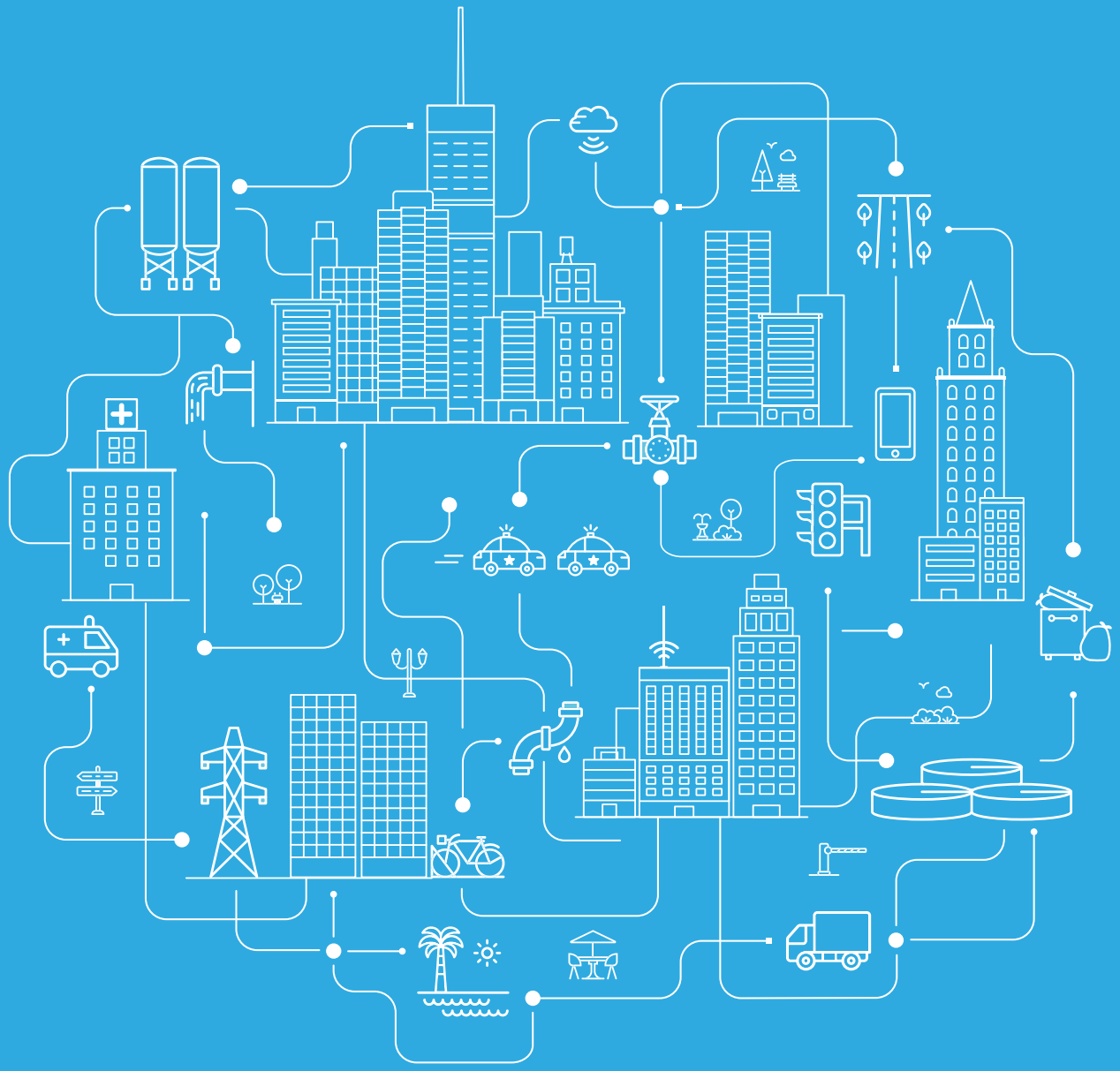
Resilient cities facing climate change

e-book



RESCCUE

RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

RESCCUE in the world of cities

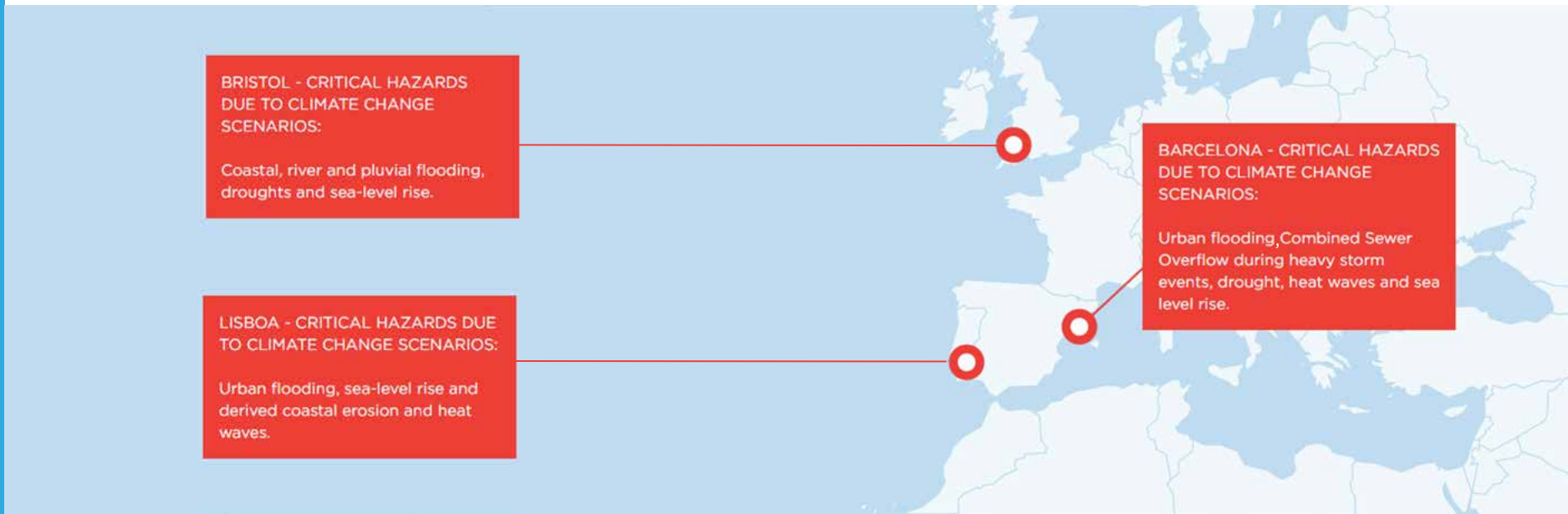
According to the United Nations, today, 54% of the world's population lives in cities, a proportion that is expected to increase to 66% by 2050. These cities are constantly facing different impacts of climate change that not only cause significant economic losses but also pose challenges to urban living.

In this context, Europe's first large-scale innovation and urban resilience project RESCCUE was born to improve urban resilience: the capability of cities to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damages and losses.

3 Cities, 3 different challenges

The models and tools developed within RESCCUE have been validated in three different cities, carefully selected by their representativeness of the European diversity in terms of climate type and city characteristics: Barcelona, Lisbon and Bristol.

The aim of having three different cities as platforms to validate and apply RESCCUE's results guarantees that the final outcome is complete, qualified and ensures its maximum replicability beyond the end of the project.



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Foreword

Marc Velasco

Aquatec-Suez Advanced Solutions

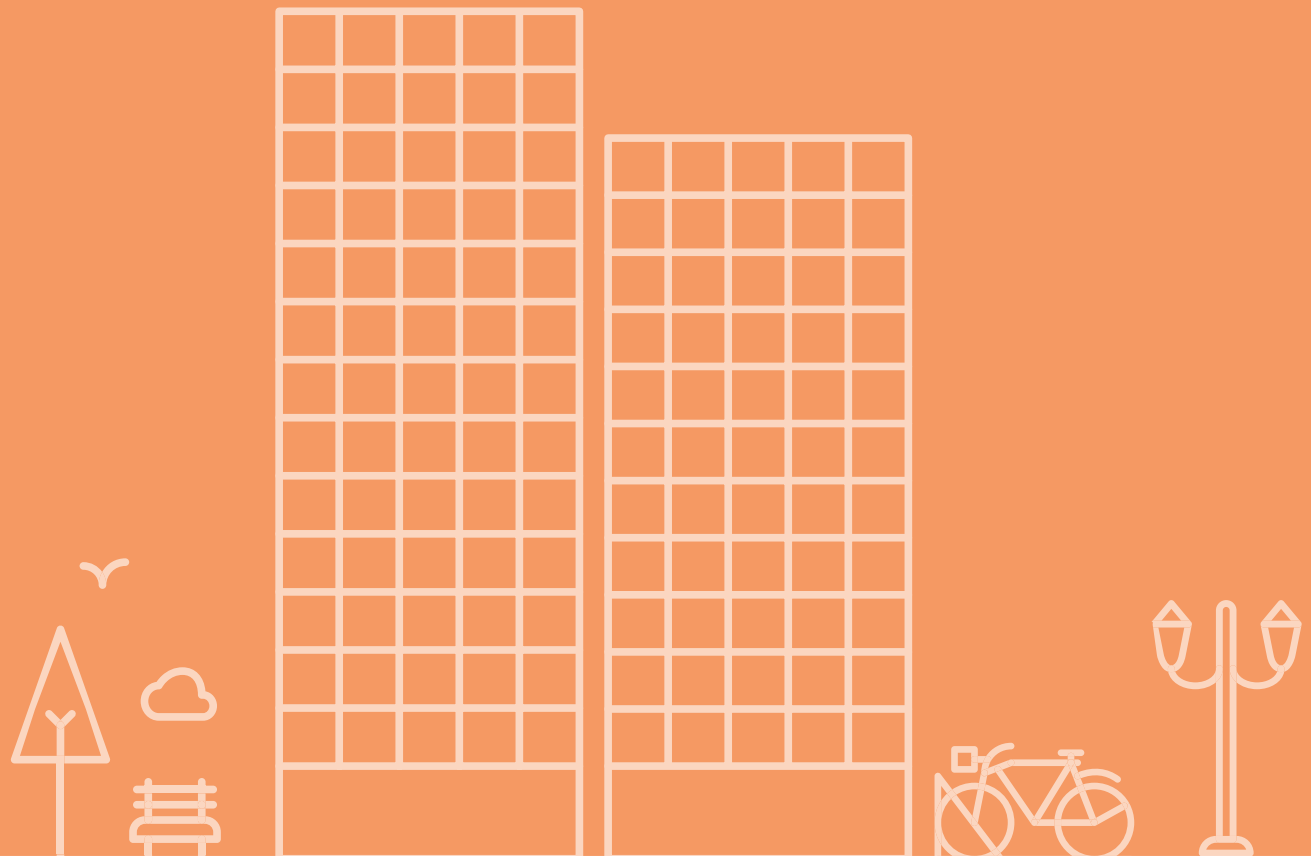
Project Coordinator

During the last four years, the RESCCUE project has been my life. For quite a long time, I have been repeating over and over one of the mottos of the project: cities are complex systems of interconnected systems. The RESCCUE consortium, with a varied canvas of partners from different worlds, has been exactly like a city, a complex system of interconnected entities. Managing this has been a challenging but very satisfying task, as we jointly managed to overcome all the problems that appeared along the way.

After four years of hard work and thanks to the involvement of a multidisciplinary team of experts, here we are, testifying that it is possible to achieve and presenting this *RESCCUE Resilient cities facing climate change* e-book.

This e-book shares the outputs of RESCCUE, showing the roadmap and supporting the reader on their own resilience path, in an easy-to-read way and including several links to the project's outputs and results. As you will see, a lot of work has been done in order to help cities increase their resilience to climate change. But this is only the beginning. I am sure that what RESCCUE has started will continue to move forward and cities will become more and more prepared for the coming challenges. So join us in our quest to RESCCUE the cities of the future!

Is this e-book for me?



RESCCUE

RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

What is this e-book?

Rita Salgado Brito, LNEC

This e-book offers the path, the knowledge, the methodologies, the tools and the experiences of the RESCCUE project.

It is aimed at those who are aware of the climate emergency we face today and those engaged in mitigating and adapting our cities and our urban services to the impacts of climate change, with a focus on water.

It was prepared to be used in any city, as there's always something in RESCCUE for any professional in charge of establishing and implementing resilience policies and plans, or for any urban services' operator.

Whether you apply our methodologies and tools to your metropolitan area, to your city boundaries or to a given part of your city, there is always a positive contribution to your resilience. You may apply them to the city as a whole or to a single service (water supply, storm water, for instance), or else go deeper, integrating the urban services (water and energy supply, for instance), where you will find an added value by considering interconnections and cascading effects in your analysis.

As you go from downscaling climate change scenarios, to pinpointing your most critical climate-related hazards, from assessing resilience to identifying and planning your resilience strategies, there are multiple gains as you follow this path. The benefits come up along the way, not only at the end.

What will you find in this e-book?

- operational, organisational and governance recommendations for you to make the most of your path in resilience;
- suggested steps you should follow on that path;
- successful experiences shared from our RESCCUE cities, Barcelona, Bristol and Lisbon;
- insights on RESCCUE's development pertinent to any city and urban services;
- best-practice advice from our team members;
- tools to support you on this path: links to RESCCUE's guidelines, templates, tools, tutorials, videos, deliverables.

We hope these guidelines inspire you to walk the path of resilience and help with the challenges you'll be faced with.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

RESCCUE: a European model for urban climate change resilience planning

Marc Velasco, Aquatec-SUEZ Advanced Solutions

The RESCCUE project (RESilience to cope with Climate Change in Urban arEas, www.resccue.eu) was born in May 2016. **It was Europe's first large-scale innovation and urban resilience project, aimed at improving the capability of cities to anticipate, prepare for, respond to, and recover from significant multihazard threats, with minimum damage**.

The RESCCUE approach turned a new page by leaving sectoral approaches behind, by considering cities as networks of interdependent systems. The four-year project went beyond the conventional analysis of the impacts of climate change on single critical infrastructures, such as energy, water or transportation. RESCCUE's perspective was a holistic one, focusing on interconnections rather than on separate city units of the urban infrastructure networks.

A multisectoral approach, a key advantage

The objective of RESCCUE was to produce a set of models and tools to analyse urban resilience based on a multisectoral approach, to overcome current difficulties related to a lack of information integration of the different urban services. To interconnect sectoral models, the project takes advantage of the **RESCCUE tools and methodologies as the basis of further software developments able to perform the assessment, management and planning of urban resilience in an integrated way**.

The three cities included as pilot sites (Barcelona, Lisbon and Bristol) were the validation platforms of the RESCCUE tool, where integrated analyses of urban resilience were performed throughout the project. These three research sites were selected because of their strong engagement with urban resilience, as demonstrated by their selection and participation in the 100 Resilient Cities program founded by The Rockefeller Foundation. The teams of the research sites shared their experiences and learned from each other, fostering together their way towards resilience. Each one followed its own path, but with a common objective of a better and safer world to live in.

The resilience roadmap for these cities, in the form of a Resilience Action Plan (RAP), was one of the key results of the project. Produced at the very end, each presented the strategic lines on which the city must focus, considering also the concrete measures that will be applied to solve specific problems. Nonetheless, these results not only aim at providing an overview of the resilience building in Barcelona, Bristol and Lisbon, but are intended to help many other cities around the world build their capacity to adapt to current and future shocks and stresses.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

3 key benefits RESCCUE delivered 3 key benefits for cities around the world:

1 **A better understanding of systems behaviour:** RESCCUE analysed the hazards, vulnerabilities and interdependencies in Barcelona, Bristol and Lisbon, easing the path for cities that want to understand how their systems behave and interconnect.

2 **Improved capacity to respond to shocks:** the urban resilience management tools developed within the project can be easily deployed in any other city around the world. By constantly monitoring key infrastructures, the tools will not only be able to detect which infrastructures are affected when shocks occur, but will also support response teams by issuing pre-defined warnings.

3 **A better future for urban living:** RESCCUE will help cities build their Resilience Action Plans, crucial documents for the planning of future investments to face climate change. Beyond the RESCCUE cities, these tools and frameworks could be used to develop RAPs in cities elsewhere.

Video

Is this e-book for me?

Rita Salgado Brito and Maria Adriana Cardoso, LNEC

Check if these items apply:

- [ ] You are concerned with water scarcity, droughts, sea level rise or flooding
- [ ] Climate change overwhelms you
- [ ] You want to deal with climate change and water in the city and don't know where to start
- [ ] You need climate change projections to better prepare for the future
- [ ] Your research focuses on climate change or resilience
- [ ] The urban service you manage or operate depends on other services
- [ ] The urban service you manage may affect the resilience of other services or of the whole city
- [ ] Getting your city prepared for climate change is your responsibility
- [ ] You are asked to address climate related hazards in urban planning
- [ ] You are a policy maker committed to climate change mitigation and adaptation and to resilience enhancement
- [ ] You deal with stakeholder engagement, social awareness and citizens' preparedness
- [ ] You need to know where your city or service stands regarding resilience
- [ ] Choosing the best solution to overcome your resilience-building setbacks is a challenge
- [ ] You need to plan for climate change and resilience
- [ ] You want to acknowledge whether the solutions you chose provide the expected resilience benefits

If you selected at least one item, then this e-book will help you. Keep reading!

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

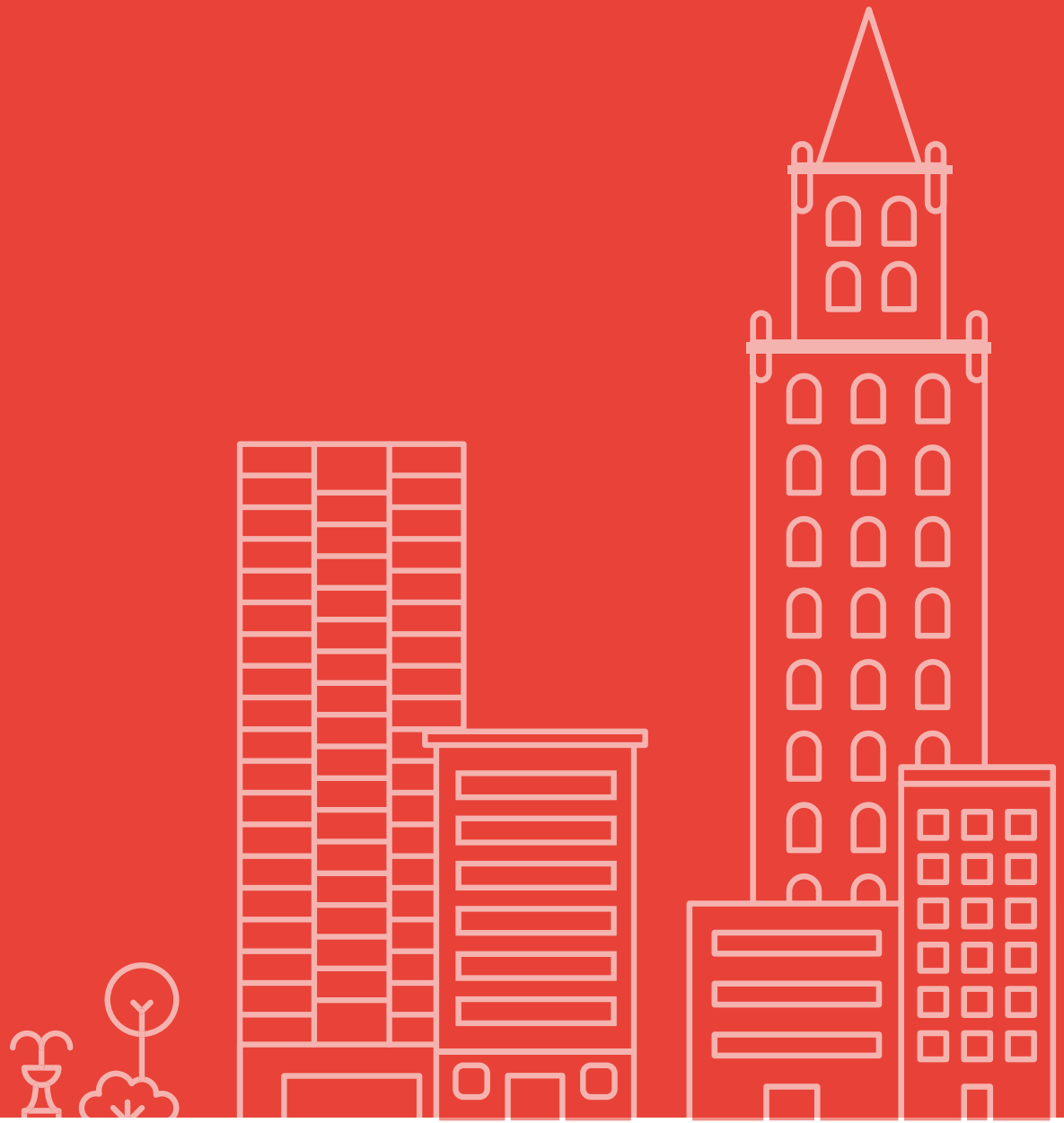
Final remarks

About RESCCUE

What can you accomplish if you follow RESCCUE's roadmap?

There are several gains for you throughout RESCCUE's path to resilience. Check them out.

Good to know first



RESCCUE

RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Recommendations for newcomers

Rita Salgado Brito, Maria Adriana Cardoso and David Pacheco, LNEC and CETAQUA

If you're willing to travel RESCCUE's path for resilience, there are some recommendations we'd like to share.

Take a look at the top operational, organisational and governance needs you should guarantee for a successful replication and follow-up of RESCCUE's results. If you tackle these, you'll make the most of our tools and maximise the impact of your efforts towards resilience.

Governance, organizational and operational needs

Top Governance needs

- Identification of resilience to climate change as a priority in the city's agenda
- Identification of strategic urban services relevant for city resilience and their representatives
- Identification of all the stakeholders relevant for city resilience and of the decision chain. Roles, responsabilities and leadership are also key
- Stakeholder engagement
- Creation of a strategic group for resilience in the city
- Establishment of a continuous process regardless of changes in the strategic group's members

Top Organisational needs

- Awareness of resilience as a collaborative process
- Identification of stakeholders with specific roles in the city and in each service
- Identification of a steering group for resilience in the city, including players from public service providers
- Integration of different knowledge sources
- Established autonomy regarding production, updating and sharing timely and consistent relevant data and information

Top Operational needs

- Access to climate change and resilience experts
- Access to historical data
- Access to inventory data on services and infrastructures
- Communication between service providers of the same service in the city
- Allocation of resources for diagnosis of resilience in the city and in the services
- Allocation of resources for identification of interconnections and of scenarios' impact

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

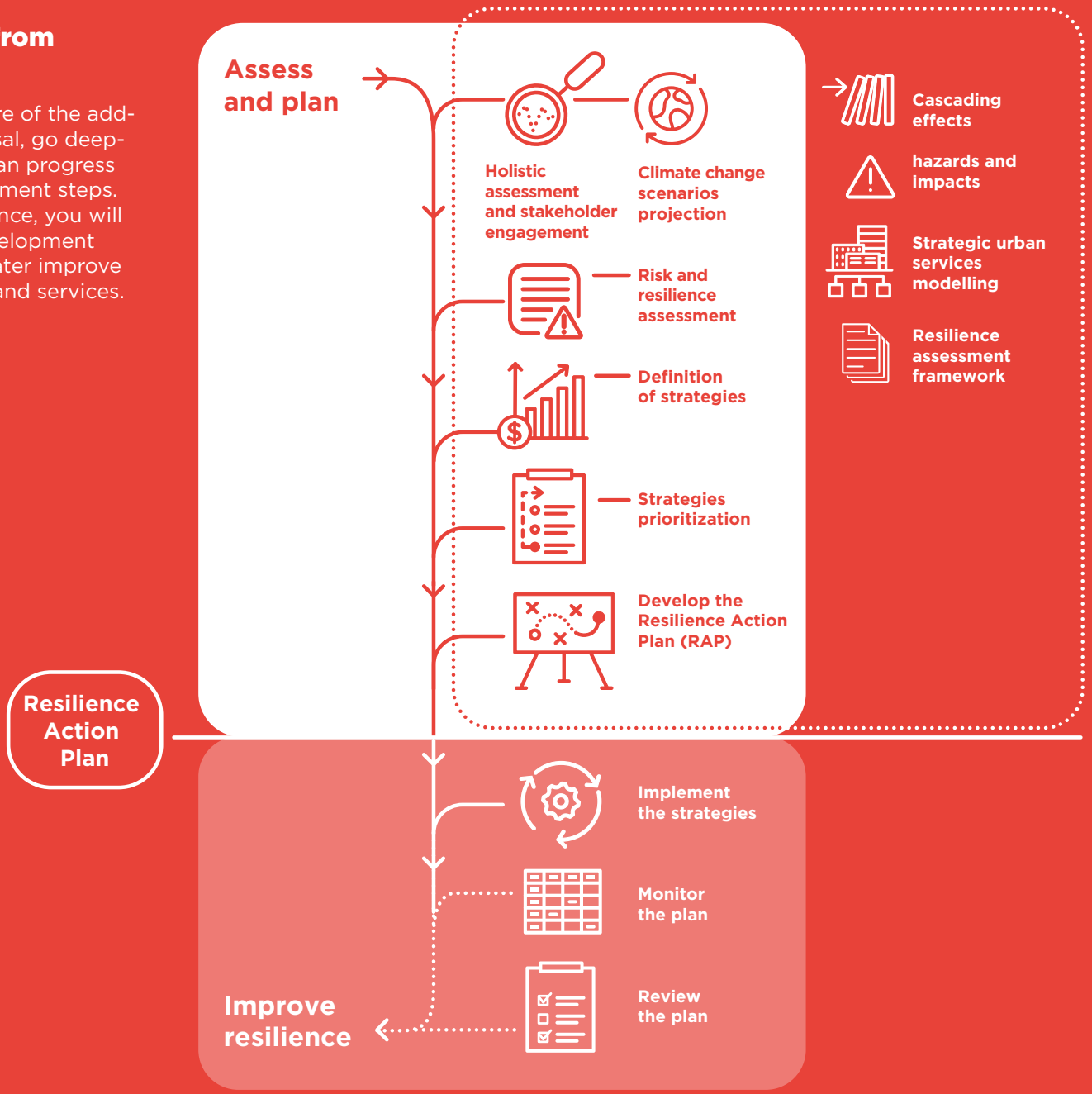
- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Suggested path from RESCCUE

If by now you are aware of the added value of our proposal, go deeper and see what you can progress in each of our development steps. While assessing resilience, you will move towards the development of a RAP, so you can later improve resilience in your city and services.



Successful experiences from RESCCUE cities

RESCCUE

RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- **Barcelona**
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Barcelona

Andoni González, Ajuntament de Barcelona

Standing on the shores of the Mediterranean, Barcelona has adopted a dense and compact growth model (16.142 inh/km^2) due to a series of historical expansions, whether planned or not, but generating a highly sustainable city model, ready to face the challenges of the future. Despite being a relatively small municipality, with a population of 1.6 million and a surface area of approximately 100 km^2, **the city has become a major economic driver in the south of the continent and it is one of the most populated metropolitan areas in Europe** (3.2 million inhabitants).

Apart from its residents, **a significant floating population, namely daily commuters and tourists** (with more than 30 million people visiting every year), **has a clear impact on the city**. The large number of activities that go on every day in Barcelona, with its economy strongly geared towards the service sector (88% of the people who work in the city), leads to an intensive use of space that puts a burden on urban services. It also poses great challenges when it comes to ensuring they function correctly and rolling out the infrastructure required to accommodate urban services in the limited space available, as well as the safety and quality of life of inhabitants and visitors.

A highly sustainable city model, ready to face the challenges of the future.

Credits to Antoni Lajusticia

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- **Barcelona**
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Nowadays, the city faces the challenges of climate change which present risks to people's health and well-being (heat waves), security (guaranteed supply of water and energy, vulnerability of infrastructures, risks of fires, etc.) and to the natural environment which the City Council and other public administrations have to provide for and protect against. The resilience of the city to climate change can be highly related to its urban services resilience, their interdependencies and cascade effects. Within RESCCUE, **the resilience assessment was carried out for flooding, combined sewer overflows, drought and heat waves, considering variables related to rainfall, sea level and temperature**. The exhaustive analysis led the city to an intense and deep level of self-knowledge about its level of resilience.

Barcelona launched its **Climate Plan in 2018**. It sets an example for other cities to be inspired by and to be replicated, as it was the first ever Covenant Cities in the Spotlight awards among large-sized city signatories, and it also supports the goals of the Paris Climate Agreement, according to the revision made by C40's against their Climate Action Planning Framework.

The RESCCUE project arose as an opportunity to enhance several aspects of the Climate Plan mostly related to the improved knowledge on climate projections and the development of sectorial and integrated models, to understand the behaviour and response of the main urban services and infrastructures in case of extreme weather events, with special regard to services interdependencies and cascading effects. The Resilience Action Plan developed within the RESCCUE project aims to update and complement the Climate Plan measures.

Successful strategies

Adapting schools to climate change

Barcelona City Council participates in the European Commission program Urban Innovation Action (UIA), as part of the Adapting schools to climate change through green, blue and grey project.

Go to link

Citizen climate projects

Barcelona City Council launched a series of grants to promote collaboration projects between the public authority and citizens in order to boost citizen involvement, support collective citizen action, promote and support innovative initiatives, and utilise co-creation processes.
Over 140 organisations and a total of 49 projects participated in the call for climate grants that endowed a budget of €200,000 for the 11 projects selected.

Go to link

Climate shelters network

In the light of heat vulnerability index results of the city, the Barcelona City Council is developing a network of climate shelters that provide good thermal comfort conditions to shelter sensitive people during heat wave events.

Urban resilience boards

The resilience boards are organised into working groups that cover the key infrastructures and services of the city aimed to reduce vulnerability and risk, associated also to natural and anthropogenic sources. The boards are headed by sector managers from the City Council in each area with the support of the Urban Resilience Department, which is responsible for managing and coordinating the stakeholders and organisations involved in the projects, leading, monitoring and reviewing the processes to enhance the resilience of the city.

Barcelona

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- **Barcelona**
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Check out what we are doing

Barcelona's Resilience Action Plan (RAP)

Barcelona developed this RAP for its city boundaries (mainly urban and peri-urban areas), with a medium/long-term planning horizon of 10 years, from 2020 to 2030, in articulation with the strategic planning horizons for Barcelona.

Go to link

What can you do?

List of everyday steps that everyone in Barcelona can take to help fight the effects of climate change.

Go to link

We are not starting from scratch

Compilation of projects, policies and plans that have been set up in the city to fight and respond to the effects of climate change.

Go to link

What is the city currently doing?

Compilation of city's practices regarding mobility, air quality, greenery and biodiversity, city model, health, water, energy, food, economic and social model and governance issues.

Go to link

How will climate change affect Barcelona?

Results of the vulnerability assessment studies carried out within the Climate Plan.

Go to link

Questions and answers on climate change

Short list of questions and answers to build awareness and communicate climate change effects to the citizenship.

Go to link

Barcelona for climate

Official website of Barcelona City Council climate action.

Go to link

Barcelona Climate Emergency Declaration

On January 2020, the city of Barcelona declared a climate emergency and accelerated a series of changes involving all players in the city.

Go to link

Barcelona

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- **Bristol**
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Bristol

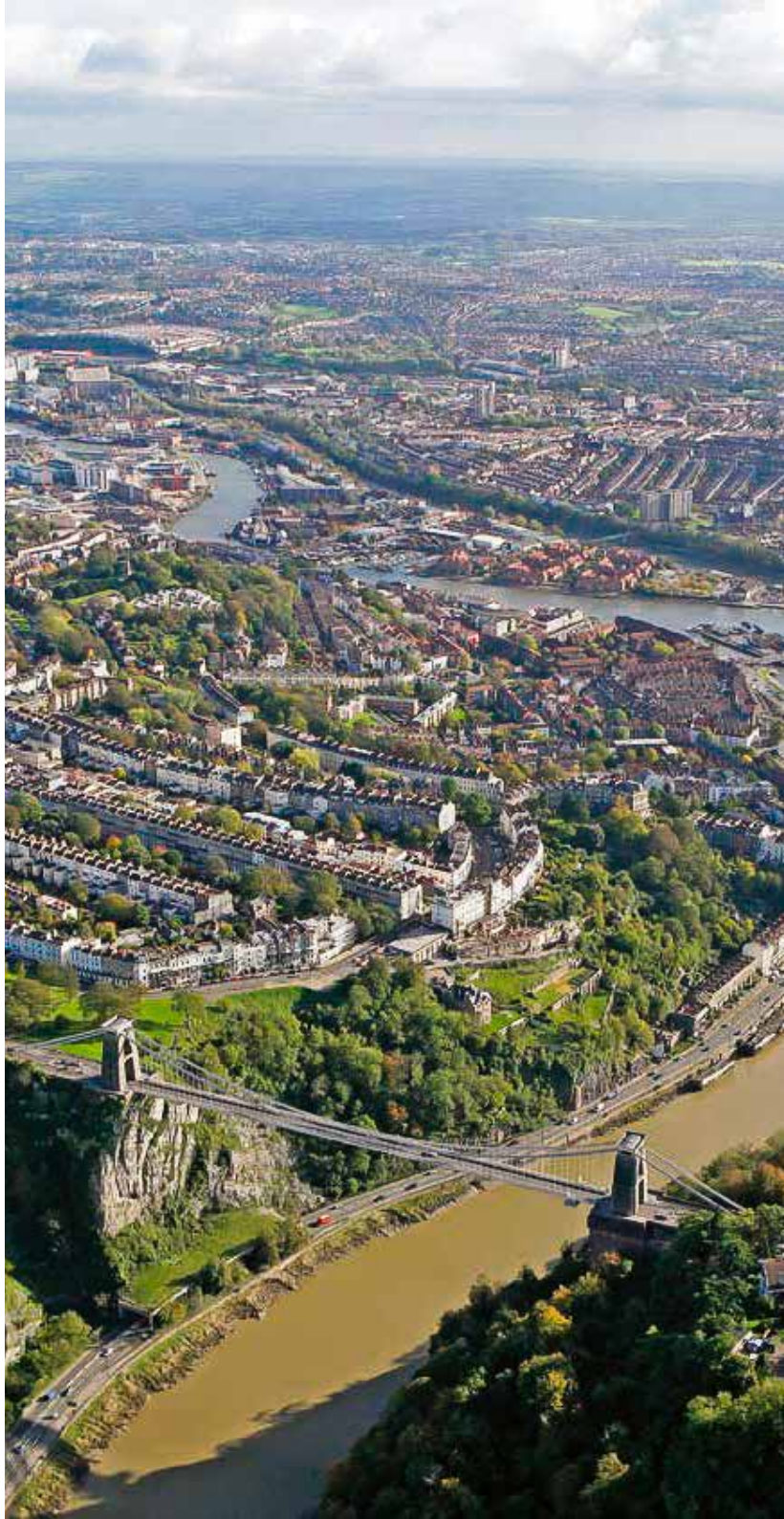
John Stevens, Bristol City Council

Bristol is a rapidly expanding city in south west England that is subjected to significant threats from flooding. This is relevant in the present day but it is expected to worsen further still in the future with the predicted impacts of climate change. **The main risks are posed from tidal river flooding and surface water flooding**. The River Avon is tidally influenced throughout the city through which it flows, through the main city centre area. This watercourse is influenced by the second highest tidal range in the world from the Severn Estuary.

This significant risk posed in the current day is heightened by what is estimated to be over a metre in height on the tide level due to sea level rise over the next 100 years. Increased river flows and more frequent, higher intensity rainfall events are anticipated to contribute more towards the flooding problem. **The growing population and aging infrastructure therefore need to adapt to this changing climate.**

The resilience of the city to climate change can be highly related to Bristol's urban services resilience, their interdependencies and cascade effects. The resilience assessment within RESCCUE was deepened for the flooding hazard related to rainfall and sea level variables. It went into a great level of detail, investigating many aspects of city resilience quite thoroughly. The RESCCUE analysis and approach has helped to enable this in developing climate adaptation strategies to better deal with the potential magnitude of the flooding problems faced.

The main risks are posed from tidal river flooding



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- **Bristol**
- Lisbon

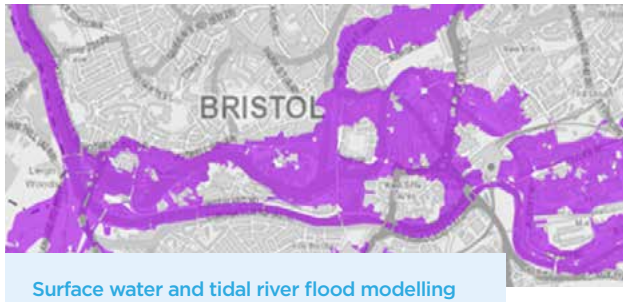
Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Tidal flooding in Bristol



Surface water and tidal river flood modelling inclusive of climate change in Bristol

Surface water flooding in Bristol

Bristol

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- **Bristol**
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

The objective of Bristol's Resilience Action Plan is to provide a roadmap to improve the resilience to climate change with focus on water. The plan considers the interactions and contributions to city's resilience of the following strategic urban services: water supply, wastewater drainage and treatment, storm water drainage, waste collection and treatment, electric energy supply and mobility.

Check out what we are doing

What BCC is doing

See how BCC aims to reduce its contribution to climate change and prepare for the impacts of climate change.

Go to link

The Action Plan

BCC Mayor's Climate Emergency Action Plan.

Go to link

Clean Air

Bristol's plans for Clean Air.

Go to link

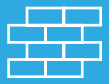
Bristol's Resilience Action Plan (RAP)

Bristol developed this RAP for the Bristol City Council administrative area and metropolitan area, with a medium-term planning horizon of five years, from 2020 to 2025, in articulation with the strategic planning horizons for Bristol.

Go to link

Successful strategies

All of the above analysis helps not only in defining the problems, but also helps to justify the business case for investment to reduce these risks. For instance, the compiling of an evidence base through damages assessments costs benefits assists with this.



New pumping station and flood defence walls

Proposals to erect a new land drainage sewer pumping station and installing riverside flood defence walls are given more emphasis by utilising the RESCCUE project analysis evidence base. In-depth interpretation of future critical tide levels and the impacts on the urban drainage network and overtopping at low spots has led to the identification of the extent of the flooding issues and generates the business case to implement such measures.

Integrated modelling

The RESCCUE approach looks at a flooding incident and what the knock-on effects are from this, ranging from property damage to power outages, waste collection issues and traffic disruption. Overlapping models that exist for these various sectors with the output from one model being input into another gives an overall indication how the city will respond, on the whole, as a singular unit.

Cascading effects

Understanding of the connectedness that lies between key city services and the reliance and interdependencies between them has proven extremely valuable. The RESCCUE concept, to either reduce these impacts or enhance the recovery time by gaining greater understanding of these systems and connections, is becoming of real benefit. Enhancing emergency response processes and making procedural adjustments and improvements on a citywide basis with critical service providers will be vital going forward.

Bristol

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- **Lisbon**

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Lisbon

Maria João Telhado, Câmara Municipal de Lisboa

Located on the northern bank of the Tagus River's estuary, with an extensive riverfront, Lisbon is the Atlantic capital of Portugal, a country with 10.3 million of inhabitants. Lisbon is located in the middle of the Metropolitan Area, with 18 municipalities and a population of 2.8 million.

Lisbon has 548,000 residents and during the day its population increases by more than 70%, as a result of daily commuting and tourism. All the soil is classified as urban, integrating two relevant dimensions: 10 km^2 of urban forest and the international airport.

The city enjoys a Mediterranean climate and is currently facing the impact of climate change, in terms of temperature, rainfall, wind and gust and sea level mean values.

The Lisbon City Government Program for 2020-2021 aims for:

- A **sustainable city** and with well-being, focusing on a permanent improvement of urban environment and quality of life of its people in the present and considering climate change scenarios;
- A **city for all citizens**, which fights exclusion and defends rights;
- A **city for sharing prosperity**, with a strong economy and employment;
- A **universalist and progressive city**, a **global** municipality;
- A **participatory and democratic city**, with an open governance, transparent, efficient and decentralised.

One of best cities in the world to live in

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- **Lisbon**

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Today, Lisbon is a complex system with more than 1,000,000 citizens who live, work, study, circulate and visit the city, the Portuguese make up the majority, with different ages, cultures, religions, ethnicities, education levels, knowledge and languages.

The vision of the city is to be one of best cities in the world to live in, combining resilience principles with sustainability, environmental, economic, social, financial and political targets of today, without jeopardising future generations.

Presently, Lisbon faces a few main challenges (aging of basic services infrastructure and buildings, aging population, economic and energy poverty, energy efficiency and environmental sustainability targets) along with relevant disruption events: earthquakes, landslide, rainfall flooding, tsunami, sea level rise, urban fire and pollution (air, water, soil and biodiversity resources).

Within RESCCUE, **resilience assessment was undertaken for the flooding hazard, related to rainfall and sea level variables**. This assessment is a step up in Lisbon's Climate Change Resilience Process and one diagnosis to be integrated in the ongoing Climate Action Plan of the city.

Within RESCCUE, a set of strategies was planned, namely regarding the adaptation of blue and green infrastructure, the promotion of urban rehabilitation, strengthening of local collaborations, the implementation of monitoring and early warning systems and the protection of urban electrical infrastructure exposed to estuarine flooding. With this set of strategies, Lisbon aims to achieve most of its long-term resilience objectives regarding climate change, with focus on water.

The pictures show the same places with and without flooding.

Cais do Sodré

29/09/2019
Equinoctial high tide level

06/02/2020
Common tide level

Torre de Belém

01/03/2018
High tide level, windstorm and storm surge

06/02/2020
Common tide level

Sete Rios

22/09/2014
Floods

06/02/2020
Common day

Lisbon

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- **Lisbon**

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Check out what we are doing

Lisbon's Resilience Action Plan (RAP)
Lisbon developed this RAP considering its city boundaries (urban area) with a medium/long-term planning horizon of 10 years, from 2020 to 2030, in articulation with the strategic planning horizons for Lisbon

Go to link

Civil Protection Municipal Emergency Plan

Go to link

Municipal Strategy for Climate Change Adaption (EMAAC) (2017)
approved by the City Council and aligned with the national policy

Go to link

Sustainable Energy and Climate Action Plan (2018)

Go to link

The Metropolitan Plan for Climate Change Adaption for Lisbon Metropolitan Area – PMAAC (2019)

Go to link

C40 network of cities for preparing and adaptation to climate change (2018)

Go to link

ECCA 2019, Web-summit 2019 and other information campaigns and training projects

Video Video

The 2020 European Green Capital Award given to Lisbon

Go to link Video

Successful strategies

To face the actual expected shocks and stresses and also to achieve the resilience and sustainable development objectives, particularly to reduce vulnerability to the expected hazards, prepare the population and the services and promote a better articulation between urban services, the successful strategies defined by the municipality are:

- Manage the municipality as a "complex vulnerable critical infrastructure", as in the European Commission co-financing projects POP-ALERT and **RESILENS**, from which you can see the videos explaining **what resilience is**, how to increase resilience **before a disruption**, **during a disruption**, and **after a disruption**.
- Manage the interdependencies between citizens, services, first responders, volunteers and other key actors and invest in a collectively engaged city.
- Invest and implement urban resilience strategies combined with SDGs goals, like in **"My City is getting ready" campaign (2010),** in the **Lisbon Resilience Action Plan (2017)** and the handbook for local government leaders **"How To Make Cities More Resilient" (2017).**
- Integrate contributions from politicians, first responders, NGO's, volunteers, experts of crucial areas: water supply, wastewater, solid waste, energy, food, health, financial, public lighting, transport and infrastructure, civil protection, legal order, safety, public administration, environment, urban planning, heritage, public relations, research and ICT; an example is the **participatory budget.**
- Invest in education and training, setting a Resilience curriculum in schools and reinforcing the continuous process of Growing Up in Safety dedicated to different public targets.
- Update the **Lisbon intelligent platform** including a real-time warning system to monitor the city;.
- Promote the **policy of open data**, such as in the **Lisbon open data platform**, and the **Lisbon GIS data**, providing sets of geographical data.

Lisbon

Hands-on for resilience to CC: what can I do?

RESCCUE

RESilience to cope with CLimate Change in URban areas.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- **Climate change scenarios projection**
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Climate change scenarios projection

Robert Monjo, FICLIMA

In a context of climate change like the one the world is currently living in, citizens, besides trying to slow it and fight its causes, need to adapt and prepare for incoming changes in the weather we are already experiencing to improve its resilience towards future hazards. Within this scenario in Europe, the RESCCUE project was born as a way to study and analyse how climate will change and to help the cities of Barcelona, Bristol and Lisbon prepare for those new challenges.

Methodology

A huge amount of weather data was collected from the three research sites thanks to the collaboration with different entities, such as AEMet, Servei Meteorològic de Catalunya or Lisbon City Council, amongst others, in order to characterise their current climate and trends. After that, all this data was checked and homogenised to avoid noise and disruptions in the next steps (see here for further details).

Then, a set of **statistical downscaling** procedures (FICLIMA methodology, explained with detail here) were performed, by using 10 different climate models with two main emission scenarios, based on the results of the 5th report of the Intergovernmental Panel on Climate Change (IPCC). With this, highly accurate local projections of future climate change at decadal and climatic scales were obtained for all of the selected localities.

Within RESCCUE, we wanted to deliver only the best information to the three cities, so the performance of the downscaled models was checked according to the *historical experiment* (**validation procedure**). All of this work led to a set of local climate projections of those variables that define day-to-day weather: *precipitation, temperature, wind gusts, atmospheric pressure, relative humidity, evapotranspiration, snowfall, sea level and wave height*. Particularly, an **ensemble strategy** was followed to present not just one but a range of values to assess all possible future scenarios.

Climate extremes scenarios

However, when talking about resilience towards future climate change, the situations that cause most disruptions and threats for the cities and their inhabitants are not just the mean values characterising a possible future climate, but one-off extreme phenomena that are inherent to the natural variability of a location's climate.

To comply with the best contribution to these cities' resilience, RESCCUE developed projections for future **extreme events** as well, including other indicators: *heat and cold waves, tropical and frost nights*, among others. By their analysis and the information given by the three cities' services, a set of common thresholds for extreme events was defined for the three of them, plus specific criteria demanded by each city to cover local necessities. As such, all of this work can be escalated to any other location that might be interested in the future, no matter its particularities.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

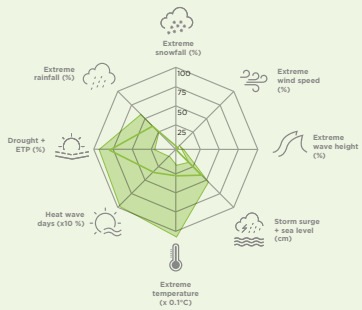
- **Climate change scenarios projection**
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

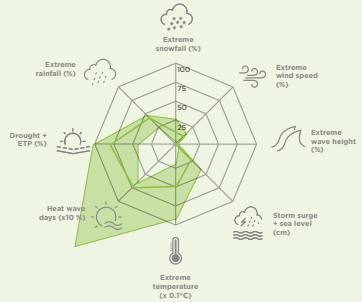
About RESCCUE

Just like before, the simulation of extreme events were validated and used for each city (see more details here). The projections were also presented as an ensemble to provide the best information for the cities to develop tools and plans to improve their resilience against future worst-case events (figure below). This way, they will diminish as much as possible the impact and disruption caused by them.

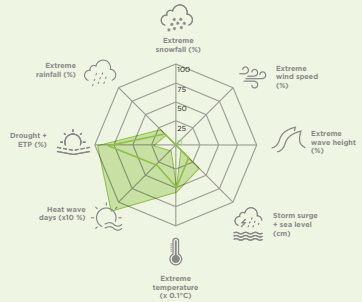
Bristol



Barcelona



Lisbon



Extremes Compass Rose for Barcelona, Lisbon and Bristol: maximum point change in climate extreme events along the century taking into account return periods between 2 and 100 years. The centre represents no changes and the edge corresponds to an increase of 100% for every variable, except for heat wave days (border is +1000%), for storm surge (border is +100 cm) and extreme temperature (border is +10°C). Thick lines represent the median scenario and the shaded area is the uncertainty region (5-95%).

Check out our guidelines

Go to link

Check out

Our local climate scenarios database for the three regions:

Go to link

GEO-Tiff climate data available in the CLARITY platform:

Go to link

Classification of droughts around the world, generated in RESCCUE:

Go to link

Best-practice advice

- **Find historical references:** Use **observed data** with great **quality control** to serve as a reference.
- **Obtain derived variables:** Use tools/models fitted with **local climate simulations** in order to obtain derived variables as flood level, water quality, energy demand, etc.
- **Identify exceeding thresholds:** Identify **danger thresholds** according to observed damages in past and apply to the simulated variables.
- **Achieve confidence level:** Analyse **all possibilities** of predictions/projections, and sort them to estimate an interval of frequency of cases (for the negative effects).

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- **Holistic assessment, cascading effects and stakeholder engagement**
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Holistic assessment, cascading effects and stakeholder engagement

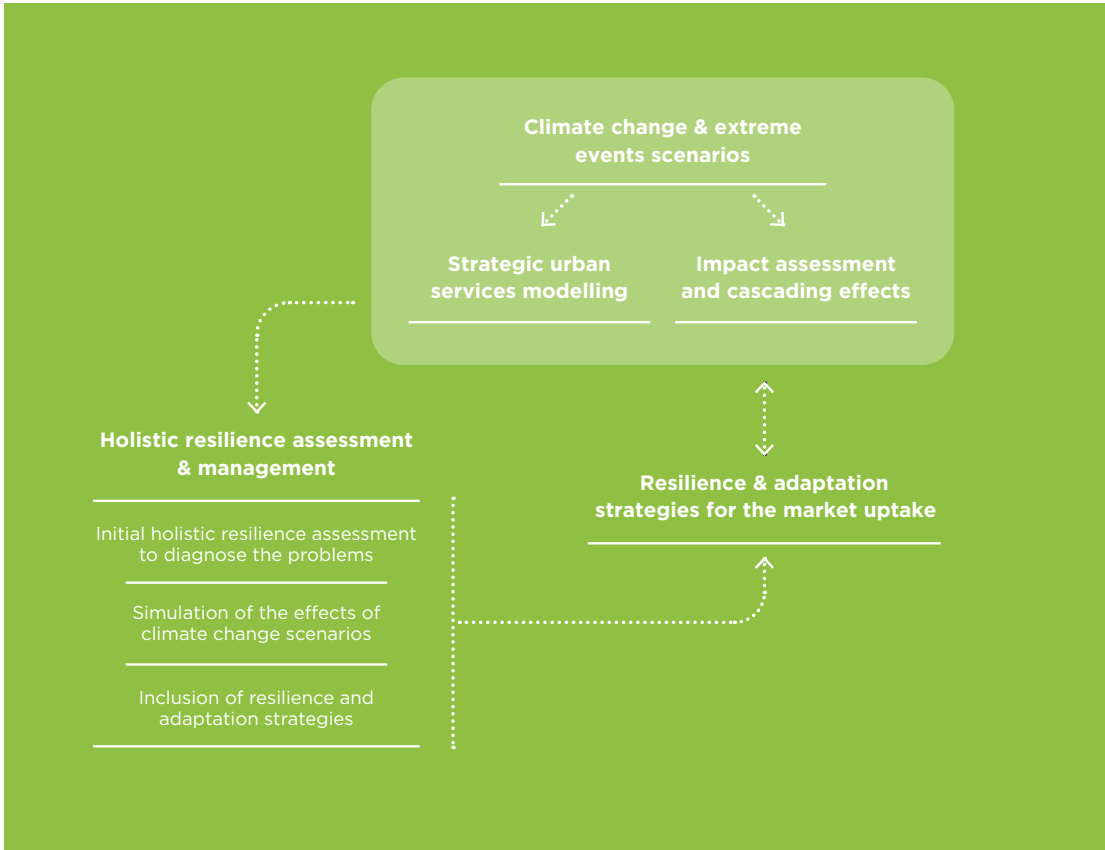
Marc Velasco, Aquatec-SUEZ Advanced Solutions

Roadmaps for urban resilience

Holistic assessment, cascading effects and stakeholder engagement within RESCCUE focus on the all-inclusive understanding of cities.
Cities are complex systems of interconnected systems, and being able to understand how these depend on each other is crucial for their transversal management.

Taking advantage of the urban resilience management tools developed within the project, a resilience assessment of the three RESCCUE research sites was carried out. Starting from a strategic analysis, the local needs and roadmaps for urban resilience are considered from the very beginning. This is then used to define the scope of the analysis, deciding which services will be analysed, the geographical boundaries, the critical infrastructures taken into account, etc.

In order to implement a holistic resilience assessment, detailed information on climate variables, as well as simulations on hazards and impacts on strategic urban services, must be used. With this information, the holistic assessment can be done, also including the effects of climate change and the benefits obtained by implementing adaptation strategies. Although the strategies could be directly obtained from the traditional approach -using the results of sectorial models- they can strongly benefit from a holistic approach -being able to consider the co-benefits and transversal effects.



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- **Holistic assessment, cascading effects and stakeholder engagement**
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

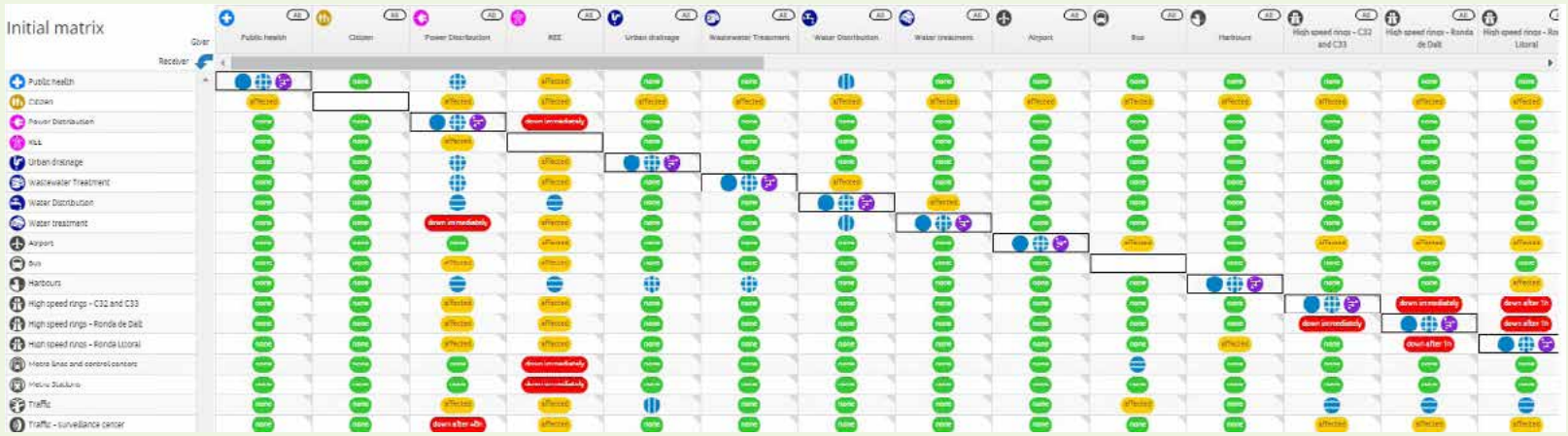
Questions to be asked

In order to carry out the resilience assessment knowledge about the systems functioning is needed. Which are the most vulnerable elements? Where is the impact taking place? How are the several services and infrastructures connected to each other? To be able to answer to all these questions, a lot of data is needed.

In order to do so, detailed models must be used, as well as information coming from the service managers, climate services or other sources. **The data collection in a resilience assessment is of paramount importance**, so the information about services, infrastructures, interdependencies and impact can then be used to simulate the cascading effects and understand how the city responds to all kinds of disruptive events.

Interdependencies matrix in the Barcelona case study

Source: Interdependencies - Hazur®, project "Re-Internal interdependencies between the infrastructures of "Metro stations and TMB Control Centers" service.



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- **Holistic assessment, cascading effects and stakeholder engagement**
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

The resilience assessment carried out in the three RESCCUE research sites not only was useful to understanding the cities' current state, but also to test the robustness and functionalities of the urban resilience management tools developed within the project. This is precisely why after the initial implementation several improvements were done to the tool and to the whole methodology.

Global understanding of the cities

These new developments included in the urban resilience management tools developed within the project (see more details here) allowed us to do a re-assessment in the three research sites. This enabled us to overcome the challenges from the initial resilience study and to close the whole cycle of the RESCCUE approach by including the climate change scenarios, the simulations of hazards, impact assessments and the adaptation strategies. These additional tasks allowed us to have a global understanding of the cities' state, as well the effectiveness of the strategies, being thus able to contribute the RESCCUE resilience roadmap developed in the Resilience Action Plans (RAPs).

Section links

Report from HAZUR® implementation in Barcelona, Lisbon and Bristol — Go to link

Report from HAZUR® re-assessment in each city - Considering a new approach regarding stakeholders involvement and considering climate change and adaptation strategies — Go to link

Check out our guidelines

Go to link

Check out these demos

Go to link

Enhanced communication system for stakeholder participation

An enhanced communication system for stakeholder participation has been developed and it levers resilience. This document presents three main stages: a theoretical framework, a practical guidance and a final section related to city practices. The lessons learnt by the three City Councils have been gathered in this document which is expected to be useful for other cities.

Go to link

Best-practice advice

- **Holistic vision:** the complexity of cities' services is better understood when analysing them together. Undertaking a resilience assessment may be done by assessing all the key services at the same time.
- **Strategy and action:** although some of the decisions must be taken at a strategic level, some others require the involvement of the day-to-day managers of the systems. Urban resilience requires that both levels are addressed at the same time, taking advantage of the best part of each of them.
- **Today and tomorrow:** urban resilience has to be managed today, but also considering the future challenges. In order to define robust strategies that still function in the future, climate change has to be considered to define the resilience roadmap.
- **Learn and improve:** advanced tools can only be functional as long as they are kept up-to-date. New developments and improvements must be undertaken constantly to ensure a good quality of the tool.

Hazard assessment for urban services operation

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- **Hazard assessment for urban services operation**
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Beniamino Russo, AQUATEC

Climate related hazards for urban services operation, for both current and future climate change scenarios, need to be assessed. That's why the RESCCUE project proposed and tested methodologies based on integrated models, which were also applied to quantify the hazard reduction capacity of different adaptation measures.

So, how can we achieve a comprehensive risk assessment? The first key component is hazard assessment. The image below shows the risk definition used in the three RESCCUE cities , regarding the impact of hazardous events with a given likelihood.

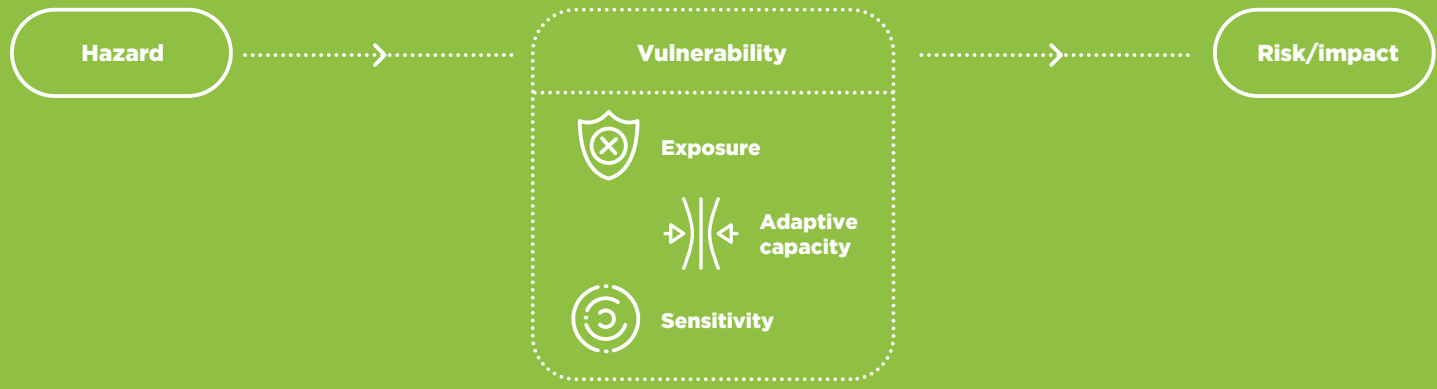
Urban flooding

Urban floods are a major hazard in Barcelona, Bristol and Lisbon. For the three cities, this was quantified in a similar way: **by setting up an urban drainage model to simulate both the urban drainage network and surface flooding** (1D/2D models), either in the whole city or in the most vulnerable areas.

These models need physical and topographic data in order to both set up and calibrate the models, so there are some data requirements, such as high resolution rainfall data (historic data for calibration validation, IDF curves, detailed DTM, boundary conditions, etc.) or water level in sewers.

Such flood models include different flood processes depending on the physical and infrastructural characteristics of the city. In fact, the three cities are affected by pluvial flooding due to limited urban drainage infrastructure capacity. For example, Barcelona is also affected by coastal flooding, due to, for instance, sea level rise and storm surges. Lisbon is affected by estuarine

RESCCUE risk definition



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

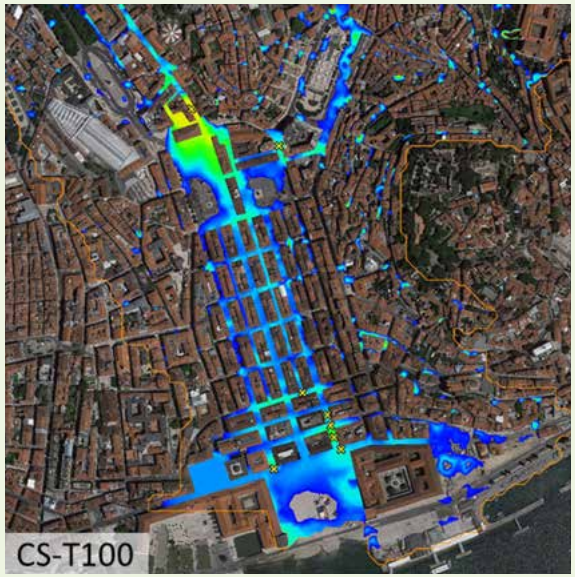
- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- **Hazard assessment for urban services operation**
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

flooding, due to the interaction between the river and the sea; and Bristol, by fluvial and tidal flooding.

Example of a computer flood simulation (Lisbon) Flood levels range from lower (green) to higher flow depths (blue).



Urban floods generate several hazards, affecting pedestrians, road traffic, electrical stations, etc. In some cases, flood hazards are calculated by applying specific hazard criteria for urban areas. For instance, severe hazard for pedestrians results from a combination of flood depth and water velocities that produce pedestrian instability in flood waters; similarly, severe hazard for the road traffic can result from specific criteria regarding flood water depth causing traffic disruption.

Cascading effects to other services and citizens

Flood hazard determination integrates flood, electrical and traffic sectorial models. Electric and traffic flood hazard models for the three RESCCUE sites were based on GIS (Geographic Information System) approaches. Moreover, in Barcelona and Bristol, different dynamic models were developed for flood impact analysis on surface transport, using spatial and temporal advanced outputs.

Example of a flood derived traffic hazard (Bristol)

Barcelona and Lisbon also quantified flood hazards for waste collection containers. These hazards were computed by applying waste container stability criteria to flood simulation results.

There are also many other hazards that are not derived from urban flooding and that were calculated in RESCCUE and presented in the next page.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- **Hazard assessment for urban services operation**
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Combined sewer overflows, hazards due to sea level rise and droughts

In Barcelona and Bristol, hazards related to combined sewer overflows (CSO) were assessed. Bristol used an urban drainage model to compute the number and volume of CSOs and defined hazard levels as a function of such variables. Urban drainage models for CSO simulations are similar to flood models, in terms of data requirements, while the model setup can be simpler (the simulation of 2D flooding can be omitted). Barcelona used a coupled urban drainage and sea water quality model to compute sea water bacterial concentrations from CSOs and defined hazards for people bathing based on these concentrations.

Example of bathing people hazard (red=severe hazard and green and blue=low hazard) due to polluted sea water from CSO (Barcelona)

Barcelona also assessed the hazards due to sea level rise on coastal infrastructure, the future drought hazard for water resources availability and the impacts of river turbidity for drinking water supply.

The drought and river turbidity are hydrological/water resources models that require water level measures in hydrometric river stations and reservoirs, turbidity measurements in the river, hydrological data to characterise hydrological losses, evapotranspiration data, exploitation rules of the reservoirs, etc.

The impact of climate change on hazard assessment

The main climate variables, like future temperatures, winds, rainfalls or sea water levels, were estimated in the climate scenarios projections (check page 23). These future climate variables were used as inputs for all the different hazard models in order to quantify hazard increments due to climate change. For instance, high flood hazard areas in Barcelona show future increments in the range of 7-30%; Lisbon, 1-11%; and Bristol, 0-7%. In all the three cases the future rainfall intensities were estimated to be approximately 10-20% more intense when compared to actual ones.

The benefits of implementing adaptation measures

Finally, RESCCUE evaluates the benefits of implementing adaptation measures, selected together with the project stakeholders. The capacity of these measures in reducing hazards was calculated based on the different multi-sectorial models presented: Barcelona selected green infrastructure and conventional structural solutions to reduce flood and CSO impacts. A similar approach was followed in Lisbon for flooding, while in Bristol local measures were proposed to solve specific problems in flood prone areas and flood defence walls to face river and tidal floods.

Overall, this model based framework, tested for three different cities, can be considered generally applicable to other cities. The models and the observation data needed for this methodology are also generally available through the Internet and by the municipalities or utilities (water, electrical, traffic, etc.). For the water sector, and particularly for urban flood modelling, high temporal resolution rainfall data and high spatial resolution Digital Terrain Models were shown to be relevant.

The outputs of this hazard assessment were used for risk assessment and also for an urban resilience analysis that will analyse in a holistic city perspective the cascade effects of the different hazards quantified here. For example, a flood can temporarily disrupt traffic and this causes economic damage to many business activities.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

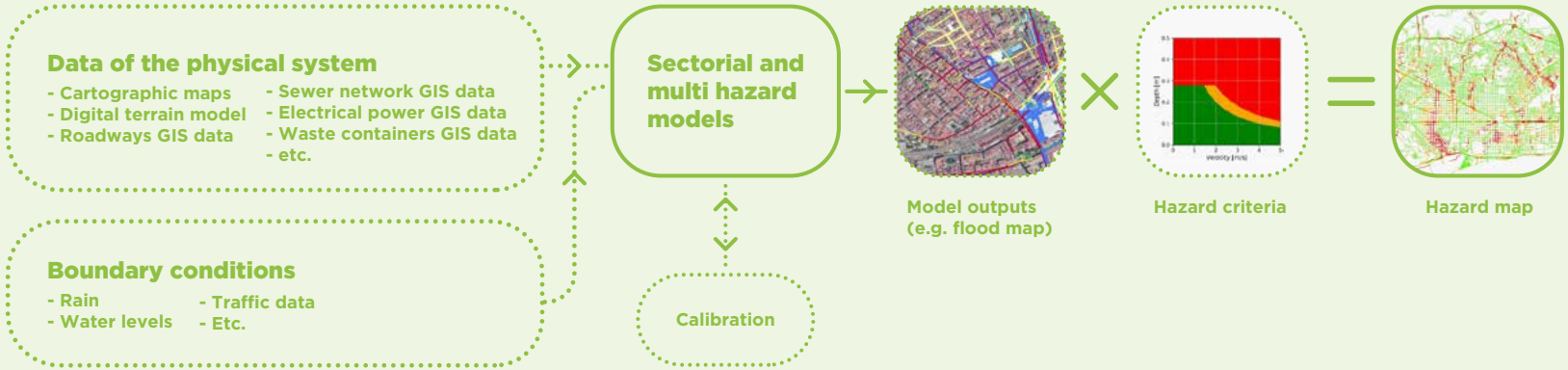
Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- **Hazard assessment for urban services operation**
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

From model set-up to hazard maps



Section links

Report on extreme events prediction

Go to link

Check out our guidelines

Go to link

Check out our web-based repository

Go to link

Best-practice advice

- **Stakeholder involvement is key** to address the multiple interests related to urban infrastructure management.
- **Sharing information** among stakeholders of several urban services is very important (and sometimes difficult) to achieve a reliable integrated model that provides multi-hazard assessment.
- Organization of **project progress meetings** provides a continuous overview of the status of the project.
- **Adaptation measures** can be evaluated also based on their capacity to reduce different climate related hazards. The implementation of hazard reduction measures suppose socio-economic risk reduction.
- **Communication of the knowledge on hazards** to the public improves awareness

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- **Vulnerability & Risk assessment**
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Vulnerability & Risk assessment

Barry Evans, Exeter University

The RESCCUE project focused on the Vulnerability, Risk and subsequently Impact Assessments on infrastructures and services within each of the case study areas. These assessments are carried out for a number of return periods for both present day and future climate change scenarios. With each city having different levels of data and models available to them, the methodologies employed by each city have been designed with these limitations in mind and thus allow for greater transferability to other cities.

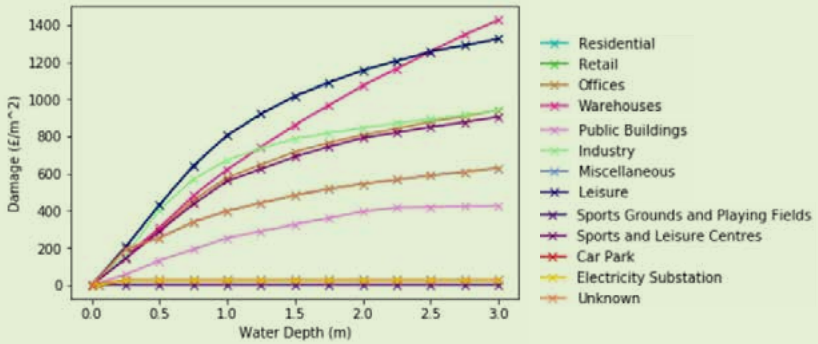
Standard approach

The risk assessment is developed based on inventory after looking at hazard, vulnerability and loss (see RESCCUE risk definition in previous section). Recurring to hazard maps, it seeks to combine this data with inventory information relating to infrastructures, their relative vulnerability with respect to the hazard that can then be analysed/modelled to determine risks/losses and impact.

Depth-damage and vulnerability curves

As an example, for the impact assessment of properties within case study areas, depth-damage curves were used to define the vulnerability of properties in relation to their land-use classifications and flood depths (figure on the top).

Example depth-damage curves for various land-use classes



The next figure shows an example of an impact assessment of buildings during a 1 in 20 year fluvial and tidal combined flood event under a future climate change scenario that utilises these curves.

Impact assessment example of buildings affected during a 1 in 20 year fluvial+tidal flooding event for a future climate change scenario

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- **Vulnerability & Risk assessment**
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

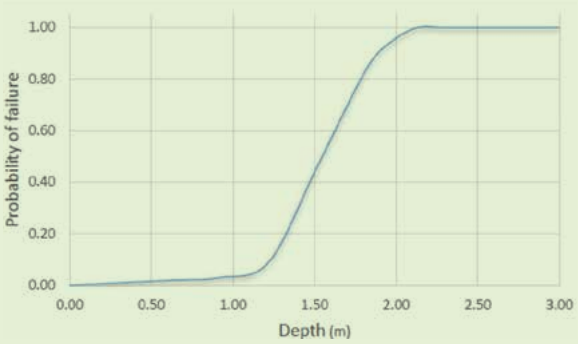
Final remarks

About RESCCUE

In a similar fashion to that of depth-damage curves, fragility curves can also be employed when considering the impact of given hazards on critical services (figure below). These fragility curves, when used within impact assessment, help provide indications as to which service may be affected by a given hazard and where and what infrastructures and/or services, that are dependent on the impacted service, may also be affected.

Based on information gained via the hazard, risk and impact assessments within the study area, you can then look to examine what adaptation and mitigation measures could be employed to either directly reduce the hazard or modify the vulnerability of the infrastructures within the city. Through comparative analysis of impact, with and without adaptation measures, a city can begin to evaluate the effectiveness of such measures.

Example fragility curve for a critical service such as electricity due to flooding water level



Check out our deliverables

Go to link

Check out our guidelines

Go to link

Best-practice advice

- Consider **historical events** within the city, for reference.
- **Engage with service providers and city decision-makers** within the city and gauge what are their primary concerns in respect to risks from hazards.
- Have a clear understanding of **what data and models are available** for the city.
- **Communicate results** with service providers and city decision-makers, and **use feedback** from these meetings as an opportunity to validate and refine model outputs.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- **Definition of strategies and prioritization**
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Definition of strategies and prioritization

Eduardo Martínez-Gomariz and
Maria Guerrero-Hidalga, CETAQUA

The RESCCUE project covers the development of a framework to promote resilience strategies, the creation of a measures database, and the establishment of a methodology to be able to define all resilience strategies by prioritizing the measures depending on their investment needs, co-benefits and resilience effectiveness.

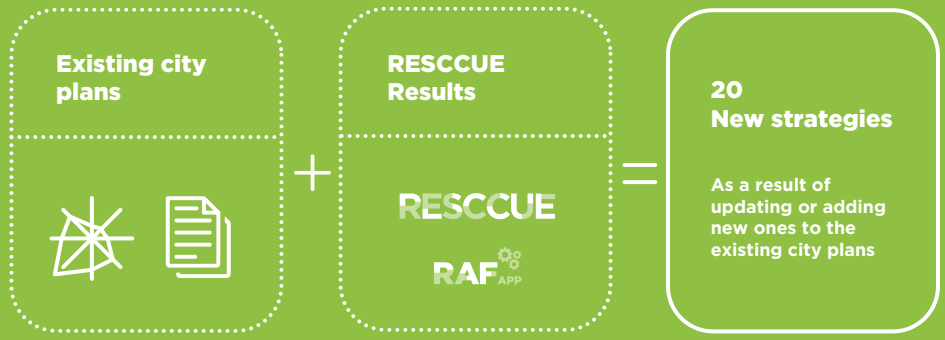
Stakeholders engaged in strategies definition

Two workshops were held in each research site with the aim of discussing the approach to prioritise adaptation measures and also to identify a list of adaptation strategies needed, according to the climate impacts that threaten the cities today and to be former prepared for the future ones (figure to the right).

Urban services- and social-oriented

The proposed methodology distinguishes between two approaches, one related to urban services-oriented strategies (identified through RESCCUE project), and another one focused on social-oriented strategies (mostly identified in existing plans). The latter approach is not the prima-

Strategies to cope with climate impacts identified through the workshops in Lisbon



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- **Definition of strategies and prioritization**
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

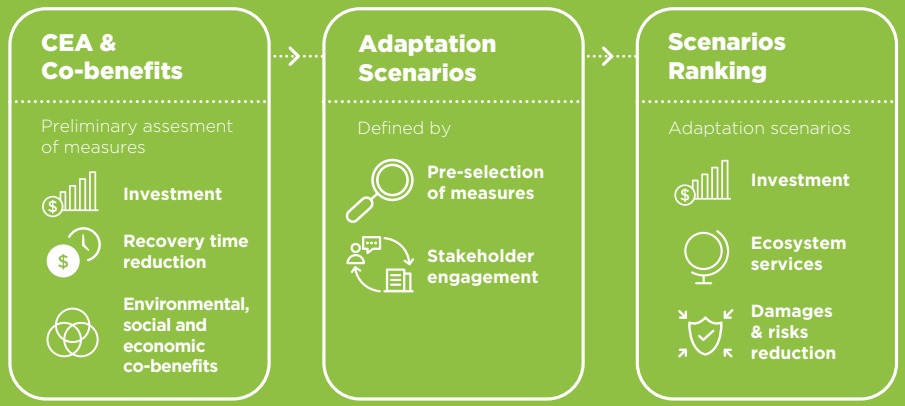
ry objective of RESCCUE project, however these strategies have been taken into consideration due to their importance for city planners. The former approach is included in the strategy list for each city and their origin is a City Council identification to address citizens' vulnerabilities and welfare. Focusing on the first group, the results obtained in the different tasks of the project are inputs to the implementation of the prioritisation methodology proposed. The prioritised adaptation measures will be analysed also in the Resilience Action Plan (RAP) development for each city.

Both approaches are based on three key variables: investment, city recovery time and co-benefits (figure to the right above) (see more details here). While the first category (urban services-oriented) is proposed to be assessed through a multiple-step method formed mainly by a cost effectiveness analysis (CEA) and a cost-benefit analysis (CBA), the one proposed for the second type of strategies (social-oriented) refers to a multi-criteria analysis. Furthermore, a description of the climate-related problems for each city is publicly available, as well as new strategies identified for each of them. They have been summarised in RESCCUE's deliverables.

Prioritisation of resilience actions

Since one of the main innovations of the proposed methodology to prioritise adaptation measures is the consideration of the level of risk reduction (figure to the right below), among others, the implementation of this methodology has been conducted in close association with vulnerability and risk assessment activities, where climate-related risks are analysed for the three cities. Specifically, results for the prioritisation method are available for the three cities, Barcelona, Bristol and Lisbon.

Schematic overview of the methodology implementation



Pluvial flood risks considered for the case study of Barcelona

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- **Definition of strategies and prioritization**
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Enhanced communication with stakeholders

In parallel, an enhanced communication system for stakeholder participation has been developed.

Section links

Multisectorial resilience strategies framework and strategies database development — Go to link

Report on methodologies for the selection of resilience strategies — Go to link

Online Platform

Web-based platform to support the selection of adaptation measures and strategies

Go to link

Check out our guidelines

Go to link

Best-practice advice

- **Collaboration between the city decision-makers, experts and stakeholders** from different urban utilities is essential through the entire process, in order to characterise, analyse and adress holistically the most relevant issues to the city.
- Adaptation measures should be selected **considering their over-all impact to the city**, since cascading effects may occur among urban services.
- It is recommended **to prioritise adaptation measures under different criteria** -not only financial- in order to make decisions based in other important socio-economic factors, such as effi-ciency in risks reduction.
- **Lessons learnt by City Councils should be shared** in order to join efforts to enhance the communication system for stakeholder participation.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- **Resilience assessment and development of a RAP**
- Dissemination and replication

Final remarks

About RESCCUE

Resilience assessment and development of a Resilience Action Plan (RAP)

Maria Adriana Cardoso, LNEC

Resilience Assessment Framework and web-tool

Since assessing the current and future status of resilience constitutes the basis for cities to know where they stand, to support decision-making on strategies, actions and measures to adopt, planning in the long, medium and short terms and assessing progress, RESCCUE provides a Resilience Assessment Framework and a web-tool to support any city to carry out its own assessment.

The RAF is grounded on RESCCUE's scope, i.e. urban resilience to climate change, with a focus on water. **It considers**:

Four resilience dimensions:

1. Organisational: which integrates governance relations and urban population involvement, at the city level
2. Spatial: also at the city level, refers to urban space and environment
3. Functional: which assesses the resilience of strategic services
4. Physical: which focuses on the resilience of their infrastructure

The last two dimensions also allow us to know the contribution of each service to city's resilience.

The services: water supply, wastewater, storm water, solid waste management, energy supply and mobility, including their interdependencies.

The RAF, mainly aligned with UNDRR (United Nations Office for Disaster and Risk Reduction) and UN-Habitat frameworks, is objective-driven and has a **tree structure – the resilience objectives are assessed through criteria that are quantified by metrics**.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- **Resilience assessment and development of a RAP**
- Dissemination and replication

Final remarks

About RESCCUE

It contributes to:

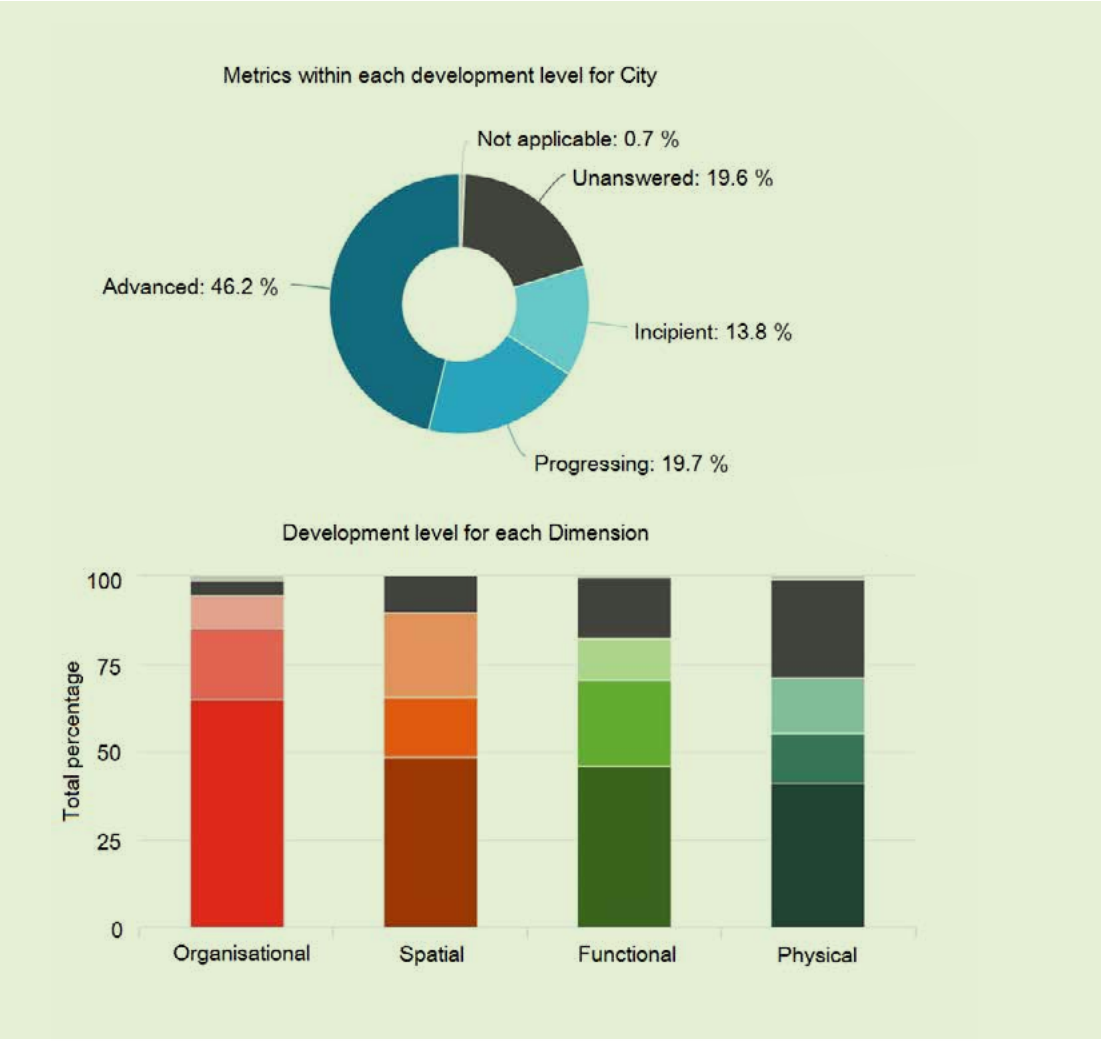
- Directing and facilitating an objective-driven resilience diagnosis of urban cities and services, using common criteria and identifying data gaps, strengths, weaknesses, opportunities and threats;
- Supporting decision-making on a selection of resilience measures and development of strategies to enhance resilience;
- Outlining a path to co-build Resilience Action Plans tailored to each city;
- Tracking the progress of resilience-building in the city or service over time.

The RAF development counted on internal and external stakeholders. A workshop was held in each research site (Lisbon, Barcelona and Bristol) with the aim of discussing the assessment approach. Each research site applied the RAF to carry out its testing in order to ensure coherence, feasibility and effectiveness of the approach, and of its contribution to the RAP development.

The RAF provides the assignment of a degree of relevance to each metric:

- **Essential,** includes metrics required to integrate the resilience assessment of any city or service;
- **Complementary**, considers additional metrics to integrate city or service specific aspects', corresponding to a more detailed resilience assessment;
- **Comprehensive**, adds metrics recommended whenever a more in-depth assessment is aimed, for a city or service with higher maturity in its resilience path.

Therefore, the proposed RAF enables a tailored assessment of any city, regardless of their resilience maturity, and supports the identification of a resilience development level for each dimension and for each service (figure below). Darker tones correspond to Advanced resilience levels, intermediate tones to Progressing and lighter tones to Incipient resilience levels.



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- **Resilience assessment and development of a RAP**
- Dissemination and replication

Final remarks

About RESCCUE

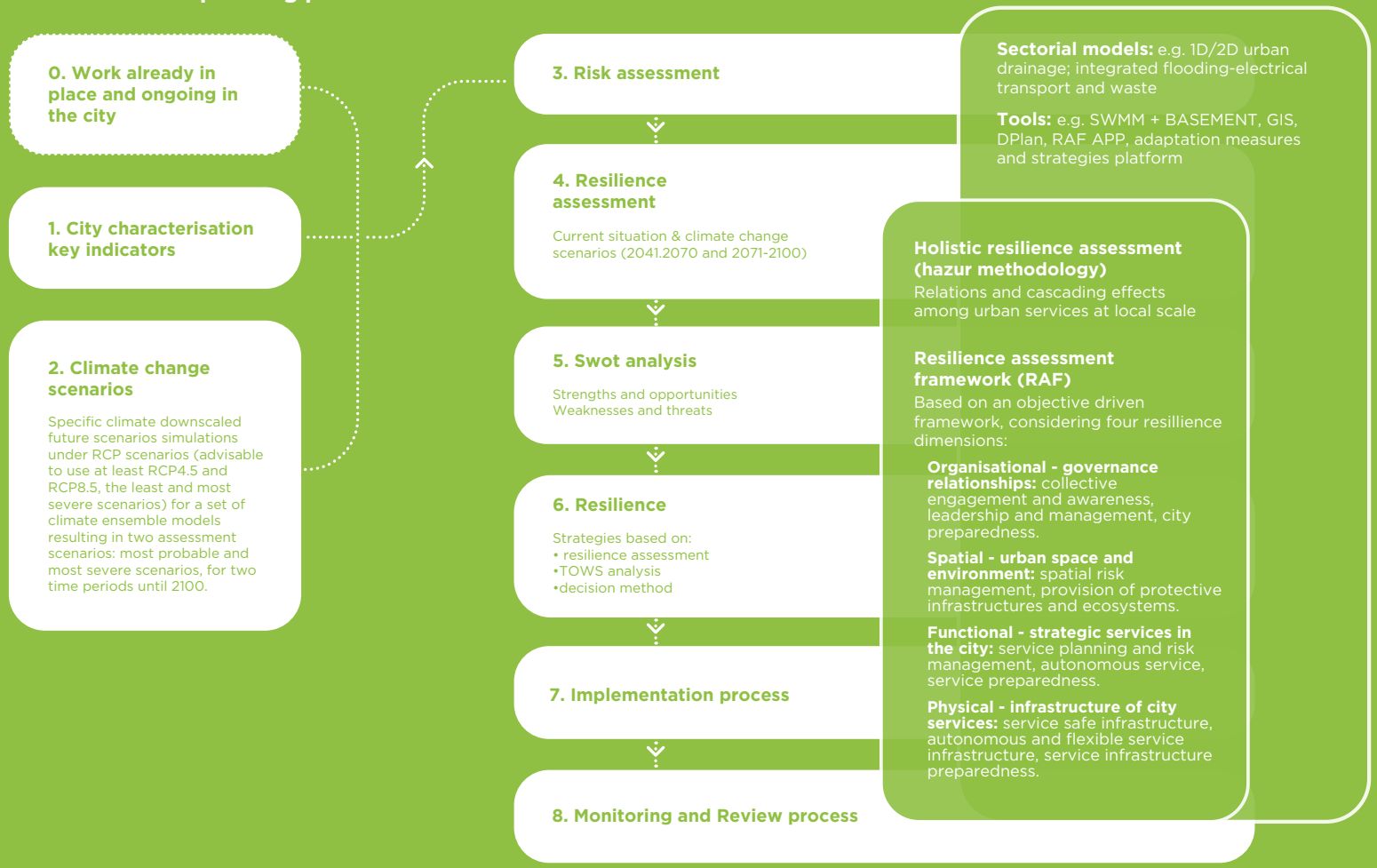
Development of a RAP

RESCCUE project provides a framework (Figure below), guidance, approaches and tools for any city to develop a Resilience Action Plan in order to enhance resilience to climate change, with a focus on water. This is a thematic plan that contributes to the city's global planning.

The RAP framework allows integration with work and tools already in place in the city.

If the city intends to move forward, it needs to define the plan scope, focus and time horizon for the RAP.

RAP framework: the planning process



Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- **Resilience assessment and development of a RAP**
- Dissemination and replication

Final remarks

About RESCCUE

If the city has already started its path towards resilience and has already carried out intensive work, therefore, it is important to acknowledge the work already done, as well as the plans, policies, strategies and other initiatives related to resilience and climate change already existing in the city. The proposed framework intends to facilitate integration with the work and tools already in place in the city, thus giving support to know the city:

- Know the services and infrastructure
- Gather a multidisciplinary team
- Recall city past climate events characteristics and impact
- Acknowledge what already contributes to the city's resilience
- Project future CC scenarios
- Simulate the effects of CC on the city and services
- Assess and diagnose city resilience
- Select and plan the implementation of the strategies to enhance city resilience
- Acknowledge compliance with city resilience objectives from implementing the chosen strategies

To continuously ensure city resilience considering city dynamics, it is fundamental to undertake the RAP monitoring and review. Therefore, it is important to also plan these steps.

Essential to develop a RAP

Know!
Know your city and its urban services.

Assess!
Assess how resilient are your city and services by diagnosing your resilience maturity and constraints.

Plan!

- What do you want to accomplish regarding resilience? Identify your resilience objectives.
- Which actions will improve your resilience?
- Where will you apply these actions and which ones will you prioritize?
- When will you carry out these actions?
- Who is going to implement them?

Do it!
Implement, monitor and review the RAP.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- **Resilience assessment and development of a RAP**
- Dissemination and replication

Final remarks

About RESCCUE

Check out:

Check out our web-based Resilience Assessment Framework tool:

Go to link

User: Int_review
Password: R3v_resC#cue/2019

Check out our RAP template:

Go to link

Check out our RAP Guidelines:

Go to link

Check out our RAF app demo video:

Go to link

Check out our workshops:

Go to link

Stakeholders' involvement, clear communication in a collaborative process strongly coordinated, based on the best available information, are key to assess and plan for resilience

Best-practice advice

- An effective and robust **implementation of the RAF** as well as of the **RAP development requires to:**
  - involve multiple parties, in a collaborative process allowing incorporation of the best available information;
  - recognize the broad duties of each stakeholder, both in their specific roles as well as contributors to the city as a whole, as an inherent aspect in these collaborative processes;
  - assemble a multi-stakeholder team in order to consider different points of view and to improve individual perceptions of the different resilience dimensions and interdependencies;
  - consequently, improve support of decision-making processes and exploitation of opportunities for using information and resources in a more efficient way;
- **Clear communication among stakeholders** is fundamental to their involvement and to the RAP co-building process.
- **Whole process coordination** is key for the successful implementation of the RAF and RAP development namely in planning action and ensuring its implementation, monitoring and revision. Therefore, implementation of the frameworks should follow a stepwise approach.
- **Early in the process**:
  - clearly establish the scope of the RAP, namely, which hazards, services, infrastructures are included;
  - identify and commit stakeholders, assemble teams and responsibilities, and establish leading principles of collaboration, including setup of a coordination and supporting group (CSG);
  - define the context of the plan including time horizon, geographical unit for the plan;
  - agree on CC scenarios to plan for;
  - identify data requirements and select analysis tools for supporting assessment;
  - set a program for application of the tools by each party of the team with responsibilities assigned;
  - provide opportunities for debating sessions and supporting actions by CSG.
- **Resilience assessment is a key phase** to establish a diagnosis and, subsequently, to define a plan for improvement.
- **Data and information** on cities and services are key to undertake an assessment and develop a RAP.
- Considering **integration** of the work already developed by the city, as well as **aligning** with the city's **existing** plans, policies or strategies, is essential to an efficient and effective knowledge and planning.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- **Dissemination and replication**

Final remarks

About RESCCUE

Dissemination and replication

David Pacheco and Eduardo Martínez-Gomariz, CETAQUA

Communicating innovation

Research and innovation cannot be conceived without communication. Throughout the project's lifetime, RESCCUE has placed much effort on dissemination tasks, aiming at allowing general and specialised audiences to access information about the project progress and its outcomes, as well as promoting the widest application of the RESCCUE tools and methodologies in other cities.

To meet these objectives, a Dissemination and Exploitation Plan was established at the beginning of the project. This document defined the strategy and concrete actions related to the protection, communication, dissemination and exploitation of the results of the RESCCUE project. Furthermore, a **Business Plan** for the RESCCUE project was developed to describe not only the business logic behind the business opportunities of the RESCCUE project marketable outputs, but also the assets and resources that would make the business successful.

Climate change-related communication addressed to general audiences has increased over the last decades, and especially over the last few years. Consequently, several concepts, such as urban resilience, are standing out in the public discourse. In this sense, **the media plays a key role, as it helps to inform and shape public opinion on events such as natural disasters**. Over the last four years, RESCCUE has been featured in several newspapers, as well as technical magazines and online portals, with the aim of raising awareness about climate change and urban resilience. Furthermore, the RESCCUE website, the project's main dissemination tool, became a reference portal on urban resilience by offering curated content on this topic developed by the several project partners.

RESCCUE website became a reference portal on urban resilience

Our contribution to other cities and the scientific community

On the other hand, scientific dissemination is vital to provide a stronger understanding of current research to the scientific community. RESCCUE was presented in more than 50 European and international congresses and other events with the aim of disseminating its approach, advances and results to interested audiences as well as presenting the main ideas of urban resilience and its benefits to society. RESCCUE published several project-related papers in different peer-reviewed journal, as well as a special issue on the project published in the Sustainability Journal, entitled "Integrated assessment of climate change impacts and urban resilience: from climate and hydrological hazards to risk analysis and measures". Finally, the datasets developed within the project are also available in open-access portals, easily accessible to the scientific community and to other cities.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- **Dissemination and replication**

Final remarks

About RESCCUE

RESCCUE also led or participated in different **joint dissemination initiatives in search of a greater impact at EU level**. For instance, RESCCUE took part in the **Common Dissemination Booster (CDB)**, an initiative promoted by the European Commission dedicated to the dissemination of research projects' results, and sponsored the European Urban Resilience Forum, a Resilient Cities side event, organised by ICLEI in Bonn (Germany) in 2019.

In this regard, RESCCUE, together with BINGO and PLACARD, co-organised the **European Climate Change Adaptation Conference (ECCA) 2019**, the largest conference on climate change adaptation in Europe. This event, which was held in Lisbon in May 2019 and attended by more than 1,000 participants, was a major opportunity for RESCCUE to gain visibility and disseminate its approach results, reaching different audiences at a national, European and international level.

Check out beyond the three case studies

Finally, in order to ensure the replicability of the tools and methodologies developed within the project, RESCCUE developed the following:

RESCCUE Toolkit

The RESCCUE toolkit is the place where the tools and methodologies developed within RESCCUE are gathered. Here you can find all you need to make your city resilient.

Go to link

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- **Dissemination and replication**

Final remarks

About RESCCUE

RESCCUE Guidelines

Several guidelines on the RESCCUE project were produced aiming at providing the end-users with its most relevant outputs. These materials, available both printed and online, synthesise the key outputs in an attractive and easy-to-understand format and present a roadmap on how to apply the RESCCUE tools and methodologies in different cities.

Go to link

Urban Resilience in a context of Climate Change conference (URCC 2020)

Apart from several local workshops in the three cities where the RESCCUE tools and methodologies were applied, the project organised the Urban Resilience in a context of Climate Change (URCC) conference in Barcelona. This event brought together experts from academia, administrations, businesses and local communities to discuss the multiple aspects of urban resilience and climate change.

Best-practice advice

- **Build a strategy:** In order to communicate effectively, define the communication and dissemination goals and establish the path to meet them from the first minute.
- **Focus on the topic:** Instead of focusing on the project, build a communication strategy around the issue the project is addressing.
- **Identify key stakeholders:** Diversity is needed both in background and intervention experience levels.
- **Promote co-creation:** Development of urban resilience is also a co-creation process where **engagement and communication procedures** must be followed in a **cyclic way** so that stakeholders are involved at the initial stage of the process and are kept engaged through a continuous communication plan.
- **Put yourself in the audiences' shoes:** Before defining what you want to explain, think who the target audiences are. Put yourself in the audiences' shoes in order to understand their needs.
- **Communicate effectively to them:** Establish the discourse, split it into different messages, define the target audience and assign each message to the different audiences.
- **Use the appropriate language** for popular technical communication in order to properly engage stakeholders and make them active during all the co-creation process.
- **Build a brand:** A research project should become a trusted voice on a specific topic. Use the expertise of the beneficiaries to become a reference on the issue the project is addressing.
- **Communicate local:** Local and regional media are effective targets. Use the project's local connections to engage citizens and other local audiences.
- **Replicability is the goal:** Replicability of the projects' results is a crucial objective. Pack the project outcomes in an easy-to-understand and appealing way to ensure its further application beyond the project's lifetime.

Communicating effectively from the first minute is key to meet the two main goals: raise awareness and promote the replicability of the project results.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

Final remarks

Marc Velasco, Aquatec-SUEZ Advanced Solutions

As you may have seen while reading this e-book, RESCCUE has been a challenging and successful project, that has only been possible due to the hard work of all the involved people. I would like to take this opportunity to acknowledge the work and support from my colleagues in Aquatec – SUEZ Advanced Solutions, the Work Package Leaders from FIC, University of Exeter, Opticits, Cetaqua and LNEC, the city representatives from the Ajuntament de Barcelona, Câmara Municipal de Lisboa and Bristol City Council, as well as all the other partners from IREC, UN-Habitat, Endesa, EDP Distribuição, Hidra, Urban DNA, AdTA, EIVP and Wessex Water.

RESCCUE project has been quite a journey for all of us that have been involved in it, and I hope that it can also become something special to you. Along the 4 years of the project, we've learnt that the only way to make our cities stronger and more prepared is by working together in a holistic and transversal way. This is why I would like to tell to decision makers and urban service operators that you are not alone in this. So take advantage of all the work that we have done, so you don't have to start from square one. If you haven't done it yet, now is the time to check the RESCCUE toolkit, where you will be able to find the key RESCCUE results to replicate the work in your city.

What we have started in RESCCUE is only the beginning. Now it is time to pass on the baton, so you can move forward to transform your city to be more and more prepared for the coming challenges.

Index

RESCCUE in the world of cities

Foreword

Is this e-book for me?

Good to know first

Successful experiences from resccue cities

- Barcelona
- Bristol
- Lisbon

Hands-on for resilience to cc: what can I do?

- Climate change scenarios projection
- Holistic assessment, cascading effects and stakeholder engagement
- Hazard assessment for urban services operation
- Vulnerability & Risk assessment
- Definition of strategies and prioritization
- Resilience assessment and development of a RAP
- Dissemination and replication

Final remarks

About RESCCUE

About this e-book

Date: June 2020

Citation: Brito, R., Cardoso, M.A., Pacheco, D., Velasco, M., González, A., Evans, B., Russo, B., Martínez-Gomariz, E., Stevens, J., Guerrero-Hidalga, M., Telhado, M.J., Monjo, R. (2020). Resilient cities facing climate change. RESCCUE e-book. RESCCUE project deliverable D6.3.

About RESCCUE

Name: RESilience to cope with Climate Change in Urban arEas – a multisectorial approach focusing on water

Acronym: RESCCUE

Funding: European Union's Horizon 2020 Research and Innovation Programme

Call and topic: H2020-DRS-09-2015 - Disaster Resilience; Climate Change topic 1: Science and innovation for adaptation to climate change: from assessing costs, risks and opportunities to demonstration of options and practices

Grant Agreement Number: 700174

Budget: €8.057.266,5

EU contribution: €6.896.991,76

Duration: 55 months
(May 2016 – November 2020)

Consortium: 17 partners

Coordinator: Aquatec – SUEZ Advanced Solutions

About the authors

Andoni González Gómez
Member of the technical staff of the Urban Resilience Department of the City Council of Barcelona since 3 years and in charge of the RESCCUE Project Technical Support from the Barcelona City Council.

Barry Evans
Research Fellow at the University of Exeter in the Centre for Water Systems. His background is within the field of Catastrophe Modelling focusing in the field of Urban Flooding.

Beniamino Russo
PhD in Civil engineering, full professor of Hydraulics and Hydrology at the Technical College of La Almunia (University of Zaragoza, Spain) and Director of the GIHA (Group of Hydraulic and Environmental Engineering) Research Group. R&D+i project manager at AQUATEC Suez Advanced Solutions. Associated professor at the Technical University of Catalonia.

David Pacheco Modesto
Environmental communications specialist. He is in charge of the design, implementation and evaluation of the communication strategy of different European research projects.

Eduardo Martínez-Gomariz
PhD in Civil Engineering. He has 15 years of experience in water-related projects and currently he holds the position of R&D Project Manager at Cetaqua (SUEZ group), and has been involved in the management and development of urban resilience-related EU funded projects

John Stevens
BSc Geological Sciences, FdSC River and Coastal Engineering. He works in Bristol City Council on the Local Flood Risk Management Strategy to manage the city's current and predicted future flood risk.

Marc Velasco i Droguet
MSc in Civil Engineering. More than 10 years of experience in water-related projects, particularly modelling floods, sewer networks and water resources. He has been involved in several FP7 projects related to climate change and water.

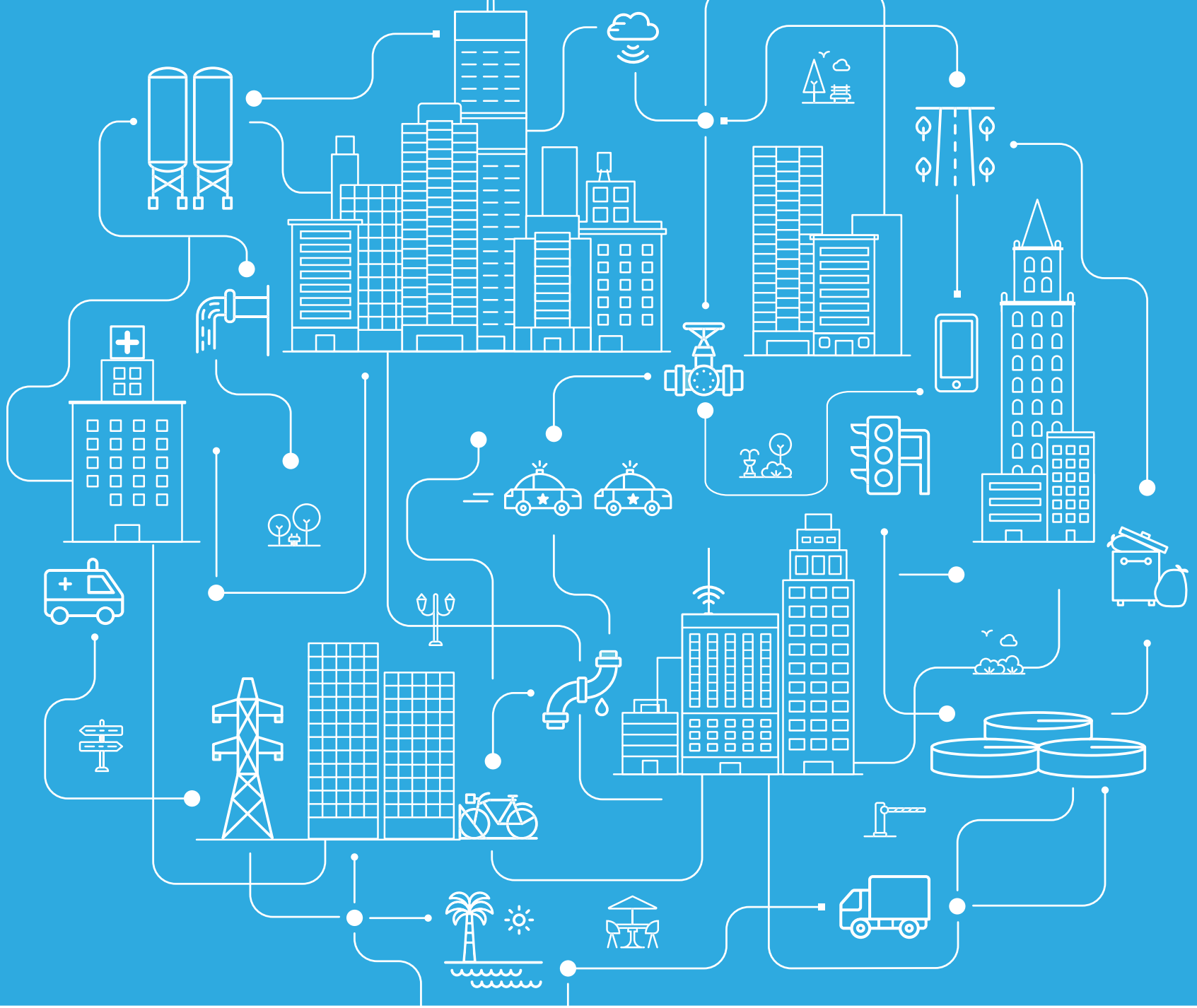
Maria Adriana Cardoso
Civil Engineer, MSc., PhD. Researcher at Urban Water Unit of the National Civil Engineering Laboratory of Portugal: urban water services performance assessment, infrastructure asset management and safety and resilience planning.

María Guerrero-Hidalga
Environmental economist specialized in the welfare evaluation of water cycle-related projects and assessment methods to value the impact of climate-related extreme events to society and the economy.

Maria João Telhado
Degree in Geography and Regional Planning (FCSH/UN 1989); Master's degree in GIS (IST/UL 1998) and Post-graduation in Training for Teaching Geography at Secondary School (FCSH/UN 1991). Head of Environment and Energy Division from the Lisbon City Hall, since 2018.

Rita Salgado Brito
PhD in Civil Engineering with more than 20 years of experience in urban drainage. Assistant Researcher in the National Civil Engineering Laboratory of Portugal (LNEC), in the Urban Water Division (NES) within the Hydraulics and Environment Department (DHA).

Robert Monjo Agut
PhD in Physics from the Universitat de València. Professor in the Department of Algebra, Geometry and Topology in the Complutense University of Madrid. Vice President of the Meteofederation. He has participated in more than 20 international climate research projects.



RESCCUE

RESILIENCE TO COPE WITH CLIMATE CHANGE IN URBAN AREAS.