



## Climate-Resilient Development Pathways in Metropolitan Regions of Europe

### **Deliverable 8.5 - Data Management Plan (DMP) - Interim 1**

July 2024

## Grant Agreement Number 101137851

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## Table of Contents

|                                                                      |           |
|----------------------------------------------------------------------|-----------|
| List of figures                                                      | 5         |
| Abbreviations                                                        | 5         |
| <b>Executive summary</b>                                             | <b>6</b>  |
| <b>Introduction</b>                                                  | <b>7</b>  |
| <b>1. DMP objectives and updates</b>                                 | <b>8</b>  |
| 1.1. Objectives                                                      | 8         |
| 1.2. Updates                                                         | 8         |
| <b>2. Data summary</b>                                               | <b>9</b>  |
| 2.1 Types of data                                                    | 11        |
| 2.1.1. Data from available resources                                 | 12        |
| 2.1.2. New data generated by the project                             | 12        |
| 2.1.3. Data derived from stakeholder engagement activities           | 13        |
| 2.1.4. Data derived from communication and dissemination activities  | 14        |
| 2.2. Data formats                                                    | 14        |
| 2.3. Data curation and storage                                       | 15        |
| 2.4. Roles and responsibilities                                      | 15        |
| <b>3. FAIR data</b>                                                  | <b>17</b> |
| 3.1. Making data findable                                            | 17        |
| 3.2. Making data openly accessible                                   | 18        |
| 3.3. Making data interoperable                                       | 19        |
| 3.4. Increase data use from available sources                        | 20        |
| <b>4. Other research outputs</b>                                     | <b>22</b> |
| <b>5. Allocation and resources</b>                                   | <b>23</b> |
| <b>6. Data security</b>                                              | <b>24</b> |
| <b>7. Ethical aspects and GDPR compliance</b>                        | <b>25</b> |
| <b>8. Other issues</b>                                               | <b>27</b> |
| <b>9. Next steps</b>                                                 | <b>28</b> |
| <b>References</b>                                                    | <b>29</b> |
| <b>ANNEX 1 - Invitation Letter and Consent Form for stakeholders</b> | <b>30</b> |

## List of figures

|                                                                                                                         |    |
|-------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1. CARMINE data and knowledge flows between WPs. WP7 and WP8 support the implementation of all WPs.....          | 11 |
| Figure 2. Methodological frameworks, data flows and key outputs of the WP2 and WP3, and feeds to other project WPs..... | 13 |
| Figure 3. CARMINE data flow within WP4 for DT development.....                                                          | 18 |

## Abbreviations

| Abbreviations | Full wording                                              |
|---------------|-----------------------------------------------------------|
| CA            | Consortium Agreement                                      |
| CF            | Communication Framework                                   |
| C3S           | Climate Change Service of Copernicus                      |
| CSA           | Case Study Area                                           |
| DEC           | Dissemination, Exploitation and Communication Strategy    |
| DMP           | Data Management Plan                                      |
| DOI           | Digital Object Identifier                                 |
| DT            | Digital Twin                                              |
| GA            | Grant Agreement                                           |
| GDPR          | General Data Protection Regulation                        |
| IDSS          | Impact-Based Decision Support                             |
| IPR           | Intellectual Property Right                               |
| FAIR          | Findability, Accessibility, Interoperability, Reusability |
| FDMS          | Federated Data Management Solution                        |
| LL            | Living Lab                                                |
| MRE           | Metropolitan Regions of Europe                            |
| NbS           | Nature-based Solutions                                    |
| OA            | Open Access                                               |
| ORE           | Open Research Europe                                      |
| PI            | Principle Investigator                                    |
| SC-HUB        | Stakeholder Community Hub                                 |
| WP            | Work Packages                                             |

## Executive summary

The Data Management Plan (DMP) provides a description of the data handling including data collection, its organization, curation, storage, and provision for its access, preservation, security, quality assurance, allocation of persistent identifiers, metadata, licensing, rules, and procedures for sharing and deletion of data, both during and after the CARMINE project. Furthermore, DMP aims to explain the data used and its connection to the project's Work Packages (WP), and how the data generated by the project will be accessible to various communities of users and stakeholders.

## Key words

Data, format, FAIR, digital twin, living labs, stakeholder engagement, nature-based solutions, physical modelling, socioeconomic modelling, vulnerability, work packages, tasks, data flow, open access.

## Introduction

The "Climate Resilient Development Pathways in Metropolitan Regions of Europe" (CARMINE) project addresses the urgent need for adaptation strategies for the metropolitan regions of Europe (MRE). Bridging the local and regional scales, CARMINE aims to provide knowledge-based climate resilient pathways for these regions, facilitated by an Impact-based Decision Support System (IDSS) and science-based research & innovation roadmaps for multi-level governance, in support of local climate adaptation and resilience of metropolitan communities.

The project's goals will be achieved through a synergic implementation of eight WPs and corresponding tasks, as well as through continuous flows of data and science-based knowledge. The CARMINE project collects relevant baseline data and information from open resources, harmonizes and stores them in an interdisciplinary database and produces new data at fine resolutions for representative case study areas (CSAs), while coordinating with the DestinE initiative. The synergic data flows and the overall data management within CARMINE is described in the project's DMP developed under WP8 (Task 8.2). The DMP aims to provide guidance for managing the newly generated and collected data during the project's implementation period. Furthermore, the DMP tackles the management process of both confidential/restricted and public data to be used within the project.

## 1. DMP objectives and updates

The DMP of the CARMINE project is built upon the initial version of the data management outline presented in the project proposal and provides further information on the datasets and data-sharing practices that will be applied during the implementation period of the project.

### 1.1. Objectives

The objectives of the CARMINE DMP version are:

- Describe the handling of research data during and after the project,
- Outline the data that will be collected and/or generated,
- Specify the data that will be shared/made open access,
- Provide information about the curation and preservation of the data sets.

### 1.2. Updates

CARMINE DMP will be periodically updated as essential additional information becomes available during the lifetime of the project. The DMP is therefore a 'living' document that should reflect the current state of the data and will be completed when the project ends.

This document will be updated four times during the project's lifetime. According to the Grant Agreement (GA), the first version of the DMP will be implemented in M6 (D8.2 - Data Management Plan - Interim 1). Afterwards, the DMP will be updated three times in M18 (D8.6 - Data Management Plan – Interim 2), M36 (D8.7 - Data Management Plan – Interim 3) and delivered as a final report in M48 (D8.8 - Data Management Plan - Final). The final report of the DMP will describe the collection, storage, evaluation, and exploitation of the data produced by the project after the CARMINE project completion. The new versions of the DMP will be created to reflect the status of project data, including the outputs of the modelling, data processing and sharing flows within the project consortium and with stakeholders for co-designing the CARMINE IDSS, as well as any changes in consortium policies or external factors, according to guidance.

MeteoRo is the partner responsible for the elaboration and update of the DMP throughout the project implementation period.

## 2. Data summary

Data managed within the CARMINE project are used for analysis, validation, reusability, dissemination, communication, and demonstration purposes. The project benefits from the exploitation of various open data sources at the European and CSA levels, which is used to provide input data to the CARMINE project. During the project's lifetime, the CARMINE partners decide on the process of assimilating any new robust data into the project's assessment approach. Data sources provided by CARMINE partners, or third parties satisfy specific properties and are subject to constraints and limitations for access and exploitation. Thus, they should follow specific IPR (Intellectual Property Rights), legal restrictions and institutional data sharing regulations that have been specified in the CARMINE consortium agreement (CA), already signed by the partners and subject to further refinement during the project duration, if necessary. According to the CA, cooperation between consortium partners shall take place to fulfil legal obligations arising under applicable data protection laws (the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and relevant national data protection law applicable to said Party) within the scope of the performance and administration of the Project and of this CA. Furthermore, the partners shall, where necessary, conclude a separate data processing, data sharing and/or joint controller agreement before any data processing or data sharing takes place.

CARMINE develops and uses a Federated GDPR-conformant Data Management Solution (FDMS) to store data and make it available for analytics throughout the consortium, and outside stakeholders. It integrates all relevant data at the CSA level (i.e., in situ data from sensors, remote sensing, models, stakeholder knowledge), from various available sources (e.g. EUROSTAT, COPERNICUS, national inventories), at different spatial and temporal resolutions. The CARMINE project also integrates relevant research outputs of the existing studies and evidence-based research such as the projects from the topic HORIZON-MISS-2021-CLIMA-02-03 "Towards asset level modelling of climate risks and adaptation" (ICARIA, MIRACA and RISKADAPT), HORIZON-MISS-2021-CLIMA-02-01 "Development of climate change risk assessments in European regions and communities based on a transparent and harmonised Climate Risk Assessment approach" (CLIMAAX), and the Study on Adaptation Modelling for Policy Support (European Commission, 2021). This work will support the (co-)development of: (i) adaptation and mitigation pathways including Nature-based Solutions (NbS) scenarios (WP1), (ii) socioeconomic vulnerability profiles, risk assessment, climate change risk scenarios and an interactive atlas of climate resilience at metropolitan region scale (WP3), (iv) digital twins (DTs) for the selected MRE and DT transferability approaches in other MREs (WP4), (v) CARMINE IDSS (WP5) and (vi) policy pathways for multi-level climate change governance in Europe (WP6).

The data flow throughout and between the WPs and the CARMINE FDMS are critically important for the **achievement of the CARMINE's project goal**, to support metropolitan communities to become climate resilient through co-produced knowledge-based decision support tools and adaptation and mitigation pathways in line with objectives of the EU Mission on Adaptation by 2030 (with the perspective of 2050), and its **specific objectives (SOs)**: *SO1 - To review the*

*available resources, tools, practices, policies, and methodologies, and identify the gaps, challenges and barriers that hamper the successful advance of the resilience pathways in the MRE; SO2 - To develop high-resolution risk assessment models linking climate, earth system processes, and socioeconomic drivers, for enriched data fusion and effectiveness of adaptation and mitigation actions in the MRE; SO3 - To co-produce a climate adaptation and resilience framework combining Living Labs (LLs) and DT approaches that supports decision making processes for resilience and disaster risk management in the MRE, including Nature-Based Solutions; SO4 -To provide state-of-the-art Impact-based Decision Support Services (IDSS) blending climate and environmental data into socioeconomic impact and risk assessments, for user-friendly access to high spatially resolved modelling outputs in support of local adaptation assessments and plans; and SO5 - To conduct the participatory development of better coordinated and impactful modelling and risk assessment, in support of roadmaps of R&I priorities on adaptation, informed policies, and cross-sectoral plans towards the 2030-2035 timeframe and beyond (i.e., 2050).*

The CARMINE FDMS will be continuously refined and updated throughout the project lifetime, to feed the development of the proposed decision-support tools and respond to the stakeholders needs and requirements, permanently monitored through direct interactions facilitated by WP1 (LLs and SC-HUB), while taking into account the data needed in and data created by the CARMINE Digital Twins (T4.3).

For ensuring that data related activities respond to real needs of our stakeholders, this activity will receive the guidance by the Stakeholder Engagement Strategy (WP1) and Dissemination, Exploitation and Communication Strategy (WP7). Figure 1 provides an overview of the data and knowledge flows between the WPs of the CARMINE project.

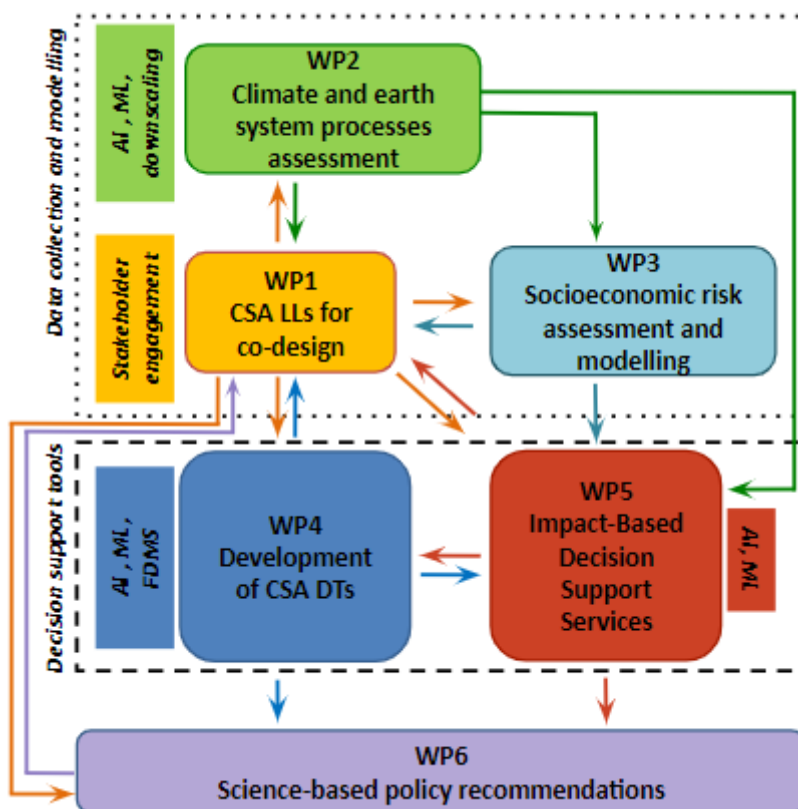


Figure 1. CARMINE data and knowledge flows between WPs. WP7 and WP8 support the implementation of all WPs

## 2.1 Types of data

To achieve its five specific objectives, the CARMINE project uses data from available sources, as much as possible from its consortium members and societal partners, as well as any pertinent data to be found with permissive licences. Where additional data is needed to support the implementation of the co-designed methodology and its operationalisation, the consortium members aim to generate new data relevant at the CSA level, retrieved through stakeholder engagement (WP1 and WP6 – LLs, SC-HUB), assessment (WP2 and WP3) and modelling (WP3) activities.

The project integrates various data (and metadata) from different available sources (in situ measurements, modelling, remote sensing) and fields, including economics (e.g., cost-benefit evaluations, damage-cost estimations, risk assessments), climate science (e.g., climate risk scenarios, climate change hotspot, climate hazard indicators), physical modelling (e.g., climate modelling, land cover modelling), data engineering (e.g., harmonized database), and quantitative data (e.g., from LL or other engagement activities). Tailoring the modelling outputs by considering the data and knowledge needs and requirements derived stakeholder engagement activities conducted in eight representative MREs is the main activity in all the CARMINE CSAs. These activities will co-produce actionable knowledge that will feed the DTs and IDSS tools.

This first version of the DMP provides preliminary details on the data available from different sources and those generated by the project (new data), which are all briefly described hereafter. Further updates on data types are to be provided in the next versions of the DMP.

### 2.1.1. Data from available resources

The CARMINE project benefits from and further exploits the existing openly available data and knowledge. The pool of available research resources includes: the Climate-ADAPT platform; Copernicus Climate Change Service (C3S); CMCC Data Delivery System (<https://dds.cmcc.it/>); previous or ongoing research & innovation European projects (i.e., FP7, H2020, HEU), through the networking facilitated by the common partners between CARMINE and other projects (i.e., P20, P22, P24); global climate and non-climate data and knowledge initiatives at European level (i.e., DestinE, GEOSS, OGC, WMO IUCS, U4SSC); some project partners that share their data according to the regulations stipulated in the CA of the project; stakeholder engagement activities in the CSAs (WP1 and WP6).

### 2.1.2. New data generated by the project

The CARMINE project integrates and downscales climate model outputs (WP2) and conducts socioeconomic modelling (WP3) activities to provide the necessary input data for risk assessment at local scale in the eight CSAs, to feed DTs and the IDSS, and to support the provision of the other project's outcomes – i.e., the adaptation and mitigation pathways (WP1), climate hazard indicators over the CSAs (WP2), climate risk scenarios (WP3), the interactive climate resilience atlas (WP3) and the science-based policy recommendations (WP6). The outputs of the modelling process will also ensure the provision of tailored science-based knowledge at the scale of the MREs (with assessed uncertainty) that will maximize the uptake of the CARMINE's results within the stakeholder community.

The new scientific data generated by CARMINE at the metropolitan region scale (WP2, WP3) result mainly from:

- (i) Development and testing simulation chains for physical climate modelling (WP2 / T2.2)
- (ii) Physical urban modelling at local scale (including NbS applications for adaptation and mitigation) (WP2 / T2.3)
- (iii) Assessments of socioeconomic vulnerability to climate change (WP3 / T3.1)
- (iv) Modelling of climate change costs and risks (WP3 / T3.2, T3.3)
- (v) The activities related to the operation of the DTs (WP4).

Figure 2 illustrates the main data flows within the WP2 and WP3 and their key outputs and further feeds.

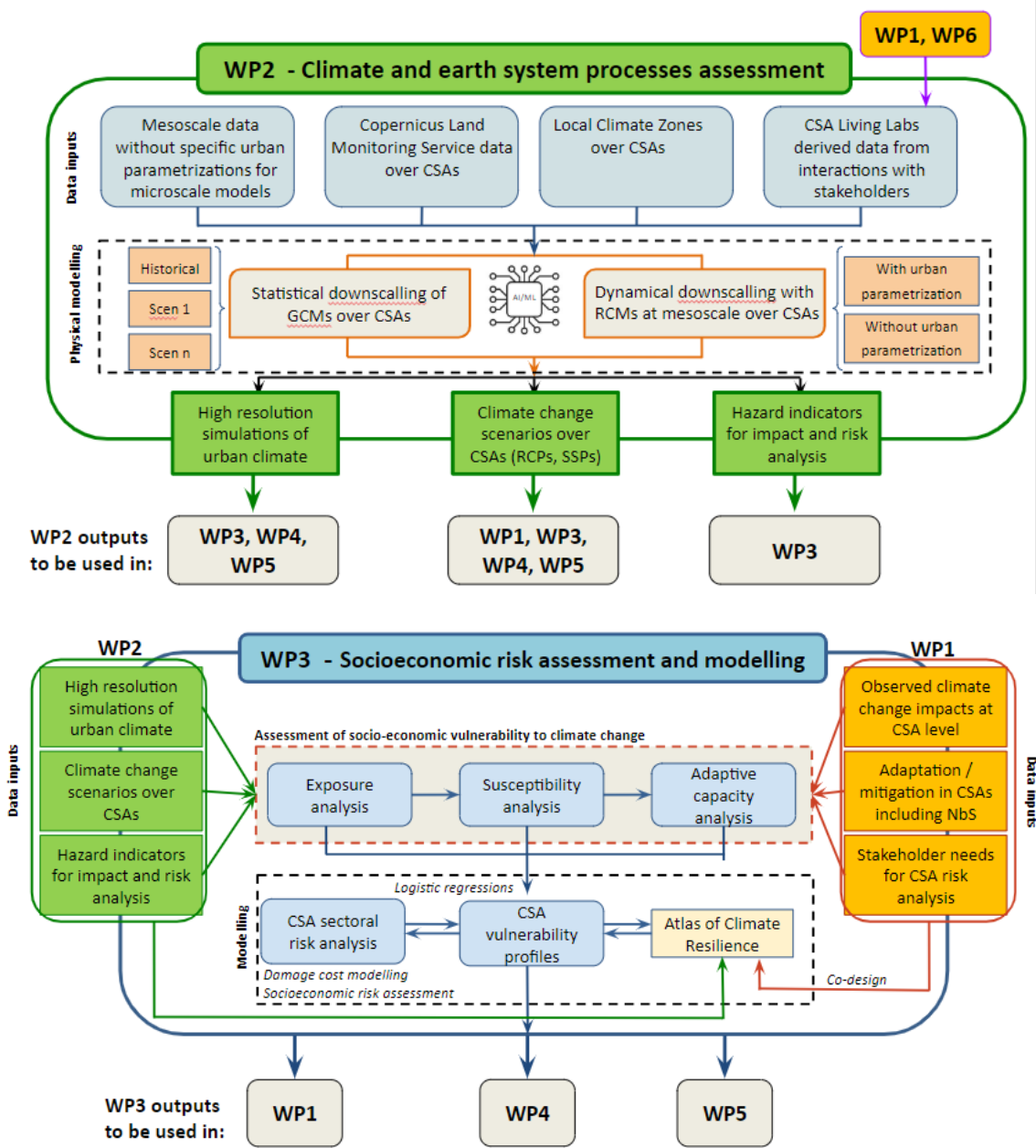


Figure 2. Methodological frameworks, data flows and key outputs of the WP2 and WP3, and feeds to other project WPs

### 2.1.3. Data derived from stakeholder engagement activities

The project aims to extract and exploit the available CSA (metropolitan region scale) data and information throughout the LLs activities and interactions within the SC-HUB, following the guidelines of the Target groups (stakeholder) Engagement Strategy (D1.1) and Living Labs Handbook (D1.6). The co-design and co-development of the CARMINE IDSS (WP5) and elaboration of the policy recommendations (WP6) will significantly rely on the data and knowledge derived at the case study level. However, the CARMINE research involves personal data collection and processing, but personal data will not be sensitive (e.g., participant name, contact

person, email, affiliation), as defined under EU law. Only relevant (personal) data will be collected and no more than what is needed for the research study and stakeholder engagement activities. The project does not foresee any systematic collection of any special categories of data, as defined under Article 9 of the General Data Protection Regulation (GDPR) (<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679>). In this respect, a stakeholder consent letter will be developed, and all project partners will disseminate the document during their first interactions with stakeholders.

The CARMINE research team adopts methods and procedural measures in relation to matters such as data recording style, personal identifiers, transcription and processing procedures, lifespan of unprocessed data, type and places of storage, and put all measures in place for data safety. Specifically, all data will be kept separately from identifying information. CARMINE stores all relevant CSA-related information securely.

#### 2.1.4. Data derived from communication and dissemination activities

During the participation in public events (webinars, final event), registration data (name, email, organisation) are collected in a GDPR-compliant online registration form and stored in dedicated archives stored in the project's SharePoint, accessible within the project consortium. The data gathered will not be used for any purpose other than that explicitly outlined in the disclaimer or terms and agreements of a form and without prior explicit consent from the user. This data are collected for tracking and reporting purposes and, with explicit consent from the users, for further communication and dissemination activities.

## 2.2. Data formats

Data formats generated, retrieved, and collected in the CARMINE project include, but are not limited to:

1. Tabular data in ASCII format (\*.txt, \*.csv),
2. Array data (\*NetCDF, \*.HDF, \*.npy),
3. Classic spatial data, including vector data in ESRI shapefile/geodatabase format, raster data in GeoTIFF format, point clouds in las format
4. Cloud native spatial data, including Cloud Optimised GeoTIFF (COG) and zarr for raster data and GeoParquet, FlatGeobuf and PMTiles for vector datasets,
5. Survey questionnaires and related quantitative data,
6. Audio files (\*.mp3), multimedia files (video recordings in \*.mp4), images (\*.jpg, \*.png),
7. Model scripts and data harmonisation codes, developed using open-source coding languages (e.g., Python, R), version control software (Git), and trusted repositories (e.g., GitHub, Gitlab, Zenodo),
8. Project reports, presentations, and documentations in text (\*.txt), Pdf (\*.pdf), MS Word (\*.docx), MS PowerPoint (\*.pptx) formats; compressed files (\*.rar, \*.zip).

### 2.3. Data curation and storage

The CARMINE Database, together with other research outputs (i.e., scripts, codes), integrates both observational and numerical simulation data derived through physical hazard assessments and socioeconomic risk assessment and modelling. The collected and generated data will be curated and preserved in the project's database, which will follow data quality, security, and privacy standards and relevant EU legislation (i.e., GDPR).

The research data management process in the CARMINE project includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing. According to the GA, each partner has valid and unique roles in the project, in relation to capacity and available resources (including human resources, with demonstrated knowledge capability and skills, equipment, tools, facilities) and research IT infrastructures for data storage, processing and modelling, which are tailored for the execution of the project. In case of complex needs, storage solutions in trusted open-access repositories (e.g., Zenodo) will be used, for free availability during the lifetime of the project and beyond it. In addition, CARMINE will co-develop a Federated Data Management Solution (FDMS) (WP4 / Task 4.1) to store data and make it available for analytics throughout the consortium, and outside stakeholders. The FDMS is linked to the architecture design and implementation of DTs (WP4) and supports the development of the CARMINE IDSS (WP5) to (i) ensure that science-based information is correctly parsed and represented across geographical scales, in accordance with existing standards and rules, and (ii) facilitate the operational coordination with the Climate-ADAPT Platform.

The estimated size for project management data (project reports, presentations, documentation, images, and multimedia files) is about 500 GB. These data will be preserved in the dedicated Teams Sharing Point of the project, with open access provided to all project partners.

### 2.4. Roles and responsibilities

The data management roles and responsibilities within the CARMINE project consortium are set for managing any emerging issues regarding the data collection, processing, storage, sharing, and preservation of IPR, GDPR, and Open Access (OA) principles and regulations during the lifetime of the project.

The CA stipulates specific responsibilities for data protection. Accordingly, "the Parties shall cooperate in order to enable one another to fulfil legal obligations arising under applicable data protection laws (the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and relevant national data protection law applicable to said Party) within the scope of the performance and administration of the Project and of this Consortium Agreement". Furthermore, "in particular, the Parties shall, where necessary, conclude a separate data processing, data sharing and/or joint controller agreement before any data processing or data sharing takes place".

The management of intellectual property rights (IPR) throughout the project's implementation period and beyond will include a joint ownership agreement between project partners, which will define the contributions of each partner and its valid role in carrying out the project activities. The CARMINE partners respect IPR issues and follows the IPR Management Guidelines throughout the project and issues are treated and agreed on during the negotiation of the GA.

The WP7 leader and task leaders will manage and coordinate all communication, exploitation, and dissemination activities following the regulations of the CARMINE Dissemination, Exploitation & Communication Plan (DEC - D7.1 to D7.4) and Communication Framework (CF - D7.5 to D7.7), as core actions under WP7. The implementation of the two guidelines will ensure the management and protection of the CARMINE data. The communication, exploitation, and dissemination team also has the responsibility to stimulate the achievement of the largest possible project audience, maximize the project's impact, and monitor the project's key performance indicators. In addition, the WP7 leader, and task leaders are responsible for the development and promotion of the visual identity of CARMINE and carry out branding strategies with consistent style, visual identity, correct logo usage, and presentation of the project.

Principal Investigators (PIs) from each partner within the CARMINE Consortium will ensure that every member of their working group knows, understands, and follows the regulations of the DMP and Grant Agreement (GA) stipulations regarding "the data, know-how or information whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights". The PIs will have continuous communication with the Project Coordinator when any practical data handling issues emerge during the project's implementation period.

### 3. FAIR data

The science-derived data managed within the CARMINE project aims to follow the 'Findability', 'Accessibility', 'Interoperability' and 'Reusability' (FAIR) principles, EU standards and regulations. Adhering to FAIR principles help in increased data sharing, collaboration, and reproducibility of research findings.

#### 3.1. Making data findable

All research data (from available sources and newly generated) will be discoverable and identifiable through standardized metadata, which will be added to all datasets. These metadata will be rich and comprehensive to allow description of the content, context, and origin of the data. All the science-derived data preserved under the CARMINE Database will follow the FAIR principles with the following details:

- **Data identifier:** Every published dataset will have a persistent and unique identifier called dataset ID (such as DOIs), that is valid throughout the entire lifetime of the project. The persistent identifiers will facilitate findability and accessibility for both humans and machines, enabling the research partners, professionals and other interested parties (stakeholders) to locate and access the data in a rapid and efficient way.
- **Metadata:** Metadata input is mandatory for all research data (newly generated or from available sources) and is recorded at the time of each dataset's creation or collection. The metadata will be made compatible with metadata standards from data archive centres (e.g., INSPIRE, Pangaea), stored in a centralized metadata catalogue, and will be openly accessible for all audiences, increasing the project's impact and guaranteeing transparent research. Metadata of deposited data will be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s), venue and embargo; Horizon Europe funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organizations. Where applicable, the metadata will include persistent identifiers for related publications and other research outputs.
- **Search function:** Users can search for metadata using various types of keywords (author, year, research topic, or other free text), facilitating the research datasets findability.
- **Versioning:** Versioning is included in all structured datasets and is identifiable via a version ID. One dataset ID can be linked with multiple version IDs for multiple versions.

### 3.2. Making data openly accessible

All CARMINE data, including data from available sources and newly generated, will be harmonised, and made part of the CARMINE Database. Exceptions are made to the data subject to any legal or ethical restrictions. This database will be openly accessible in compliance with European Open Science Cloud (EOSC) requirements and 'Web of FAIR data' principles. Access to the data and metadata will be provided through free and standardized access and communication protocols, which will be retrievable by their identifiers. The research data and metadata will remain available and findable during the project's lifetime.

CARMINE will implement a FDMS (WP4) to facilitate the data access openly throughout the consortium for analytical purposes (Figure 4), and open exchange of relevant CSA data and information. Furthermore, the CARMINE IDSS (WP5) will be fed with science-based data and LL-derived information empowered by open data flows and visualization tool based on an API service to ensure rapid, flexible and accessible access to the CARMINE data.

The Project Coordinator will coordinate the development of the procedures regarding the data usage beyond the end of the project, considering that (i) the project will find out new data challenges and opportunities to be valued after the end of the project, and (ii) the DMP will be continuously updated and further developed during the project.

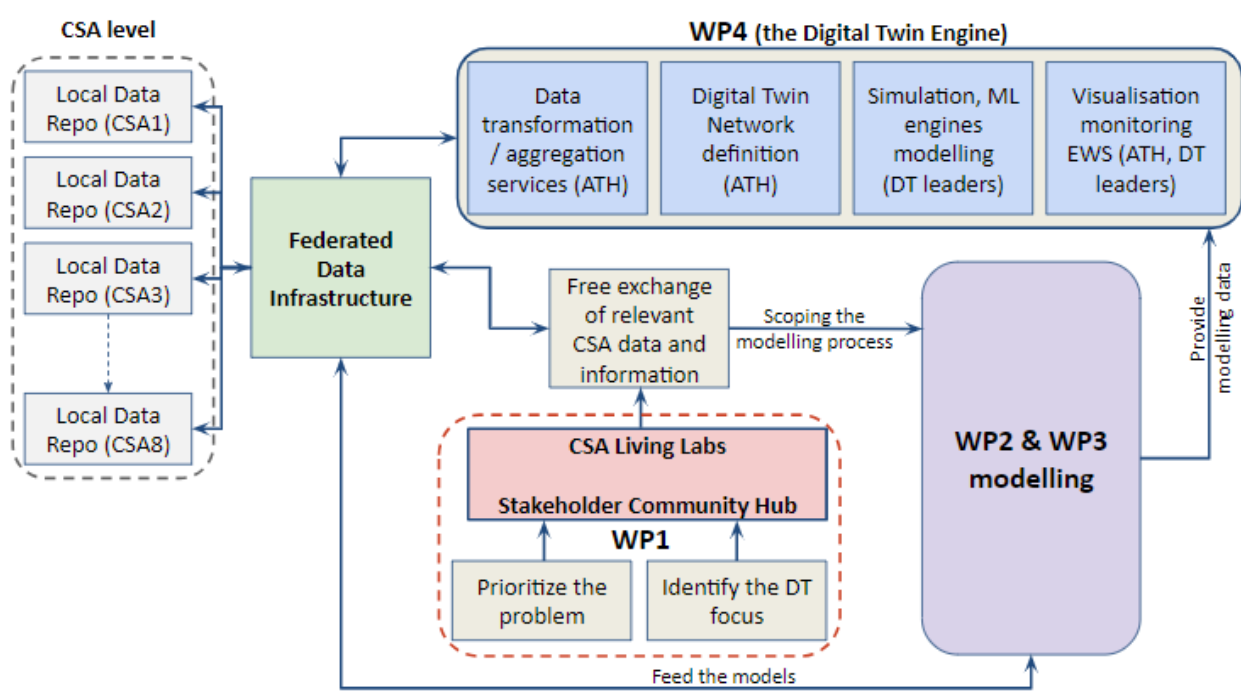


Figure 3. CARMINE data flow within WP4 for DT development

The CARMINE project will provide several public documentations that aim to maximize the accessibility and uptake of project's scientific results, such as:

- Reports describing the framework for the creation of LLs in each CARMINE CSAs (D1.7) and functionalities of the SC-HUB (D1.8),
- Reports describing the climate modelling framework for physical risk assessment (D2.2) and local modelling framework for NbS (D2.3),
- Report on the selection of hazard indicators for risk analysis and uncertainty evaluation for risk assessment (D2.4),
- Report providing the full description of the core architectures of CSA DTs (D4.2) and IDSS (D5.6),
- Guidelines for DT transferability (D4.5),
- Report describing the framework for multi-level climate change governance (D6.1),
- Review report on policy for climate resilience and development options (D6.5).

The research data available through specific agreements with third parties will only be accessible with permission granted by the original data owners. The data access protocols will allow for authentication and authorization.

Project management-related data, stored in the CARMINE Teams SharePoint, is accessible to all project members without restriction if no confidential information is considered. Project management-related data include contact details of partners, financial information (expenses and resources), meeting minutes, and participant lists. These data cannot be passed to third parties outside the consortium unless the following conditions are met: 1) No confidential, personal, financial, or commercially sensitive information is included; 2) Permission from the beneficiaries or relevant stakeholders has been obtained; 3) Sharing the data does not damage the project's communication, exploitation, or dissemination results falling under IPR or GDPR regulations.

### **3.3. Making data interoperable**

All CARMINE project data will adhere to widely adopted standard data formats, facilitating compatibility with available open applications. Standard and open formats will be chosen whenever possible. Otherwise, format specifications will be defined and provided.

The GA establish the specific conditions for granting the rights of ownership of the results and on materials, documents and information received for policy, information, communication, dissemination and publicity purposes. The agreed regulations are intended to guarantee the long-term preservation of the CARMINE data and results, as well as their findability, accessibility, interoperability and reusability during the lifetime of the project and beyond.

Full metadata will be given for all datasets (new and use from available sources) within the CARMINE project, including general details, data coverage usage (e.g., license, citations, digital object identifiers), standards, formats, vocabularies, and lineage statements (e.g., original data source, tools for processing) to ensure findability, accessibility, and interoperability of data/research outputs. Metadata will use a formal, accessible, shared, and broadly applicable language (XML format) to ensure efficient knowledge representation for users. Furthermore, metadata uses vocabularies that follow FAIR principles and will include qualified references to other data/metadata, where necessary. All CARMINE data and associated metadata will be made available under an OA license to facilitate their reusability.

### **3.4. Increase data use from available sources**

Both the data from available sources and newly generated data and project management data can be exchanged and further exploited within the CARMINE consortium. The project will use the specific functionalities of the DTs and IDSS, co-designed with the engaged end-users, to ingest trusted scientific data and information, search and download of tailored data and access the core metadata that are relevant for decision-making at CSA level. The CARMINE data will be annotated via a common open metadata standard for search and discovery – according to FAIR principles, based on common metadata standards and transforming metadata from data sets to comply.

The project partners will agree on license types for the newly generated datasets within the project and will preserve the licenses of data from available sources, to optimise the reuse of the available data. The CARMINE data will not be made reusable by third parties if the owner of the data is not a public entity. Data will be made available for use after the end of the CARMINE project, and it is intended to remain re-usable indefinitely.

Openly available research data produced by the project will be licensed under Creative Commons Public Domain Dedication (CC-0) and Creative Commons Attribution-Non-Commercial No-Derivatives 4.0 International (CC BY-NC-ND 4.0). Other licenses will be used for the data made openly available in trusted repositories such as Zenodo (GNU General Public License version 2). The reuse of the CARMINE data will also be ensured through: (i) detailed and accurate description of the relevant attributes of each indicator and time series, (ii) clear and accessible description of the data usage licenses and provenance, (iii) the compliance of the urban domain community standards.

Embargo times for opening access to the CARMINE data are defined by each dataset owner in the metadata, but they will not cover more than three years after data collection. All data that can encompass any personal data protection or privacy (GDPR) and IPR issues will not be publicly disclosed.

The consortium is committed to use Open Research Europe (ORE) scholarly fully open access publishing service for Horizon Europe to enable rapid publication times and publication outputs that support research integrity, reproducibility, transparency and enable open science practices. The project has dedicated part of its budget to cover the fees associated with open-access publication to facilitate dissemination. The CARMINE project partners adhered to the ‘green’ and

‘gold standard’ of open access, which will facilitate the availability and reusability of all project research data and outputs, including the output data and peer-reviewed articles in open-access scientific journals.

## 4. Other research outputs

Other research outputs generated by the CARMINE project refer to source model codes and scripts for data harmonisation, processing and post-processing to derive tailored products to meet stakeholder needs and data visualisation. These research results will be openly available in trusted and dedicated repositories such as GitHub (<https://github.com/>) and Gitlab (<https://gitlab.com/>). Open access will be ensured primarily for the project partners from WP2-WP5 deeply involved in the physical hazard assessment and socioeconomic modelling, risk assessments and co-development of the CARMINE DTs and IDSS.

## 5. Allocation and resources

WP8 lead partner (MeteoRo) is responsible for the overall project management and coordination of the project, including the efficient cooperation between project partners towards the achievement of the specific objectives of the project, the monitoring and management of the scientific consistency and quality of the research outputs and results, and the minimization of project management risks. Compliance with data management decisions as they relate to the CARMINE DMP will be ensured through the implementation of the following measures:

- WP leaders are considered responsible for adhering to the specifications above in their respective work packages.
- The PIs of each beneficiary organisation in the consortium are considered responsible for the DMP actions. They will support the WP8 in all issues related to research data management. The principal investigators of each beneficiary should ensure that personnel working on the project have read the CARMINE DMP and apply/exercise all the principles as described in the present document.
- The main data collectors and providers contributing to the development of the CARMINE Database (WP1, WP2, WP3) have the ultimate responsibility of complying with the specifics of the CARMINE DMP, as well as with the related GDPR policies and IPR regulations.

For all work packages, no additional costs are expected compared to how all beneficiaries currently store data as part of their normal work. Resources for long-term preservation will be decided in due course.

## 6. Data security

The CARMINE consortium acknowledges that the collected, processed, post-processed and shared data (both scientific and project management data) during the lifetime of the project may contain sensitive and confidential information. The project consortium ensures the protection and security of the data using servers and security systems offering encryption at several levels and providing flexibility in protecting data from disclosure due to database server theft, unscrupulous administrators, and insecure networks. Data security measures are implemented, including provisions for data recovery and the secure storage and transfer of sensitive information.

Partners are informed to consult with their organisation's IT professionals to set up and manage data security and make sure the right safeguards are in place.

Full description of the data security and confidentiality measures (in place and/or required for handling any dataset within the project), will be detailed and updated on the course of the project.

## 7. Ethical aspects and GDPR compliance

Any ethical or legal issues that can have an impact on data sharing can also be discussed in the context of the ethics review.

Stakeholder engagement is of central importance to gather all relevant CSA data (LLs) for scoping and supporting physical hazard assessments (WP2), socioeconomic risk assessment and modelling (WP3) understanding current policy levers for adaptation (WP6) and prioritize the development of CSA DTs (WP4) and IDSS (WP5) and derive needs and requirements for tailored data and information relevant for supporting the decision-making process at metropolitan scale. In support of LL activities, consent forms for informed stakeholder engagement (Annex 1) are to be used by partner organisations conducting the research at CSA level (LLs). The consent forms will collect key (non-sensitive) information about the stakeholders engaged in the CARMINE LLs (i.e., the name, organisation, contact details, types of activities envisioned for engagement, frequency of engagement meetings and signature of the involved stakeholder). The consent forms will be stored as non-digital hard copies by the partner organisation conducting the research. These forms will not be used for further analysis or shared with external partners/third parties and omitted from datasets for analysis. Informed consent forms may be available to the CARMINE coordinator upon prior inquiry and sent in a secure way. All consent forms will be located with each respective partner and stored securely. All hard copies will be destroyed one year after the CARMINE project completion.

All the project meetings (i.e., WP or project progress meetings, annual consortium meetings) organized on site, virtual, or hybrid, and interviews/dialogues with the stakeholders will be recorded (based on consent agreement) and transcripts will be created based on audio recordings. Any other identifiable information (direct or strong indirect personal identifiers) contained within the interviews will be omitted from transcripts, including personal/contact data. Transcripts will be stored as document files digitally at the partner organisations conducting the research or organising the meetings. Transcriptions will be analysed by those partner organisations who collected the data, or consortium members with expertise in qualitative research methods. Appropriate security measures (file encryption) will be taken. The data won't be stored in unprotected cloud services, shared with third parties, or made publicly available. Transcriptions and audio recordings will be stored in digital files by the partner organisations who collected them for one year after the project end and all copies will be destroyed by consortium members afterwards.

Therefore, misuse of the stakeholder-driven data should be avoided, and confidentiality procedures should be respected to ensure the privacy of respondents and organisation as well as the protection against possible identification of respondents during the project lifetime. In this respect, to cover ethical requirements and data protection according to GDPR, an informed consent letter was conceived to ensure the confidentiality degree of engaged stakeholders. It is required that all project partners obtain the informed consent of engaged stakeholders for collecting and processing their personal data. All information provided (name, email, IP address, phone, etc.) is kept confidential by encryption that turns all data into an unreadable format and

only authorized persons from the project can decrypt the data and read it. Besides, all qualitative and quantitative data collected through surveys will not be assigned at the level of the interviewed person. Therefore, all project partners will use the information gathered from stakeholders without revealing the source of the information or other personal data.

For face-to-face interviews conducted in CSAs, data collected will adhere to the GDPR and ethical approval procedures from relevant partners. Prior to the interview, interviewees will be provided with information sheets on data protection and consent forms for informed consent. Interviewees will be assured confidentiality throughout the project and will be informed about the possibility of withdrawing their participation in the project at any time. In some CSAs, interviewees will also have the option to indicate whether their interview data and contact information can be used for follow-up research after the project concludes. The CARMINE project will ensure informed consent and anonymity for participants completing online questionnaires. Data collection will comply with all relevant European regulations and ethical guidelines.

## 8. Other issues

No further issues are foreseen at this stage.

## 9. Next steps

For the next version of this document (Data Management Plan - Interim 2), MeteoRo will implement a comprehensive catalogue based on the GeoNetwork open-source platform. This catalogue will enable all project partners to document the data they will use in the project and will support multiple metadata standards to ensure broad compatibility and interoperability. By including support for various metadata standards, we aim to enhance the discoverability, accessibility and reusability of the data.

This initiative is important for ensuring transparency, consistency and high data quality across the project. It will facilitate effective collaboration among all partners and stakeholders. The catalogue will serve as a centralized resource for tracking data contributions, usage and compliance with the project's data management policies.

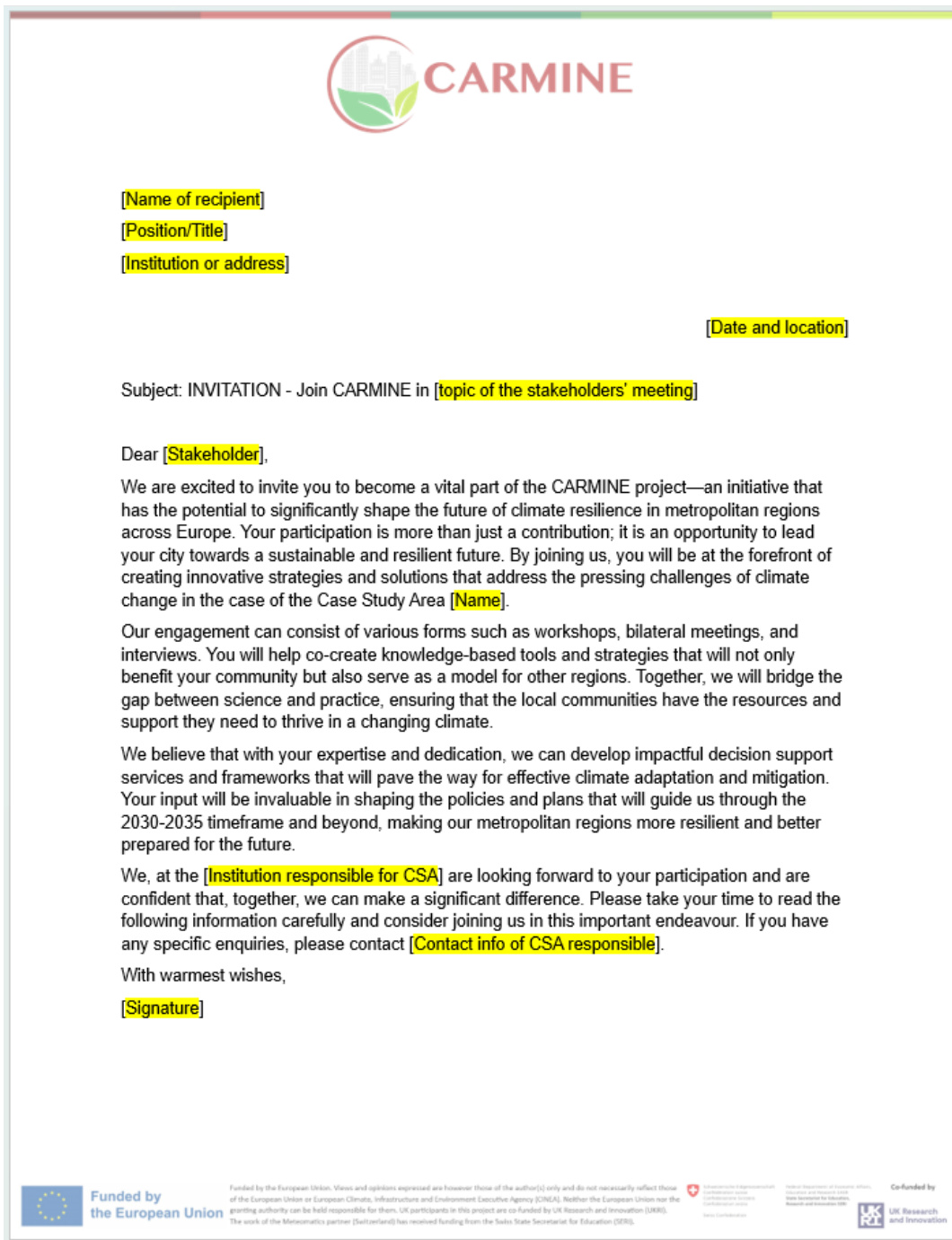
## References

European Commission (2021) Study on adaptation modelling. Task 2 Comprehensive Desk Review Annex: Climate Adaptation Models and Tools. CLIMA / A.3 / ETU / 2018 / 0010. Final Report. 453 p, (available at <https://op.europa.eu/o/opportal-service/download-handler?identifier=cfa86c26-764e-11eb-9ac9-01aa75ed71a1&format=pdf&language=en&productionSystem=cellar&part=> )

## ANNEX 1 - Invitation Letter and Consent Form for stakeholders

### Annex 1.1: Template invitation letters for stakeholders (image).

*Note: Information in yellow is to be adapted to each case. The letter has two pages. The template presents the minimum information required to be present in the invitation letter. For improving stakeholders' engagement partners can translate the letter in their national language or add a paragraph with the specific objectives / challenges of their CSA.*



 **CARMINE**

[Name of recipient]  
[Position/Title]  
[Institution or address]

[Date and location]

Subject: INVITATION - Join CARMINE in [topic of the stakeholders' meeting]

Dear [Stakeholder],

We are excited to invite you to become a vital part of the CARMINE project—an initiative that has the potential to significantly shape the future of climate resilience in metropolitan regions across Europe. Your participation is more than just a contribution; it is an opportunity to lead your city towards a sustainable and resilient future. By joining us, you will be at the forefront of creating innovative strategies and solutions that address the pressing challenges of climate change in the case of the Case Study Area [Name].

Our engagement can consist of various forms such as workshops, bilateral meetings, and interviews. You will help co-create knowledge-based tools and strategies that will not only benefit your community but also serve as a model for other regions. Together, we will bridge the gap between science and practice, ensuring that the local communities have the resources and support they need to thrive in a changing climate.

We believe that with your expertise and dedication, we can develop impactful decision support services and frameworks that will pave the way for effective climate adaptation and mitigation. Your input will be invaluable in shaping the policies and plans that will guide us through the 2030-2035 timeframe and beyond, making our metropolitan regions more resilient and better prepared for the future.

We, at the [Institution responsible for CSA] are looking forward to your participation and are confident that, together, we can make a significant difference. Please take your time to read the following information carefully and consider joining us in this important endeavour. If you have any specific enquiries, please contact [Contact info of CSA responsible].

With warmest wishes,

[Signature]

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**Project:** Climate-Resilient Development Pathways in Metropolitan Regions of Europe (Project Acronym: [CARMINE](#))

**Project duration:** February 2024 – January 2028

**Project objective:** The CARMINE objective is to provide knowledge-based climate resilient development pathways in metropolitan regions of Europe, that bridge the local and regional scales by providing impact-based decision support services and multi-level climate governance supporting local adaptation, including both traditional and nature-based solutions.

**Meeting objective** [\[To be adapted to the meeting topic\]](#)

\*\*\* Draft Agenda \*\*\*

[\[Date and time\]](#)

|                 |                                                       |
|-----------------|-------------------------------------------------------|
| <b>9:30 am</b>  | Welcome                                               |
| <b>9:35 am</b>  | Presentation of the project<br><i>Speaker: [name]</i> |
| <b>9:45 am</b>  | Presentation of the CSA<br><i>Speaker: [name]</i>     |
| <b>10:00 am</b> | Discussion and next steps<br><i>Speaker: [name]</i>   |
| <b>10:30 am</b> | Closing remarks and end of the meeting                |



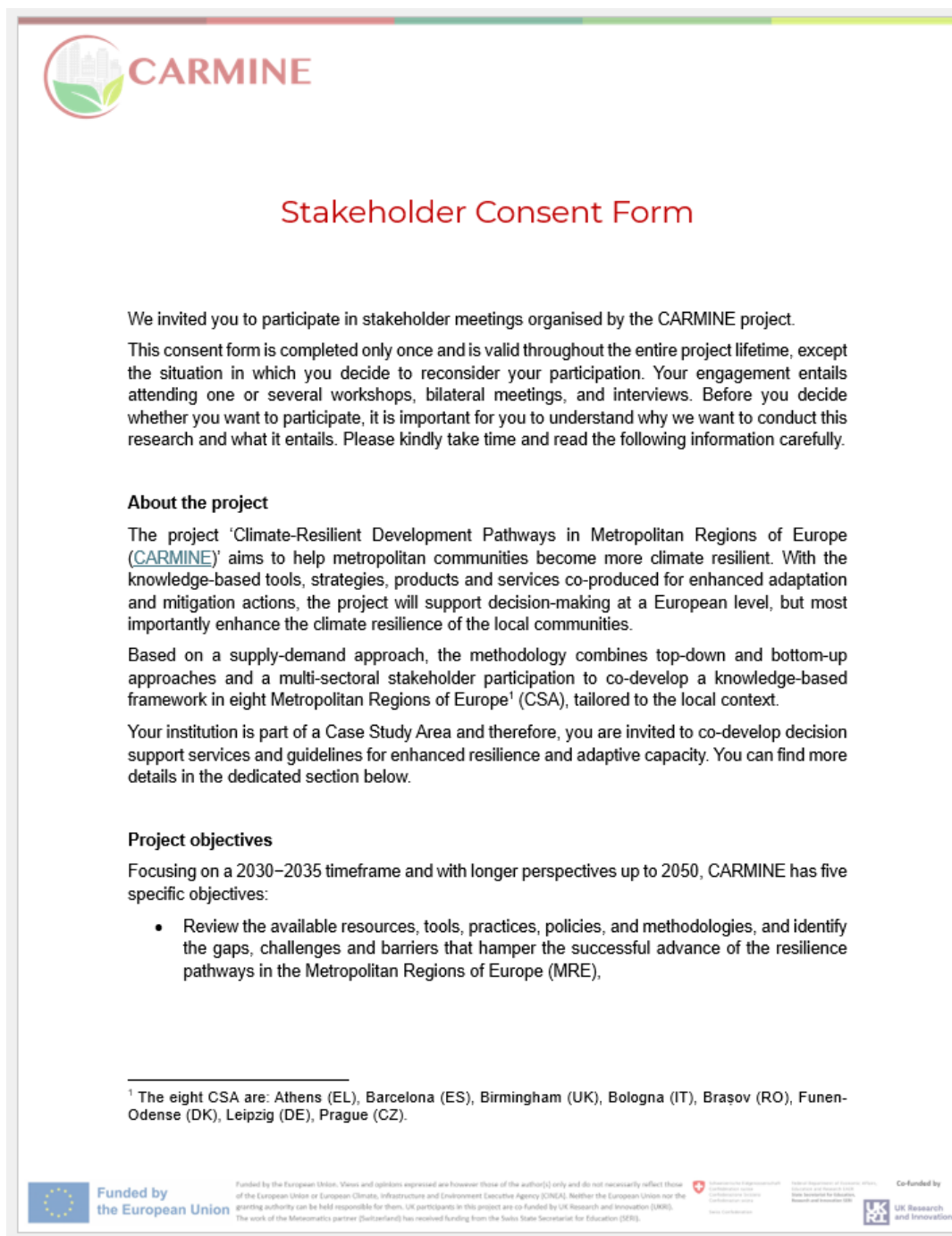
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## Annex 1.2: Template Stakeholder Consent Form (image)

*The template presents the minimum information required to be present in the stakeholder consent form, as approved by the management of CARMINE project and reviewed by the Ethics Advisor. If needed to increase stakeholders' engagement it can be translated in the national language.*



**CARMINE**

## Stakeholder Consent Form

We invited you to participate in stakeholder meetings organised by the CARMINE project.

This consent form is completed only once and is valid throughout the entire project lifetime, except the situation in which you decide to reconsider your participation. Your engagement entails attending one or several workshops, bilateral meetings, and interviews. Before you decide whether you want to participate, it is important for you to understand why we want to conduct this research and what it entails. Please kindly take time and read the following information carefully.

### About the project

The project 'Climate-Resilient Development Pathways in Metropolitan Regions of Europe (CARMINE)' aims to help metropolitan communities become more climate resilient. With the knowledge-based tools, strategies, products and services co-produced for enhanced adaptation and mitigation actions, the project will support decision-making at a European level, but most importantly enhance the climate resilience of the local communities.

Based on a supply-demand approach, the methodology combines top-down and bottom-up approaches and a multi-sectoral stakeholder participation to co-develop a knowledge-based framework in eight Metropolitan Regions of Europe<sup>1</sup> (CSA), tailored to the local context.

Your institution is part of a Case Study Area and therefore, you are invited to co-develop decision support services and guidelines for enhanced resilience and adaptive capacity. You can find more details in the dedicated section below.

### Project objectives

Focusing on a 2030–2035 timeframe and with longer perspectives up to 2050, CARMINE has five specific objectives:

- Review the available resources, tools, practices, policies, and methodologies, and identify the gaps, challenges and barriers that hamper the successful advance of the resilience pathways in the Metropolitan Regions of Europe (MRE),

<sup>1</sup> The eight CSA are: Athens (EL), Barcelona (ES), Birmingham (UK), Bologna (IT), Braşov (RO), Funen-Odense (DK), Leipzig (DE), Prague (CZ).

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- Develop high-resolution risk assessment models linking climate, earth system processes, and socioeconomic drivers, for enriched data fusion and effectiveness of adaptation and mitigation actions in the MRE,
- Co-produce a climate adaptation and resilience framework combining Living Labs (LL) and Digital Twins (DT) approaches that supports decision-making processes for resilience and disaster risk management in the MRE, including Nature-Based Solutions (NBS),
- Provide state-of-the-art Impact-based Decision Support Services (IDSS) blending climate and environmental data into socioeconomic impact and risk assessments, for user-friendly access to high spatially resolved modelling outputs in support of local adaptation assessments and plans,
- Conduct the participatory development of better coordinated and impactful modelling and risk assessment, in support of roadmaps of research and innovation (R&I) priorities on adaptation, informed policies, and cross-sectoral plans towards the 2030-2035 timeframe and beyond (i.e., 2050).

#### What is the meeting about?

The objective of these meetings is to co-develop decision support services and guidelines for enhanced resilience and adaptive capacity, including early warning and disaster risk management systems. In this respect, we need to cooperate closely with local to regional communities (stakeholders and users), decision-, and policymakers (local authorities) to co-develop cross-sectoral frameworks for adaptation and mitigation actions. The feedback provided will be used to co-design and co-develop the decisional tools to ensure that all requirements are addressed and science-based R&I roadmaps for multi-level climate governance supporting local adaptation assessments and plans are delivered.

#### Who is invited to participate?

All interested and relevant stakeholders come from government, local authorities, research & academia, industry, NGO and civil society.

#### What is the degree of privacy and confidentiality of the information provided?

All information provided will be kept confidential and private. No personal details (such as name, email, or IP address) will be collected or shared when reporting on the outcomes of stakeholder meetings. If CARMINE shares work or articles from a stakeholder, proper credit will be given. For public events organized by CARMINE, such as webinars, workshops, or conferences, the participant list may be shared with fellow participants to facilitate collaboration. However, any participant can request to be removed from these lists.



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#### **What happens to my personal data?**

All information provided (name, email, IP address, phone, etc) is kept confidential by encryption that turns all data into an unreadable format and only authorised persons from the project can decrypt the data and read it. Besides, all qualitative and quantitative data collected through surveys will not be assigned at the level of the interviewed person.

#### **What happens if I reconsider my participation in the CARMINE project?**

If you decide that you no longer want to participate in the project, you can stop the involvement at any time without suffering adverse consequences of any kind.

#### **Does my agreement have an expiration date?**

This agreement to disclose personal data expires in 2028 when the mandatory monitoring period for the project expires.

#### **Is there any risk to participating in the CARMINE project?**

No, there are no known or likely risks. In the unlikely event that any issues arise, you have the option to withdraw your participation and submit your concerns to the project management team.

#### **Who reviewed and approved the CARMINE approach?**

The CARMINE approach was reviewed and approved by the General Assembly, Scientific Advisory Board and an external independent Ethics Advisor.

#### **Can I ask additional questions?**

Please reach out to us if you have any questions or would like more information, by contacting us at the following address:

[contact@carmine-project.eu](mailto:contact@carmine-project.eu)



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Thank you for taking the time to read this information. We hope you will join us in this important journey to make our cities more resilient to climate change.

Your participation is essential, Let's work together to create a better, more sustainable future!

- ☐ I confirm that I have read and understood the information sheet for the CARMINE project. I had a chance to analyse the information, ask questions and get satisfactory answers to them.
- ☐ I understand that my participation is voluntary, and that I am free to withdraw at any time without giving any reason
- ☐ I agree with using and disclosing personal data in compliance with the current GDPR regulations. I have received a signed copy of this form.
- ☐ I agree to be engaged in the CARMINE project.

**Participant name**

**Affiliation / Institution name**

**E-mail address**

**Date and signature**



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