIFE. • Horizon 2020. **Periodo de actuación:** 2022-2025 **Indicadores:** • Monetización de los servicios de la huerta.	
Beneficios asociados	Valoración de la imagen de la huerta y del territorio.

Figure 39. Measure A.4.2.2 Acknowledgement of the containment function of the rural territory [31].

RECUPERACIÓN Y PROTECCIÓN DE LA HUERTA PERIURBANA EXISTENTE	
Agentes implicados: Ayuntamiento de València, Red de Distribución de Agua del Municipio.	
Adaptación	Prioridad medio plazo
Descripción de la acción: Recuperación y protección de la huerta periurbana existente. Código Plan de Adaptación: **A.11.2.1** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • LIFE Programme • IDAE • Proyectos Clima • Marguerite **Periodo de actuación:** 2022-2025 **Indicadores:** • Huerta periurbana existente recuperada y protegida.	
Beneficios asociados	Permeabilización del suelo urbano, aumentando así la infiltración de las aguas lluvia al subsuelo.

Figure 40. Measure A.11.2.1 Recovery and protection of existing periurban Huerta [31].

The *Regional Climate Change and Energy Strategy* [37] also includes measures related to agriculture, most of which could be applied in the Huerta. Similar to the *SECAP*, the Strategy doesn't have an associated budget, and therefore depends on other funding sources in order to develop the proposed actions within the proposed 2020–2030 timeframe.

Moreover, some other projects based on European funding have started working in the adaptation of the Huerta (or neighbouring areas) to climate change, with the participation of Las Naves[5] or the Valencia city among other partners. For instance, the AELCLIC ("Adaptation of European Landscapes to Climate Change") project (co-funded by EIT Climate-KIC) worked during 2019 in the Huerta area between Valencia and Alboraya in order to create a local network of stakeholders able to co-define the contents of a potential Landscape Adaptation Plan to Climate Change (LACAP). The results and materials used in the Huerta pilot [38] and also those produced after the cross-cutting analysis of the works developed in 15 representative landscapes distributed across Europe [39] are freely available. Another project "Green Cities for Climate and Water Resilience, Sustainable Economic Growth, Healthy Citizens and Environments" (GrowGreen) [40], funded by Horizon 2020, is currently developing and monitoring a range of nature-based solutions (NBS) demonstrative actions in the Benicalap district, next to the Huerta, and in some cases focused on the transition zones between Huerta and city. Finally, Valencia has just started working in TOMORROW [41], another Horizon 2020 funded project, which aims at "empowering local authorities to lead the transition towards low-carbon, resilient and more liveable cities".

2.1.5. Support needed to build resilience

Based on the existing knowledge available to the City of Valencia with respect to hazards facing the Huerta (as described above), its associated gaps and shortcomings, as well as information gathered from various departments and stakeholders (among them the Department of Agriculture, Consell de l'Horta, Department of the Environment, Las Naves and the Climate and Energy Foundation), three priority objectives can be identified with respect to building cultural heritage resilience:

- To acknowledge and explore how the Huerta helps to mitigate the effects of climate change in the urban environment of València.
- To understand and demonstrate in detail the impacts of possible climate change scenarios on the Huerta.
- To design detailed resilience strategies in order to cope with these identified impacts.

As described previously, these objectives seek to fill an existing knowledge gap, given that the vulnerability level of the Huerta to climate change, and its role in the city's overall ability to adapt to climate impacts, have not been assessed in detail in the existing plans and strategies.

Specific support needs still need to be better identified after discussion with stakeholders, in order to clarify the need for addressing specific impacts or focusing on selected Huerta zones.

[5] Las Naves is the social and urban innovation centre for the city of Valencia, promoting urban innovation with a clear commitment to the people. Its objective is to improve directly or indirectly the quality of life of the residents of the city. Las Naves manages and develops projects and innovative solutions with the active participation of all major stakeholders from the local innovation environment across four so-called "propellers": public sector, private sector, academia and civil society. Las Naves' projects revolve around five main areas: Mobility, Energy and Water, Agri-food, Health and Healthy City, and Creative and Cultural Industries [98].

2.2. La Albufera de València

2.2.1. Overview

The Albufera de València (hereafter the Albufera) is a site of 21,120 ha in size, designated as a Wetland of International Importance under the Ramsar agreement. It is also designated as a Natural Park, under the regional protected area regime, and as a Natural 2000 site, under the European Habitats and Birds Directives. The following description of the site is provided by the Ramsar convention [42]:

> *Albufera de Valencia. 05/12/89; Comunidad Valenciana; 21,000 ha; 39°20'N 000°21'W. Special Protection Area EC Directive; Natural Park. A large coastal lagoon fed by streams, rivers and irrigation channels, fringed by areas of rice cultivation. The site is separated from the sea by an urbanized dune peninsula. Vegetation is dominated by aquatic, halophytic, and dune communities. The site's fauna is notable for its species diversity. Regional endemics include fish and crustaceans. The area supports a rich assemblage of breeding waterbirds, and large numbers of various species of waterbirds, especially ducks, winter at the site. Human activities include rice cultivation, fishing, and hunting. Ramsar site no. 454. Most recent RIS information: 1999.*

A map of the Natural Park is shown in Figure 41 [43]. The most important areas owned by the city of Valencia are the coastal lagoon, some of the rice cultivation areas, and most of the sand bar (locally known as “Devesa”), including emblematic locations such as the population nuclei of El Saler and El Palmar. The remaining areas of the Natural Park belong to neighbouring municipalities such as Silla, Catarroja or Sueca.

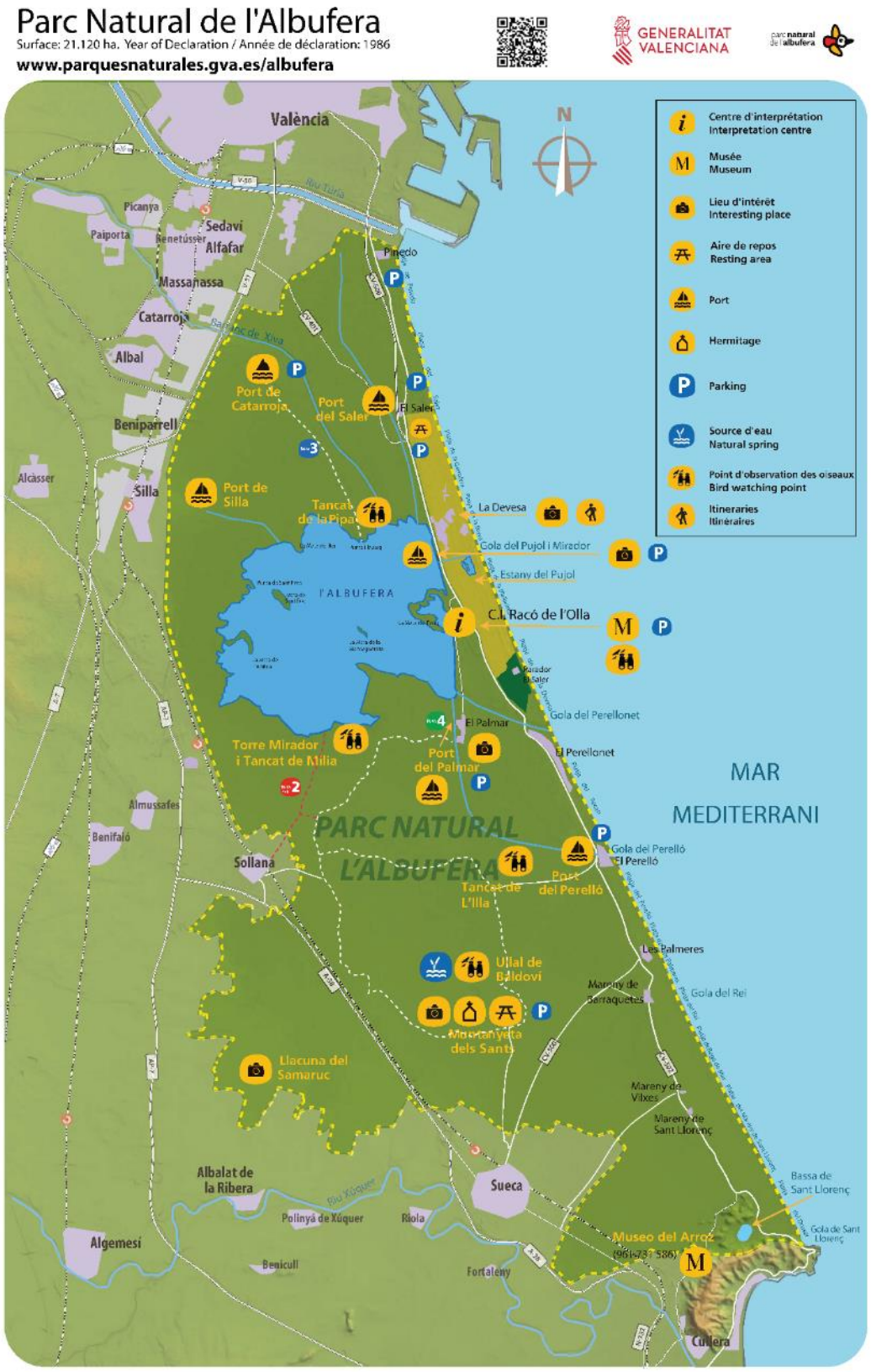


Figure 41. Albufera Natural Park Map [43].

2.2.2. Stakeholders

The Albufera management scheme is highly complex. Although the lagoon belongs to the city of Valencia, its water level (and, by extension, the water management regime of the surrounding rice paddies) is managed by rice farmers. These farmers control the body ("Junta de desagüe") which manages the gates in the "golas" (channels between the lagoon and the sea). The city of Valencia is involved in the regular maintenance of the golas, beaches, irrigation channels and other areas of the wetland, and for many years has supported the ecological restoration of the dune systems (which was funded via successive LIFE projects such as LIFE00 NAT/E/007339 [44] and LIFE04 NAT/ES/000044 [45]). These ecosystems, located in the sandbar ("Devesa"), were partly destroyed during early stages of an intended residential development of the area that started in the 1960s, and was finally stopped due to the strong public opposition[6]. Many of these maintenance and restoration actions are managed by the city's *in situ* technical office ("Oficina Técnica Devesa-Albufera").

The regional government is also involved in managing the Albufera, since it is responsible for most of the competences related to the area's protected status. A comprehensive legal regime exists [46]. The principal decision-making body for most of the protected area management matters is the management board ("Junta Rectora") of the Natural Park, where many stakeholders are present (from several departments of the regional government, to a representative of the lateen sailing sports federation – see the complete list in [47]). Their technical office in the Park is very active too, and undertakes many different actions throughout the year, including environmental and wildlife monitoring, which are summarised in annual management reports [48].The forest management branch of the regional government is also involved in the management of the area, since the forest in the Devesa is registered as public woodland, and therefore subject to a complementary specific management regime.

National authorities are also involved in the management and maintenance of the Albufera. For example, the Jucar Basin Management Agency (CHJ),which depends on the Spanish government, is in charge of establishing how much water (a critical element of the ecosystem) is assigned to the Albufera by means of hydrological planning. The CHJ is also responsible for a monitoring and control network which collects data on hydro-morphological, physical-chemical and biological parameters, some of them continuously monitored through different sensors located in the lagoon and surroundings [49].

The Albufera inhabitants are also key stakeholders to be considered. There are residents not only in the population nuclei which are part of the Valencia municipality, such as El Saler, El Palmar or El Perellonet, but also in scattered buildings which were built in the Devesa area before the 1960s urban development of the area was stalled. Other important stakeholders in the Albufera are boat operators people engaged in commercial fishing, hunters, the restaurant sector and tourism operators, including birding specialist guides. Civil society organisations such as A.E.Agró and SEO-Birdlife have been involved in the area for many years, and are for instance together in charge of the management of an artificial wetland for water treatment (Tancat de la Pipa). The Fundació Assut is another organisation very active in the area. Finally, the València area of the Albufera also includes a research centre focused on aquatic fauna

[6] More details can be found in [44] and [45]

(Centre d'Investigació Piscícola d'El Palmar) and a wildlife recovery centre (Centro de recuperación de Fauna del Saler).

2.2.3. Hazards affecting the site

General information from the 2015 VA of the city of Valencia has been already cited in section 2.1.3, along with its limitations. There has been no vulnerability mapping undertaken for the Albufera itself in the VA, nor a detailed analysis of potential impacts on its ecosystems due to climate change. However, there is a brief list of existing and potential impacts in the wetland, such as those associated with water temperature rise, decrease in rainfall, heavy rains and sea level rise [32]. Analysing in detail potential impacts such as future water quality changes in the Albufera and consequences for its natural and cultural heritage requires complex modelling at catchment scale, which has been out of the scope of previous studies.

The Albufera lagoon has been suffering from eutrophication for decades, due to excessive nitrogen and phosphorus inputs from fertilisation of the rice paddies and associated untreated, polluted waters discharged into the channels leading to the lagoon. The forecast temperature rise and changes in rainfall and water availability (and demand) according to the climate change scenarios projected at regional level are expected to aggravate these water quality problems, exacerbating the ecological deterioration of the lake [32]. Moreover, the lagoon and its surroundings are already showing salinisation processes, which will increase as the sea level continues to rise, causing additional changes in the lagoon ecosystem and rice cultivation. Salinity is a key factor in shallow lakes such as the Albufera, since it is one of the main water quality parameters that determines changes in the composition of plankton, which in turn strongly influences the eutrophication level of the lagoon and therefore its whole ecological status. Due to its proximity to the sea, and the low altitude of the sandbar that separates the lagoon from the sea, sea level rise could potentially lead not only to the total change of the lake ecosystem composition due to extreme salinisation, but even to its complete disappearance under the sea. The same can be said regarding the dune and forest areas of the Devesa sand bar, which additionally will suffer an increase in already high wildfire risk, as the climate becomes hotter and drier. Other potential challenges include an increase in the presence of invasive species, or the damage caused by increasingly frequent convective storms, affecting almost every ecosystem in the area, from the beaches to the forest and golas.

2.2.4. Measures proposed to address hazards and build resilience

The management regime of the Albufera Natural Park does not explicitly take into account climate change yet. However, some special measures aimed at improving the ecological status of the lagoon have been agreed by the local, regional and national administrations, and will be integrated by the Jucar basin management agency in the current review of the basin hydrological plan which, by law, needs to take climate change into account regarding the allocation of water resources[7].

[7] The new plan would be intended to cover the period 2021-2027, however at the time of writing the intended date of completion was unknown, and a related public consultation had been placed on hold due to the state of

Other measures have been proposed, but not implemented yet, for instance in the Valencia's *SECAP* [31]. The adaptation measures detailed in the Annex to the *SECAP* include one combined measure for both the Huerta and the Albufera, already mentioned (Figure 36. Measure A.5.2.1: Transmission of the values of the Huerta and the surroundings of the Albufera Natural Park as an element of authenticity). Other proposed measures related to the Albufera are shown in Figure 42 (Increasing the participation in the "Junta de Desagüe") and Figure 43 (dune conservation actions). Other measures, such as those shown in Figure 44 and Figure 45, do not mention explicitly the Albufera, but could be easily applied to it.

REGULACIÓN PARA MAYOR PARTICIPACIÓN EN LA JUNTA DE DESAGÜE DE LA ALBUFERA DE VALENCIA	
Agentes implicados: Ayuntamiento de València, Gobierno de Valencia	
Adaptación	Prioridad medio plazo
Descripción de la acción: Regulación que implique mayor participación en la Junta de desagüe de la Albufera de Valencia y para el abordaje de la problemática de la gestión del agua de forma integral (ciclos de inundación y vaciado) en el parque natural ya que tiene un impacto muy grande sobre el ecosistema del mismo y de la franja marítima. Código Plan de Adaptación: **A.12.1.3** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • European Agricultural Fund for Rural Development (EAFRD) • European Maritime and Fisheries Fund (EMFF) • LIFE Programme • Cross-border cooperation • Natural Capital Financing • Facility (NCFF) **Periodo de actuación:** 2022-2025 **Indicadores:** • Junta de desagüe de la Albufera de Valencia creada.	
Beneficios asociados	Protección de las especies residentes en el municipio y conservación de las especies autóctonas.

Figure 42. Measure A.12.1.3 Regulation for greater participation in the Albufera de Valencia drainage board [31].

emergency arising from the COVID-19 pandemic. See more information here https://www.chj.es/es-es/medioambiente/planificacionhidrologica/Paginas/PHC-2021-2027-Indice.aspx

ACOMETER LABORES DE CONSERVACIÓN DE LA LÍNEA DE DUNAS	
Agentes implicados: Ayuntamiento de València, Gobierno de Valencia	
Adaptación	Prioridad corto plazo
Descripción de la acción: Acometer labores de conservación de la línea de dunas. Código Plan de Adaptación: **A.12.1.4** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • European Agricultural Fund for Rural Development (EAFRD) • European Maritime and Fisheries Fund (EMFF) • LIFE Programme • Cross-border cooperation • Natural Capital Financing • Facility (NCFF) **Periodo de actuación:** 2017-2021 **Indicadores:** • Biodiversidad en el municipio conservada.	
Beneficios asociados	Protección de las especies residentes en el municipio y conservación de las especies autóctonas.

Figure 43. Measure A.12.1.4 Undertake conservation work on the dune line [31].

DESARROLLAR ACUERDOS INTERINSTITUCIONALES PARA GESTIONAR EL RIESGO CLIMÁTICO DE MANERA EFICIENTE	
Agentes implicados: Ayuntamiento de València, Estado, Generalitat	
Adaptación	Prioridad a corto plazo
Descripción de la acción: Crear o reforzar los mecanismos de coordinación / cooperación entre otras administraciones y el Ayuntamiento de Valencia de forma transversal a todos los sectores: - entre el Estado y el Ayuntamiento (ej. Costa: competencia de Estado). - entre la Generalitat y el Ayuntamiento. - a nivel de área metropolitana. Identificar donde fallan los mecanismos de coordinación actuales; crear mecanismos de retroalimentación entre organizaciones para informar de las necesidades a los que dispongan de las competencias; crear convenios de cooperación para llevar a cabo iniciativas interterritoriales. Código Plan de Adaptación: **A.9.1.1** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, no se han encontrado ayudas disponibles. **Periodo de actuación:** 2017-2021 **Indicadores:** • Grado de comunicación y coordinación entre el Ayuntamiento y otras administraciones. • Acuerdos institucionales sobre cambio climático de forma eficiente gestionados.	
Beneficios asociados	Mayor comunicación entre las instituciones, siendo mejores y más eficientes las medidas tomadas ante riesgos climáticos.

Figure 44. Measure A.9.1.1 Develop inter-institutional agreements to manage climate risk efficiently [31].

TRANSPOSICIÓN PLAN DE ACCIÓN TERRITORIAL DE LA INFRAESTRUCTURA VERDE DEL LITORAL EN LA PGOU Y OTRAS NORMATIVAS MUNICIPALES	
Agentes implicados: Promotores privados de vivienda; constructores; ingenierías y urbanistas; ciudadanía; Administraciones públicas estatales y regionales; Servicios municipales.	
Adaptación	Prioridad medio plazo
Descripción de la acción: Transposición Plan de Acción Territorial de la Infraestructura Verde del Litoral (Pativel) en el PGOU y otras normativas municipales del PATIVEL, del PATRICOVA y de todas las planificaciones sectoriales sostenibles que contribuyen a incrementar la resiliencia del territorio ante el cambio climático. Código Plan de Adaptación: **A.8.1.2** **Ayudas:** Para la realización de esta medida, en el momento de redacción del presente Plan, se podría contar con las siguientes ayudas: • European Agricultural Fund for Rural Development (EAFRD) • Community-led Local Development (CLLD) • Integrated Territorial Investments ITI • LIFE Programme • Urban innovation actions • CIVITAS activity Fund Sustainable mobility • Cross border cooperation • Transnational cooperation • INTERRG EUROPE • URBACT III • Proyectos Clima **Periodo de actuación:** 2022-2025 **Indicadores:** • Número de medidas de adaptación al cambio climático en el PGOU. • Introducir la adaptación en la planificación y ejecución urbanística municipal.	
Beneficios asociados	Crear ciudades resilientes al cambio climático que permitan reducir sus impactos y desarrollar sus capacidades adaptativas.

Figure 45. Measure A.8.1.2 Transposition of the territorial action plan for coastal green infrastructure into the general urban development plan (land-use planning) and other municipal regulations [31].

The *Regional Climate Change Strategy* [37] mentioned earlier also includes many measures which could be applicable in the Albufera. For instance, Measure 61 deals with adaptation measures of crops in wetlands, while Measure 77 aims at maximising wetlands' capacity to act as buffer zones regarding storms or coastal erosion. Both measures are quoted below. Acronyms contained within square brackets refer to the regional department or departments responsible for the measure implementation ("MN" refers to the competent department for the natural environment, and "AG" refers to the competent department in the domain of agriculture and stockbreeding).

***Measure 61. Adapting crops in wetlands**. Linked actions:*

[MN] [AG] To promote farming compatible with wetlands conservation; to establish progressive measures to dispose rice straw residues, in order to reduce carbon dioxide emissions from straw burning.

[MN] [AG] To promote crops more compatible with maintaining flooded areas, increasing the flow absorption capacity in flood season.

[MN] [AG] Limiting the use of fertilizers in certain crops in order to promote their role reducing the amount of organic matter reaching the wetlands.

[MN] [AG] To promote farming practices that prevent organic matter to be stored in the soil in a non-stabilised form, such as the adjustment of mowing height.

[MN] [AG] Research on more cost-effective and sustainable channels and ditches maintenance systems. Conservation and restoration of the irrigation networks considered of historical interest and traditional in order to recover the crops on water-meadows along rivers and streams, as well as on their slopes, to recover previous microclimatic conditions, to increase air moisture as a way to promote cloud formation and improve precipitation patterns.

Measure 77. To maximise the wetlands capacity to buffer against storm impacts (floods and coastal erosion). *Linked actions:*

[MN] Preservation of coastal sandbars or shingle banks linked to wetlands.

[MN] Preservation of river mouths (designated wetlands[8]).

[MN] Monitoring of salinization processes. Installation of a network of piezometers in wetlands.

[MN] Maintenance of adequate water levels to prevent seawater intrusion.

[MN] Impact assessment of the increased salinity in natural ecosystems.

Some existing projects that could be considered in order to avoid redundancies and exploit potential synergies are the already-mentioned TOMORROW project, the "PIMA Adapta Costas" (aimed at improving the resilience of the Spanish coast regarding climate change impacts [50]) or some other European funded projects such as the Interreg Delta Lady [51]. In a further step the scope of those projects, which could complement or support key actions that the ARCH project could develop in the Albufera area, will be clarified.

To date, and subject to the above-mentioned uncertainties, no specific climate change adaptation measures in the Albufera have been identified as implemented or currently under implementation to address these climate challenges[9], beyond the mentioned dune restoration project developed over the past decades, or the analysis and incorporation of the Albufera water requirements as part of updated hydrological planning at basin scale.

2.2.5. Support needed to build resilience

The previous paragraphs show some potential lines of action that could be developed by the ARCH project in Valencia. The lack of associated budget for either the Regional Strategy or the Valencia Action Plan is one of the main reasons why the ARCH project is so important,

[8] Reference to the Valencian Wetlands Catalogue [99] (in the Valencia Region, wetlands have been given special conservation status, including a specific category of protected areas).

[9] It should be noted that some relevant actions, e.g. measures from the *Regional Climate Change Strategy* [37] mentioned above, have been proposed but not yet applied to the Albufera. Further consultation with stakeholders is needed to determine whether these actions are planned for implementation, and if so, in what time frame.

since it could act as a powerful lever to develop some of those actions, which are mainly dependent on external funding.

Some of the identified potential actions show synergies with some of the measures that could be implemented in the Huerta area. At the same time, some measures proposed in the previous section in relation to the Huerta area could also be extended to and benefit the Albufera area, for instance in relation to the identified knowledge gaps in relation to the vulnerability of the Albufera to climate change, and the role it can play within the city's adaptation to climate change strategy.

In particular, assessing how is the Albufera helping the city to cope with the changing climate, or how will it do it in the future, seems particularly relevant. Modelling climate change impacts on agriculture, aquatic and forest ecosystems would also be needed in order to be able to design resilience strategies in order to cope with these identified impacts. At the same time, this should also be considered as a prerequisite for maximizing those potential environmental services provided by the Albufera and Huerta regarding climate change adaptation in the city.

Again, discussion with stakeholders is still needed in order to prioritize specific support needs or focusing on addressing specific impacts or selected Albufera zones or ecosystems.

3. Governance framework for cultural heritage management

3.1. International

UNESCO[10] and European Cultural conventions[11] started in 1952 and 1954, respectively to address cultural recommendations and agreements. Since then, they have worked towards the protection of World Cultural and Natural Heritage. In 2009, the irrigators' tribunal of the plain of Valencia (linked to the Huerta) was inscribed on the UNESCO representative list of the intangible cultural heritage of humanity[12]. Furthermore, in 2002, the Food and Agriculture Organization of the United Nations launched a programme[13] to support the conservation of Globally Important Agricultural Heritage Systems (GIAHS). Recently, in 2019, the Huerta was added to the GIAHS list.

On the other hand, at European level the protection of European cultural heritage (both natural and architectural), in rural and island regions is covered by a resolution adopted in 2006 by the European Parliament[14].

3.2. National

Guided by international frameworks, Spain has deployed several regulations[15] that set the basis for the management of cultural heritage (using the title 'historical heritage'). According to law 16/1985, of 25 June, Spanish Historical Heritage includes buildings and movable objects of artistic, historical, palaeontological, archaeological, ethnographic, scientific or technical interest. It also includes documentary and bibliographic heritage, archaeological sites and areas, as well as natural sites, gardens and parks, which have artistic, historical or anthropological value.

3.2.1. Management of historical heritage

Historical heritage is managed by the Ministry of Culture and Sports while natural heritage is managed by the Ministry of Ecological transition. There are two sub-directorates in charge of

[10] https://whc.unesco.org/

[11] https://www.coe.int/en/web/culture-and-heritage/european-cultural-convention

[12] https://ich.unesco.org/en/RL/irrigators-tribunals-of-the-spanish-mediterranean-coast-the-council-of-wise-men-of-the-plain-of-murcia-and-the-water-tribunal-of-the-plain-of-valencia-00171

[13] http://www.fao.org/giahs/background/a-global-partnership/en/

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52006IP0355

[15] Law 16/1985, of 25 June, on Spanish Historical Heritage; Law 10/2015 of 26 May on the Safeguarding of Intangible Cultural Heritage; Law 1/2017 of 18 April on the restitution of cultural property unlawfully removed from the territory of Spain or another Member State of the European Union, transposing Directive 2014/60/EU of the European Parliament and of the Council of 15 May 2014 into Spanish law; Royal Decree 111/1986, of 10 January, partially implementing Law 16/1985, of 25 June, on Spanish Historical Heritage ; Royal Decree 1680/1991, of 15 November, implementing the ninth additional provision of Law 16/1985, of 25 June, on Spanish Historical Heritage, on State guarantees for works of cultural interest; Law 16/1985 on Historical Heritage; Royal Decree 111/1986 on the partial implementation of the Law

the protection and conservation of Spanish cultural heritage, dependent on the Directorate General of Fine Arts and Cultural Heritage.

General Sub-directorate for the Protection of Historical Heritage: responsible for the legal protection of cultural heritage. This entity is responsible for relations with other states and international organisations, such as UNESCO, in the field of cultural heritage, in the following cases, except for the European Heritage Days, which are coordinated by the Cultural Heritage Institute of Spain. In addition, this Sub-directorate coordinates the following bodies:

- Spanish Historical Heritage Council: Coordinating body between the State Administration and the Autonomous Communities[16] whose purpose is to facilitate communication and exchange of action programmes and information relating to Spanish Cultural Heritage.
- Board for the Qualification, Valuation and Export of Spanish Historical Heritage Goods: Collegiate consultative body attached to the General Directorate of Fine Arts and Cultural Goods and Archives and Libraries responsible for reviewing applications for export, import and acquisition of goods.

General Sub-directorate of the Spanish Cultural Heritage Institute: main functions are the elaboration and execution of plans for the conservation and restoration of Spanish cultural heritage; the study of updated methods and techniques for its restoration and conservation; the archiving, technical treatment and diffusion of the relevant documentation; interventions and works carried out in each specific case; the diffusion and exchange with international bodies; the training of technicians who attend to the aims of the Institute, and the proposal of agreements for the conservation of heritage with other public administrations and public or private entities.

3.2.2. Management of natural heritage

A legally-binding *Strategic Plan for Natural Heritage and Biodiversity*[17] , published in 2011, establishes goals, objectives and actions to promote the conservation, sustainable use and restoration of natural heritage and biodiversity for the period 2011-2017. Its application will be extended until another strategic plan is adopted to replace it.

This national Strategic Plan incorporates the commitments made by Spain at international and EU level in the field of biodiversity, in particular those derived from the United Nations Convention on Biological Diversity's *Strategic Plan for Biodiversity 2011-2020* (approved by the Contracting Parties in October 2010) and the *EU Biodiversity Strategy to 2020* (adopted in

[16] An Autonomous Community is a Spanish administrative territorial entity. The Spanish constitutional system establishes a system of recognition of territorial autonomy that grants States legal and administrative functions similar in many aspects to that of a federal state. Territorially the system of decentralisation is organized with 17 Autonomous Communities, Comunidad Valenciana being one of them; and two cities with statute of autonomy - Ceuta and Melilla-.

[17] https://www.miteco.gob.es/es/biodiversidad/temas/conservacion-de-la-biodiversidad/valoracion-y-aspectos-economicos-de-la-biodiversidad/cb_vae_plan_estrategico_patrimonio_nat_bio.aspx

May 2011 by the European Commission and endorsed by the Council of Environment Ministers in June 2011).

The Spanish Inventory of Natural Heritage and Biodiversity[18] is one of the instruments to store knowledge and plan to care for natural heritage and biodiversity, together with the *State Strategic Plan for Natural Heritage and Biodiversity* and the *Natural Resource Management Plans,* in accordance with Law 42/2007, of 13 December, on Natural Heritage and Biodiversity. Within this inventory the Albufera is included under “Other Natural Protected Areas”.

3.3. Regional

At the regional level, Law 4/1998 on Valencian Cultural Heritage aims at the protection, conservation, dissemination, promotion, research and enhancement of Valencian cultural heritage [52].

There is also a general inventory of Valencia's cultural heritage. This is divided into goods of cultural interest, goods of local relevance, movable goods of heritage relevance and intangible goods of local relevance. Within this classification, goods related to the Huerta are considered, such as farmhouses (“alquerías”) and “barracas”, typical constructions of the Huerta (see Figure 46 and Figure 47). Also inventoried as Valencian cultural heritage are some traditional irrigation channels and their related infrastructure (Figure 48), and even traditional paths connecting Valencia with neighbouring municipalities through the Huerta (Figure 49).

Figure 46. „Alquería de Pallés“ (Huerta farmhouse, Valencia Municipality). Element included within the general inventory of Valencia's cultural heritage [1].

[18] https://www.boe.es/buscar/doc.php?id=BOE-A-2011-8228

Figure 47. „Barracas de Panach“ (Huerta farmhouses, Valencia Municipality). Element included within the general inventory of Valencia's cultural heritage [1].

Figure 48. „Llengües del braç de dalt-del mig“ (Part of the Huerta irrigation network, Valencia Municipality). Element included within the general inventory of Valencia's cultural heritage [1].

Figure 49. „Camí Vell de Picassent“ (Old path from Valencia to neighbouring Huerta municipalities). Element included within the general inventory of Valencia's cultural heritage [1].

There are also additional relevant protected heritage elements that are located within Valencia’s Huerta areas, but are not directly related to farming. The most prominent examples are those related to religious symbols, places of worship or other religious sites, such as the old “Sant Miquel dels Reis” monastery (Figure 50).

Figure 50. „Monasteri de Sant Miquel dels Reis“ (Monastery within the Valencia municipality Huerta). Element included within the general inventory of Valencia's cultural heritage [1] [53].

The Water Tribunal, a key element of the Huerta which has already been mentioned (locally known as “Tribunal de las Aguas de la Vega de Valencia” or simply “Tribunal de las Aguas”) is also included within the regional inventory of Valencia’s cultural heritage as an intangible element in the domain of traditional knowledge [54] (Figure 51).

Figure 51. „Tribunal de las Aguas de la Vega de Valencia“ (which meets weekly in the Apostles Gate of Valencia Cathedral). Element included within the general inventory of Valencia's cultural heritage [54].

There are also regionally protected heritage elements in the Albufera area of the Valencia municipality. Besides those pertaining to some of the previously described categories, related to farming or religious worship, some elements are unique to the Albufera conditions. For instance, the gates in the “Gola de Pujol” (one of the channels between the Albufera Lagoon and the sea, crossing the Devesa forest area – see Figure 52), the dock and boatyard facility in the El Palmar population nuclei, as well as some drainage pump stations essential to complex water management in the rice paddies.

Figure 52. „Comportes de la Gola de Pujol“ (gates in the „Gola de Pujol“ channel). Element included within the general inventory of Valencia's cultural heritage [55].

Regarding intangible heritage, two of the traditional activities pursued in the Albufera (traditional fishing and lateen sailing) are also protected at a regional level (they were designated together as a single element, including traditional knowledge and activities related to both areas) [56].

Figure 53. „Actividades tradicionales de la Albufera de Valencia“ (traditional activities from the Albufera de Valencia). Element included within the general inventory of Valencia's cultural heritage [56].

The Regional Plan for the Huerta [1] also includes an inventory of protected cultural items (Document 5 of the Plan) where the main cultural resources in the whole Huerta area (not only in the Valencia municipality, but also in neighbouring municipalities) are catalogued and mapped. Some of these items are located in the Albufera agricultural areas which are included within the scope of this Regional Plan. Several levels of protection are also defined in the Plan, with their corresponding norms.

Lastly, there is a regional inventory of heritage and notable trees protected by law which was recently updated [57]. As shown in Figure 54, the inventory comprises several trees or groups of trees (which are shown as a single element) within the Huerta and Albufera sites, which are subject to the provisions of the regional tree heritage law [58].

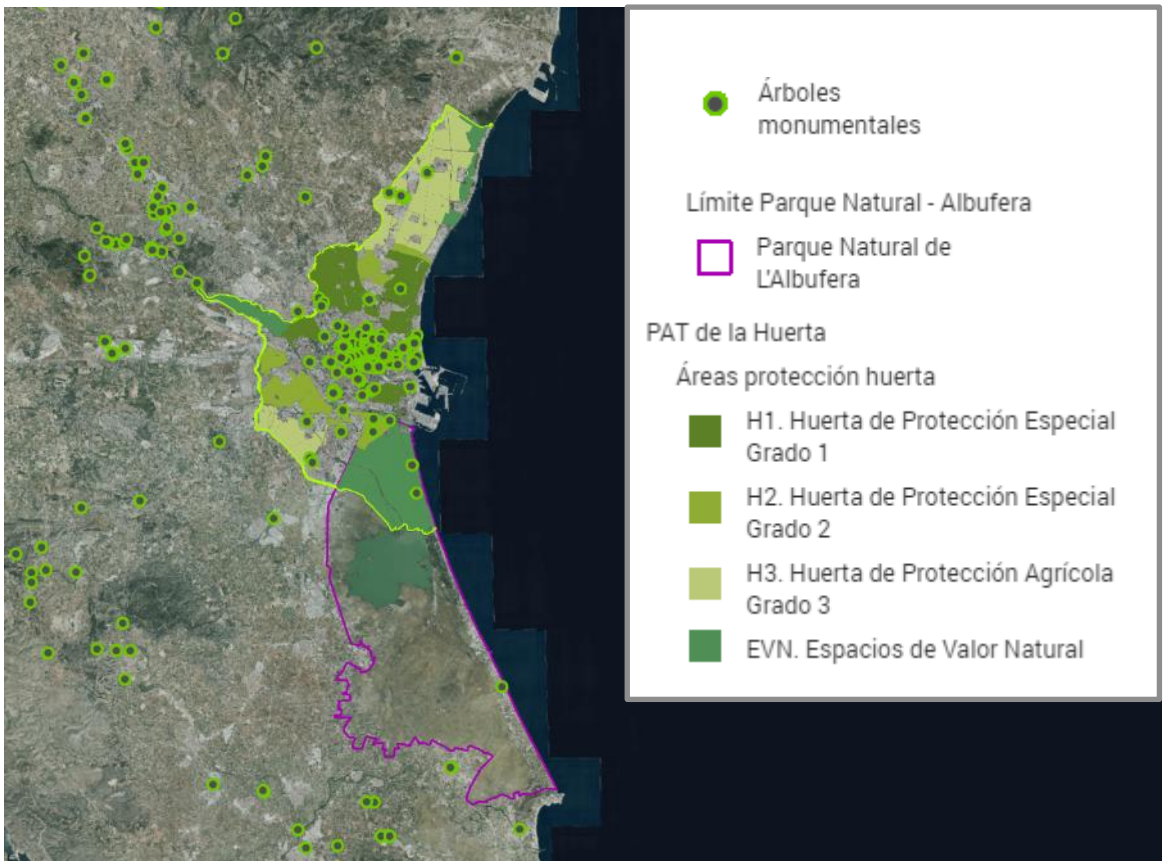


Figure 54. Heritage and notable trees ("Árboles monumentales") included in the regional inventory within and surrounding Huerta ("Áreas protección huerta") and Albufera ("Límite Parque Natural-Albufera") protected areas [24].

3.4. Local

Within the Department of Education, Culture and Sports, there is a delegation of heritage and cultural resources that includes the Historical and Artistic Heritage Service. At the same time, the Resource Management area of the City Council has a delegation of municipal heritage that is mainly responsible for legal heritage management.

In the area of Urban Ecology, Climate Emergency and Energy Transition, there is a section dedicated to trees of heritage significance, within the Delegation of Sustainable Gardening and Renaturalisation of the City.

The last revision of the Valencia masterplan included a Catalogue of Protected Goods and Areas. It was organised in two parts, depending on the rural or non-rural character of each element. The rural section of the Catalogue [59] is highly relevant, since it includes lists, maps and norms relative to the most important items catalogued in both the Huerta and Albufera areas of Valencia, such as irrigation channels, historic roads, typical rural huts ("Barracas") or the "Golas", channels connecting the Albufera Lagoon and the sea.

Local and regional catalogues and inventories are, to some extent, redundant, since heritage protection at regional level usually implies some level of protection at local level, and vice versa.

3.5. Gaps and needs

Although there is a full set of regulations and other legal texts setting a comprehensive governance framework for heritage protection, as has been described, recent events such as the demolition of the “Forn de la Barraca” (a historical building in the Huerta area of the neighbouring municipality of Alboraya), despite strong public opposition, show that this governance framework is far from being ideal. More closely associated with the objectives of the ARCH project, it should be noted that no specific mention to climate change has been found in the heritage protection governance framework review [60]. Therefore, no current mechanisms have been identified in order to proactively assess and mitigate potential impacts of climate-related hazards on historic areas.

4. Governance framework for disaster risk reduction

4.1. International

In 1994, a UN World Conference on Disaster Risk Reduction (DRR) was convened to discuss how to tackle the growing natural disasters. The focus was on developing effective measures around preparation, response and mitigation of disasters.

In 2000, the United Nations International Strategy for Disaster Reduction (UNISDR) was launched and five years later the **Hyogo Framework for Action**[19] launched, the main UN-wide policy on the subject of DRR existing at the time of its conception (2005-2015). Later on, in 2015, the **Sendai Framework**[20] for action 2015-2030 was adopted which is based on four priorities: (1) Understanding disaster risk, (2) Strengthening disaster risk governance to manage disaster risk, (3) Investing in disaster risk reduction for resilience, (4) Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and construction.

At EU level, a framework for EU cooperation on disaster prevention across all types of natural and man-made hazards was agreed in 2009[21]. Risk assessment together with risk analysis are the pillars of this prevention framework which are fundamental for a successful disaster management strategy. Two years later, the EU undertook to identify the risks Europe may face in the future based on national risk assessments[22]. This overview focuses primarily on risks that may have cross-border impacts and/or those larger scale impacts that may be experienced by more than one Member State.

4.2. Spanish Emergencies and Risk Management of Cultural Heritage.

4.2.1. National Plan for Emergencies and Risk Management in Cultural Heritage (NPERMCH)

In 2015 the Spanish government approved a *National Plan for Emergencies and Risk Management in Cultural Heritage* (NPERMCH)[23]. This plan promotes the conservation of cultural heritage by the implementation of preventive measures and actions in order to correct the deterioration of heritage over time. In this sense, the NPERMCH, like other national plans, is a multidisciplinary tool designed to be managed at different levels with the participation of different administrations (state, autonomous and local) and other public and private entities,

[19] https://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf
[20] https://www.unisdr.org/we/coordinate/sendai-framework
[21] https://eur-lex.europa.eu/legal-content/es/ALL/?uri=CELEX:52014SC0134
[22] https://ec.europa.eu/echo/files/about/COMM_PDF_SEC_2010_1626_F_staff_working_document_en.pdf
[23] https://sede.educacion.gob.es/publiventa/plan-nacional-de-emergencias-y-gestion-de-riesgos-en-patrimonio-cultural/patrimonio-historico-artistico/20705C

for the promotion of knowledge, the programming of preventive actions, the training of technicians and the dissemination of knowledge about cultural heritage.

4.2.1.1. Objectives of the NPERMCH

The NPERMCH responds to the risk of damage as a result of a catastrophe, whether natural or anthropogenic. Disasters of anthropogenic origin are often related to negligence or carelessness (failures in surveillance or security systems that cause fires, floods, etc., lack of maintenance of buildings, etc.) and in other cases intentional (deliberately-lit fires, theft and illicit traffic, vandalism, politically or religiously motivated attacks and armed conflicts).

The overall objective of the NPERMCH is to define and implement preventive and palliative actions necessary for the protection of cultural property, against the action of phenomena of natural origin or other causes of anthropogenic origin likely to cause immediate damage.

In line with this, the NPERMCH has three fundamental goals: (i) to design measures or procedures for the prevention and protection of cultural heritage in the event of a catastrophe; (ii) to establish for these cases an action methodology to minimise the damage that could occur and to design action instruments and (iii) to coordinate the different institutions that intervene in emergency situations that affect the safety of people and property.

To this end, it is necessary to establish mechanisms for collaboration and participation at the state, regional and local levels, of the institutions responsible for civil protection and those responsible for safeguarding cultural heritage, as well as to manage the necessary resources, guaranteeing the rescue and protection of cultural property. The NPERMCH is a key instrument for executing 1) the Preliminary Phase and 2) the Damage Assessment and Emergency Intervention Phase of the National Coordination and Support Plan for the Protection of Cultural Property[24] and is considered fundamental for its operational efficiency.

In addition to the broad objective and goals outlined above, the specific objectives of the NPERMCH are as follows:

- Identify phenomena or hazards of natural origin that can seriously affect cultural property, as well as the probability of occurrence based on geographical, climatological, geological and biological parameters, etc.
- Identify hazards of anthropogenic origin -whether intentional, fortuitous or deriving from negligence- that can seriously affect cultural property and the probability of occurrence based on sociological, political, economic, etc. parameters.
- Identify and geographically locate the cultural property that may be affected by the various risks.
- Design measures to prevent and protect cultural property from the various risks to which it may be exposed.

[24] Note that a link to this plan could not be located at the time of writing.

- Establish coordination mechanisms between the different administrations.
- Design a damage assessment methodology in accordance with the provisions of the Coordination and Support Plan for the Protection of Cultural Property.
- Establish a criterion for prioritising actions.
- Plan resources and protocols for urgent action for the safeguarding and rescue of cultural property in the event of an emergency.
- To exchange knowledge and experiences between the different institutions that intervene in an emergency.
- To make society aware of the importance of safeguarding cultural assets, involving all citizens.

4.2.2. NPERMCH Guidelines for Autonomous Communities

In order to deal with the damage caused by catastrophic episodes, it is recommended that Autonomous Communities (among them Valencia) create their own cultural heritage emergency management units which, in collaboration with Civil Protection and cultural institutions, would then draw up prevention and action programs to safeguard cultural heritage.

These units, to be formed by technicians from different public administrations, would be in charge of urgent attention in emergency situations that could affect the integrity of cultural property and/or the people involved in rescue and recovery tasks; the design and application of preventive measures to avoid or minimise the consequences of disasters; the definition of lines of action, research and documentation programmes, as well as the training and dissemination programmes contained in this plan. Specifically, a unit would be required to undertake:

- Elaboration of the Map of Cultural Heritage Risks in its regional scope.
- Definition of the immediate measures to be implemented or recommended, in coordination with the other responsible agents involved.
- Elaboration of emergency intervention proposals.
- Elaboration, where appropriate, of Master Plans for the orderly recovery of the cultural heritage affected by the catastrophe and the monitoring of each of the interventions.

At the time of writing, it was unclear how the work undertaken by Valencia's emergency management unit was to be funded. This is to be explored in consultation with local stakeholders.

4.3. Regional

There is not a unique competent body at regional level regarding DRR. On the contrary, competences are shared among different departments according to the type of risk.

For instance, the Agriculture, Rural Development, Climate Emergency and Ecological Transition Department is responsible for wildfire prevention at the regional level [61]. In this regard, a complex regulatory and planning framework exists, under which the Albufera Natural Park, for instance, is subject to a specific Forest Fire Prevention Plan according to its protected area status [62]. At the same time, the whole municipality of Valencia (including its part of the Albufera National Park) is also under the framework of the Lliria forest management zone, which includes other municipalities as well, and also has its own specific Forest Fire Prevention Plan [63]. Other regional forest fire prevention plans and measures also apply [64]. There is also an online dashboard (see screenshot in Figure 55) regarding wildfire information at regional level [65], which serves as an information hub for every stakeholder involved in fire prevention and analysis.

Figure 55. Integrated Wildfire Management System (screenshot) [65].

The Mediterranean Center for Environmental Studies (CEAM), which is a foundation dependent on the Regional Department of Agriculture, Rural Development, Climate Emergency and Ecological Transition, has also a webpage named “CEAMET” [66] which is used to disseminate public information, forecasts and warnings in relation to several environmental risks. For instance, CEAMET is used in the framework of the Extreme Temperatures Warning System (in partnership with the Regional Health Department), UV Radiation Warning System, and Tropospheric Ozone Warning System (see Figure 56).

Figure 56. Entry point to the CEAMET Warning Systems (screenshot) [66].

In addition to the former examples of complex governance at the regional level, a regional flood risk management plan (PATRICOVA) was developed by the regional department competent on land use planning [67].

There is also a different body in charge of the regional emergency telephone number “1·1·2 Comunitat Valenciana” [68], which depends on the Justice, Interior and Public Administration Department. It not only attends emergency calls, but also, among many other competences, functions as an access point to most of the real-time information regarding risks monitored at the regional level, such as wildfire or weather risks (see Figure 57). It also provides guidelines to citizens on best practices regarding protection from different hazards, such as flood risk, wildfire risk or seismic risk [69].

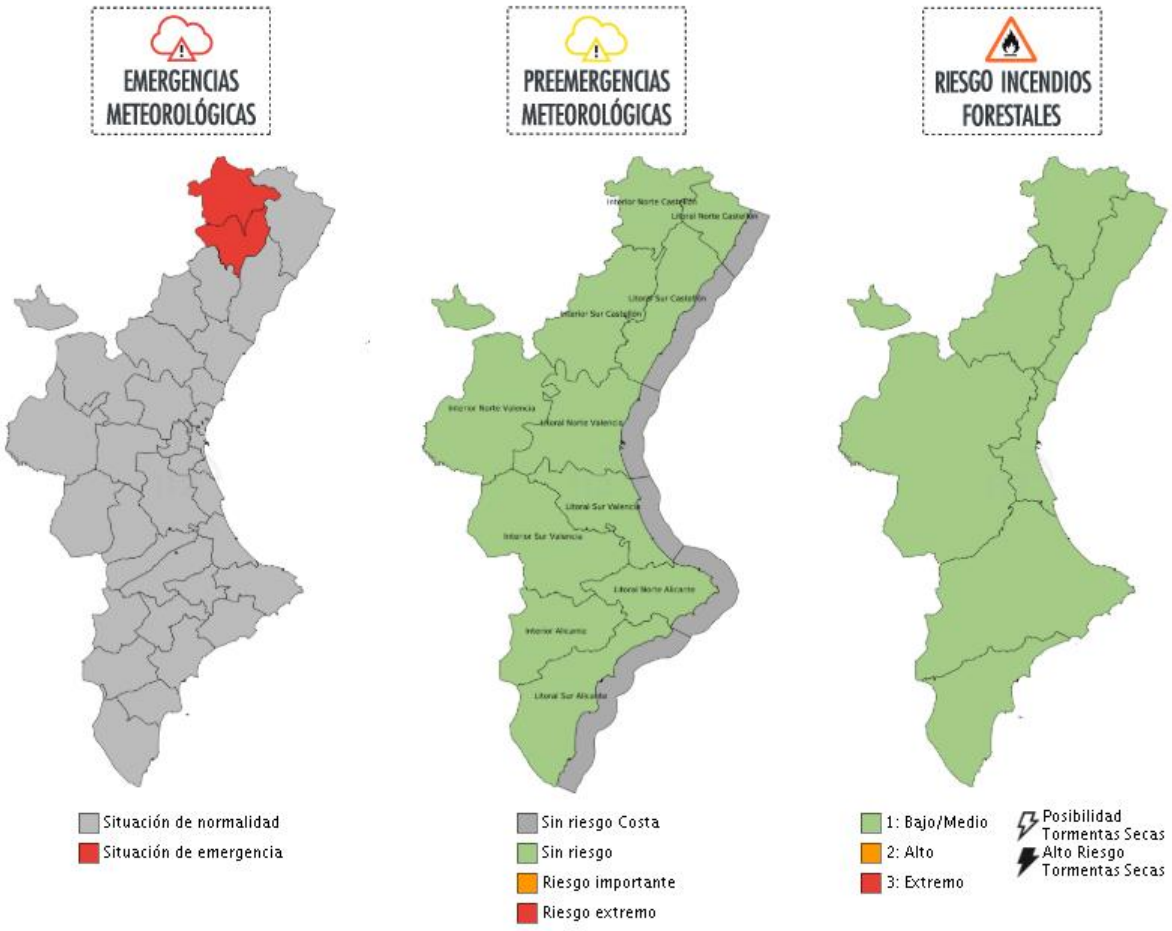


Figure 57. 1·1·2 Comunitat Valenciana Meteorological Risks Warnings (screenshot) [68].

4.4. Local

The city's Health Service is responsible for issuing health alerts regarding risks such as those caused by UV radiation and extreme temperatures [70].

The Air Quality city agency is in charge of the activation/deactivation of the local air pollution protocol in cases of high levels of PM10 or nitrogen dioxide [71], based on the data recorded by the regional air quality measurement network.

The city also has a Citizens' Protection Area [72], which includes the City Fire and Civil Protection Departments. The City Fire Department is not only in charge of firefighting, but also of fire prevention, and has a special fire station located next to the Albufera forest area ("Devesa del Saler"). There are also currently in force a specific operating procedure regarding wildfires in the Devesa del Saler [73] and a city ordinance in relation to fire protection [74]. It should also be noted that, according to regional regulations, every Valencian municipality where forested land is found needs to prepare a Local Fire Prevention Plan [75]. In the case of the municipality of Valencia, such a Plan has yet to be developed, for reasons that were unknown at the time of writing.

The city is also able to order the closure of the city parks and gardens, including cemeteries, in case of weather related hazards, as set out in the corresponding Parks and Gardens City Ordinance [76].

Surveillance, rescue, life-saving and safety in the city beaches are also under the responsibility of the Beaches Service of the city [77], as established in the City Ordinance related to Beaches and Neighbouring Zones Use [78]. The city is therefore responsible, among other competences, for enforcing bathing prohibitions, in the presence of any health hazard detected by the Regional Department with competence in the Environmental area, or even shutting down the bathing areas if needed by any identified risk.

4.5. Gaps and needs

No explicit mention of heritage protection among the local governance framework for DRR has been found during this first stage of research, suggesting there is an opportunity here to establish links between these two areas of management. However, further information is needed in order to confirm this, as mentioned in the following section.

5. Governance framework for climate change adaptation

5.1. International adaptation framework

The main adaptation documents and initiatives in Europe are listed below.

5.1.1. EU Climate Change Adaptation Strategy (2013)

The overall objective of the strategy is to contribute to a Europe more resilient to climate change and variability. This translates into improved preparedness and responsiveness to the impact of climate change at local, regional, national and European levels, with particular emphasis on better coordination and a common approach. The strategy has three priorities, divided into eight actions, which are shown in Figure 58. The documents on which the strategy is based are the SWD (Staff Working Documents) 2013: numbers 133-139. These documents cover the following themes: Adaptation in coastal and marine areas; Impacts on human, animal and plant health; Adaptation of infrastructures; Climate change, environmental degradation and migration; Technical guidelines for Cohesion Policy programmes and investments; Principles and recommendations for rural development programmes; and Guidelines for the development of adaptation strategies.

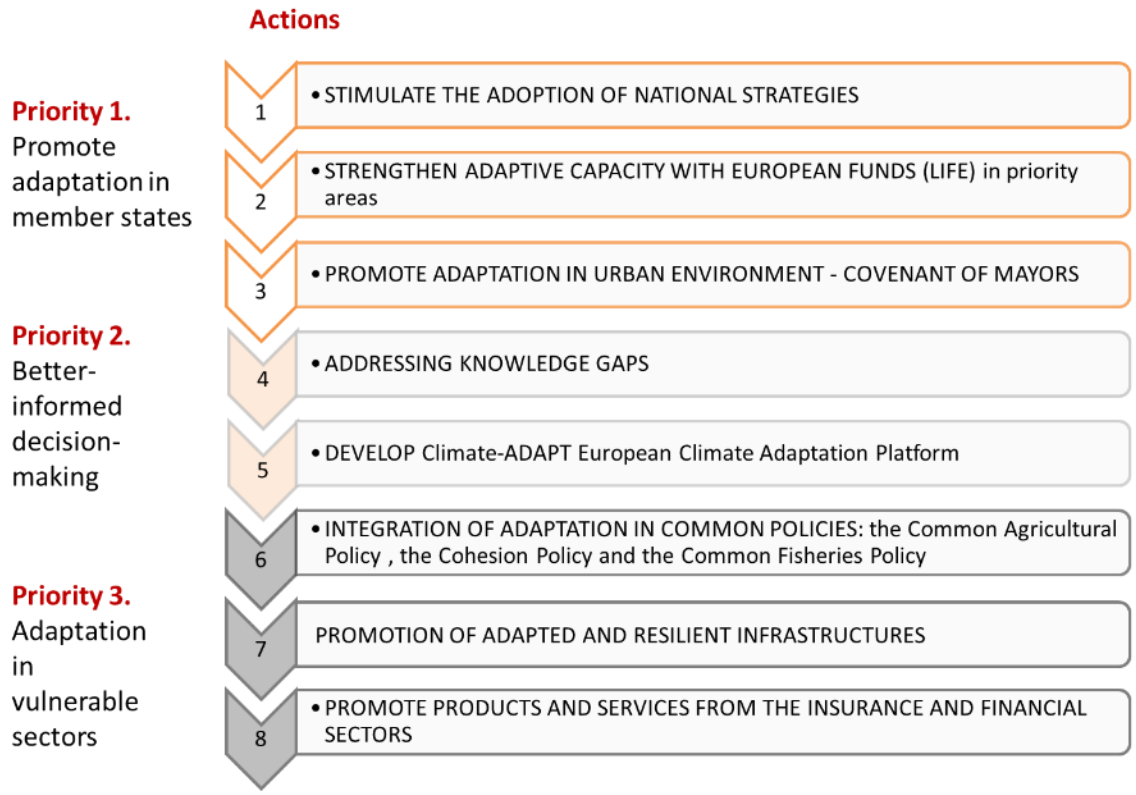


Figure 58. Priorities and key actions to contribute to a more climate-resilient Europe.

The Commission recognises the importance of cities for successful adaptation by translating this into the European Climate Change Strategy (Action 3). Based on the model of the Covenant of Mayors, the Commission supports mitigation and adaptation in cities, notably by launching a voluntary commitment to adopt local mitigation and adaptation strategies and awareness-raising activities.

5.2. Spanish adaptation framework

5.2.1. Key National Documents and Policies on Adaptation

5.2.1.1. Spanish Strategy for Climate Change and Clean Energy (EECCEL). Horizon 2007-2012-2020

This document is the first climate change strategy including adaptation in its content. However, the strategy is largely mitigation-oriented in order to comply with the Kyoto Protocol, though it also mentions adaptation briefly. The main adaptation related objective is the development and implementation of the PNACC (described below). The EECCEL also includes objectives in this area of awareness, sensitisation and research on climate change and clean energy.

5.2.1.2. National Plan for Adaptation to Climate Change (PNACC) and Third Work Programme (TPT) (2006, 2014)

The main objective of this Plan is the integration of adaptation to climate change into the planning and management of different socio-economic sectors and Spanish systems. The specific objectives are the generation of regional climate scenarios, the promotion of impact assessments, vulnerability and adaptation options in all sectors and ecological systems contemplated in the Plan, the progressive promotion of integrated cross-sector assessments in different geographical areas, as well as the dissemination and communication of the main results obtained. It also establishes the need to strengthen R&D&I as well as periodic monitoring and evaluation reports of the PNACC and its component projects. Despite the interdependence of several sectors among them, the Plan is divided into 16 sectors for its development: Biodiversity, Water Resources, Forests, Agricultural Sector, Coastal Zones, Hunting and Inland Fishing, Mountain Areas, Soil, Fishing and Marine Ecosystems, Transport, Human Health, Industry and Energy, Tourism, Finance - Insurance, Urbanism, Construction. In the first work program, 3 of these sectors or systems were identified as priorities: Water Resources, Coastal Zones and Biodiversity.

The third work programme of the PNACC continues to develop the objectives of the PNACC and to maintain the structure of the second programme with 4 axes and two pillars:

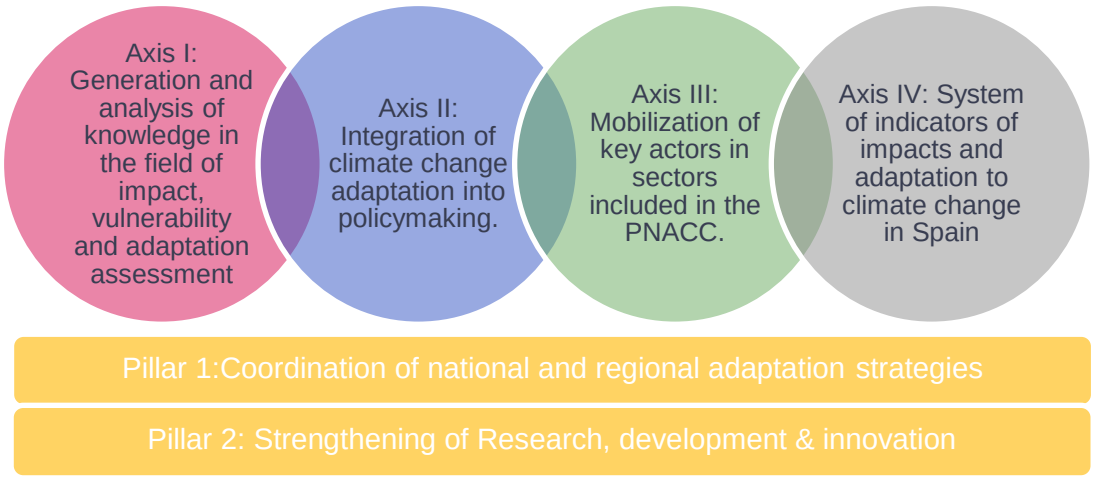


Figure 56. Structure of the Spanish PNACC.

The fourth PNACC monitoring report summarizes the progress made between 2015-2018 corresponding to the third work programme. In this period, in the area of knowledge generation, new sectoral assessments have been developed that affect strategic areas such as biodiversity, water, soil - desertification, agriculture, aquaculture, tourism, health, energy, marine environment and coastal areas.

The creation of the PIMA ADAPTA instrument, which is fed by income from auctions of emission allowances, has allowed for a substantial expansion of support economic to projects in the area of adaptation. In this context Valencia was supported to restore the native riverbank vegetation and the elimination of common cane (*Arundo donax*) in the Turia Natural Park. On the other hand, the LIFE SHARA project is enabling the strengthening of the components relating to the management knowledge, training and governance, all strategic areas in the case of adaptation. Among the inspiring experiences of adaptation to climate change disseminated within the framework of LIFE SHARA an example from Valencia was highlighted: Changing the city from food policies.

5.2.1.3. Strategy for adaptation to climate change on the Spanish coast (2016)

This strategy is based on and shares objectives with the Coastal Act (Act 22/1988), later amended by Act 21/2013.

The general objectives of the Strategy:

- Increase the resilience of the Spanish coast to climate change and climate variability.
- Integrate adaptation to climate change into the planning and management of the Spanish coast.

The strategy consists of three parts: i) current diagnosis of the coast, ii) specific objectives, general guidelines and proposed measures, iii) implementation and monitoring and iv) annex of the plans and programmes linked by sectors and autonomous communities. The strategy lists 26 adaptive measures to favour the resilience of the Spanish coast. Aligned with this strategy an action to repair the protection layer of the Marjal dels Moros in Valencia was deployed.

Furthermore, in the context of the coast context, the Ministry of Agriculture and Fisheries, Food and Environment presents a comprehensive study that proposes definitive solutions to the erosion of the southern coast of Valencia[25].

5.2.2. Recent developments

The Spanish Government has recently declared a state of climate emergency [79]. The declaration included the commitment to pass a number of measures within the following 100 days, such as, among others, a national Climate Change and Energy Transition Law. These measures had not yet been approved at the time of writing, and were placed on hold due to the state of emergency arising from the COVID-19 pandemic. The National Adaptation Plan will also be reviewed, including a new monitoring system. Therefore, the next months will be key in setting the new framework in which adaptation to climate change will take place in Spain.

5.3. Regional

The main responsibilities in climate change at a regional level are assigned to the General Directorate of Climate Change, which is dependent on the Autonomous Secretariat for Climate Emergency and Ecological Transition of the Regional Department of Agriculture, Rural Development, Climate Emergency and Ecological Transition.

The Regional Government has also declared a state of climate emergency [80]. Among other measures in current development, a regional Climate Change Law is also being prepared. However, the procedure for preparation and adoption of such a regulation was also placed on hold at the time of writing due to the state of emergency arising from the COVID-19 pandemic.

The Regional Government has also adopted the Regional Climate Change Strategy update [37], which has already been extensively cited in previous sections. The main objectives of the Regional Strategy in relation to Climate Change Adaptation are:

- To identify vulnerabilities
- Risk detection
- To increase resilience in the economic fabric and the Valencian society

[25] https://www.miteco.gob.es/es/costas/temas/proteccion-costa/estrategias-proteccion-costa/valencia/estrategia-proteccion-valencia.aspx

- To adopt preventive measures to minimise the potential damages that climate change might produce on people and the environment.

The strategy includes a comprehensive list of measures and actions in relation to mitigation, adaptation, and also with a combined approach integrating mitigation and adaptation. Several work lines are established, and within each of them general measures are set, and later disaggregated into actions. For each action, the regional department or body in charge is identified.

There are also several bodies through which public engagement and participation in climate change are promoted and conducted. Some of them are currently under review, such as the Climate Change Experts Valencian Committee, but others are still active, such as the Advisory and Participatory Environmental Board ("CAPMA") [81] in which the main social and professional groups are present.

5.4. Local

The municipal government structure [29] includes an Area of Urban Ecology, Climate Emergency and Energy Transition. Within this area, especially relevant to the ARCH project are the Departments of Climate Energy and Energy Transition, as well as the Department of Protected Areas Conservation and Devesa-Albufera. There is also a Department of Agriculture, Sustainable Food and Huerta, within the Innovative Development of Economic Sector and Labour Area.

There is also a Municipal Climate and Energy Foundation ("València Clima i Energia"), which depends on the Department of Climate Energy and Energy Transition [82]. Its main areas of work are climate change information and training, as well as the transformation of the city in terms of resilience and ability to face the present and future challenges from global warming.

The previously cited *SECAP* of Valencia [31], prepared in accordance with the requirements of the EU Covenant of Mayors for Climate & Energy initiative [83] is the most updated document in relation to local commitments in relation to climate change. The adaptation measures proposed are detailed, prioritised and allocated time schedules in the Annex to the Plan.

5.5. Gaps and needs

As mentioned previously, the current policy and regulatory framework at national and regional level is under revision. Therefore, future developments in the next few months should be considered in the next steps of the project. Further, given that governance is complex, due to the involvement of many bodies and other stakeholders. A round of meetings with the main authorities involved will be developed in order to verify and complete the information presented herein.

6. Expected impacts of climate change-related and natural hazards

The purpose of this section is to report and review the preliminary collection of relevant information about hazards, exposed elements, as well as impacts provided by ARCH city partners in collaboration with their local research partners, in order to offer an initial overview on the risks that might affect the selected historic areas and their communities. It should be noted that the content in this section is not exhaustive, but rather should be understood as a departure point to serve as a basis for future work.

This section is structured as follows: a description of the methodology is provided, followed by a Risk Profile Table, outlining hazards, exposed elements, impacts, and corresponding resilience-building measures already planned or implemented to date. Next follows a review, interpretation, and validation of the information provided in the Risk Profile Table. Finally, an outlook is provided concerning further risk analysis work in the context of the ARCH project.

6.1. Methodology

In order to elicit relevant information for risk analyses from city partners, ENEA, Fraunhofer, ICLEI, and Tecnalia developed a Risk Profile Table template (see Part 6.2 below) based on the central risk components identified in the 5th Assessment Report of the Intergovernmental Panel on Climate Change [84]: hazards, exposed elements, impacts (physical, societal, functional, economic, and intangible), as well as corresponding resilience-building measures already planned or implemented to date. This template was filled out by city partners and provides a starting point from which to conduct more detailed risk analyses. Furthermore, it allows to provide a useful starting point for the data, models, methods, and tools to be developed during the project

The information provided in the Risk Profile Table was reviewed and harmonised by ENEA in order to provide a comparable description across all city cases and ensure relevance to (and validity for) similar on-going[26] and/or future initiatives and projects in the field of disaster risk reduction, climate change adaptation, and cultural heritage preservation.

The following standards, reference material, and tools were identified as most suitable for this exercise:

- The City Climate Hazard Taxonomy [84] for classification of hazards[27];

[26] E.g. United Nations Office for Disaster Risk Reduction: Words into Action guidelines: National disaster risk assessment. UNDRR, 2017. Online: https://www.undrr.org/publication/words-action-guidelines-national-disaster-risk-assessment

[27] It should be noted that hazards were identified and named in the Risk Profile Table based on [30] rather than [84].

- The UNDRR QRE Tool [30] and ISO standard 37120 Sustainable cities and communities — Indicators for city services and quality of life[28] for the classification of exposed elements and impacts; and
- The ICOMOS CCHWG[29] classification and INSPIRE[30] directive for the classification of heritage assets.

Based on the harmonised information, initial proposals for risk analysis focus actions (e.g. which methods and tools to apply for which part/issue of a historic area) were formulated by ENEA. The initial proposals will be further defined during the co-creation process and in exchange with the relevant local stakeholders.

[28] https://www.iso.org/standard/68498.html

[29] https://adobeindd.com/view/publications/a9a551e3-3b23-4127-99fd-a7a80d91a29e/g18m/publication-web-resources/pdf/CCHWG_final_print.pdf

[30] INSPIRE, Infrastructure for Spatial Information in EuropeD2.8.III.2 Data Specification on Buildings – Technical Guidelines (5.3.1.1.4. Classification of buildings, pages 43-45).

6.2. Risk profile table

Heritage site (historic area)	**Hazard**[31]	**Exposed element** [32]	**Impacts**					**Corresponding resilience-building measure**	**Notes/Evidence**
			Physical	**Societal**	**Functional**	**Economic**	**Intangible**	**Description** (please indicate specific S or general G)	
Huerta	Flood (*) (riverine flooding, coastal flooding and flash floods) and Convective Storms (**) *(Unless indicated otherwise, the information in subsequent columns applies to both hazards)*	Buildings. Natural environment Tangible heritage (irrigation infrastructure, agricultural machinery and equipment). Intangible cultural heritage (agricultural traditional skills and customs). People (urban area and at the site). Road, railroad and other infrastructure networks.	Damage to buildings, roads and other infrastructure and equipment. Loss of agricultural soil due to erosion (* and **) or salinization(*). Loss of irrigation water due to damage to storage or distribution infrastructures (* and **) and salinization (*).	Injury and mortality. Loss of access to key services such as food provision and access to critical infrastructures.	Disruption of transport services and water supply. Disruption of ecosystem services (food production, etc).	Agricultural losses due to damages to crops, cropland, infrastructures or machinery, among other. Loss of tourism revenue due to service disruption.	Damage or loss of cultural heritage (buildings, infrastructures, etc).	Flood mapping, zoning, and monitoring (S). (*) Flood defence works (S).(*) Early warning systems (S). Water supply diversification and infrastructure improvements (S). Coastal defences (S). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Green Infrastructure Management (G).	[1], [24], [31], [37], [67], [25], [85], [86], [87], [88], [89],

[31] Note: the UN Office for Disaster Risk Reduction (UNDRR)'s Resilience Scorecard defines 'hazard' as 'a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation'. Of these, the ARCH project is addressing natural and climatic hazards.

[32] Note: the UN Office for Disaster Risk Reduction's Resilience Scorecard defines 'exposure' as 'the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas'.

Heritage site (historic area)	**Hazard**[31]	**Exposed element** [32]	**Impacts**					**Corresponding resilience-building measure**	**Notes/Evidence**
			Physical	**Societal**	**Functional**	**Economic**	**Intangible**	**Description** (please indicate specific S or general G)	
Huerta	Extreme temperature (*) and Drought (**) *(Unless indicated otherwise, the information in subsequent columns applies to both hazards)*	Natural environment, crops and croplands. Intangible cultural heritage (agricultural traditional skills and customs). People (urban area and at the site).	Damage to crops, soils and the natural environment. Increased evapotranspiration (*).	Illness or death (*). Loss of access to key services such as food provision. Increased competition for water.	Decrease of the ecosystem services (less food production if disruption to water supply, or very extreme heat events, or due to new or increase of existing pests and diseases).	Decrease of agricultural productivity leading to loss of revenue. Loss of tourism revenue due to service disruption (*).	Damage or loss of cultural heritage (such as agricultural traditional customs).	Extreme temperatures and heat waves program (S) (*). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Various measures within the River Basin Management Plan (S)(**)	[31], [37], [25], [1], [87], [89], [86], [85], [24], [90], [88], [91]
Huerta	Insect infestation	Natural environment, crops and croplands. Tangible cultural heritage (channels) Intangible cultural heritage (agricultural traditional skills and customs). People (urban area and at the site).	Damage to crops, and the natural environment.	Illness or death. Loss of access to key services such as food provision.	Decrease of the ecosystem service (less food production if new or increase of existing pests).	Decrease of agricultural productivity leading to loss of revenue. Loss of tourism revenue due to service disruption.	Damage or loss of cultural heritage (such as agricultural traditional customs).	Regional Action Plan on Vector-Borne Diseases (S). Asian Tiger Mosquito Prevention and Control Campaign (S). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S).	[31], [37], [25], [1], [89], [86], [85], [24], [92], [93]

Heritage site (historic area)	**Hazard**[31]	**Exposed element** [32]	**Impacts**					**Corresponding resilience-building measure**	**Notes/Evidence**
			Physical	**Societal**	**Functional**	**Economic**	**Intangible**	**Description** (please indicate specific S or general G)	
Albufera	Flood (*) (riverine flooding, coastal flooding and flash floods) and Convective Storms (**) *(Unless indicated otherwise, the information in subsequent columns applies to both hazards)*	Buildings. Natural environment. Tangible cultural heritage (irrigation infrastructure, agricultural machinery and equipment). Intangible cultural heritage (agricultural and fishing traditional skills and customs). People (urban area and at the site). Road and other infrastructure networks. Boats and jetties. “Golas” (sea-lagoon channels) and associated infrastructure. “Motas” (traditional elevated paths and field margins for water management).	Damage to buildings, boats and jetties. Impacts on roads, channels and other infrastructure. Loss of soil due to erosion or salinization. Loss of irrigation water due to damage to storage or distribution infrastructures and salinization. Loss or damage to highly valuable ecosystems. Damage to “golas”, “motas” and associated infrastructure.	Injury and mortality. Loss of access to key services such as food provision. Loss of jobs and associated impacts in local people.	Damage to coastal, forest and lagoon ecosystems. Loss of crops and fish stocks. Disruption of transport and tourist services. Disruption to electricity and water supply.	Agricultural losses due to damages to crops, cropland, infrastructures or machinery, among other. Loss of tourism revenue due to service disruption. Fishing losses.	Damage or loss of cultural heritage (traditional leisure activities in the forest lagoon areas, buildings, infrastructures, jetties, traditional fishing equipment and practices, etc).	Flood mapping, zoning, and monitoring (S) (*). Flood defence works (S) (*). Early warning systems (S). Water supply diversification and infrastructure improvements (S). Coastal defences (S). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Green Infrastructure Management (G). Forest Management (G) (**). Protected Area Management (G).	[67], [37], [31], [1], [25], [85], [86], [87], [88], [89], [46], [24], [94]

Heritage site (historic area)	**Hazard**[31]	**Exposed element** [32]	**Impacts**					**Corresponding resilience-building measure**	**Notes/Evidence**
			Physical	**Societal**	**Functional**	**Economic**	**Intangible**	**Description** (please indicate specific S or general G)	
Albufera	Wave action	Beaches. “Golas” (sea-lagoon channels) and associated infrastructure. Lagoon shores and banks. People. Road and other infrastructure networks. Boats and jetties. Fishing equipment.	Loss of highly valuable ecosystems. Damage to “golas”, and associated infrastructure. Damage to buildings, boats and jetties. Impacts on roads, channels, fishing equipment and other infrastructure.	Injury and mortality. Loss of access to key services due to increased coastal erosion.	Damage to coastal and lagoon ecosystems. Loss of fishing equipment. Disruption of fishing and tourist services.	Loss of tourism revenue due to service disruption and damage to beaches, jetties and other areas. Fishing losses.	Damage or loss of cultural heritage (traditional leisure activities in the beach and lagoon areas, buildings, infrastructures, jetties, traditional fishing equipment and practices, etc).	Coastal defences (S). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Green Infrastructure Management (G). Protected Area Management (G).	[37], [31], [1], [25], [85], [86], [87], [88], [89], [46], [24]
Albufera	Extreme temperature (*) and Drought (**) *(Unless indicated otherwise, the information in subsequent columns applies to both hazards)*	Natural environment, crops and croplands. Intangible cultural heritage (agricultural and fishing traditional skills and customs). People (urban area and at the site).	Damage to crops, soils and the natural environment. Increased evapotranspiration. Increased wildfire risk.	Illness or death. Loss of access to key services such as food provision. Increased competition for water.	Increased eutrophication of lagoon water and damages to forest areas, leading to a worse ecological state. Decrease of the ecosystem services (such as less food production, or due to new or increase of existing pests and diseases).	Agricultural losses due to damages to crops and cropland. Loss of tourism revenue due to service disruption. Fishing losses.	Damage or loss of cultural heritage (traditional leisure activities in the forest and lagoon areas, fishing practices, etc).	Extreme temperatures and heat waves program (S) (*). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Forest Management (G). Protected Area Management (G). Green Infrastructure Management (G). Various measures within the River Basin Management Plan (S) (**).	[37], [31], [1], [25], [85], [86], [87], [88], [89], [46], [24], [90], [94], [91]

Heritage site (historic area)	**Hazard**[31]	**Exposed element** [32]	**Impacts**					**Corresponding resilience-building measure**	**Notes/Evidence**
			Physical	**Societal**	**Functional**	**Economic**	**Intangible**	**Description** (please indicate specific S or general G)	
Albufera	Wildfire	Natural environment, crops and croplands. Intangible cultural heritage (agricultural and fishing traditional skills and customs). People (urban area and at the site). Buildings. Roads and other infrastructure. Wildlife	Damage to crops, soils, the natural environment and human-made structures.	Illness or death, direct or indirect (e.g. due to air quality problems). Loss of access to key services such as the place of residence or food provision.	Damage or total destruction of the ecosystem, leading to a decrease of the ecosystem services. Disruption in transport and other services. Loss of housing.	Agricultural losses due to damages to crops and cropland. Loss of tourism revenue due to service disruption. Fishing losses. Impacts on buildings and other human-made structures.	Damage or loss of cultural heritage (traditional leisure activities in the forest, beach and lagoon areas, fishing practices, etc).	Albufera Natural Park Fire Prevention Plan (S). Forest Management (G). Protected Area Management (G). Green Infrastructure Management (G).	[37], [31], [1], [25], [85], [86], [87], [88], [89], [46], [24], [94]
Albufera	Insect infestation	Natural environment, crops and croplands. Tangible heritage (channels). Intangible heritage (agricultural traditional skills and customs). People (urban area and at the site).	Damage to crops, and the natural environment.	Illness or death. Loss of access to key services such as food provision.	Decrease of the ecosystem services (less food production if new or increase of existing pests).	Decrease of agricultural productivity leading to loss of revenue. Loss of tourism revenue due to service disruption. Fishing losses.	Damage or loss of cultural heritage (traditional leisure activities in the forest, beach and lagoon areas, fishing practices, etc).	Regional Action Plan on Vector-Borne Diseases (S). Asian Tiger Mosquito Prevention and Control Campaign (S). Various measures within the Valencian Climate Change and Energy 2030 Strategy (S). Various measures within the Valencia Sustainable Energy and Climate Action Plan (S). Forest Management (G). Protected Area Management (G). Green Infrastructure Management (G).	[37], [31], [1], [25], [85], [86], [87], [88], [89], [46], [24], [92], [93], [94]

Note: Hazards identified and named based on [30] .Due to the size of both areas (Huerta and Albufera) and their complex land use, regulatory and governance frameworks, the previous table should not be considered as complete or comprehensive, but rather the first stage of an exploratory process to be further refined during the project development.

6.3. Preliminary classification of hazards, exposed elements, and impacts

The purpose of this section is to review, interpret, validate, and harmonise the information provided in the Risk Profile Table as a sound basis for the project to address Valencia's risks for the two historic areas that will be examined, i.e. Huerta and Albufera. This preliminary analysis covers:

a) hazards,

b) elements exposed to those hazards, and

c) impacts that the identified hazards might cause on the exposed elements.

A related purpose is to identify possible data gaps, and proposals for focus project actions in the context of the city case.

6.3.1. Hazards

The Valencia city authors of previous sections show an awareness of the hazards that are affecting the two selected sites, as also highlighted by the preliminary resilience assessment presented later in part 7. Seven different hazard types have been identified in the Risk Profile Table. Five of them – *Convective Storms*, *Drought*, *Extreme temperature*, *Flood* and *Insect Infestation* – are hazards affecting both areas, whereas *wave action* and *wildfire* only affect Albufera. For the purpose of this discussion, these hazards have been classified in Table 1 below according to the hazard categories belonging to the *C40 City Climate Hazard Taxonomy*[33]. which are broken down into main hazard types, and hazard sub-types[34].

The hazard categories identified in the Risk Profile Table for both Huerta and Albufera are: ***Meteorological, Climatological, Hydrogeological, and Biological.*** Although not specifically reported in the Risk Profile Table (because it was based on the QRE tool and associated terminology), the hazards ***extreme precipitation and sea-level rise*** can be extrapolated from identification of convective storms, coastal flooding and wave action, while ***pollution*** was identified elsewhere in this report (see part 2.2.3). Therefore, human-induced hazards have also been included in the hazard classification. Table 1 below lists all hazard categories and (sub-)types identified for Huerta and Albufera.

[33] https://www.c40.org/researches/city-climate-hazard-taxonomy

[34] It should be noted that C40's taxonomy has some limitations in that the hazards classified as "Meteorological, climatological and hydrological" are themselves the result of meteorological events. Conflating meteorological and climatic hazards is problematic as the two types have different time scales. At the time of writing, discussion on hazard classification is ongoing and a single system has not yet been agreed upon.

Hazard Group	Hazard Main Type	City Climate Hazard Type (sub type indicated in brackets where applicable)
Meteorological	Precipitation	Rain storm
	Wind	Severe wind; Cyclone
	Lightning	Electrical storm (Lightning/thunderstorm)
	Extreme temperature - Cold	Extreme winter conditions (Ice, hail); Cold wave (Cold snap, frost); Extreme cold weather (Cold days)
	Extreme temperature - Hot	Heat wave; Extreme hot weather (Hot days)
Climatological	Water scarcity	Drought (Lack of precipitation and seasonal melt (snow, glacial))
	Wild fire	Forest fire; Land fire (Bush fire, grass fire, pasture fire, scrub fire)
Hydrological	Flood	Flash/surface flood; River flood; Coastal flood
	Wave action	Storm surge
	Chemical change	Salt water intrusion
Biological	Insects and microorganisms	Water-borne disease; Vector-borne disease; Air-borne disease; Insect infestation

Table 1. Hazard categories and types identified for both Huerta and Albufera. Bold characters indicate hazard types relevant for Albufera only.

6.3.2. Exposed Elements

The elements exposed to the aforementioned hazards, identified within the Risk Profile Table for Huerta and Albufera have been reorganised in Table 2 below, according to the following categories:

- Natural Environment
- Built Environment: critical Infrastructures and Buildings;

- Cultural heritage;
- Services (essential or basics and productive);
- Human and social aspects.

Here, the cultural heritage category subsumes all exposed elements that are in themselves heritage, i.e. exposed elements declared as heritage are only categorised as such and not as any of the other categories (e.g. traditional fishing equipment is not categorised under services while non-traditional fishing equipment is).

Exposed Element Categories	Exposed Element Types
Natural Environment	Ecosystems
	Wildlife
Built Environment	Buildings
	Road, railroad and other critical infrastructures
	Storage and irrigation water infrastructures, channels
Cultural Heritage	Tangible and Intangible elements (see Table 3)
Services, essential and productive	Cropland
	Agricultural machinery and equipment
	Fishing Equipment
	Boats and Jetties
Human and Social Aspects	External people (e.g. tourists,)
	Local people

Table 2. Exposed elements identified for both Huerta and Albufera; in bold the ones that are peculiar to Albufera only.

Table 3 reports in further detail the exposed elements categorised as cultural heritage. Here, reference has been made to the six categories identified by the ICOMOS Climate Change and Cultural Heritage Working Group, CCHWG (2019). For Huerta and Albufera, four out of the six CCHWG categories are of particular relevance, i.e.: **Movable heritage, Building and Structures, Cultural Landscapes and Intangible Heritage**. These cultural heritage categories have been broken down further into cultural heritage types (i.e. Archaeological heritage and Associated and Traditional Communities) to provide a more detailed picture.

Exposed Cultural Heritage Categories	Exposed Cultural Heritage Types
Moveable heritage	Traditional agricultural equipment **Traditional fishing equipment**
Archaeological resources	Archaeological finds
	Archaeological materials
	Archaeological sites
	Archaeological monuments
Buildings and structures	Buildings
	“Golas”
	“Motas”
	Hydrographic, irrigation and drainage network
Cultural landscapes	Combined works of nature and humankind
Associated and traditional communities	
Intangible heritage	Knowledge and skills to produce traditional crafts: Agricultural traditional skills **Traditional fishing practices**
	Social practices: **traditional leisure activities in lagoon, beaches and forest areas**
	Cultural heritage value
	Performing arts
	Festive events
	Rituals, Agricultural traditional customs
	Oral traditions
	Knowledge and practices concerning nature and universe

*Golas, sea-lagoon channels and associated infrastructure. **Motas traditional elevated paths and field margins for water management*

Table 3. Categories and sub-categories of the cultural heritage exposed elements identified for both Huerta and Albufera; underlined characters identify elements peculiar to Huerta and bold characters the ones peculiar to Albufera only. In Italics elements that may be relevant for future analysis, although not included in the Risk Profile Table.

6.3.3. Impacts

The identification of impacts in the Risk Profile Table for Valencia is exhaustive and well supported by the evidence and information collated in this baseline report. Table 4 below briefly reports the different impacts identified for the five categories of impacts, included in the Risk Profile Table for the different exposed elements categorised as per Table 3.

		Impacts				
Exposed Elements		*Physical*	*Functional*	*Societal*	*Economic*	*Intangible*
Natural Environment	Ecosystem	Increase in existing pests /diseases. Decease in fishes. Costal Erosion. Physical damage to lagoon, shores, banks & beaches. Evapotranspiration & eutrophication of lagoon water	Decrease in ecosystem services (including food provision)		Agricultural sector: direct economic losses and loss of revenue	Loss of agricultural traditional skills and customs
	Wildlife		Decrease in ecosystem services	Loss of access to key services	Fishing, hunting and tourism sector: direct economic losses and loss of revenue	Loss of cultural heritage values
Built Environment	Buildings	Physical Damage			Direct Economic loss due to physical damage	
	Storage & irrigation infrastructures, channels	Physical Damage	Loss/ disruption of service	Loss of access to key services		

		Impacts				
Exposed Elements		*Physical*	*Functional*	*Societal*	*Economic*	*Intangible*
	Road, railroad and other critical infrastructures	Physical Damage	Loss/ Disruption of service	Loss of access to key services		
Cultural Heritage	Tangible and Intangible elements	Physical Damage	Loss/ Disruption of service	Loss of access to culture	Direct Economic loss due to physical damage	Loss of cultural heritage values
Services, essential and productive	Cropland	Loss of crops	Loss/ Disruption of service	Loss of access to food provision	Agricultural sector: Direct economic loss & LoR*	Loss of agricultural traditional skills and customs
	Agricultural machinery & equipment	Direct Physical Loss	Loss/ Disruption of service	Loss of access to food provision	Agricultural sector: Direct economic loss & LoR*	Loss of agricultural traditional skills and customs
	Boats & Jetties		Loss/ Disruption of service		Tourism Sector: direct economic loss & LoR	Traditional leisure activities in lagoon areas
	Fishing Equipment		Loss/ Disruption of service	Loss of access to key services	Fishing: direct economic losses and loss of revenue	Traditional fishing equipment/ practices
Human and Social Aspects	External			Loss of Tourism	LoR from tourism	
	Local	Illness, injury and mortality		Loss of Jobs	Impact on Local Economy	

Table 4. Physical, Functional, Societal, Economic and Intangible impacts identified for the different exposed elements in the two selected sites; bold characters highlight the impacts peculiar to Albufera only.

The identified hazards (Table 1) are reported to affect all or some of the identified exposed elements (Table 2 and Table 3), potentially causing (with slight differences) the impacts identified in Table 4.

Risk analyses, implemented with different methods and levels of complexity (depending on the available data, knowledge, time, and personnel) will be needed to quantify the likelihood, level and extent of the expected impacts, as briefly indicated in the following section.

6.4. Outlook and implications for further risk analyses within ARCH

The Risk Profile Table identified several exposed elements for the two sites and different potential hazards that can cause cascading and interdependent impacts. As part of the ARCH project it will not be possible to analyse all identified issues with the same level of detail. While for some of them a simplified approach will likely be sufficient, for selected ones, detailed analyses will be conducted, e.g. supported by data collected through field sensors and measurements. A prioritisation for where to concentrate the attention might be based on the combination of multiple criteria, as an example:

- exposed cultural heritage at higher risk,
- potential for cascading effects,
- high social and cultural value of cultural heritage,
- weaker resilience essentials. See discussion in chapter 7.
- Local municipal and regional stakeholder´s prioritisation based on standing strategies and plans as will be reported in the forthcoming deliverable D3.2 (Local partnership and work plan).

In further detail, the prioritisation could be conducted as follows:

- Identification of the cultural heritage at higher risk via a detailed risk analysis aimed at providing insights into the interactions of the identified hazards with the exposed elements and with all dimensions of their vulnerabilities (physical, environmental, social, economic and cultural), including the likelihood (more or less probable) of the hazards and the level (more or less severe) of the expected impacts on each exposed element. Workshops or structured interviews with the local stakeholders might be conducted for filling out qualitative risk matrices, similar to the one represented in Figure 57 below.

		CONSEQUENCE				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
LIKELIHOOD	Almost Certain 5	low	medium	high	extreme	extreme
	Likely 4	low	medium	high	extreme	extreme
	Possible 3	low	medium	high	high	extreme
	Unlikely 2	low	medium	medium	high	extreme
	Rare 1	low	low	medium	medium	high

Figure 57. Example of qualitative risk matrix identifying the Risk severity (with qualitative terminology from low to extreme and associated couloirs, as a function of hazard likelihood and severity of impacts/consequences (from insignificant to Catastrophic) from ISO31000 [35].

- Identify cascading and interrelated impacts, e.g. by using an adapted impact chain methodology (see e.g. [96] or [97] defined as part of the RESIN project).
- Assess the social and cultural value of cultural heritage with local stakeholders and communities by identifying non-quantifiable values of their tangible and intangible cultural heritage elements (Figure 58) using an online questionnaire or app (for further details, also see Section 6 of Camerino's baseline report).
- Identify weaker resilience essentials, using the ARCH Resilience Assessment Framework currently in development in work package 7.

35 Standards Australia (2009). AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines

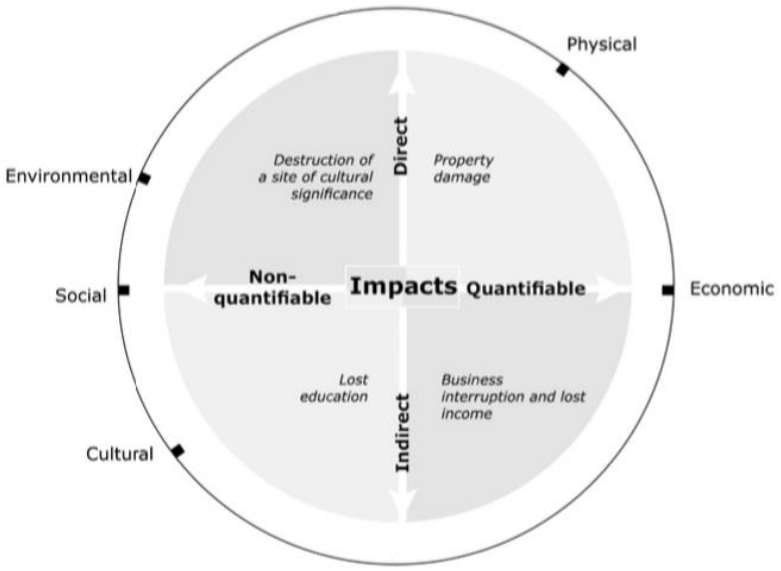


Figure 58. Direct and indirect impacts of disasters according to [98].

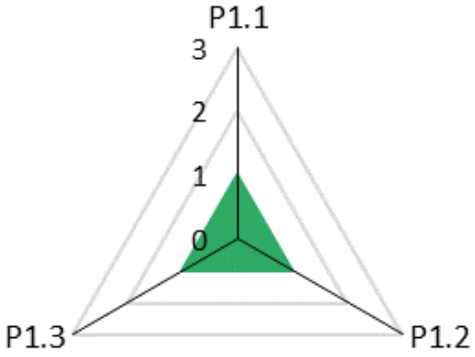
To support the above-mentioned steps the ARCH DSS could be employed as a participatory WebGIS tool to support stakeholder engagement using visualisations and geospatial information on hazards and impacts that Valencia might have already available.

7. Preliminary resilience assessment

The following resilience assessment was developed using the preliminary version of the UNDRR Disaster Resilience Scorecard for Cities [99]. The preliminary assessment was conducted within the framework of a webinar between Las Naves, Tecnalia, and Fraunhofer on January 13, 2020. As the original Scorecard is aimed at city-level, not all questions were immediately applicable on the level of historic areas or single heritage assets. Wherever possible, answers were provided for the historic areas under examination (e.g. with regard to hazard scenarios). For all other questions, answers were provided on city-level (e.g. with regard to city masterplans). The results give a first indication of the overall resilience of the city with some – but not exclusive – focus on the historic areas examined by ARCH. In addition, the application of the Scorecard will be used as input for the development of the ARCH Resilience Assessment Framework specifically focused on historic areas. Lastly, the preliminary resilience assessment results presented in the baseline reports should not be employed to develop resilience action plans, as not all necessary stakeholder groups were involved in the assessment process.

It should also be noted that due to the scope of the Scorecard and the particularities of Valencia historic areas in relation to the rest of the city cases, the resilience of Huerta and Albufera might not be fully reflected on the assessment.

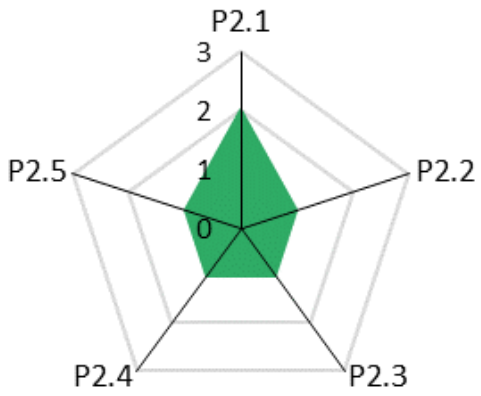
7.1. Essential 01: Organise for resilience



P1.1	Does the City master plan (or relevant strategy/plan) adopt the Sendai Framework?	1
P1.2	Is there a multi-agency/sectoral mechanism with appropriate authority and resources to address disaster risk reduction?	1
P1.3	Is resilience properly integrated with other key city functions / portfolios?	1

Regarding Essential 01 València achieves a resilience score of 3/9. The city has no overall city master plan compliant with the Sendai Framework, but instead has several sectoral plans that partially comply with the Framework (score of 1 for P1.1). Among these plans are the *SECAP*, the PATRICOVA action plan for flood risk prevention, and the municipal ordinance for the use of beaches and adjacent areas. Organisation and coordination for disaster risk reduction could be improved; the different city teams connected to DRR have authority, however inter-agency support for DRR is lacking (score of 1 for P1.2). Lastly, resilience is only integrated in key city functions on an ad hoc basis, however an action plan for climate change adaptation is currently being drafted which may improve the situation (score of 1 for P1.3).

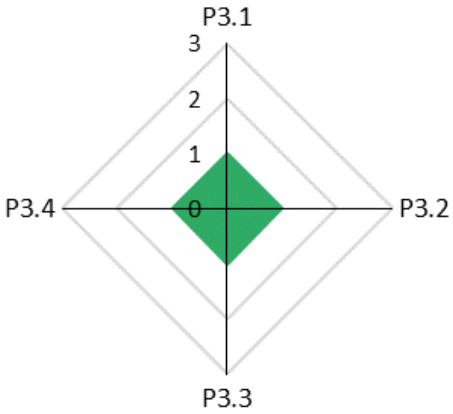
7.2. Essential 02: Identify, understand and use current and future risk scenarios



P2.1	Does the city have knowledge of the key hazards that the city faces, and their likelihood of occurrence?	2
P2.2	Is there a shared understanding of risks between the city and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks?	1
P2.3	Are their agreed scenarios setting out city-wide exposure and vulnerability from each hazard, or groups of hazards (see above)?	1
P2.4	Is there a collective understanding of potentially cascading failures between different city and infrastructure systems, under different scenarios?	1
P2.5	Do clear hazard maps and data on risk exist? Are these regularly updated?	1

For Essential 02, València achieves a resilience score of 6/15. The city understands the main hazards affecting it, but currently has no defined process for updating this information (score 2 for P2.1). Individual system risks – at least for water management and flooding – are known, but not systematically shared among relevant stakeholder groups in order to understand cascading effects (score of 1 for P2.2). Disaster scenario information is only available for some hazards, with an aim to provide more information on these as part of the climate change adaptation action plan (score of 1 for P2.3). As a result, from P2.2 and P2.3, the understanding of cascading effects is limited (score of 1 for P2.4). Lastly, hazard maps currently only exist for heat waves and flooding in the urban environment (score of 1 for P2.5).

7.3. Essential 03: Strengthen financial capacity for resilience

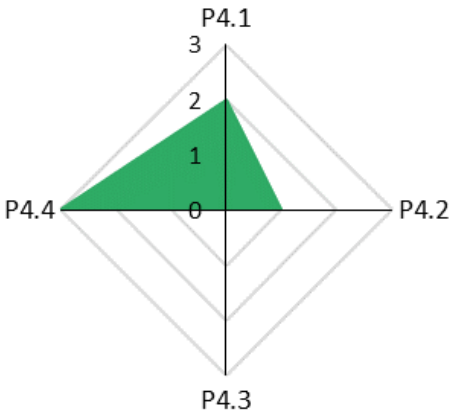


P3.1	The city / lead agencies understand all sources of funding, and the “resilience dividends”, are well connected, understand all available routes to attract external funding and are actively pursuing funds for major resilience investments.	1
P3.2	Does the city have in place a specific ‘ring fenced’ (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)?	1
P3.3	What level of insurance cover exists in the city, across all sectors – business and community?	1
P3.4	What incentives exist for different sectors and segments of business and society to support resilience building?	1

Regarding Essential 03 València achieves a resilience score of 4/12, which leaves significant room for improvement. Currently, there is only limited knowledge about available funding approaches for resilience measures (score of 1 for P3.1) and no coordinated, dedicated budget for local disaster risk reduction exists. However, there are regional/national emergency funds available (score of 1 for P3.2). In addition, the level of insurance coverage varies significantly

across sectors (score of 1 for P3.3), and only a limited number of incentives to promote resilience building exists (score of 1 for P3.4).

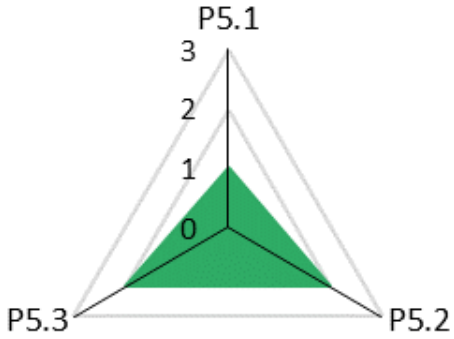
7.4. Essential 04: Pursue resilient urban development



P4.1	Is the city appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres?	2
P4.2	Are approaches promoted through the design and development of new urban development to promote resilience?	1
P4.3	Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?	0
P4.4	Are zoning rules, building codes and standards widely applied, properly enforced and verified?	3

Regarding Essential 04 València achieves a resilience score of 6/12. There exist zoning plans for the whole city as well as the Huerta that incorporate hazard and risk mapping, but no systematic process for updating these plans (score of 2 for P4.1). Resilience approaches for new urban developments are not promoted in a consistent way, although a number of strategic documents related to this topic exist (score of 1 for P4.2). While building codes and standards exist, these do not address specific hazards or risks the city faces[36] (score of 0 for P4.3). However, existing building codes are compulsory and enforced by the city (score of 3 for P4.4).

7.5. Essential 05: Safeguard natural buffers to enhance the protective functions offered by natural ecosystems



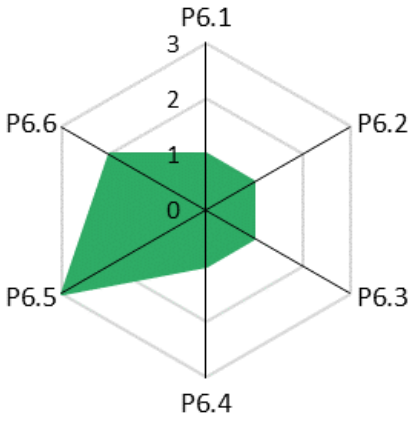
P5.1	Beyond just an awareness of the natural assets, does the city understand the functions (or services) that this natural capital provides for the city?	1
P5.2	Is green and blue infrastructure being promoted on major urban development and infrastructure projects through policy?	2
P5.3	Is the city aware of ecosystem services being provided to the city from natural capital beyond its administrative borders? Are agreements in place with neighbouring administrations to support the protection and management of these assets?	2

For Essential 05 València achieves a resilience score of 5/9. The city and key stakeholders are becoming more aware of the functions provided by their key natural assets, especially the

[36] Present building codes and standards (e.g. EN ISO 15927-1-6 or EN ISO 52000-1) consider historic/present climate and not future climate in their calculations. Furthermore, building codes and standards are out of the scope of local governments, having little margin of manoeuvre

Huerta, but this awareness is still incomplete (score of 1 for P5.1). At the same time, green and blue infrastructure is promoted heavily and several studies and strategies in this area exist. However, guiding material for practitioners could still be improved (score of 2 for P5.2). Related to P5.1, the city is becoming more aware of the functions provided by natural capital beyond the city administrative borders, with the new Huerta law aiming to create a common forum with neighbouring municipalities (score of 2 for P5.3).

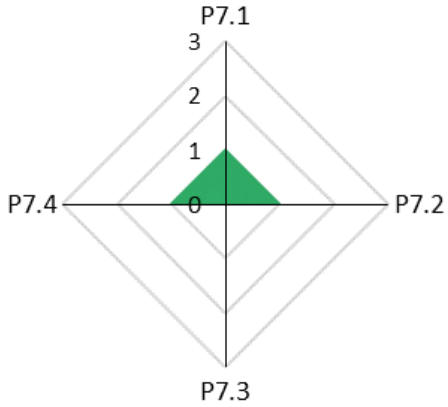
7.6. Essential 06: Strengthen institutional capacity for resilience



P6.1	Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?	1
P6.2	Does a co-ordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public?	1
P6.3	Extent to which data on the city's resilience context is shared with other organizations involved with the city's resilience.	1
P6.4	Are there training courses covering risk and resilience issues offered to all sectors of the city including government, business, NGOs and community?	1
P6.5	Are training materials available in the majority of languages in common use in the city?	3
P6.6	Is the city proactively seeking to exchange knowledge and learn from other cities facing similar challenges?	2

Regarding Essential 06 València achieves a resilience score of 9/18. While the city can access most of the skills and resources necessary to respond to identified disaster scenarios, gaps still exist (score of 1 for P6.1). Some programmes and channels exist for disseminating hazard, risk, and disaster information, but at most 25% of the population is reached, leaving significant room for improvement (score of 1 for P6.2). In addition, only a limited number of available data layers are shared within the city / other organisations, and the data shared is usually raw and requires interpretation (score of 1 for P6.3). Only a limited number of training courses for government employees, business owners, NGOs, and community members covering risk and resilience issues exist (score of 1 for P6.4). However, the existing training material is usually available in all languages commonly used in the city, namely Valencian and Castilian Spanish (score of 3 for P6.5). Lastly, the city understands the importance of knowledge sharing and seeks networking opportunities to exchange on lessons learned (score of 2 for P6.6).

7.7. Essential 07: Understand and strengthen societal capacity for resilience

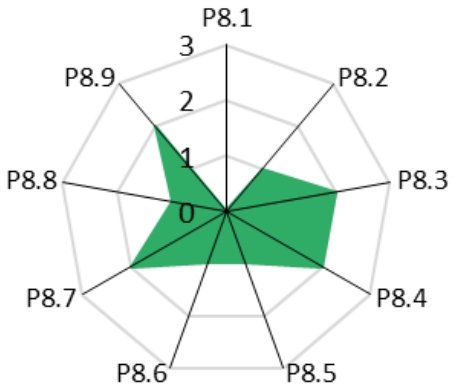


P7.1	Are “grassroots” or community organizations participating in risk reduction and post-event response for each neighbourhood in the city?	1
P7.2	Are there regular training programmes provided to the most vulnerable populations in the city?	1
P7.3	What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months?	0
P7.4	How effective is the city at citizen engagement and communications in relation to DRR?	1

For Essential 07 València achieves a resilience score of 3/12. While grassroots organisations help with awareness raising for disaster risk reduction, their involvement in risk reduction and post-event response could be intensified (score of 1 in P7.1). Similarly, only some channels for citizen engagement related to disaster risk reduction exist (score of 1 for P7.4). In addition, while a mapping of vulnerable population groups exists, they do not receive any specific disaster training (score of 1 for P7.2). Lastly, no information about the proportion of businesses with a documented and regularly reviewed business continuity plan is available (score of 0 for P7.3).

7.8. Essential 08: Increase infrastructure resilience

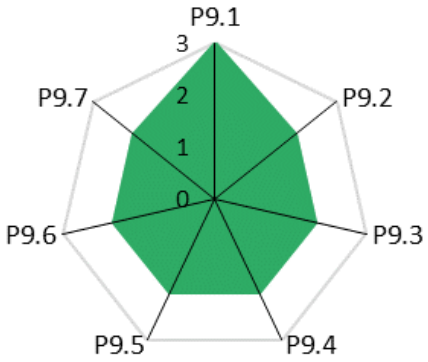
Regarding Essential 08 València achieves a resilience score of 12/27. There are no plans or forums to tackle critical infrastructure resilience (score of 0 for P8.1), and only a limited number of protective infrastructure exist (score of 1 for P8.2), such as shelters in the case of flash flooding or heavy rain. Because the information on potential disaster scenarios is limited, the city expects some loss of service for the water and energy systems under the “most severe” scenario (score of 2 for P8.3 and P8.4) and some loss of service for the transport and communication systems under the “most probable” scenario (score of 1 for P8.5 and P8.6). More than 90% of major injuries can be treated within 24 hours under the “most severe” scenario (score of 2 for P8.7). In addition, up to 10% of teaching facilities are likely at risk under the “most probable” scenario (score of 1 for P8.8). Lastly, equipment levels of first responders are estimated to be adequate for the “most severe” scenario, although this might require relying on mutual aid arrangements (score of 2 for P8.9).



P8.1	Is critical infrastructure resilience a city priority, does the city own and implement a critical infrastructure plan or strategy?	0
P8.2	Is existing protective infrastructure well-designed and well-built based on risk information?	1
P8.3	Would a significant loss of service for these two essential services be expected for a significant proportion of the city under the agreed disaster scenarios?	2
P8.4	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)?	2
P8.5	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would transport infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc) and passable?	1
P8.6	Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event?	1
P8.7	Would there be sufficient acute healthcare capabilities to deal with expected major injuries in 'worst case' scenario?	2
P8.8	% of education structures at risk of damage from "most probable" and "most severe" scenarios	1
P8.9	Will there be sufficient first responder equipment, with military or civilian back up as required?	2

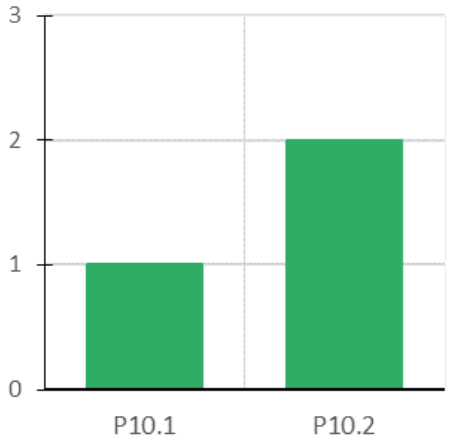
7.9. Essential 09: Ensure effective disaster response

For Essential 09 València achieves a resilience score of 15/21. The city estimates that it will reach more than 90% of its population with its early warning systems (score of 3 for P9.1) and has a comprehensive disaster management plan. However, this plan contains gaps (score of 2 for P9.2). The local disaster risk management authority has enough staff to cover all neighbourhoods within 24 to 48 hours in case of a surge event scenario (score of 2 for P9.3) and equipment/supply needs are defined and linked to disaster scenarios (score of 2 for P9.4). Similarly, emergency food and basic relief items should be sufficient under the "most severe" scenario (score of 2 for P9.5). There also exists a local emergency operations centre with hardened / redundant communications that should withstand the "most severe" scenario. However, only the most essential agencies for disaster risk management participate in crisis management (score of 2 for P9.6). Lastly, the city conducts annual drills involving both the public and professionals in a limited number of test scenarios (score of 2 for P9.7).



P9.1	Does the city have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?	3
P9.2	Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies?	2
P9.3	Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?	2
P9.4	Are equipment and supply needs, as well as the availability of equipment, clearly defined?	2
P9.5	Would the city be able to continue to feed and shelter its population post-event?	2
P9.6	Is there an emergency operations centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with “most probable” and “most severe” scenarios?	2
P9.7	Do practices and drills involve both the public and professionals?	2

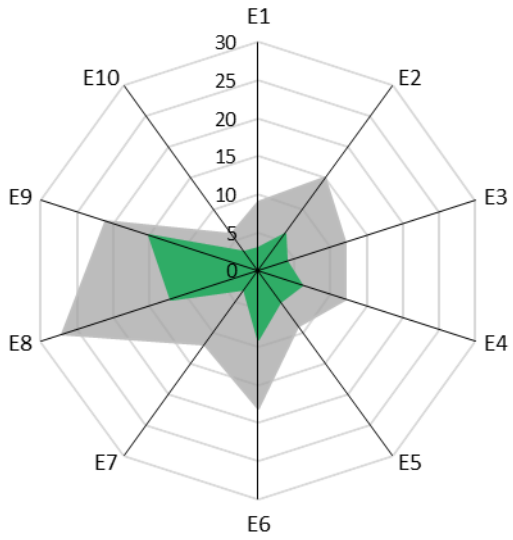
7.10. Essential 10: Expedite recovery and build back better



P10.1	Is there a strategy or process in place for post-event recovery and reconstruction, including economic reboot, societal aspects etc.?	1
P10.2	Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects?	2

For Essential 10, València achieves a resilience score of 3/6. Some post-recovery plans exist, but these are not comprehensive and are not understood by relevant stakeholders (score of 1 for P10.1). In terms of lessons learnt, there are clear processes in place to capture lessons from previous failures for coping post-event, but the mechanism to transfer these lessons to the design and delivery of future rebuilding projects needs improvement (score of 2 for P10.2).

7.11. Overall resilience of València



Overall, València achieves a resilience score of 66/141 with significant room for improvement in most Essentials. The exception to this is Essential 09, due to the large reach of València's early warning system, its comprehensive disaster risk management plan, good coverage in terms of emergency staff and food supply, and the existence of a local emergency operations centre.

The city achieves its lowest score in Essential 07, because grassroots movements are not sufficiently involved in disaster risk management processes, vulnerable population groups do not receive tailored training for disasters, no information about the coverage of business continuity plans is available, and only a limited number of channels exists for citizen engagement.

8. Conclusion

The protection of both the Huerta and Albufera, as cultural heritage landscapes and ARCH focus sites, is of high importance for the local economy, culture and biodiversity in Valencia. From the perspective of cultural heritage, risk management and adaptation to climate change, it seems that the junction between them has not yet been sufficiently explored in Valencia, neither in general terms, nor in regard to the ARCH focus sites. According to this first analysis, at local level, it seems that climate change is not yet proactively considered in existing approaches to managing and protecting cultural heritage. Conversely, DRR also seems to be not focused on heritage protection yet. This has yet to be confirmed by means of several meetings with relevant stakeholders, for instance in order to verify the degree in which the Guidelines for the Autonomous Communities from the NPERMCH are being implemented. No reference has been found in relation to the works that should be developed under these guidelines, such as the elaboration of the Map of Cultural Heritage Risks in the Comunitat Valenciana and subsequent steps (such as the definition of measures or emergency intervention proposals). If those lines of action, research and documentation are indeed not being developed, this should be considered a major gap in the governance framework for heritage management and protection. In addition, it is of note that the NPERMCH does not explicitly consider natural heritage, which is at the core of the recognised heritage values shared by the Huerta and Albufera cultural peri-urban landscapes.

From the climate adaptation perspective, heritage protection is considered in the Regional Strategy and local *SECAP,* precisely in relation to the mentioned measures and actions involving the Huerta and Albufera. However, as mentioned previously, the lack of budget allocation to such measures and actions restricts their application, unless external funding can be secured or new budget lines made available, for instance after the passing of the new key pieces of legislation currently being drafted, such as the future national and regional Climate Change Laws. These regulations had been placed on hold at the time of writing due to the state of emergency arising from the COVID-19 pandemic.

The key strategies that will determine the alignment of the ARCH project´s outcomes with Valencia´s vision and policies are those developed by the municipal and regional departments of agriculture and climate change, and can be found in key documents such as the city's *SECAP* and the regional *Climate Change Strategy 2020-2030*. However, some gaps have been identified in relation to the basic scientific knowledge which should be available prior to developing any resilience strategy for Huerta and Albufera, such as a more detailed vulnerability analysis, or impact modelling on agriculture, aquatic and forest ecosystems, in order to be able to better assess the several meteorological, climatological, hydrological, biological and human-induced hazards identified. Due to the complexity and size of both geographical areas, further discussion with stakeholders is also needed in order to prioritize specific support needs which might be addressed via the ARCH project.

For this and other reasons, during the ARCH project´s timeline an improved coordination of the stakeholders from Huerta and Albufera is envisioned. It is expected that improved coordination and cooperation among stakeholders, together with the knowledge that will be shared with Valencia city staff as part of the project, would improve Valencia´s social, physical and economic resilience against climate hazards. It is also anticipated that collecting and

promoting evidence of the extent to which the Huerta and Albufera are able to mitigate the effects of climate change within the city may serve to highlight their importance and as such to further protect these and other natural (heritage) sites.

In addition, given that Valencia City already promotes a management discourse that recognises the role of green and blue infrastructure in responding to the current context of climate emergency, there is an opportunity here for the ARCH project to align with this agenda and support its realisation through decision support tools focused on the Huerta and Albufera.

9. Bibliography

[1] Conselleria de Vivienda, Obras Públicas y Vertebración del Territorio, “Plan de acción territorial de ordenación y dinamización de la Huerta de València.,” 2018. [Online]. Available: http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/pat-horta-de-valencia. [Accessed 28 Jan. 2019].

[2] Ajuntament de València, “Resumen Estadístico de la Ciudad de València (Recull) 2019,” 2020. [Online]. Available: http://www.valencia.es/ayuntamiento/webs/estadistica/Recull/Recull2019_Castellano.pdf. [Accessed 30 Jan. 2020].

[3] Ajuntament de València, “Anuario Estadístico de la ciudad de València 2019,” 2019. [Online]. Available: http://www.valencia.es/ayuntamiento/catalogo.nsf/CatalogoUnTitulo?readForm&lang=1&serie=15&titulo=Anuario%20Estad%EDstico%20de%20la%20ciudad%20de%20Val%E8ncia%202019&bdOrigen=ayuntamiento/estadistica.nsf&idApoyo=58FB3C7A3D56E414C1257DD40057EB6C. [Accessed 31 Jan. 2020].

[4] A. Boix Palop, C. Marzal Raga, C. Gimeno Fernánez and P. Herrero Vicent, “Estudio sobre las posibilidades de reclasificación del Sector PRR-4 “Benimaclet” del Plan General de Ordenación Urbana de València, su hipotético coste y las medidas de planificación propias de un urbanismo sostenible e integrador para una futura (...).,” 2019. [Online]. Available: http://roderic.uv.es/handle/10550/72441. [Accessed 20 Feb, 2020].

[5] Ajuntament de València, “Anuario Estadístico de la ciudad de València 2005,” 2005. [Online]. Available: http://www.valencia.es/ayuntamiento/anuario.nsf/fCategoriaVista?readForm&nivel=6_3&Vista=vListadoAnuario&Categoria=Anuario%202005&lang=1&expand=2&subexpandido=5&bdorigen=ayuntamiento/estadistica.nsf. [Accessed 22 April 2020].

[6] EUROSTAT, “Glossary:At risk of poverty or social exclusion (AROPE),” 2019. [Online]. Available: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:At_risk_of_poverty_or_social_exclusion_(AROPE). [Accessed 29 Jan. 2020].

[7] Instituto Nacional de Estadística, “Risk of poverty or social exclusion (Europe 2020 Strategy)(income year before the interview). National results.,” 2018. [Online]. Available: https://www.ine.es/jaxiT3/Tabla.htm?t=10010&L=1. [Accessed 2 April 2020].

[8] Ajuntament de València, “SUBVENCIONES A ENTIDADES PARA EL DESARROLLO DE PROYECTOS DE INTERVENCIÓN EN EL ÁMBITO DE LA ACCIÓN SOCIAL EN EL MUNICIPIO DE VALÈNCIA 2019,” 18 April 2019. [Online]. Available: https://www.valencia.es/ayuntamiento/tablon_anuncios.nsf/0/B7322B2B8E27BF39C125

83D8004317ED/$FILE/20190410%20INFORMACI%C3%93N%20ACS%20%20WEB%202019%20c.v.revisat.pdf?OpenElement&lang=1. [Accessed 24 April 2020].

[9] Conselleria de Sanitat Universal i Salut Pública, “Epidemiología, Vigilancia de la Salud / Sanidad Ambiental / Programa de temperaturas extremas,” [Online]. Available: http://www.sp.san.gva.es/sscc/opciones2.jsp?CodPor=121&Opcion=SANMS519100&CodPunto=2543&MenuSup=SANMS519000&Nivel=2. [Accessed 20 Feb. 2020].

[10] Conselleria de Sanitat Universal y Salut Pública, “Programa de Prevención y Atención de los Problemas de Salud Derivados de las Temperaturas Extremas en la Comunitat Valenciana,” 2019. [Online]. Available: http://www.sp.san.gva.es/DgspPortal/docs/PROGRAMA_OLA_2019.pdf. [Accessed 29 Jan. 2020].

[11] Ajuntament de València, “Estadística. Catálogo de Publicaciones,” 2020. [Online]. Available: http://www.valencia.es/ayuntamiento/catalogo.nsf/CatalogoPublicaciones?readForm&lang=1&nivel=7&numPagina=1&bdOrigen=ayuntamiento/estadistica.nsf&idApoyo=58FB3C7A3D56E414C1257DD40057EB6C. [Accessed 23 April 2020].

[12] Ajuntament de València, “Estudios y documentos. DIAGNÓSTICO SOCIAL DE LA CIUDAD,” 2019. [Online]. Available: http://www.valencia.es/ayuntamiento/bienestarsocial.nsf/vDocumentosTituloAux/Estudios%20y%20documentos?opendocument&lang=1&nivel=11. [Accessed 23 April 2020].

[13] Ajuntament de València, “Áreas vulnerables en la ciudad de València 2016,” 2018. [Online]. Available: http://www.valencia.es/ayuntamiento/catalogo.nsf/CatalogoUnTitulo?readForm&lang=1&serie=60&titulo=%C1reas%20vulnerables%20en%20la%20ciudad%20de%20Val%E8ncia%202016&bdOrigen=ayuntamiento/estadistica.nsf&idApoyo=58FB3C7A3D56E414C1257DD40057EB6C. [Accessed 29 Jan. 2020].

[14] Ajuntament de València, “DIAGNÓSTICO SOCIAL DE LA CIUDAD,” 2019. [Online]. Available: http://www.valencia.es/ayuntamiento/bienestarsocial.nsf/vDocumentosTituloAux/Estudios%20y%20documentos?opendocument&lang=1&nivel=11. [Accessed 29 Jan. 2020].

[15] Ajuntament de València, “Estudio del distrito Pobles del Sud 2019,” 2019. [Online]. Available: http://www.valencia.es/ayuntamiento/bienestarsocial.nsf/0/C21AD3D57EAC31F8C12584EF003130D5/$FILE/20190617%20Pobles%20del%20Sud.%20Definitivo.%2017%20de%20junio%20de%202019.pdf?OpenElement&lang=1. [Accessed 20 Feb. 2020].

[16] Ajuntament de València, “Estudio del distrito de Pobles del Nord 2017,” 2017. [Online]. Available: http://www.valencia.es/ayuntamiento/bienestarsocial.nsf/0/13E8938A8A51525DC12584

EF00340778/$FILE/Estudio%20del%20distrito%20de%20Pobles%20del%20Nord%202017.pdf?OpenElement&lang=1. [Accessed 20 Feb. 2020].

[17] Ajuntament de València, “Diagnóstico de necesidades sociales en la ciudad de València: colectivos vulnerables y nuevos perfiles de vulnerabilidad en un contexto de grave crisis económica,” 2017. [Online]. Available: valencia.es/ayuntamiento/bienestarsocial.nsf/0/C9796F87708E8A4FC125824E003F0C79/$FILE/DIAGNÓSTICO%20SOCIAL%20INFORME%20TOTAL%20FASE%20I%20Y%20II%20%2021_02_2018.pdf?OpenElement&lang=1. [Accessed 29 Jan. 2020].

[18] AIREF, “LA ECONOMIA VALENCIANA EN 2018 Y PERSPECTIVAS 2019: Moderada desaceleración del crecimiento,” Cámara de València, València, 2018.

[19] Tribunal de las Aguas de la Vega de Valencia, “Tribunal de las Aguas de la Vega de Valencia,” [Online]. Available: https://tribunaldelasaguas.org/en/?start=6. [Accessed 21 Feb. 2020].

[20] Horta Viva, “Horta Viva,” [Online]. Available: https://www.hortaviva.net/en/#regdl=categories. [Accessed 21 Feb. 2020].

[21] Generalitat Valenciana, “Bird watching - Ornithological Tourism,” 2020. [Online]. Available: http://en.comunitatvalenciana.com/what-to-do/active-tourism/bird-watching-ornithological-tourism. [Accessed 21 Feb. 2020].

[22] Instituto Nacional de Estadística, “Media de los cuatro trimestres del año. Parados. Tasas de paro por sexo y grupo de edad,” 2020. [Online]. Available: https://www.ine.es/jaxiT3/Datos.htm?t=4887#!tabs-tabla. [Accessed 23 April 2020].

[23] Ajuntament de València, “Encuesta de Población Activa. Trimestre 4 / 2019,” 29 Jan. 2020. [Online]. Available: https://www.valencia.es/ayuntamiento/estadistica.nsf/vDocumentosTituloAux/A78E6A1FA02B236FC12575470046DAAD/$FILE/EPA_cast.pdf. [Accessed 21 Feb. 2020].

[24] Institut Cartogràfic Valencià, “Visor de Cartografía Generalitat Valenciana,” [Online]. Available: https://visor.gva.es/visor/. [Accessed 28 Jan. 2020].

[25] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Plan de Desarrollo Agrario de la Huerta de València,” 2019. [Online]. Available: http://www.agroambient.gva.es/es/web/agricultura/novedades/-/asset_publisher/cDoEgHxQ2gTH/content/plan-de-desarrollo-agrario-de-la-huerta-de-valencia. [Accessed 28 Jan. 2020].

[26] Ajuntament de València, “Estudio del distrito Pobles del Sud 2019,” 2019. [Online]. Available: http://www.valencia.es/ayuntamiento/bienestarsocial.nsf/0/C21AD3D57EAC31F8C12584EF003130D5/$FILE/20190617%20Pobles%20del%20Sud.%20Definitivo.%2017%20de%20junio%20de%202019.pdf?OpenElement&lang=1. [Accessed 29 Jan. 2020].

[27] European Environment Agency, “Europe's Environment - The Dobris Assessment. State of the environment report No 1/1995,” May 1995. [Online]. Available: https://www.eea.europa.eu/publications/92-826-5409-5. [Accessed 24 Feb. 2020].

[28] Presidencia de la Generalitat, “LEY 5/2018, de 6 de marzo, de la Generalitat, de la Huerta de València,” 12 March 2018. [Online]. Available: http://www.dogv.gva.es/es/disposicio-consolidada?signatura=002588/2018&url_lista=. [Accessed 21 Feb. 2020].

[29] Ajuntament de València, “Áreas de gobierno y Delegaciones,” [Online]. Available: https://www.valencia.es/ayuntamiento/ayuntamiento.nsf/vDocumentosTituloAux/Areas%20y%20Delegaciones?opendocument&nivel=2%5f4&lang=1. [Accessed 30 Jan. 2020].

[30] UN Office for Disaster Risk Reduction (UNDRR), “Quick Risk Estimation (QRE) Tool,” [Online]. Available: https://www.unisdr.org/campaign/resilientcities/assets/toolkit/QRE%20Tool/QRE%20Tool%20-%20UNDRR%20-%20Oct%202019_English.xlsm. [Accessed 27 Jan. 2020].

[31] Ajuntament de València, “Sustainable Energy and Climate Action Plan of Valencia,” 2019. [Online]. Available: https://www.covenantofmayors.eu/about/covenant-community/signatories/action-plan.html?scity_id=11935. [Accessed 28 Jan. 2020].

[32] Factor CO2, “Análisis de vulnerabilidad al cambio climático del municipio de Valencia,” 25 March 2015. [Online]. Available: https://mycovenant.eumayors.eu/docs/document/15441_1507911537.pdf. [Accessed 25 Feb. 2020].

[33] Factor CO2, “Proyecciones climáticas para el municipio de Valencia,” 20 Feb. 2015. [Online]. Available: https://mycovenant.eumayors.eu/docs/document/15441_1507911574.pdf. [Accessed 25 Feb. 2020].

[34] Factor CO2, “Plan de Adaptación al Cambio Climático de València 2050,” 2017. [Online]. Available: https://www.valencia.es/ayuntamiento/energias.nsf/0/8B7F4BFFA988C100C12581AF003BE403/$FILE/PACCV_20170127.pdf?OpenElement&lang=1. [Accessed 31 Jan. 2020].

[35] CORDEX initiative , “EURO-CORDEX - Coordinated Downscaling Experiment - European Domain,” [Online]. Available: https://www.euro-cordex.net/. [Accessed 25 Feb. 2020].

[36] Factor CO2, “Análisis de vulnerabilidad al cambio climático del municipio de Valencia. Extensión del informe previo de fecha 25 de marzo de 2015.,” 30 March 20116. [Online]. Available: https://www.valencia.es/ayuntamiento/Energias.nsf/0/57AABB553B187CC8C1257F870

0396AD6/$FILE/An%C3%A1lisis_vulnerabilidad.pdf?OpenElement&lang=1. [Accessed 03 April 2020].

[37] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Estrategia Valenciana de Cambio Climático y Energía 2030,” 2019. [Online]. Available: http://www.agroambient.gva.es/es/web/cambio-climatico/2020-2030. [Accessed 28 Jan. 2020].

[38] AELCLIC Project, “South-Western Europe,” 2019. [Online]. Available: https://aelclicpathfinder.com/south-western-europe. [Accessed 30 Jan. 2020].

[39] AELCLIC Project, “Results,” 2019. [Online]. Available: https://aelclicpathfinder.com/results. [Accessed 30 Jan. 2020].

[40] GrowGreen Project, “GrowGreen, a partnership for greener cities to increase liveability, sustainability and business opportunities,” [Online]. Available: http://growgreenproject.eu/. [Accessed 30 Jan. 2020].

[41] Energy Cities, “TOMORROW. Leading the energy transition bottom-up.,” [Online]. Available: https://energy-cities.eu/project/tomorrow/. [Accessed 30 Jan. 2020].

[42] Ramsar Convention, “Albufera de Valencia,” [Online]. Available: https://rsis.ramsar.org/ris/454. [Accessed 29 Jan. 2020].

[43] Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural, “Tourist map of the Natural Park,” [Online]. Available: http://www.parquesnaturales.gva.es/documents/80302883/166264158/Mapa+tur%C3%ADstico_ingl%C3%A9s-franc%C3%A9s.pdf/eba8fa61-541c-4115-a744-d4eeefb68367. [Accessed 29 Jan. 2020].

[44] European Commission, “Dunas Albufera - Model of restoration of dunes habitats in 'L'Albufera de Valencia',” [Online]. Available: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=1785&docType=pdf. [Accessed 22 Feb. 2020].

[45] European Commission, “Enebro Valencia - Recovery of the littoral sand dunes with Juniper spp in Valencia,” [Online]. Available: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2625&docType=pdf. [Accessed 22 Feb. 2020].

[46] Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural, “Legislación del Parque Natural de l'Albufera,” [Online]. Available: http://www.parquesnaturales.gva.es/es/web/pn-l-albufera/legislacion-del-parque. [Accessed 28 Jan. 2020].

[47] Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural, “DECRETO 52/2019, de 29 de marzo, del Consell, de modificación del Decreto 71/1993, de régimen jurídico del Parque Natural de l'Albufera.,” 11 April 2019. [Online].

Available: http://www.dogv.gva.es/es/disposicio?id=4213&sig=003370/2019&L=1&url_lista=+. [Accessed 22 Feb. 2020].

[48] Conselleria de Agricultura, Medio Ambiente, Cambio Climático y Desarrollo Rural, “Memorias de gestión,” [Online]. Available: parquesnaturales.gva.es/es/web/pn-l-albufera/memorias-de-gestion. [Accessed 30 Jan. 2020].

[49] Confederación Hidrográfica del Júcar, “Redes de control,” [Online]. Available: https://www.chj.es/es-es/medioambiente/albufera/Paginas/Redesdecontrol.aspx. [Accessed 30 Jan. 2020].

[50] Ministerio para la Transición Ecológica y el Reto Demográfico, “PIMA Adapta,” [Online]. Available: https://www.miteco.gob.es/es/cambio-climatico/planes-y-estrategias/PIMA-Adapta.aspx#ancla1. [Accessed 30 Jan. 2020].

[51] Interreg Delta Lady, “Floating Cultures in River Deltas,” [Online]. Available: https://www.interregeurope.eu/deltalady/. [Accessed 30 Jan. 2020].

[52] Presidencia de la Generalitat, “LEY 4/1998, de 11 de junio, de la Generalitat Valenciana, del Patrimonio Cultural Valenciano. Disposición consolidada.,” 2017. [Online]. Available: http://www.dogv.gva.es/es/disposicio-consolidada?signatura=1137/1998&idioma=es&L=1&url_lista=. [Accessed 24 April 2020].

[53] Ajuntament de València, “INFOCIUTAT: ANTIC MONESTIR DE SANT MIQUEL DELS REIS,” [Online]. Available: https://www.valencia.es/ayuntamiento/infociudad_accesible.nsf/vDocumentosWebListadov/525956CB506DC89FC12572C20023B7C9?OpenDocument&bdOrigen=&idapoyo=&nivel=3&lang=2. [Accessed 25 Feb. 2020].

[54] Conselleria de Educación, Cultura y Deporte, “Tribunal de las Aguas de la Vega de Valencia,” [Online]. Available: http://www.ceice.gva.es/patrimonio-cultural/ficha-inmaterial.php?id=17464&lang=es. [Accessed 25 Feb. 2020].

[55] Conselleria de Educación, Cultura y Deporte, “Comportes de la Gola de Pujol,” [Online]. Available: http://www.ceice.gva.es/patrimonio-cultural/ficha-inmueble.php?id=17342&lang=es. [Accessed 25 Feb. 2020].

[56] Conselleria de Educación, Cultura y Deporte, “Actividades tradicionales de la Albufera de Valencia,” [Online]. Available: http://www.ceice.gva.es/patrimonio-cultural/ficha-inmaterial.php?id=23129&lang=es. [Accessed 25 Feb. 2020].

[57] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “RESOLUCIÓN de 15 de enero de 2020, del director general de Medio Natural y de Evaluación Ambiental, por la que se actualiza el Catálogo de Árboles Monumentales y Singulares de la Comunitat Valenciana,” 15 Jan. 2020. [Online]. Available:

http://www.agroambient.gva.es/documents/20551003/163052224/Cat%C3%A0leg+d%27Arbres+Monumentals+i+Singulars+de+la+Comunitat+Valenciana/dc68cb0f-1b57-4a81-bc5d-b4415e328cc2. [Accessed 26 Feb. 2020].

[58] Presidencia de la Generalitat, “LEY 4/2006, de 19 de mayo, de la Generalitat, de Patrimonio Arbóreo Monumental de la Comunitat Valenciana,” 25 May 2006. [Online]. Available: http://www.dogv.gva.es/es/disposicio-consolidada?signatura=2845/2006&idioma=es&L=1&url_lista=. [Accessed 26 Feb. 2020].

[59] Ajuntament de València, “CATÁLOGO DE BIENES Y ESPACIOS PROTEGIDOS. De origen Rural.,” 2012. [Online]. Available: https://www.valencia.es/ayuntamiento/urbanismo.nsf/vDocumentosTituloAux/59554911F786991DC125798F003A1AB1?OpenDocument&bdOrigen=ayuntamiento%2Furbanismo.nsf&idapoyo=693E082FE52C3836C125798F0039D4DB&lang=1. [Accessed 28 Jan. 2020].

[60] Conselleria de Educación, Cultura y Deporte, “Información jurídica y normativa aplicable al patrimonio cultural valenciano,” 2017. [Online]. Available: http://www.ceice.gva.es/es/web/patrimonio-cultural-y-museos/informacion-juridica-administrativa. [Accessed 24 April 2020].

[61] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Prevención de Incendios Forestales y Sensibilización,” [Online]. Available: http://www.agroambient.gva.es/es/web/prevencion-de-incendios. [Accessed 29 Jan. 2020].

[62] Conselleria de Territori i Habitatge, “Planes de prevención de incendios forestales de la Red de Espacios Naturales Protegidos y Otros - Albufera,” 2006. [Online]. Available: http://www.agroambient.gva.es/es/web/prevencion-de-incendios/planes-de-prevencion-de-incendios-forestales-de-la-red-de-espacios-naturales-protegidos/-/asset_publisher/J8VsgHcswUqD/content/albufera. [Accessed 29 Jan. 2020].

[63] Conselleria de Governació i Justicia, “Planes de prevención de incendios forestales de demarcación - Lliria,” 2015. [Online]. Available: http://www.agroambient.gva.es/es/web/prevencion-de-incendios/planes-de-prevencion-de-incendios-forestales-de-demarcacion/-/asset_publisher/G7Yr70d2P4Cc/content/lliria?redirect=http%3A%2F%2Fwww.agroambient.gva.es%2Fes%2Fweb%2Fprevencion-de-incendios%2Fplan. [Accessed 29 Jan. 2020].

[64] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Prevención de Incendios Forestales y Sensibilización. Información general. Normativa Comunitat Valenciana,” [Online]. Available: http://www.agroambient.gva.es/es/web/prevencion-de-incendios/comunitat-valenciana. [Accessed 29 Jan. 2020].

[65] Generalitat Valenciana, “Sistema Integrado de Gestión de Incendios Forestales,” [Online]. Available: http://www.prevencionincendios.gva.es/Inicio. [Accessed 29 Jan. 2020].

[66] Fundación CEAM, “CEAMET,” [Online]. Available: http://www.ceam.es/ceamet/cast/index.html. [Accessed 29 Jan. 2020].

[67] Conselleria de Política Territorial, Obras Públicas y Movilidad, “PATRICOVA Plan de Acción Territorial de carácter sectorial sobre prevención del Riesgo de Inundación en la Comunitat Valenciana,” 2015. [Online]. Available: http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/patricova-plan-de-accion-territorial-de-caracter-sectorial-sobre-prevencion-del-riesgo-de-inundacion-en-la-comunitat-valenciana. [Accessed 28 Jan. 2020].

[68] Conselleria de Justicia, Interior y Administración Pública, “112 CV,” [Online]. Available: http://www.112cv.gva.es/es/inicio. [Accessed 29 Jan. 2020].

[69] Conselleria de Justicia, Interior y Administración Pública, “Información al Ciudadano,” [Online]. Available: http://www.112cv.gva.es/es/informacion-al-ciudadano. [Accessed 29 Jan. 2020].

[70] Ajuntament de València, “Alertas Sanitarias,” [Online]. Available: https://www.valencia.es/ayuntamiento/sanidad.nsf/vDocumentosTituloAux/Programas%20Salud-Alertas%20sanitarias?opendocument&lang=1&nivel=3. [Accessed 29 Jan. 2020].

[71] Ajuntament de València, “PROTOCOL DE MESURES QUE CAL ADOPTAR DURANT EPISODIS D'ALTA CONTAMINACIÓ PER DIÒXID DE NITROGEN O PM10 A L'AJUNTAMENT DE VALÈNCIA,” [Online]. Available: http://www.valencia.es/ayuntamiento/maparuido.nsf/0/C43072C43771C52BC1258163002996DA/$FILE/propuesta%20protocol%20mesures%20qualitat%20del%20aire.pdf?OpenElement&lang=2. [Accessed 29 Jan. 2020].

[72] Ajuntament de València, “Protección Ciudadana,” [Online]. Available: http://www.valencia.es/ayuntamiento/bomberos.nsf/vDocumentosTituloAux/Portada?opendocument&lang=1&nivel=1. [Accessed 29 Jan. 2020].

[73] Ajuntament de València, “PROCEDIMIENTO OPERATIVO DE ACTUACIÓN EN INCENDIOS FORESTALES EN LA DEVESA DEL SALER,” 2017. [Online]. Available: valencia.es/ayuntamiento/bomberos.nsf/0/6DBD12EB83938BD7C125827A003B276F/$FILE/PROCOP%201.11%20INCENDIOS%20FORESTALES%20EN%20LA%20DEVESA%20DEL%20SALER.pdf?OpenElement&lang=1. [Accessed 29 Jan. 2020].

[74] Ajuntament de València, “Ordenanza Municipal de Protección contra Incendios,” 2007. [Online]. Available: https://sede.valencia.es/sede/descarga/doc/DOCUMENT_1_ORD0013_C. [Accessed 29 Jan. 2020].

[75] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Planes locales de prevención de incendios forestales (PLPIF),” [Online]. Available: http://www.agroambient.gva.es/es/web/prevencion-de-incendios/planes-locales-de-prevencion-de-incendios-aprobados. [Accessed 29 Jan. 2020].

[76] Ajuntament de València, “Ordenanza Municipal de Parques y Jardines,” 2003. [Online]. Available: https://sede.valencia.es/sede/descarga/doc/DOCUMENT_1_ORD0012_C. [Accessed 29 Jan. 2020].

[77] Ajuntament de València, “Servicio de Playas,” [Online]. Available: http://www.valencia.es/ayuntamiento/playas.nsf/. [Accessed 29 Jan. 2020].

[78] Ajuntament de València, “Ordenanza Municipal de Utilización de las Playas y Zonas Adyacentes,” 2016. [Online]. Available: https://sede.valencia.es/sede/descarga/doc/DOCUMENT_1_ORD0148_C. [Accessed 29 Jan. 2020].

[79] Ministerio para la Transición Ecológica y el Reto Demográfico, “El Gobierno declara la emergencia climática,” 2020. [Online]. Available: https://www.miteco.gob.es/es/prensa/ultimas-noticias/el-gobierno-declara-la-emergencia-clim%C3%A1tica-/tcm:30-506550. [Accessed 30 Jan. 2020].

[80] Generalitat Valenciana, “DECLARACIÓN INSTITUCIONAL DE EMERGENCIA CLIMÁTICA,” 2019. [Online]. Available: http://www.agroambient.gva.es/documents/163279113/168811583/Declaraci%C3%B3n/439c2767-f807-40b0-ac61-0d2d35bb27c8. [Accessed 30 Jan. 2020].

[81] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “CAPMA,” [Online]. Available: http://www.agroambient.gva.es/es/capma. [Accessed 30 Jan. 2020].

[82] València Clima i Energia, “¿Qué es?,” [Online]. Available: http://canviclimatic.org/es/. [Accessed 30 Jan. 2020].

[83] Covenant of Mayors for Climate & Energy, “Covenant initiative,” [Online]. Available: https://www.covenantofmayors.eu/about/covenant-initiative/origins-and-development.html. [Accessed 30 Jan. 2020].

[84] C40 Cities, “City climate hazard taxonomy,” 2015. [Online]. Available: http://www.c40.org/researches/city-climate-hazard-taxonomy.

[85] Oficina Española de Cambio Climático (OECC), “Plan Nacional de Adaptación al Cambio Climático (PNACC). Desarrollo y resultados alcanzados.,” Varios. [Online]. Available: https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/pnacc_desarrollo.aspx. [Accessed 28 Jan. 2020].

[86] Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, “ Visor de Escenarios de Cambio Climático. AdapteCCa.,” 2019. [Online]. Available: http://escenarios.adaptecca.es/#&model=multimodel&variable=tasmax&scenario=rcp85&temporalFilter=YEAR&layers=AREAS&period=MEDIUM_FUTURE&anomaly=RAW_VALUE. [Accessed 28 Jan. 2020].

[87] Conselleria de Vvienda, Obras Públicas y Vertebración del Territorio, “Plan de Acción Territorial de la Infraestructura Verde del Litoral (PATIVEL),” 2018. [Online]. Available: http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/plan-de-accion-territorial-de-la-infraestructura-verde-del-litoral. [Accessed 28 Jan. 2020].

[88] Swedish Meteorological and Hydrological Institute (SMHI), “SWICCA | Service for Water Indicators in Climate Change Adaptation,” [Online]. Available: http://swicca.eu/climate-graphs-and-downloads/. [Accessed 28 Jan. 2020].

[89] European Climate Adaptation Platform Climate-ADAPT, “Urban Adaptation Map Viewer,” [Online]. Available: https://climate-adapt.eea.europa.eu/knowledge/tools/urban-adaptation. [Accessed 28 Jan. 2020].

[90] Conselleria de Sanidad Universal y Salud Pública, “Programa Temperaturas Extremas - Ola de Calor,” [Online]. Available: http://www.san.gva.es/ola-de-calor. [Accessed 28 Jan. 2020].

[91] Confederación Hidrográfica del Júcar, “Plan Hidrológico de cuenca 2015-2021,” 2016. [Online]. Available: https://www.chj.es/es-es/medioambiente/planificacionhidrologica/Paginas/PHC-2015-2021-Plan-Hidrologico-cuenca.aspx. [Accessed 28 Jan. 2020].

[92] Conselleria de Sanidad Universal y Salud Pública, “Plan de acción sobre enfermedades transmitidas por vectores en la Comunitat Valenciana,” [Online]. Available: http://www.san.gva.es/mosquito-tigre;jsessionid=0AF63397C7FEB6240946E4CFDD1D43A8.appli7_node2. [Accessed 28 Jan. 2020].

[93] Ajuntament de València, “Campaña de prevención y control contra el mosquito tigre,” [Online]. Available: http://www.valencia.es/ayuntamiento/tablon_anuncios.nsf/vdocumentos/F416365C4351BF0CC1257FFE003D9547?openDocument&lang=1. [Accessed 28 Jan. 2020].

[94] Conselleria de Infraestructuras, Territorio y Medio Ambiente, “Plan de Acción Territorial Forestal de la Comunitat Valenciana,” 2013. [Online]. Available: http://www.agroambient.gva.es/es/web/medio-natural/patfor. [Accessed 28 Jan. 2020].

[95] EUROPARC España, “TOOLKIT: INCORPORACIÓN DE LA ADAPTACIÓN AL CAMBIO CLIMÁTICO EN LA ELABORACIÓN DE PLANES DE GESTIÓN,” [Online].

Available: http://www.redeuroparc.org/TOOLKIT_adaptacion_cambioclimatico. [Accessed 30 Jan. 2020].

[96] U.S. National Park Service, “Climate Change and Cultural Landscapes: A Guide to Research, Planning, and Stewardship,” 2017. [Online]. Available: https://irma.nps.gov/DataStore/DownloadFile/581556. [Accessed 30 Jan. 2020].

[97] Ministerio de Cultura y Deporte, “Comisión de Seguimiento del Plan Nacional de Emergencias y Gestión de Riesgos en Patrimonio Cultural,” [Online]. Available: culturaydeporte.gob.es/planes-nacionales/planes-nacionales/emergencias-y-gestion-riesgos/comision-seguimiento.html. [Accessed 30 Jan. 2020].

[98] Las Naves, “Somos,” [Online]. Available: https://www.lasnaves.com/somos/?lang=es. [Accessed 24 Feb. 2020].

[99] Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica, “Catálogo de Zonas Húmedas,” [Online]. Available: http://www.agroambient.gva.es/es/web/espacios-naturales-protegidos/catalogo-de-zonas-humedas. [Accessed 24 Feb. 2020].

10. Annex

10.1. Key documents governing cultural heritage management (see Chapter 3)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Convention for the Safeguarding of the Intangible Cultural Heritage	Convention	International	Non-binding	United Nations Educational, Scientific and Cultural Organization (UNESCO)	2003	The Convention established (Article 16) a Representative List of Intangible Cultural Heritage of Humanity.	No relevant timelines for the Convention itself have been identified. The created list of intangible heritage elements is annually updated.	Convention: https://ich.unesco.org/en/convention List of Intangible Cultural Heritage https://ich.unesco.org/en/00011?type=00002#tabs
Report of the 39th Session of the Conference of FAO	Report	International	Non-binding	Food and Agriculture Organization of the United Nations (FAO)	2015	The Conference endorsed the Globally Important Agricultural Heritage Systems (GIAHS) initiative as FAO Corporate programme.	No relevant timeline for the GIAHS initiative itself has been identified. Proposals to join the initiative are evaluated several times a year by the programme Scientific Advisory Group.	http://www.fao.org/3/a-mo153e.pdf

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
European Framework for Action on Cultural Heritage	Commission staff working document	International	Non-binding	European Commission	2018	Framework of continued action for Europe's cultural heritage based on a holistic, mainstreaming and integrated approach, multi-stakeholder cooperation. Five areas of action: inclusiveness, sustainability, resiliency, innovation and reinforcement of global partnerships.	Implementation of the Framework will be monitored by the Cultural Heritage Forum, an informal Commission expert group meeting at least annually since 2019.	https://ec.europa.eu/culture/content/european-framework-action-cultural-heritage_en
European Landscape Convention	Agreement	International	Binding	Council of Europe	2000	Promotes the protection, management and planning of the landscapes and organizes international co-operation on landscape issues. Aware that the landscape contributes to the formation of local cultures and that it is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity.		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Convention Concerning the Protection of the World Cultural and Natural Heritage	Agreement	International	Binding	UNESCO	1972	Provides a permanent framework – legal, administrative and financial – for international cooperation in safeguarding humankind´s cultural and natural heritage and introduces the specific notion of a "world heritage" whose importance transcends all political and geographic boundaries.		https://whc.unesco.org/en/conventiontext/
European Convention on the Protection of the Archaeological Heritage (Revised)	Agreement	International	Binding	Council of Europe	1995	This revised Convention updates the provisions of a previous Convention adopted by the Council of Europe in 1969. The new text makes the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies.		https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/143

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Law 16/1985 on Historical Heritage	Law	National	Binding	Head of State	1985	Protection, increase and transmission to future generations of Spanish Historical Heritage.		https://www.boe.es/eli/es/l/1985/06/25/16/con
Law 42/2007 on Natural Heritage and Biodiversity	Law	National	Binding	Head of State	2007	Basic legal framework of Spanish biodiversity and natural heritage conservation, sustainable use, improvement and restoration. National transposing legislation of several specific international regulations and recommendations.	The timeline of the first implementation plan of the Law (Plan Estratégico del Patrimonio Natural y la Biodiversidad) was 2011-2017. However, the second implementation plan has not yet been approved.	https://www.boe.es/buscar/act.php?id=BOE-A-2007-21490&p=20180721&tn=0
Law 4/1998, of 11 June, on Valencian Cultural Heritage	Law	Regional	Binding	Presidency of the Regional Government	1998. Several amendments and revisions since then.	Basic legal framework at regional level for public and private action in relation to the protection, conservation, dissemination, promotion, research and enhancement of the Valencian cultural heritage.		http://www.dogv.gva.es/es/disposicio-consolidada?signatura=1137/1998&idioma=es&L=1&url_lista=

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
General inventory of Valencia's cultural heritage	Inventory	Regional	Binding	Regional Department of Education, Culture and Sport	1998	List of cultural interest goods, goods of local relevance, movable goods of heritage relevance and intangible goods of local relevance.	Continuous updating	http://www.ceice.gva.es/es/web/patrimonio-cultural-y-museos/inventario-general
Law 5/2018 of the "Huerta" of Valencia	Law	Regional	Binding	Presidency of the Regional Government	2018	Basic regulatory framework of the "Huerta", including aspects such as land use, agricultural activity management and funding, improvement of living and working conditions of the people engaged in cultural activities and the preservation of the "Huerta".	Several time limits established in the law regarding the application of different provisions. Two years deadline for the own regional government in order to pass the necessary provisions to ensure the effective execution of the law.	http://www.dogv.gva.es/es/disposicio-consolidada?signatura=002588/2018&url_lista=
Regional Plan for the "Huerta" of Valencia	Plan	Regional	Binding	Regional Department of Housing, Public Works and Organisation of the Territory	2018	Land use plan in the "Huerta" of Valencia, including: report, maps, protection catalogue, norms, and landscape analysis.	Indefinite duration meanwhile not reviewed. To be updated at least every 4 years.	http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/pat-horta-de-valencia

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Valencian Government Decree 71/1993, concerning the Albufera Natural Park legal regime	Regulation	Regional	Binding	Regional Department of the Environment	1993. Several amendments and revisions since then.	Natural Park designation and establishment of its basic legal framework.		http://www.dogv.gva.es/es/disposicio-consolidada?signatura=1546/1993&idioma=es&L=1&url_lista=
Valencian Government Decree 164/2016 designating Albufera traditional activities as intangible cultural heritage	Regulation	Regional	Binding	Regional Department of Education, Research, Culture and Sport	2016	Designation of artisan fishing and lateen sailing as intangible cultural heritage and establishment of arrangements for its protection and safeguarding.		http://www.dogv.gva.es/es/disposicio?sig=008555/2016&&L=1
Master Plan for the Use and Management of the Albufera Natural Park	Plan	Regional	Binding	Regional Department of Land and Housing	2004	Albufera Natural Park detailed use and management norms, including zoning.	Latest review process started in February 2020.	http://www.dogv.gva.es/es/disposicio?sig=5268/2004&&L=1

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Regional tree heritage law	Law	Regional	Binding	Presidency of the Regional Government	2006	Establishment of a regulatory framework aiming at the conservation, dissemination, promotion, research and growth of the regional tree heritage of the Valencian Region.	An advisory committee is established, and should meet at least once per year.	http://www.dogv.gva.es/es/disposicio-consolidada?signatura=2845/2006&idioma=es&L=1&url_lista=
Regional inventory of heritage and notable trees	Inventory	Regional	Binding	Regional Department of Agriculture, Rural Development, Climate Emergency and Ecological Transition	2012. Several amendments and revisions since then.	List of trees and groups of trees protected because of age, size or local relevance reasons.	Continuous updating	http://www.agroambient.gva.es/documents/20551003/163052224/Cat%C3%A0leg+d%27Arbres+Monumentals+i+Singulars+de+la+Comunitat+Valenciana/dc68cb0f-1b57-4a81-bc5d-b4415e328cc2

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update	Link (if available)
Catalogue of Protected Goods and Areas	Part of the city Masterplan simplified review	Local	Binding	Valencia City Council	2012	Protected goods and areas catalogue, required by existing land management laws (including: reports, maps, protection catalogues, norms, and summary sheets).		https://www.valencia.es/ayuntamiento/urbanismo.nsf/vDocumentosTituloAux/59554911F786991DC125798F003A1AB1?OpenDocument&bdOrigen=ayuntamiento%2Furbanismo.nsf&idapoyo=693E082FE52C3836C125798F0039D4DB&lang=1
Local ordinance regarding the Albufera Lagoon boat register	Regulation	Local	Binding	Valencia City Council	2002	Navigation regulation in the Albufera Lagoon, which is only allowed to traditional boats, including the establishment of a local register and the related administrative procedures.		https://sede.valencia.es/sede/descarga/doc/DOCUMENT_1_ORD0014_C

10.2. Table 2: Governance framework governing disaster risk reduction (see Chapter 4)

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Sendai Framework	Agreement	International	Non-binding	United Nations Office for Disaster Risk Reduction (UNDRR)	2015	Establishment of a global framework for action to prevent new and reduce existing disaster risks, based on 7 targets, 4 priorities for action with supporting rationale and 13 guiding principles.	Valid until 2030. UNDRR is in charge of follow-up and review of the Sendai Framework by preparing periodic reviews on progress, among other actions.	http://www.unisdr.org/we/inform/publications/43291
Decision No. 1313/2013/EU	Policy / strategy	International	Binding	The European Parliament and The Council of The European Union	2013	Defines the various mechanisms that should promote solidarity and should support, complement, and facilitate coordination of Member States' actions in the field of civil protection with a view to improving the effectiveness of systems for preventing, preparing for and responding to disasters. Prevention is of key importance for protection against disasters and requires further action.		https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0924:0947:EN:PDF

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Decision 420/2019/EU	Policy / strategy	International	Binding	The European Parliament and The Council of The European Union	2019	Amendments to Decision No 1313/2013/EU on a Union Civil Protection Mechanism.		https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0420&from=EN
Directive 2007/60/EU	Guideline	International	Binding	The European Parliament and The Council of The European Union	2007	The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community. It should be read together with Act no. 7/2010 Coll. on flood protection,		https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
National Plan for Emergencies and Risk Management in Cultural Heritage (NPERMCH)	Plan	National	Non-binding	Department of Education, Culture and Sport	2015	Definition and implementation of preventive and remedial actions for cultural heritage protection against hazards, including risk identification, and programs and lines of action.	Valid for a period of 10 years. Objectives should be revised in 2020. A monitoring committee was established, and yearly monitoring reports should be published.	http://www.culturaydeporte.gob.es/planes-nacionales/planes-nacionales/emergencias-y-gestion-riesgos.html https://sede.educacion.gob.es/publiventa/descarga.action?f_codigo_agc=15107C
Albufera Natural Park Forest Fire Prevention Plan	Plan	Regional	Non-binding	Regional Department of Land and Housing	2006	Guiding document in relation to forest fire prevention in the Albufera Natural Park. Includes the analysis and diagnostic of current conditions, action plans for fire prevention and control, an economic and financial report, and specific cartography.	The economic and financial report was based on a 10-year timeframe since its approval/publication.	http://www.agroambient.gva.es/es/web/prevencion-de-incendios/planes-de-prevencion-de-incendios-forestales-de-la-red-de-espacios-naturales-protegidos/-/asset_publisher/J8VsgHcswUqD/content/albufera

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Lliria forest managament zone Forest Fire Prevention Plan	Plan	Regional	Non-binding	Regional Department of Government and Housing	2015	Guiding document in relation to forest fire prevention in the Lliria forest management zone. Includes the analysis and diagnostic of historical and current conditions, action plans for fire prevention and control, technical standards and instructions, an economic and financial report, and specific cartography.	2030	http://www.agroambient.gva.es/es/web/prevencion-de-incendios/planes-de-prevencion-de-incendios-forestales-de-demarcacion/-/asset_publisher/G7Yr70d2P4Cc/content/lliria?redirect=http%3A%2F%2Fwww.agroambient.gva.es%2Fes%2Fweb%2Fprevencion-de-incendios%2Fplan
Regional flood risk management plan (PATRICOVA)	Plan	Regional	Partially binding	Regional Department of Territorial Policy, Public Works and Mobility	2015	Sectoral plan for flood risk reduction including, among other, specific regulations, an action Plan, a list of high flood risk municipalities, cartography and an Implementation Guide.	Monitoring and implementation reports every two years. Future update once it is considered adequate according to the monitoring process.	http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/patricova-plan-de-accion-territorial-de-caracter-sectorial-sobre-prevencion-del-riesgo-de-inundacion-en-la-comunitat-valenciana

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Specific operating procedure regarding wildfires in the Devesa del Saler	Guideline	Local	Binding	Valencia City Council	2017	Definition of the resources and work plan involved in reaction to emergencies due to wildfires in the Devesa del Saler area of the Albufera.		http://www.valencia.es/ayuntamiento/bomberos.nsf/0/6DBD12EB83938BD7C125827A003B276F/$FILE/PROCOP%201.11%20INCENDIOS%20FORESTALES%20EN%20LA%20DEVESA%20DEL%20SALER.pdf?OpenElement&lang=1
Valencia city ordinance in relation to fire protection	Regulation	Local	Binding	Valencia City Council	2007	General and detailed standards in relation to fire protection, regime of sanctions.		https://sede.valencia.es/sede/descarga/doc/DOCUMENT_1_ORD0013_C

10.3. Table 3: Governance framework for climate adaptation (See Chapter 5)

Note: Strategies, policies, action plans etc. relevant for climate adaptation may also be found in plans developed for other purposes, e.g. master plans, environmental plans, and health plans.

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Paris Agreement	Agreement	International	Binding	UNFCC	2015-2016	The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.		https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
United Nations Framework Convention on Climate Change	Agreement	international	binding	The United Nations	1992	The ultimate objective of the Convention is to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system. It states that such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner		https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change
EU Climate Change Adaptation Strategy	Strategy	International (Europe)	Non-binding	European Commission	2013	Framework and mechanisms for improving the EU's preparedness for current and future climate impacts.	Last evaluated in 2018 (see report below). Update likely 2021.	https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Evaluation of the EU strategy on adaptation to climate change	Report	International (Europe)	Non-binding	European Commission	2018	This report examines the process and the results of the evaluation of the strategy COM/2018/738, including the lessons learned from its implementation.		https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1
National Climate Change and Energy Transition Law	Law	National	Binding	Department of Ecological Transition and Demographic Challenge	To be passed in 2020.	Basic national regulatory framework for climate change mitigation and adaptation.	Currently under final stages of drafting, prior to parliamentary procedure.	https://www.miteco.gob.es/es/prensa/ultimas-noticias/la-ley-de-cambio-clim%C3%A1tico-y-transici%C3%B3n-energ%C3%A9tica-entra-en-la-recta-final-de-su-tramitaci%C3%B3n-administrativa/tcm:30-506983

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
National Plan for Adaptation to Climate Change (PNACC)	Plan	National	Non-binding	Department of the Environment and Rural and Marine Affairs	2006	Reference framework for the coordination of public administrations in the development of activities regarding impact and vulnerability assessments and climate change adaptation in Spain.	Second PNACC to be adopted in 2020, including major updates.	https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/plan-nacional-adaptacion-cambio-climatico/
Third PNACC Work Programme (TPT)	Work Programmes	National	Non-binding	Department of the Environment and Rural and Marine Affairs	2014	In December 2013 the Third Work Programme was approved, which seeks to address climate change adaptation in a comprehensive manner.	The development of the PNACC is monitored through the elaboration of the Progress Reports, published in 2008, 2011, 2014 and 2018.	https://www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/3PT-PNACC-enero-2014_tcm30-70397.pdf
Strategy for adaptation to climate change on the Spanish coast	Strategy	National	Non-binding	Department of Agriculture, Fisheries, Food and the Environment.	2016	Adaptation strategy including a current diagnosis of the coast, setting of specific objectives, general guidelines and proposed measures, as well as an implementation and monitoring plan.	The development of adaptation actions until 2050 is proposed.	https://www.miteco.gob.es/es/costas/temas/proteccion-costa/estrategiaadaptacionccaprobada_tcm30-420088.pdf

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Valencian Climate Change Strategy 2020-2030	Strategy	Regional	Non-binding	Regional Department of Agriculture, Rural Development, Climate Emergency and Ecological Transition	2019	Regional mitigation and adaptation strategy, including a list of potential measures and actions as well as a monitoring system.	2030. Monitoring system established, based on several indicators to be tracked via a new software application.	http://www.agroambient.gva.es/es/web/cambio-climatico/2020-2030
Territorial Plan for Green Infrastructure in the Coastline (PATIVEL)	Plan	Regional	Partially binding	Regional Department of Territorial Policy, Public Works and Mobility	2018	Coastline land use plan, based on several criteria such as climate change adaptation, including: Information and explanatory report, planning maps, landscape assessment, regulations, economic report, strategic environmental and territorial reports, beach inventory and its regulations, proposal of coastline regional path, protections catalogue.	Indefinite duration meanwhile not reviewed. To be updated at least every 20 years or earlier, according to a list of specified criteria.	http://politicaterritorial.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/plan-de-accion-territorial-de-la-infraestructura-verde-del-litoral

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Valencia Region Forest Plan (PATFOR)	Plan	Regional	Partially binding	Regional Department of Infrastructures, Land and the Environment	2013	Forest regional plan, including, among other, an analysis of the Valencian forest ecosystems climate change adaptation potential and a proposal of potential adaptation guidelines.	Indefinite duration. To be reviewed at least every 15 years.	http://www.dogv.gva.es/es/disposicio?sig=004345/2013&&L=1 http://www.agroambient.gva.es/es/web/medio-natural/patfor
Valencia Sustainable Energy and Climate Action Plan (SECAP)	Plan	Local	Non-binding	Valencia City Council	2019	Developed within the framework of the Covenant of Mayors initiative, the SECAP includes, *inter alia*, an action plan including mitigation and adaptation actions.	2030	https://www.covenantofmayors.eu/about/covenant-community/signatories/overview.html?scity_id=11935

Name of document	Type of document	Level	Binding / non-binding	Author(s)	Year of publication	Summary of content	Timeline for future evaluation/update)	Link (if available)
Climate Change Adaptation Plan Valencia 2050	Plan	Local	Non-binding	Valencia City Council	2017	The Valencia Adaptation Plan has been structured around 4 strategic objectives (adapting people, promoting a sustainable green economy, responsible management, and designing an attractive and efficient city) that will be implemented through 14 goals.		https://www.valencia.es/ayuntamiento/energias.nsf/0/8B7F4BFFA988C100C12581AF003BE403/$FILE/PACCV_20170127.pdf?OpenElement&lang=1