RESCUE ME

RESILIENT CULTURAL LANDSCAPES

D3.1 TECHNICAL SPECIFICATIONS AND DATA MAPPING.

AUTHORS

Maria Luisa Quarta

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Deliverable No.	D3.1
Work Package	WP3
Dissemination Level	PU
Author(s)	SISTEMA (Maria Luisa Quarta)
Co-author(s)	SISTEMA (Marco Folegani), FhG (Daniel Lückerath, Katharina Milde), DRAXIS (Artemis Lavasa), LINKS (Fabio Caffaro, Mario Chiesa, Marina Nadalin, Federico Oldani, Angelica Urbanelli) TEC (Asel Villanueva, Pedro Gonzalez Bascoy, Iñigo Martinez Criado)
Contributor(s)	UNIBO (Simona Bravaglieri)
Due date	31 July 2024
Actual submission date	16 July 2024
Status	Submitted
Revision	Version 1.0
Reviewed by (if applicable)	CMCC (Dana Salpina), ICLEI (Gioele Racca)

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Summary

The present document describes the technical specifications of the different digital solutions (tools) being developed in the RescueME project within WP3 to facilitate landscape managers activities in assessment of resilience and risk, well-being of their communities and safeguarding cultural heritage.
Following a brief general description of each solution and its basic functions, this deliverable comprises mostly questions about the architecture of each tool and how they can interoperate with other tools and services, technical requirements, and functionalities. Each partner responsible for developing a tool during the project's lifetime has been invited to contribute to the document through filling out a template on technical specifications.
This document also includes the methodology adopted to describe the different datasets through the Data Mapping Form (DMF) implemented within ST3.1.3. By collecting standardised data descriptions (metadata), the DMF represents one of the first concrete measures that have been put in place within the project, not only to ensure that the FAIR principles (Findability, Accessibility, Interoperability, Reusability) [1] are applied but also to allow the evolution from data to useful information (indicators). Thanks to the DMF, both existing and newly generated data are made easily accessible, thus fostering inclusivity and collaboration, also outside the project.
Moreover, the present deliverable highlights the connection between WP1 (Assessment and monitoring of heritage values and resilience) and WP3 (Data Management and digital solutions) activities by describing the methodology used to match the datasets described in the DMF and the list of indicators identified within Task 1.1 (Structure of the model & indicators and metrics for characterisation of European CL, hazards and climate scenarios). The Actionable Resilient Historic Landscape (RHL) framework designed within this task works as a metric system for

measuring resilience across different Cultural Landscapes (see D1.1 - Actionable Resilient Historic Landscape Framework [2]).
Given that indicators have been developed with both European and local levels in mind, the present document includes both the data mapping for the ATLAS and the preliminary list of data selected at local scale by each of the five RescueME case studies (so called R-Labscapes: Portovenere, Cinque Terre & the Island, Historical Irrigation System at l'Horta de València, Hamburg – Neuwerk in the National Park Hamburg Wadden Sea, Psiloritis UNESCO Global geopark, Defensive system of Zadar). In addition, a description of the data newly generated by some of the RescueME tools is provided.
During the next phases of the project, the WP1 will be focused on the definition of the different impact models for the R-Labscapes considering the specific hazards which characterise them and designing the final list of indicators. For this reason, the above-mentioned datasets/indicators matching represents just the groundwork to set the design and requirements for the implementation of the different solutions.

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List of acronyms

ACRONYM / ABBREVIATION	DESCRIPTION
AI	Artificial Intelligence
AoI	Area of Interest
AR	Augmented Reality
BERT	Bidirectional Encoder Representations from Transformers
CAMS	Copernicus Atmosphere Monitoring Service
CDS	Copernicus Climate Data Store
CEMS	Copernicus Emergency Management Service
CH	Cultural Heritage
CIG	Crowdsourcing Intelligent Gateway
CL	Cultural Landscape
CLMS	Copernicus Land Monitoring Service
CoP	Community of Practice
DMF	Data Mapping Form
EEA	European Environment Agency
GAIA	Geodata Analytics and Intelligent Architecture
GDIP	Geospatial Data Intelligent Platform
GLOCAL	Both Global and Local
GPL	General Public License
GUF	Global Urban Footprint
IoT	Internet of Things
ISDSS	Incremental Spatial Decision Support System
JRC	Joint Research Centre
LLM	Large Language Models
MMLU	Massive Multitask Language Understanding
N/A	Not Applicable
NDSI	Normalized Snow Cover Index
NDWI	Normalized Water Index
NLP	Natural Language Processing
NUTS	Nomenclature of Territorial Units for Statistics
OGC	Open Geospatial Consortium
OSM	Open Street Map
RACER	Relevant, Accepted, Credible, Easy and Robust
RHL	Resilient Historic Landscape
SETS	Socio-economic-technical systems

SOUV	Statements of Outstanding Universal Value
SPA	Single Page Application
VR	Virtual Reality
WHL	World Heritage List
WP	Work Package

1 Introduction

RescueME aims to demonstrate how an innovative data-driven, community-based, heritage-centric actionable landscape approach to resilience enhancement can protect our cultural heritage and landscapes while supporting the transition toward a green society and economy that sustains resilient, cohesive, nature-connected communities. RescueME will develop, test, and demonstrate the effectiveness of an Actionable Framework based on the Resilient Historical Landscape approach (RHL) complemented by data, models, methods, and tools. The project will assess risks and opportunities, co-develop inclusive and just resilience strategies, and innovative solutions to protect European Cultural Heritage (CH) and Cultural Landscapes (CL) from climate change, disaster risk, as well as other stressors (such as pollution and over-tourism) with special focus on European coastal landscapes.

Within this project, the WP3 (Data Management and Digital Solutions) aims to deliver a set of advanced digital solutions, easily accessible through a single application portal (T3.4 - RescueME One-Stop Shop). The design and development of all the foreseen digital solutions follow a user-centred approach, based on a common set of definitions (T3.1 – Technical Specifications and Data Preparation), including a comprehensive multi-scale data model that will both adhere to the conceptual framework developed in WP1 (Assessment and Monitoring of Heritage Values and Resilience). The user-centred approach takes advantage of a series of workshops (both in-presence during kick-off and general assembly events, and online as within Community Meetups event series or organized on purpose) to elicit user wants and needs, scenarios and specific R-Labscapes' conditions, like main focus, hazards, existing initiatives, data, etc. The workshops so far organised, as well as the future ones, take the forms of brainstorming sessions, 1-to-1 sessions, interviews, and other creative sessions involving UI elements mock-ups, concept and conditions clustering and prioritization, and more. Other valuable inputs come from other WPs and tasks outputs, like from the ones focused on the design and development of the ATLAS and on the definition of the Impact Chains, and from the overall knowledge developed within the Consortium and during all the different activities.

The digital solutions will include a geospatial and interoperable Data Lake, a Geospatial Data Intelligent Platform for heterogeneous data aggregation, processing, and visualization, and a set of Artificial Intelligence (AI) -based tools and solutions. An Incremental Spatial Decision Support System (ISDSS) will be designed and developed to increase the resilience of CH/CL leveraging the outputs of WP1 (decision-making pathways) and WP2 (Meta-repository of solutions).

The implemented tools and solutions will be trialled via the RescueME R-Labscapes to reach out different types of local communities (citizen scientists, researchers, policy makers, CH practitioners ...). Moreover, the European Community of Practice (CoP) set up in the context

of WP4 (T4.6) will work as group of early adopters of the RescueME research outputs, including, for some of them, the tools and solutions implemented within WP3.

1.1 Aims and objectives

Overall, this document aims to serve as a comprehensive reference for all partners involved in the development, implementation, and operation of the RescueME digital solutions, guiding them through the entire lifecycle of the project from conception to deployment and beyond. To do so, the present deliverable includes:

- **Technical Specifications**: detailing the technical requirements and specifications for the digital solutions being implemented (including hardware, software, networking, and any other technical components necessary for the solution).
- **Data Mapping**: describing how data flows within the digital solution, including its sources, destinations, formats, transformations, and any data mapping required between different systems or components.
- **Interoperability**: ensuring that the digital solutions can interoperate with existing systems or external services as needed and specifying any interfaces or integration points required.
- **Functional Requirements**: outlining the functional capabilities and features of the digital solutions, including user interfaces, workflows, and any other user interactions.
- **Performance requirements**: defining performance metrics and expectations for the digital solutions, such as response times, throughput, scalability, and reliability.
- **Security considerations**: addressing security requirements and considerations for the digital solutions, including authentication, authorization, encryption, data protection, and compliance with relevant regulations or standards.
- **Deployment and operations**: providing guidance for deploying, configuring, monitoring, and maintaining digital solutions in production environments, including any necessary documentation, training, and support procedures.

1.2 Relation with other project activities

Within the framework of the RescueME project, WP3 serves as a cornerstone, intimately linked with other work packages (WPs).
In particular, the following WPs are directly connected to the WP3 activities:

- **WP1 - Assessment and monitoring of heritage values and resilience**: the indicators identified within this WP to characterise the heritage diversity of CLs will be calculated starting from the data described in the Data mapping Form (DMF) and then they will be made available through the different solutions and tools implemented

within WP3. Moreover, several WP1 tasks are directly or indirectly connected to the data described in this deliverable:

  - **Task 1.1** (Structure of the model & indicators and metrics for characterisation of European CL, hazards and climate scenarios).
  - **Task 1.2** (ATLAS of European coastal heritage landscapes typologies and climate change impacts).
  - **Task 1.3** (Multiscale risk and resilience assessment of coastal CL).
  - **Task 1.5** (Transformative pathways monitoring).
- **WP2 - Transformative resilience strategies**: the Meta-repository implemented by this WP represents one of the innovative solutions that RescueME aims at developing.
- **WP4 - Co-creation of local solutions with communities**: the R-Labscapes, which are directly involved in this WP, are the main beneficiaries of the tools and solutions implemented. Starting from the indicators identified in Task 1.1, the following task provides a resilience baseline for each R-labscape:
  - **Task 4.2** (Co-creation of resilience baseline and Impact Chains), which aims to present the current status in the R-Labscapes regarding resilience and (climate) hazards and represents the views and experiences of the stakeholders involved. The results of this task provide a starting point for the co-creation of solutions, measures, and resilience strategies later in the project.
- **WP6 - Project Management**: as part of the creation of the necessary governance structure for effective project direction and management, this WP delivers the Data Management Plan (D6.3) which aims at ensuring quality, (re)usability, and preservation of the project's data, and its valorisation.

1.3 Report structure

The present deliverable includes:

- **Section 1 – Introduction**, which includes aims and objectives of the document, relation with other project activities and description of the document structure.
- **Section 2 – Digital Solutions Technical Specifications**, which delves into the technical aspects of the proposed digital solutions for enhancing the resilience of cultural and natural heritage sites. It outlines the architecture, functionalities, and key features of the solutions, starting from the preliminary analysis performed through the internal deliverables from ST3.1.1 and ST3.1.2.
- **Section 3 – Data Model Technical Specifications**, which details the structure, relationships, and attributes of the data model designed to support the resilience solutions. It discusses the methodologies used in data modelling and highlights the importance of data interoperability and scalability.

- **Section 4 – Datasets Categorization and Description**, which provides an in-depth analysis of the datasets utilised in the project. It categorises the datasets based on their relevance to cultural and natural heritage resilience and provides detailed descriptions of each dataset. Additionally, it discusses data sources, collection methods, and quality assurance processes.
- **Section 5 - Natural Language Processing (NLP) for Local Knowledge**, which focuses on identified data sources of local knowledge (WP4) to identify innovative ways to characterise heritage values.
- **Section 6 – Conclusions**

2 Digital Solutions Technical Specifications

RescueME extends the architecture implemented in the SHELTER [3], I-REACT [4] and ResCult [5] projects to allow the ingestion and the processing of heterogeneous data sources (e.g., earth observation, sensors, and user-generated content) that will be integrated into a Big Data management platform considering relevant technologies and concepts, data management principles (e.g. FAIR [1], GEO data sharing principles [6]), standards (e.g. INSPIRE [7]), and policies (e.g. GDPR)). Figure 1 shows the RescueME high-level architecture schema which includes the different solutions described in the present deliverable and their interconnections.

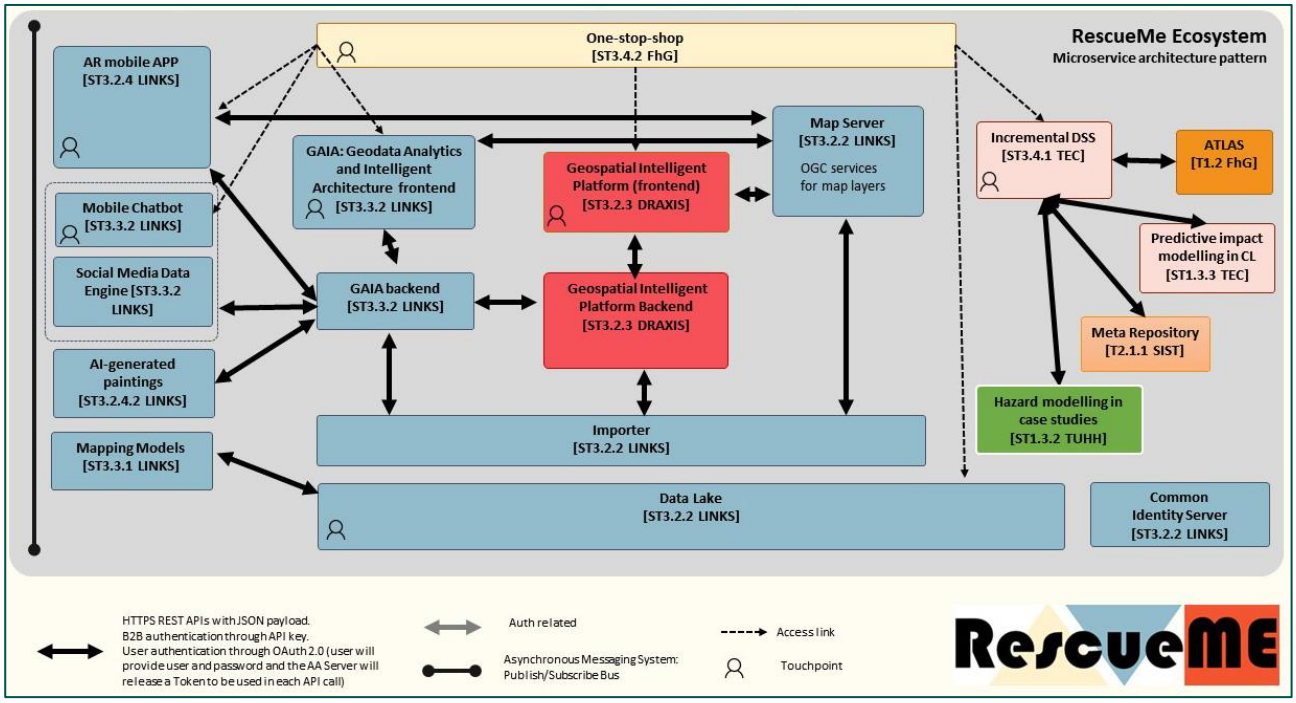


Figure 1 - RescueME high-level architecture schema

New AI algorithms will be trained and used to automatically classify social media posts according to a specific CH characterization taxonomy, separate informative from non-informative content, exploit Copernicus data to delineate the impact area of floods, landslides, and wildfires, and estimate their impact on the CH and landscape. The social media intelligence in RescueME will be built upon existing tools and AI models developed and evaluated in previous H2020 projects (e.g. SHELTER). Moreover, a Chatbot will be created to provide emergency management functionalities to practitioners, including first

responders, while providing risk educational content to improve citizen awareness. The Chatbot will be used as a crowdsourcing solution to gather and validate data, and to provide additional channels to inform and prepare people. To integrate the outputs of AI models, as well as risk assessments on the CLs, a web-based geospatial platform will be developed. It will allow further data processing and visualization, considering the needs and gaps that will emerge from the project case studies. In a selected case, an Augmented Reality (AR) application will be realised to provide a more immersive data visualisation experience.
An Incremental Spatial Decision Support System (ISDSS) for the design and monitoring o Transformative Pathways will be developed implementing different levels of decision making with different levels of information and technical requirements. The entry point will be the ATLAS of impacts linking CL typologies with the Meta-repository of solutions to offer early-stage decision making (see Figure 2).

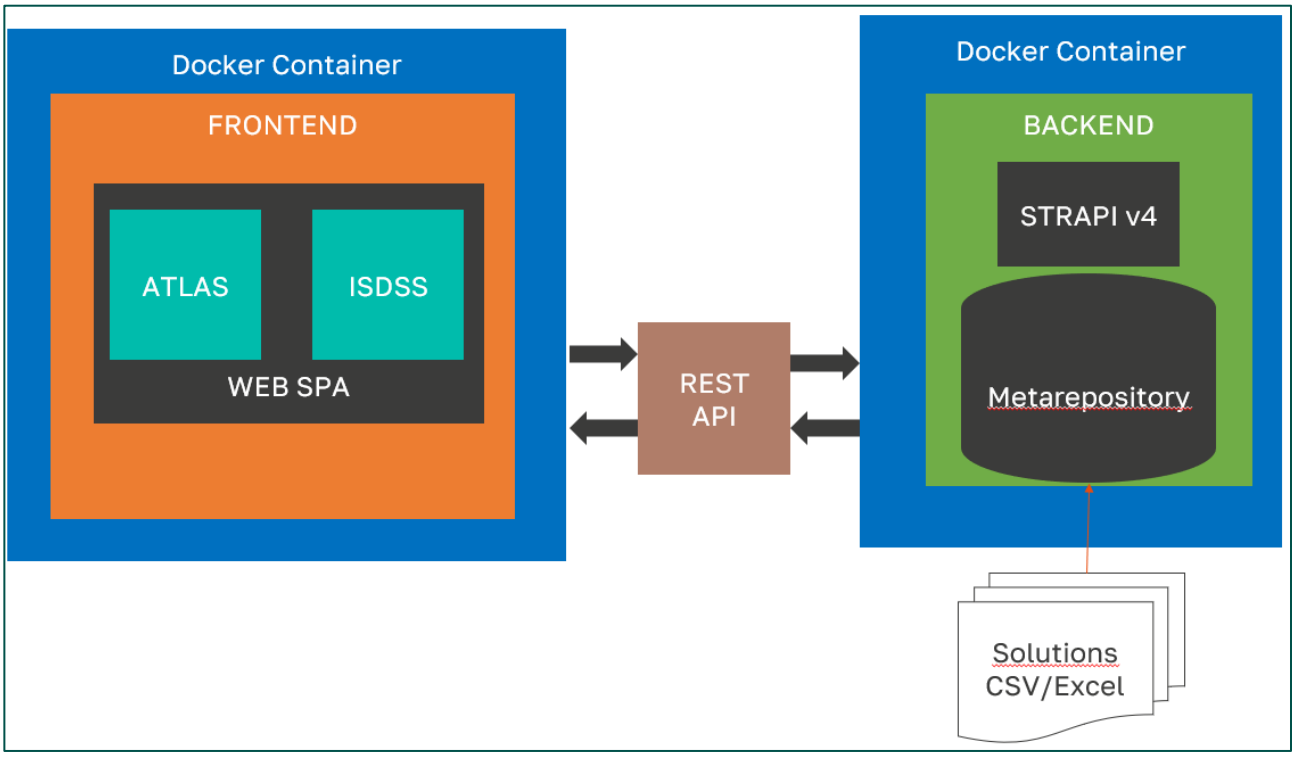


Figure 2 - RescueME ATLAS/ISDSS/Meta-repository interconnection

2.1 Introduction

The goal of this document is to produce technical descriptions of the digital solutions (tools) being developed in the RescueME project. The approach for achieving this goal was to invite each partner responsible for developing a tool during the project's lifetime to contribute to the document through filling out a template on technical specifications, requirements, and (preliminary) functionalities.

More specifically, the tools in question include the following (ordered by task):

RescueMe TOOLS				
No.	Tool or solution	WP, task and partner responsible	Identifier	Due
0	ATLAS	WP1 – T1.2 TEC	TL00_TEC-A	M12
1	Meta-repository	WP2 – T2.1 – ST2.1.1 SIST	TL01_SIST-A	M24
2	Data lake	WP3 - T3.2 - ST3.2.2 LINKS	TL02_LINKS-A	M18
3	Importer & Mapper	WP3 - T3.2 - ST3.2.2 LINKS	TL03_LINKS-B	M18
4	Web Application/ Frontend	WP3 - T3.2 - ST3.2.2 LINKS	TL04_LINKS-C	M18
5	Geospatial data intelligent platform	WP3 - T3.2 - ST3.2.3 DRAXIS	TL05_DRAXIS-A	M30
6	Generative AI	WP3 - T3.2 - ST3.2.4 LINKS	TL06_LINKS-D	M30
7	AR Mobile Application	WP3 - T3.2 - ST3.2.4 LINKS	TL07_LINKS-E	M30
8	Mapping Models	WP3 - T3.3 - ST3.3.1 LINKS	TL08_LINKS-F	M24
9	Mobile chatbot	WP3 - T3.3 - ST3.3.2 LINKS	TL09_LINKS-G	M24
10	Social Media module	WP3 - T3.3 - ST3.3.2 LINKS	TL10_LINKS-H	M24
11	Incremental Spatial Decision Support System (ISDSS)	WP3 – T3.4 - ST3.4.1 TEC	TL11_TEC-B	M34
12	One-stop-shop	WP3 – T3.4 - ST3.4.2 FhG	TL12_FHG-A	M34

Table 1 - RescueME tools and solutions

Figure 3 summarizes the different solutions by mapping them towards some relevant steps of the data value chain:

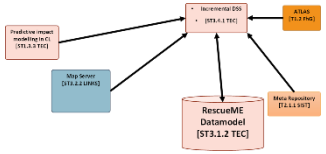
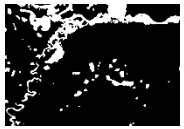
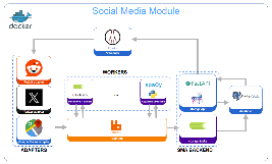
Data narration Users can get introduced to concepts, data, best practices, guidelines, etc. and can be accompanied into tackling typical tasks and processes, to achieve the knowledge they need through proper data and tools	 One-Stop-Shop
Data interaction Users can interact directly with the available content, data and tools, taking advantage of existing approaches or innovate them through iterative explorations	 Geoportal  ISDSS / ATLAS / Meta-repository  AR Application
Data elaboration These tools create and add new content and data, starting and elaborating on existing ones	 Mapping models  AI-generated images Social Media Module assets characterization
Data sources These tools made available existing or newly created content and data	Copernicus / In-situ data integration  Data Lake  Chatbot  Social Media Module content extraction

Figure 3 - Categorization of the RescueME solutions with respect to the data value chain.

Some of the information provided might only be provisional or not available; the intention is that information is continuously refined as development progresses, and in consultation with the project's R-Labscapes and their wider community, especially in terms of their functionality to directly inform the development of the tools.

2.2 ATLAS

The RescueME ATLAS is a web tool whose objective is to visualise context information at the European level. In the RescueME project, local heritage data has been collected and hazards have been modelled. Thanks to these two points, predictive impact modelling is being developed. As a result of the predictive impact modelling and cross-referencing it with the context information that has been collected for Europe at the NUTS3 level, the ATLAS allows to visualise the project regions of Europe at the NUTS3 level, with associated context information (human capital, build capital...) and also the calculated risk information (Air quality, droughts, heatwaves, landslides, pluvial floods, river floods and wildfires). In Figure 4 the workflow for generating the indicators is shown:

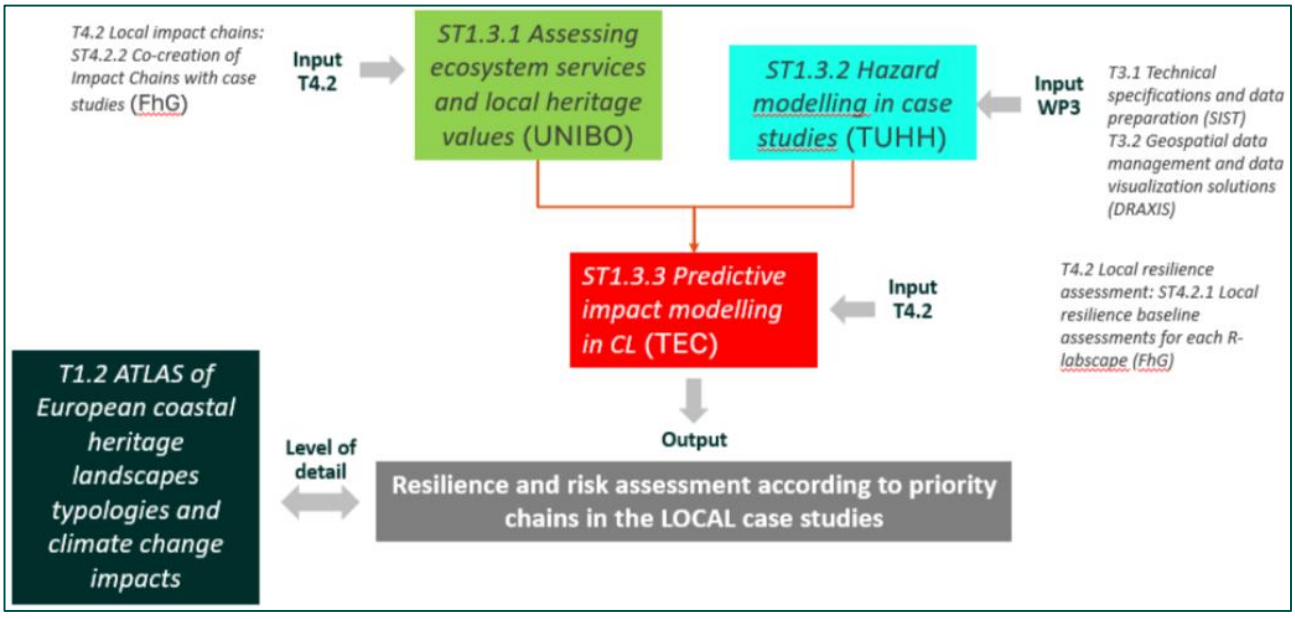


Figure 4 – ATLAS indicators' generation workflow

This tool also has a user-friendly interface, which allows the user to navigate, change maps or even show information about how these indicators have been calculated and displayed. Additionally, by clicking on any of the regions on the map it is possible to see more details of the information associated with the indicator that is loaded at that moment.
The RescueME Atlas can be accessed through the following link:
https://appwerescuemep01.azurewebsites.net/

The ATLAS allows the user to perform a comparison of all the coastal areas of Europe at the NUTS3 level, this supports the user in selecting the region of interest when launching the ISDSS. The ISDSS then allows the user to reach a higher level of precision (municipal, cadastral, or building level, depending on the case).
Figure 5 shows the ATLAS landing page while Table 2 summarises its technical specifications. More details about the activities performed to implement the ATLAS, the methods of analysis and the achieved results are available in D1.2 - Atlas of EU Coastal Heritage Landscape Typologies and CC Impacts [8].

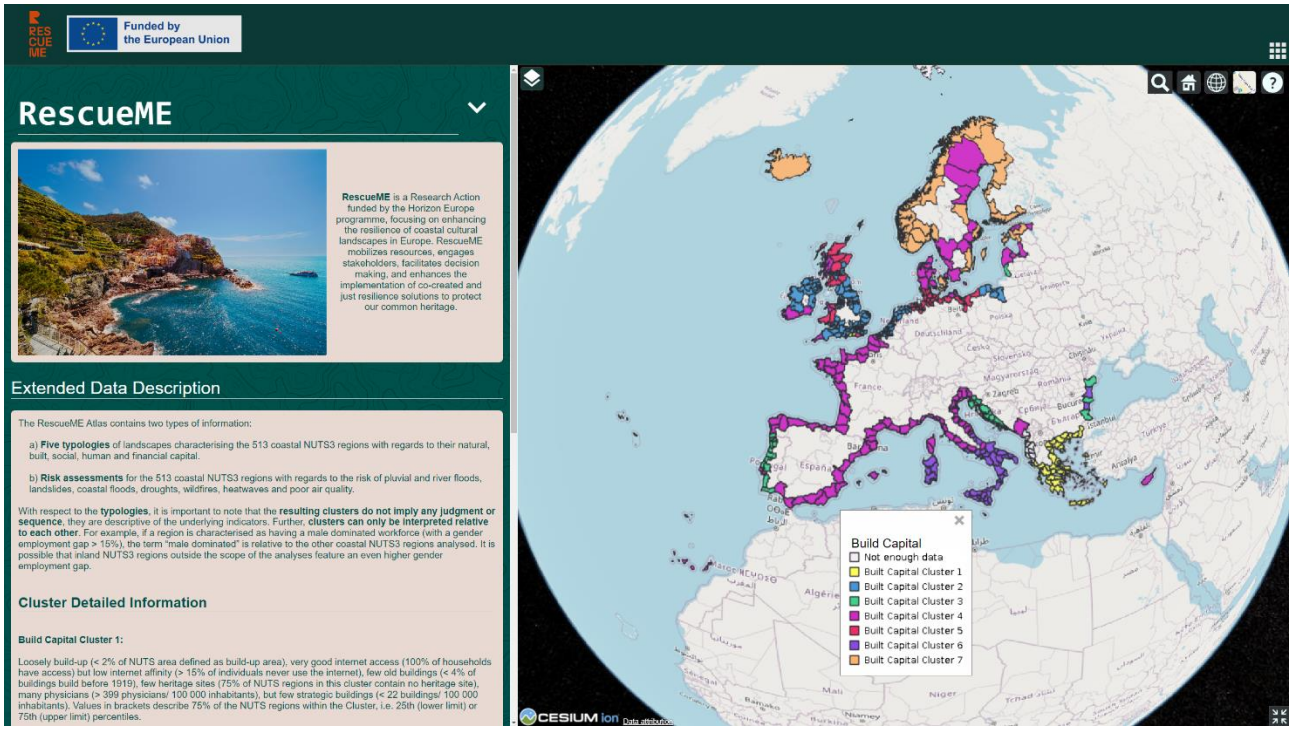


Figure 5 - Landing page of the RescueME ATLAS

SOLUTION	ATLAS
ID	**TL00_TEC-A**
Type of the solution	Software Component
Solution description	The RescueME ATLAS is a web application, accessible from https://appwerescuemep01.azurewebsites.net/. The application screen is divided into two parts, with the project information on the left side and a 3D globe showing the maps associated with the indicators on the left side. The user can interact with the calculated indicators, retrieving detailed information about them. The map is also interactive, showing a legend and allowing the user to

	access further information on the parameters and their description by clicking on the different polygons.
WP	WP1
Task	T1.2
Responsible	Amaia Lopez de Aguileta (TECNALIA)
Description	
Functional Description	**TECNALIA_ATLAS_001** Map Visualisation: the ATLAS should have the ability to visualise different maps from geoserver. **TECNALIA_ATLAS_002** Interactive Maps: the maps should be interactive, allowing the user to visualise more information or to change the queries. **TECNALIA_ATLAS_003** Context Information: the ATLAS should provide context information about the indicators visualised.
Technical Description	**Map Visualization**: Map visualisation could be achieved thanks to the integration of Cesium.js for loading maps from different sources, in this case geoserver is the selected one. **Interactive Maps**: To ensure that the user can retrieve the required data, custom click event will be developed, showing the information of the RescueME project. **Context Information**: To help the users to understand the results showed in the ATLAS, the information about the project and the indicators will be displayed in a lateral panel.
Input	Precalculated information and risk maps (via geoserver)
Output	Web visualisation
Version	1.0
License / Terms of use / SLA	CityMirror Viewer (registered) CityMirror (registered)
Online documentation	A link will be provided when available
Programming Language	Javascript
Usage description	
Frequency of use	Solution will be deployed in a server and will be available during the duration of the project.
Execution time	The application response will be real-time.
System requirements	CPU with 2.4 GHz 4GB RAM GPU desirable but not mandatory

Interoperability aspects	
Related data models	Geoserver, Shape
Information exchange protocol	REST API
Available API	A link will be provided when available.
Integration aspects	
Installation requirements	Solution will be provided as a docker container, it can be deployed in any server with docker.
Integration requirements	N/A
Software dependencies	N/A
Technical dependencies	N/A
Deployment requirements	N/A
Example of existing integration	N/A
Critical factors for the integration	N/A
Connection to other tools	Predictive impact modelling, Importer & Mapper, ISDSS
Other information	-
Security aspects	
Security issues to be covered	N/A
Integrated security solution	N/A
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	N/A
Standards used	N/A

Table 2 - Technical specifications of the RescueME ATLAS

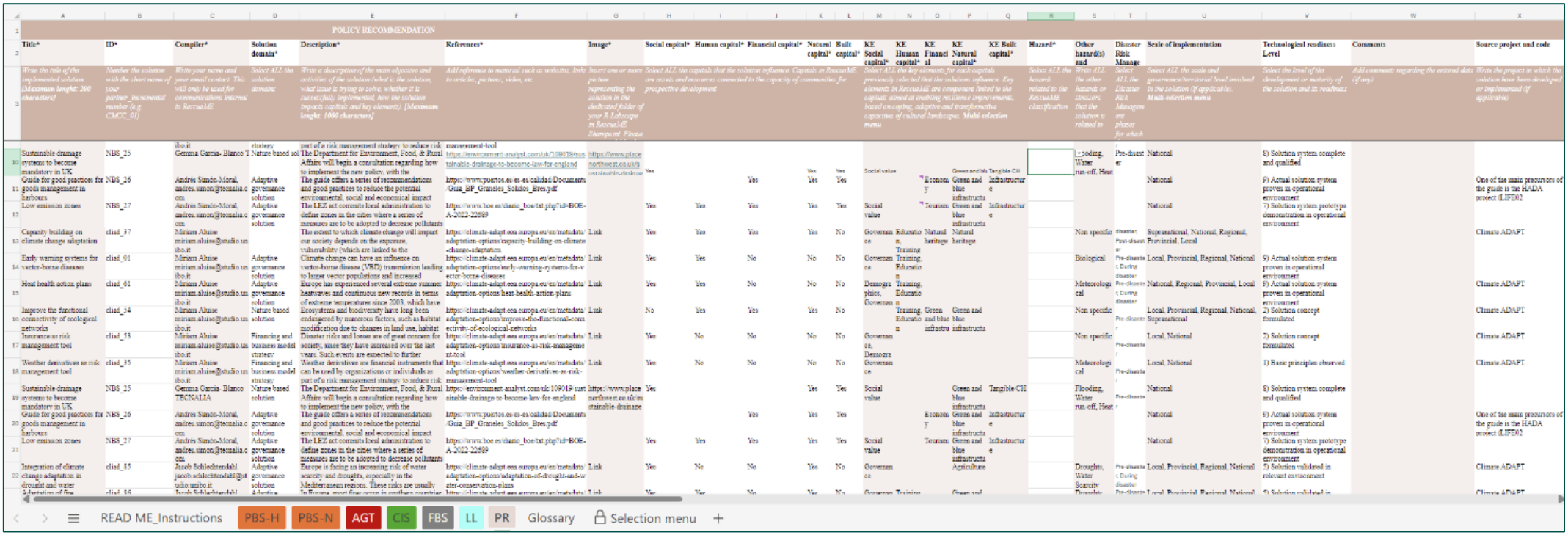
2.3 Meta-repository

The main objective of the Meta-repository (implemented within Task 2.1 - Meta-repository of resilience solutions for CL) is to offer the R-Labscapes and decision makers an integrated searchable database of solutions characterised by their effectiveness in improving CL resilience. A decision-making method will group the collected solutions into packages and monitoring indicators, and it will be implemented in the multi-level dynamic ISDSS and

monitoring platform, thanks to the RescueME Data Model (see Section 3 for more details). This will link the Meta-repository, the collected best practices, and the maps of policies to support the definition of pathways working with different levels of information using the ATLAS of coastal landscapes (TL00_TEC-A) as entry point (see Figure 2).

To facilitate the extraction of solutions from existing projects (ARCH [9], SHELTER [3], RURITAGE [10]), SISTEMA has implemented a Python script (one per solution type per existing database) which automatically fetches the needed information according to a look-up table designed by UNIBO.

Figure 6 shows the final output after all the intermediate outputs (one per project per solution type) have been merged into a unique excel file:



Title*	ID*	Compiler*	Solution domain*	Description*	References*	Image*	Social capital*	Human capital*	Financial capital*	Natural capital*	Built capital*	KE Social capital*	KE Human capital*	KE Financial	KE Natural capital*	KE Built capital*	Hazard*	Other hazard(s) and	Disaster Risk Manage	Scale of implementation	Technological readiness Level	Comments	Source project and code
Write the title of the implemented solution [Maximum lenght: 200 characters]	*Number the solution with the short name of your partner_incremental number (e.g. CMCC_01)*	*Write your name and your email contact. This will only be used for communication purposes between partners and RescueME*	*Select ALL the solution domains*	*Write a description of the main objective and activities of the solution (what is the solution, what issue is trying to solve, whether it is successfully implemented, how the solution impacts capitals and key elements). [Maximum lenght: 1000 characters]*	*Add reference to material such as websites, links to articles, pictures, videos, etc.*	*Insert one or more picture representing the solution in the dedicated folder of your R Labscape in RescueME Sharepoint. Please*	*Select ALL the capitals that the solution influence. Capitals in RescueME are assets and resources connected to the capacity of communities for prospective development*					*Select ALL the key elements for each capitals previously selected that the solutions influence. Key elements in RescueME are component linked to the capital: aimed at enabling resilience improvement, based on coping, adaptive and transformative capacities of cultural landscapes. Multi selection menu*					*Select ALL the hazards related to the RescueME classification*	*Write ALL the other hazards or disasters that the solution is related to*	*Select ALL the Disaster Risk Managem ent phases for which*	*Select ALL the scale and governance/territorial level involved in the solution (if applicable). Multi-selection menu*	*Select the level of the development or maturity of the solution and its readiness*	*Add comments regarding the entered data (if any)*	*Write the project in which the solution have been developed or implemented (if applicable)*
Sustainable drainage systems to become mandatory in UK	NBS_25	Gemma Garcia- Blanco T tbo.it	Nature based sol strategy	The Department for Environment, Food, & Rural Affairs will begin a consultation regarding how to implement the new policy, with the	https://environment-analyst.com/uk/108038/sustainable-drainage-to-become-law-for-england	https://www.placenorthwest.co.uk/s	Yes			Yes	Yes	Social value			Green and blu	Tangible Cit		Flooding, Water run-off, Heat	Pre-disast er	National	8) Solution system complete and qualified		
Guide for good practices for goods management in harbours	NBS_26	Andrés Simón-Moral, andres.simon@tecnalia.com	Adaptive governance solution	The guide offers a series of recommendations and good practices to reduce the potential environmental, social and economical impact	https://www.puertos.es/es-es/calidad/Documents/Guia_BP_Graneles_Solidos_Bres.pdf				Yes	Yes	Yes			Economy	Green and blue infrastructure	Infrastructure				National	9) Actual solution system proven in operational environment		One of the main precursors of the guide is the HADA project (LIFE02
Low emission zones	NBS_27	Andrés Simón-Moral, andres.simon@tecnalia.com	Adaptive governance solution	The LEZ act commits local administration to define zones in the cities where a series of measures are to be adopted to decrease pollutants	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2022-22689		Yes	Yes	Yes	Yes	Yes	Social value			Tourism	Green and blue infrastructure	Infrastructure				National	7) Solution system prototype demonstration in operational environment		
Capacity building on climate change adaptation	clisd_37	Miriam Altaise miriam.altaise@studio.unibo.it		The extent to which climate change will impact our society depends on the exposure, vulnerability (which are linked to the	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/capacity-building-on-climate-change-adaptation	Link	Yes	Yes	Yes	Yes	No	Governance	Education, Training	Natural heritage	Natural heritage			Non specific	disaster; Post-disast er	Supranational, National, Regional, Provincial, Local				Climate ADAPT
Early warning systems for vector-borne diseases	clisd_01	Miriam Altaise miriam.altaise@studio.unibo.it	Adaptive governance solution	Climate change can have an influence on vector-borne disease (VBD) transmission leading to larger vector populations and increased	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/early-warning-systems-for-vector-borne-diseases	Link	Yes	Yes	No	No	No	Governance	Training, Education					Biological	Pre-disaste r; During disaster	Local, Provincial, Regional, National	9) Actual solution system proven in operational environment			
Heat health action plans	clisd_01	Miriam Altaise miriam.altaise@studio.unibo.it	Adaptive governance solution	Europe has experienced several extreme summer heatwaves and continuous new records in terms of extreme temperatures since 2003, which have	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/heat-health-action-plans	Link	Yes	Yes	No	No	No	Demographics, Governance	Training, Education					Meteorological	Pre-disaste r; During disaster	National, Regional, Provincial, Local	9) Actual solution system proven in operational environment			Climate ADAPT
Improve the functional connectivity of ecological networks	clisd_24	Miriam Altaise miriam.altaise@studio.unibo.it	Nature based solution	Ecosystems and biodiversity have long been endangered by numerous factors, such as habitat modification due to changes in land use, habitat	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/improve-the-functional-connectivity-of-ecological-networks	Link	No	Yes	Yes	Yes	No		Training, Education	Green and blue infrastru	Green and blue infrastructure			Non specific	Pre-disaste r	Local, Provincial, Regional, National, Supranational	2) Solution concept formulated			Climate ADAPT
Insurance as risk management tool	clisd_53	Miriam Altaise miriam.altaise@studio.unibo.it	Financing and business model strategy	Disaster risks and losses are of great concern for society, since they have increased over the last years. Such events are expected to further	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/insurance-as-risk-management-tool	Link	Yes	No	No	No	No	Governance, Demozra						Non specific	Pre-disaste r	Local, National	2) Solution concept formulated			Climate ADAPT
Weather derivatives as risk management tool	clisd_35	Miriam Altaise miriam.altaise@studio.unibo.it	Financing and business model strategy	Weather derivatives are financial instruments that can be used by organizations or individuals as part of a risk management strategy to reduce risk	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/weather-derivatives-as-risk-management-tool	Link	Yes	No	No	No	No	Governance						Meteorological	Pre-disaste r	Local, National	1) Basic principles observed			Climate ADAPT
Sustainable drainage systems to become mandatory in UK	NBS_25	Gemma Garcia- Blanco TECNALIA	Nature based solution	The Department for Environment, Food, & Rural Affairs will begin a consultation regarding how to implement the new policy, with the	https://environment-analyst.com/uk/109019-sustainable-drainage-to-become-law-for-england	https://www.placenorthwest.co.uk/s	Yes			Yes	Yes	Social value			Green and blue infrastructure	Tangible Cit		Flooding, Water run-off, Heat	Pre-disaste r	National	8) Solution system complete and qualified		
Guide for good practices for goods management in harbours	NBS_26	Andrés Simón-Moral, andres.simon@tecnalia.com	Adaptive governance solution	The guide offers a series of recommendations and good practices to reduce the potential environmental, social and economical impact	https://www.puertos.es/es-es/calidad/Documents/Guia_BP_Graneles_Solidos_Bres.pdf				Yes	Yes	Yes			Economy	Green and blue infrastructure	Infrastructure				National	9) Actual solution system proven in operational environment		One of the main precursors of the guide is the HADA project (LIFE02
Low emission zones	NBS_27	Andrés Simón-Moral, andres.simon@tecnalia.com	Adaptive governance solution	The LEZ act commits local administration to define zones in the cities where a series of measures are to be adopted to decrease pollutants	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2022-22689		Yes	Yes	Yes	Yes	Yes	Social value			Tourism	Green and blue infrastructure	Infrastructure				National	7) Solution system prototype demonstration in operational environment		
Integration of climate change adaptation in drought and water	clisd_85	Jacob Schlechtendahl jacob.schlechtendahl@studio.unibo.it	Adaptive governance solution	Europe is facing an increasing risk of water scarcity and droughts, especially in the Mediterranean regions. These risks are usually	https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/adaptation-of-drought-and-water-conservation-plans	Link	Yes	No	No	Yes	No	Governance			Agriculture			Droughts, Water Scarcity	Pre-disaste r; During disaster	Local, Provincial, Regional, National	5) Solution validated in relevant environment			Climate ADAPT
Adaptation of fire	clisd_86	Jacob Schlechtendahl	Adaptive	In Europe, most fires occur in southern countries	https://climate-adapt.eea.europa.eu/en/metadata/	Link	Yes	Yes	No	Yes	No	Governance	Training		Green and			Droughts	Pre-disaste	Local, Provincial, Regional, National	5) Solution validated in			Climate ADAPT

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Figure 6 - RescueME Meta-repository of solutions

More details about the methodology for the extraction of existing solutions will be provided by M24 through a technical report which will be released by UNIBO together with the Meta-repository tool itself (D2.1 - RescueME resilience Meta-repository).
Table 3 summarises the technical specifications of the Meta-repository:

SOLUTION	META-REPOSITORY
ID	**TL01_SIST-A**
Type of the solution	Software component
Solution description	Searchable data base of resilience solutions characterised by their effectivity in improving the resilience of CL and their carbon footprint, including innovative solutions for resilience financing, inclusion of CCSIs, and adaptive governance models.
WP	WP2
Task	T2.1 – ST2.1.1
Responsible	Marco Folegani
Description	
Functional Description	**SIST_META-REP_001** Metadata Management: The Meta-repository provides metadata management compliant with the FAIR principles to help users discover, share, and use the different resilience solutions identified from previous research projects. Metadata management includes the ability to create metadata records, add keywords and tags, and to link the Meta-repository to the ISDSS **[TL11_TEC-B]**.
Technical Description	Catalogue of solutions from previous research projects to be accessed by the ISDSS in the form of Excel file.
Input	Contents of previous research projects mostly in the form of Excel file.
Output	Excel file
Version	-
License / Terms of use / SLA	License inherited from the previous research projects.
Online documentation	The script implemented to automate the solutions extraction from existing projects will be shared by M24 by UNIBO through a technical report.
Programming Language	Python (format: Jupyter Notebooks and python scripts; libraries: re, pandas, numpy, csv; main data structures: dictionaries, lists, pandas data frames).

Usage description	
Frequency of use	On-demand, depending on the ISDSS requests
Execution time	N/A
System requirements	N/A
Interoperability aspects	
Related data models	RescueME ontology built on previous research projects' ontologies.
Information exchange protocol	N/A
Available API	N/A
Integration aspects	
Installation requirements	Linux / Windows operating systems
Integration requirements	All the necessary input files
Software dependencies	For the JN scripts: Jupyter Lab environment and Python are required
Technical dependencies	For the JN scripts: re, numpy, pandas, itables, os and tqdm libraries;
Deployment requirements	Input, Output and src folder structure
Example of existing integration	None
Critical factors for the integration	None
Connection to other tools	ISDSS (TL11_TEC-B), which will group the different solutions into packages and monitoring indicators; ATLAS (TL00_TEC-A), which will work as an entry point for coastal landscapes.
Other information	All the above features depend on the upper-level modules in the overall RescueME architecture (e.g., the ISDSS module).
Security aspects	
Security issues to be covered	N/A
Integrated security solution	N/A
Existing security solution	N/A
Data management	
Data sharing and access limitations	No issues or limitations

Data interoperability limitations	No proprietary formats
Standards used	FAIR principles

Table 3 - Technical specifications of the RescueME Meta-repository

2.4 Data Lake

The Data Lake serves as a central repository for storing structured, semi-structured, and unstructured data, including geospatial data generated within the project. Leveraging the experience and lessons learned during the SHELTER project, a new ecosystem has been created: GAIA (Geodata Analytics and Intelligent Architecture), currently under development by the LINKS Foundation. This innovative ecosystem comprises a set of micro-services (among which the Data Lake and the Importer and Mapper), capable of ingesting spatial data and displaying it on a map. RescueMe will be the first project to utilise this advanced ecosystem, further developing and extending its capabilities.
Data originating from the project is documented in the Data Mapping Form under WP1. Due to the data's heterogeneity and volume, traditional relational databases are insufficient for effective management and processing. Instead, a big data storage system is adopted. Apache HDFS, a distributed file system that ensures data reliability, is chosen for its scalability and fault tolerance, making it suitable for large-scale data storage.
Table 4 summarises the technical specifications of the Data Lake:

SOLUTION	DATA LAKE
ID	**TL02_LINKS-A**
Type of the solution	Software, platform
Solution description	Data Lake offers a web-based platform (exploitable through API) to gather all the geospatial data generated within the project. INSPIRE compliant metadata [7] and web-based APIs will be used to guarantee interoperability with existing open-source solutions and GEO data repositories.
WP	WP3
Task	T3.2 - ST3.2.2
Responsible	Federico Oldani (LINKS)
Description	
Functional Description	**LINKS_DATALAKE_001** Data Ingestion: the Data Lake should have the ability to ingest data from various sources such as satellite imagery, geospatial files and other files.

	LINKS_DATALAKE_002 Metadata Management: the Data Lake provides metadata management compliant with INSPIRE Metadata Directive 2007/2/EC [7] to help users discover, share, and use geospatial data. Metadata management includes the ability to create metadata records, add keywords and tags, and define data access policies. **LINKS_DATALAKE_003** Data Storage: the Data Lake provides a scalable and secure environment for storing geospatial data. The Data Lake provides various storage options such as link to external resources, object storage and file storage, and supports different types of geospatial data such as shapefile, netCDF, geoTIFF, geoJSON. **LINKS_DATALAKE_004** Data Retrieval: the Data Lake provides a graphical interface that allows users to retrieve geospatial data based on their specific needs. This interface includes APIs, SQL, and other querying tools that allow users to perform spatial queries and retrieve data in different formats. **LINKS_DATALAKE_005** Data Sharing: the Data Lake provides features that allow users to share geospatial data with other users or organisations. This may include data access policies that control who can access the data, and data sharing mechanisms such as APIs or file sharing. **LINKS_DATALAKE_006** Data Security: the Data Lake provides robust security features to ensure that geospatial data is protected from unauthorised access. The Data Lake includes access control mechanisms, and other security features to safeguard data from potential breaches.
Technical Description	**Data Ingestion**: Data ingestion can be achieved through graphical interface and APIs. The solution is based on an open-source project that allows to develop plugins and extensions to customise and extend data ingestion capabilities to meet their specific needs. **Metadata Management**: Metadata model is customised to be compliant with Metadata Directive 2007/2/EC, but it can be further extended to describe geospatial data using other metadata standards. The Data Lake search API can be used to search for and discover geospatial data based on metadata attributes.

	Data Storage: the Data Lake stores each raw file in a file-based storage system such as local or distributed file systems, object storage such as Amazon S3 or Azure Blob Storage, and metadata in spatial databases (PostgreSQL). **Data Retrieval**: the Data Lake's search API allows users to search for and retrieve geospatial data based on metadata attributes. The Data Lake's API can be used to retrieve geospatial data in various formats such as GeoJSON, NetCDF, Shapefile, GeoTIFF. **Data Sharing**: the Data Lake provides access control mechanisms that allow users to share geospatial data with other users or organizations. The Data Lake's access control is based on OAuth2 authorization and authentication system, enforcing permissions on specific datasets or resources, and monitor data access and usage through audit trails. **Data Security**: the Data Lake provides robust security features to protect geospatial data from potential breaches. The Data Lake's security features include access control mechanisms and authentication mechanisms (OAuth2).
Input	The Data Lake ingests any type of data. It will be built especially to geospatial data such as geoJSON, shapefile, geoTIFF, netCDF. All the resources must be coupled with metadata compliant with INSPIRE Metadata Directive 2007/2/EC.
Output	The output of the solution is represented by the access to the raw data and its metadata.
Version	The current Data Lake solution is based on: • CKAN v2.10 • Azure Blob Storage • FusionAuth 1.17.3
License / Terms of use / SLA	• CKAN v2.9.3 (open source) • Azure Blob Storage (pay for use) • FusionAuth (freeware)
Online documentation	• CKAN [11] • Azure Blob Storage [12] • FusionAuth [13]
Programming Language	Python 3
Usage description	

Frequency of use	Every time there is the need of storing a file or geospatial file generated within the project.
Execution time	Always active
System requirements	Intel(R) Xeon(R) Platinum 8171M CPU @ 2.60GHz 16GiB System memory 30GB storage
Interoperability aspects	
Related data models	INSPIRE Metadata Directive 2007/2/EC
Information exchange protocol	-
Available API	https://docs.ckan.org/en/2.10/api/index.html
Integration aspects	
Installation requirements	• Deployment of a Docker container • Blob storage access • FusionAuth
Integration requirements	N/A
Software dependencies	N/A
Technical dependencies	N/A
Deployment requirements	N/A
Example of existing integration	The SHELTER project had successfully integrated the solution.
Critical factors for the integration	Train people to use the Data Lake.
Connection to other tools	Importer & mapper **[TL03_LINKS-B]**, EO-based mapping **[TL08_LINKS-F]**
Security aspects	
Security issues to be covered	• User authentication • Authorization system
Integrated security solution	FusionAuth offers OAuth2 authorization and authentication system.
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	None
Standards used	FAIR [1], GEOSS [14], INSPIRE Metadata [7], ISO 19115 [15]

Table 4 – Technical specifications of the RescueME Data Lake

Release at M18

The Data Lake comprises a Big Data storage for raw data and a management component, here termed as Catalog, orchestrating data ingestion and retrieval.
The high-level architecture of the Data Lake is shown in Figure 7.

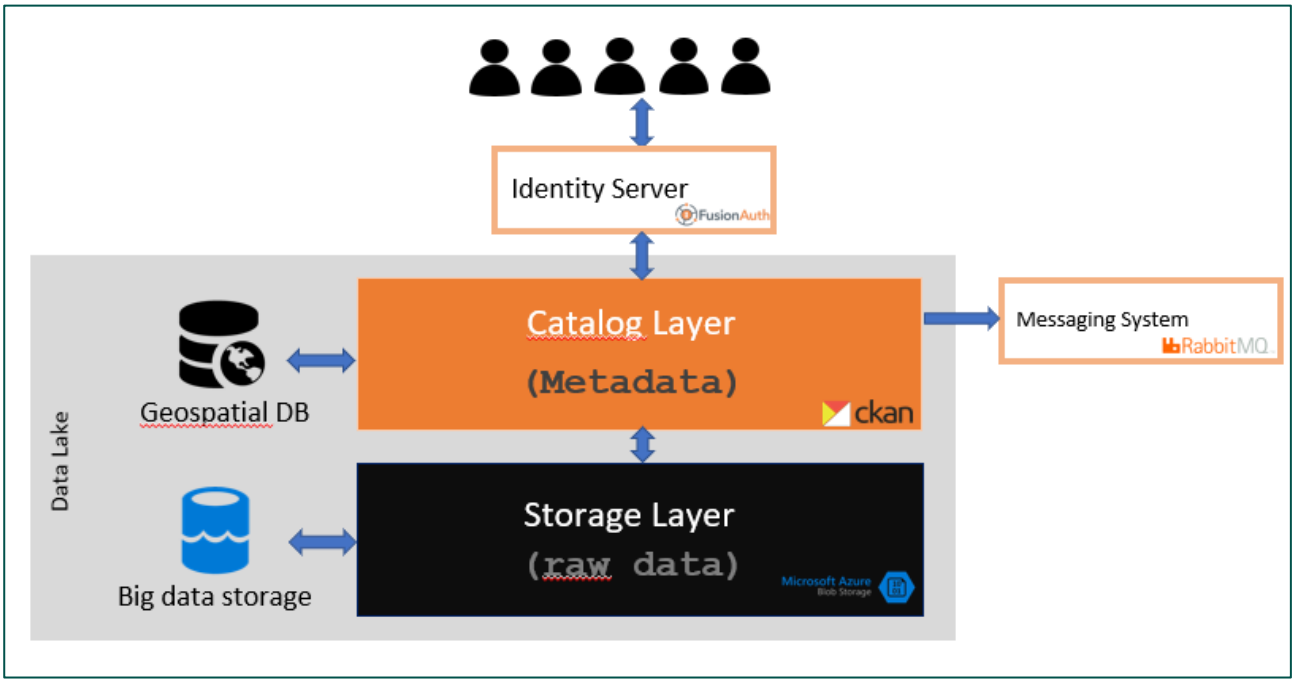


Figure 7 - RescueME Data Lake architecture

Data Storage

The Data Lake integrates Microsoft Azure Blob Storage for big data storage. This service facilitates the storage of heterogeneous data and aligns with the project's analytics requirements. Azure Blob Storage, an extension of HDFS APIs, ensures scalability and supports long-term data retention.

Data Catalog

CKAN [11] is selected as the data management system due to its flexibility and ability to handle INSPIRE-compliant metadata [7] and geospatial data. Through plugins and enhancements, CKAN provides a user-friendly interface for exploring, searching, and uploading resources to the Data Lake. It interacts with other project components, such as the Authorization and Authentication System and Messaging Bus. In the RescueMe release the CKAN component has been upgraded to its latest version (2.10) that brought major changes [16], leading to the upgrade and in some cases the new development of its plugins. The core functionality of CKAN (in Figure 8 the internal architecture) has been extended through the integration of various plugins, some of which were already available within the community, while others were developed by LINKS Foundation (Table 5).

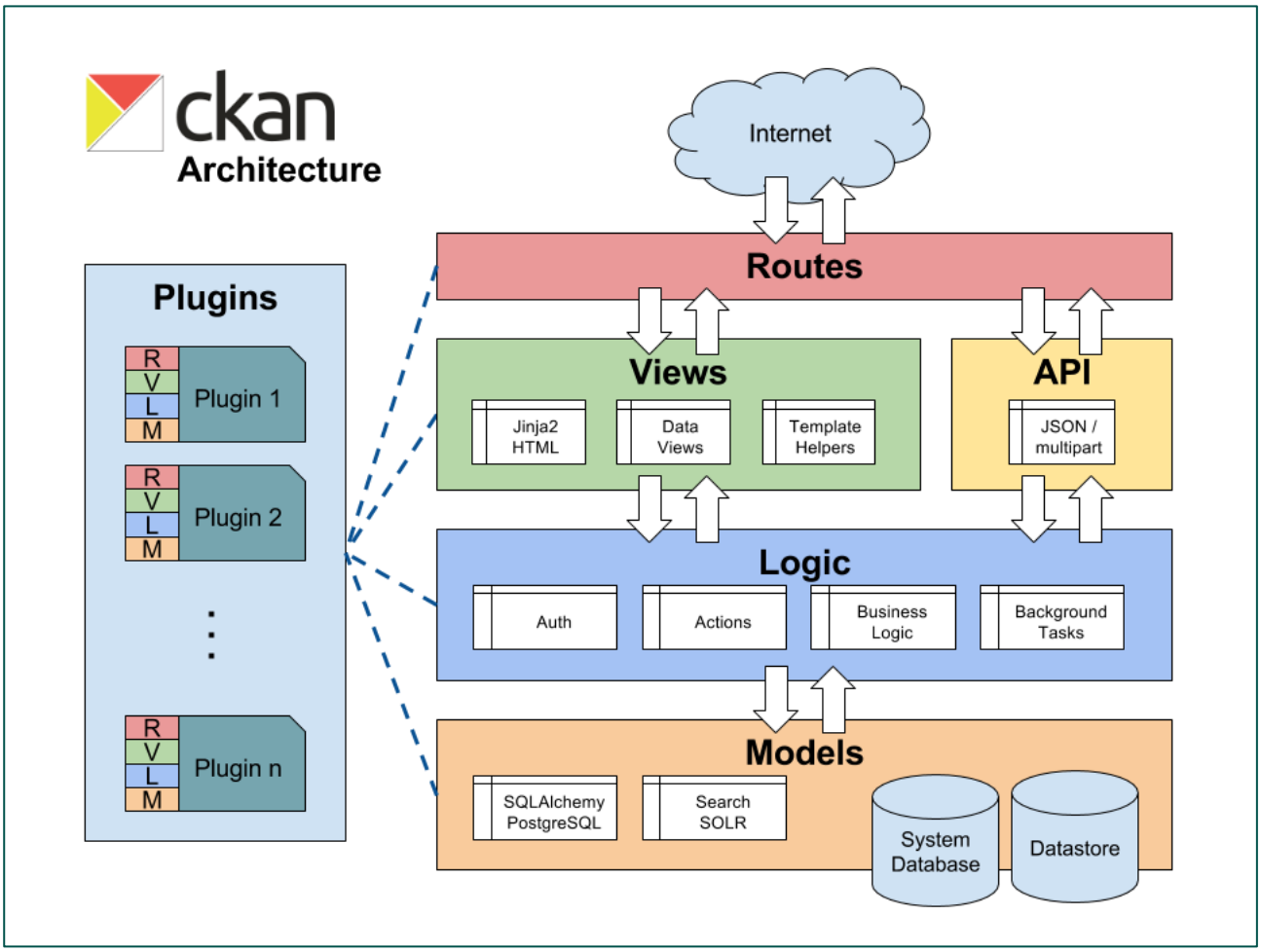


Figure 8 - CKAN internal architecture

Plugin name	Description	Source link
spatial	enables the addition of spatial extents to metadata and facilitating spatial data querying	https://github.com/ckan/ckanext-spatial
geoview	allows users to preview maps of data stored in the Big Data Storage.	https://github.com/ckan/ckanext-geoview
datesearch	efficient data retrieval based on specified datetime intervals	Modified version of https://github.com/geosolutions-it/ckanext-datesearch

oauth2	interfaces with FusionAuth for user authentication	Forked from: https://github.com/conwetlab/ckanext-oauth2 and internally developed to be compatible with the latest version of CKAN
cloudstorage	Integration with Microsoft Azure's Big Data Storage. ensures direct upload of data to blob storage and maps data URLs into the database for easy retrieval by users.	https://github.com/TkTech/ckanext-cloudstorage
scheming	Customization of metadata fields compliant with INSPIRE standards	https://github.com/ckan/ckanext-scheming
notify	send notifications to a messaging system upon data storage modifications (upload, modification, or deletion).	Internally developed

Table 5 - CKAN plugins

Geospatial Database

PostgreSQL 12 with PostGIS 3.4.2 extension is chosen to manage spatial data efficiently. This solution supports spatial queries and integrates seamlessly with CKAN, enabling the storage of metadata with spatial information.

Graphic User Interface

The Data Lake release is deployed at:
https://datalake.gaia-project.cloud/,
the access is restricted to authenticated user only. Any access rule modification will be discussed. Figure 9, the initial page of the Data Lake ready to display all the datasets uploaded.

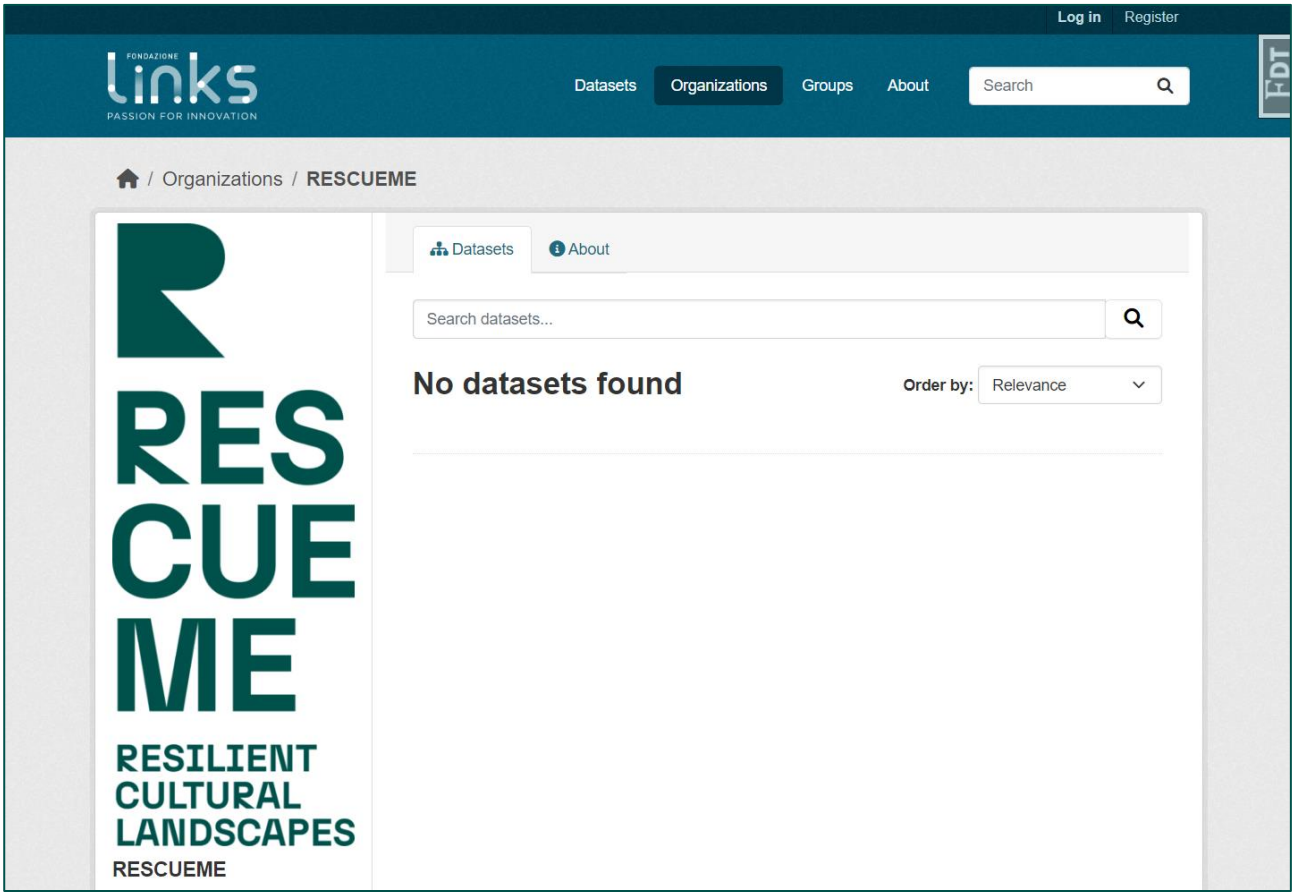


Figure 9 - RescueME Data Lake Graphic User Interface

2.5 Importer & Mapper

This module is composed by two main interconnected functional elements: the Mapper, a map server exposing and giving access to the geospatial data generated within the project by means of Open Geospatial Consortium (OGC) services [17] such as WMS, WMTS, WFS or WCS, and the Importer, a routine that after the reception of a notification signalling a change in the Data Lake, performs the corresponding edit to the contents available through the Mapper, fetching the relevant data and creating, updating or deleting the map layers of interest. The importer also generates a list of available layers available through API, which must be provided in a convenient format to allow their subsequent request.

Figure 10 shows the inner architecture of the module:

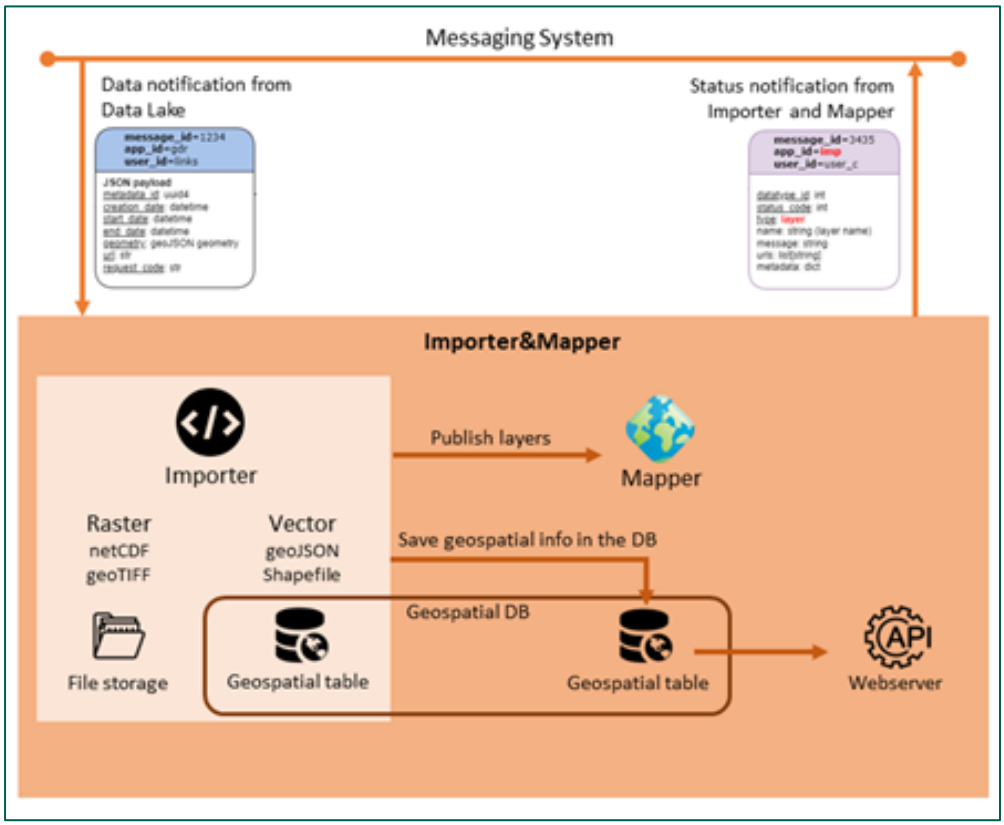


Figure 10 - RescueME Importer & Mapper architecture

The Importer is a routine waiting for change notification from the Data Lake through a message broker. Upon a change event (upload, edit, deletion) relative to a raw geospatial file resource within the Data Lake, the Importer expects a notification from the message broker with the following format:

```
{
   "metadata_id": Metadata GUID,
   "id": Resource GUID,
   "datatype_id": File data type (5 digits integer number),
   "type": Change event type (create, update, delete),
   "creation_date": Creation ISO timestamp,
   "start_date": Start of the time range covered by the file, ISO
timestamp,
   "end_date": End of the time range covered by the file, ISO timestamp,
   "geometry": Coordinates of the area covered by the file, GeoJSON format,
   "request_code": Code of the request linked to file change the event,
   "url": URL pointing to the file
}
```

The geospatial file linked to the change notification is fetched from the URL and loaded as one or more layers in the Mapper, with support for both vectorial (GeoJSON) and raster (GeoTIFF, NetCDF) file formats. Finally, the Importer sends a notification status on the message broker, notifying the success or failure of the layer importing. The Mapper is the server exposing the map layers via OGC services. In addition to these two elements, a

support database provides persistent storage for both, holding the resource list, that is the set of available layers and relative metadata, and storing some of the layers themselves. The used standard vector data formats are GeoJSON and shapefile and the two commonly used raster formats are GeoTIFF and netCDF. The data collected and processed by SAFERS will exploit these file formats. As Output, for every layer attempted to be imported, the Importer produces an outcome notification to the message broker with the following format, with a routing key referencing the request code:

```
{
   "datatype_id": Layer data type (5 digits integer number),
   "status_code": 200 if successful import, otherwise 500,
   "name": Name of the imported layer,
   "message": If import was unsuccessful, this field contains a reference
              to the occurred error,
   "type": "layer",
   "urls": [],
   "metadata": {},
}
```

Finally, the API server allows to query and access the information regarding the available layers. In particular, the GET request /layers allows to retrieve the list of layers accessible from the Mapper grouped by their datatype, and including their metadata, creation date, and list of referenced timestamps in the layer (temporal dimension). The request parameters allow filtering the results by originating request code, datatype id, time interval or geographical area. Figure 11 shows an example of a layer representing the temperature:

Figure 11 - Example of a layer imported by the RescueME Importer & Mapper

Table 6 summarises the technical specifications of the Importer & Mapper:

SOLUTION	IMPORTER & MAPPER
ID	TL03_LINKS-B
Type of the solution	Software component
Solution description	The Importer & Mapper is a software component that automatically imports the geospatial data from the Data Lake and publishes the data as a layer on a map server. The map server offers OGC services to render the data as tiles on the frontend (not included). The importer also offers a set of APIs to query the database of available layers.
WP	WP3
Task	T3.2 - ST3.2.2
Responsible	Federico Oldani (LINKS)
Description	
Functional Description	**LINKS_IAM_001** Import Geospatial Data: The Importer & Mapper software component must automatically import geospatial data from the Data Lake. This includes importing data in different formats such as Shapefile, GeoJSON, and GeoTIFF. **LINKS_IAM_002** Publish Data as a Layer: The Importer & Mapper software component must publish the imported geospatial data as a layer on the map server. The layer must

	be identifiable by a unique name and must include the relevant metadata associated with the layer. **LINKS_IAM_003** Offer OGC Services: The map server must offer OGC services such as WMS, WMTS, and WFS. The software component must interact with the map server to enable these services. **LINKS_IAM_004** Provide API for Querying Layers: The Importer & Mapper software component must offer a set of APIs to query the database of available layers. The APIs allow users to search for layers based on different criteria such as name, metadata, or geographic extent. **LINKS_IAM_005** Layer Styling: The software component must allow users to apply a style on the layer. **LINKS_IAM_006** Enable User Authentication: The software component must enable user authentication to restrict access to the API and the map server. Users should be able to authenticate using different mechanisms such as username and password or OAuth2. **LINKS_IAM_007** Implement messaging bus: The software component must implement a messaging bus to share the successful import and publish of a new layer.
Technical Description	**Import Geospatial Data**: The Importer & Mapper software component listen to messages on the messaging bus for every new upload on the Data Lake. Then, it retrieves geospatial data from the using a CKAN API. **Publish Data as a Layer**: The software component sends save metadata on an internal Geospatial DB and publish to the GeoServer the imported data as a layer. The layer includes information such as the name, the datatype ID, and the layer style. **Offer OGC Services**: GeoServer offers OGC services such as WMS, WMTS, and WFS to render the data as tiles on the frontend. The software component interacts with GeoServer to enable these services and configure the desired settings. **Provide API for Querying Layers**: The software component exposes a RESTful API that allows users to query the database of available layers. The API uses GeoServer's REST API to retrieve the necessary information and returns the results in a user-friendly format.

	Enable User Authentication: The software component can be configured to enable user authentication using GeoServer's built-in security mechanisms. **Provide Documentation and Support**: The software component provides documentation and support to users. The documentation describes how to use the software component.
Input	Geospatial files coupled with INSPIRE metadata
Output	Map Tiles through OGC services
Version	The solution is based on: • Importer (v2.0 developed by LINKS) • Mapper (GeoServer 2.23)
License / Terms of use / SLA	Open source
Online documentation	https://docs.geoserver.org/
Programming Language	Importer: Python 3 GeoServer: Java
Usage description	
Frequency of use	Every time a new geospatial file is uploaded on the Data Lake.
Execution time	Always active (real-time)
System requirements	Intel(R) Xeon(R) Platinum 8171M CPU @ 2.60GHz 16GiB System memory > 100GB storage
Interoperability aspects	
Related data models	INSPIRE Metadata Directive 2007/2/EC
Information exchange protocol	N/A
Available API	https://docs.geoserver.org/stable/en/user/rest/index.html
Integration aspects	
Installation requirements	• Deployment of a Docker container • Messaging bus access
Integration requirements	N/A
Software dependencies	N/A
Technical dependencies	• Messaging bus • Data Lake
Deployment requirements	N/A
Example of existing integration	SHELTER project successfully integrated the solution.

Critical factors for the integration	N/A
Connection to other tools	Data Lake **[TL02_LINKS-A]**
Security aspects	
Security issues to be covered	User authentication
Integrated security solution	Basic authentication with username and password
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	None
Standards used	GEOSS [14], INSPIRE Metadata [7], ISO 19115 [15], OGC [17]

Table 6 - Technical specifications of the RescueME Importer & Mapper

2.6 Web application / Frontend

End-user interaction with RescueMe will be through a web-based dashboard. This dashboard will enable decision makers and visitors to effectively visualise all available project data and maps generated within the project. The dashboard will communicate directly with a backend module: it will act as a proxy and will manage the connection between the frontend, the Chatbot, the Social Media module and the Identity server.

The Web-based Dashboard will provide a map view presenting location pins of different data categories where each data point can be expanded to display more detailed information. Additionally, notifications of relevant new data points will accumulate in a different section of the dashboard.

To access the platform, the users will need to provide valid credentials.

Table 7 summarises the technical specifications of the Web application / Frontend:

SOLUTION	WEB APPLICATION
ID	**TL04_LINKS-C**
Type of the solution	Software, platform
Solution description	The web application shows the output coming from the Chatbot, the Social Media module and the Importer & Mapper module.
WP	WP3
Task	T3.2 - ST3.2.2
Responsible	Luca Bruno – luca.bruno@linksfoundation.com (LINKS)

	Xileny Seijas Portocarrero - xileny.seijasp@linksfoundation.com (LINKS)
Description	
Functional Description	**LINKS_WEBAPP_001** displays the information coming from the Chatbot and allows users to filter the output with time and space filters. **LINKS_WEBAPP_002** displays the information coming from the Social Media module and allows users to filter the output with time and space filters. **LINKS_WEBAPP_003** allows the management of users as back-office functionalities. **LINKS_WEBAPP_004** summarises in a dashboard the ongoing situation, by displaying data through charts. **LINKS_WEBAPP_005** allows the user to create a custom map request for the Importer & Mapper module.
Technical Description	The platform will be implemented as a Single Page Application (SPA) based on ReactJs library. The solution will contain Mapbox-gl library for the management of map view. The authentication procedure will be implemented with a redirection to the form provided by FusionAuth module. For an initial version, the web application will be available in English and Italian; if required, all the languages related to the project will be made available.
Input	Input data is in JSON format
Output	There is no data for other modules, but the input information will be visualised with charts on a Dashboard or pins and layers on a map.
Version	Version of the solution: V2.0.0 ReactJs version: 17
License / Terms of use / SLA	Open source
Online documentation	A link will be provided when available
Programming Language	Typescript
Usage description	
Frequency of use	The solution will stay up and running for all the duration of the project.
Execution time	Real-time
System requirements	CPU with 2.4 GHz 2GB memory No GPU needed

Interoperability aspects	
Related data models	• Chatbot and Social Media module entities • Geodetic system: EPGS:4326 • Date time in ISO 8601: YYYY-MM-DDTHH:mm:ssZ
Information exchange protocol	JSON, REST APIs
Available API	A link will be provided when available.
Integration aspects	
Installation requirements	Virtual machine Project domain to be linked to the web application.
Integration requirements	N/A
Software dependencies	N/A
Technical dependencies	N/A
Deployment requirements	N/A
Example of existing integration	The starting solution is a part of SHELTER project [3]
Critical factors for the integration	N/A
Connection to other tools	Mobile Chatbot **[TL09_LINKS-G]**, Social media data engine **[TL10_LINKS-H]**, Importer & Mapper **[TL03_LINKS-B]**
Security aspects	
Security issues to be covered	Authentication based on username/email and password
Integrated security solution	Integration with Identity Server, that is FusionAuth.
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	N/A
Standards used	N/A

Table 7 - Technical specifications of the RescueME Web application / Frontend

2.7 Geospatial Data Intelligent Platform

The Geospatial Data Intelligent Platform (GDIP) will act as a geospatial Gateway for data collection, processing, analysis and geospatial visualization of the data used in the project and data provided by external models, including the tools delivered in Task 3.2 (Geospatial data management and data visualization solutions) and eventually existing systems available within the case studies. Specifically, the Geospatial platform will establish a connection with the Data Lake, various open data sources and any R-Labscape local sensors that may be available. To facilitate the comprehension of the user interface and the user experience, mock-ups have been prepared to thoroughly establish and communicate the different steps of the workflow process that will be developed (example in Figure 12).

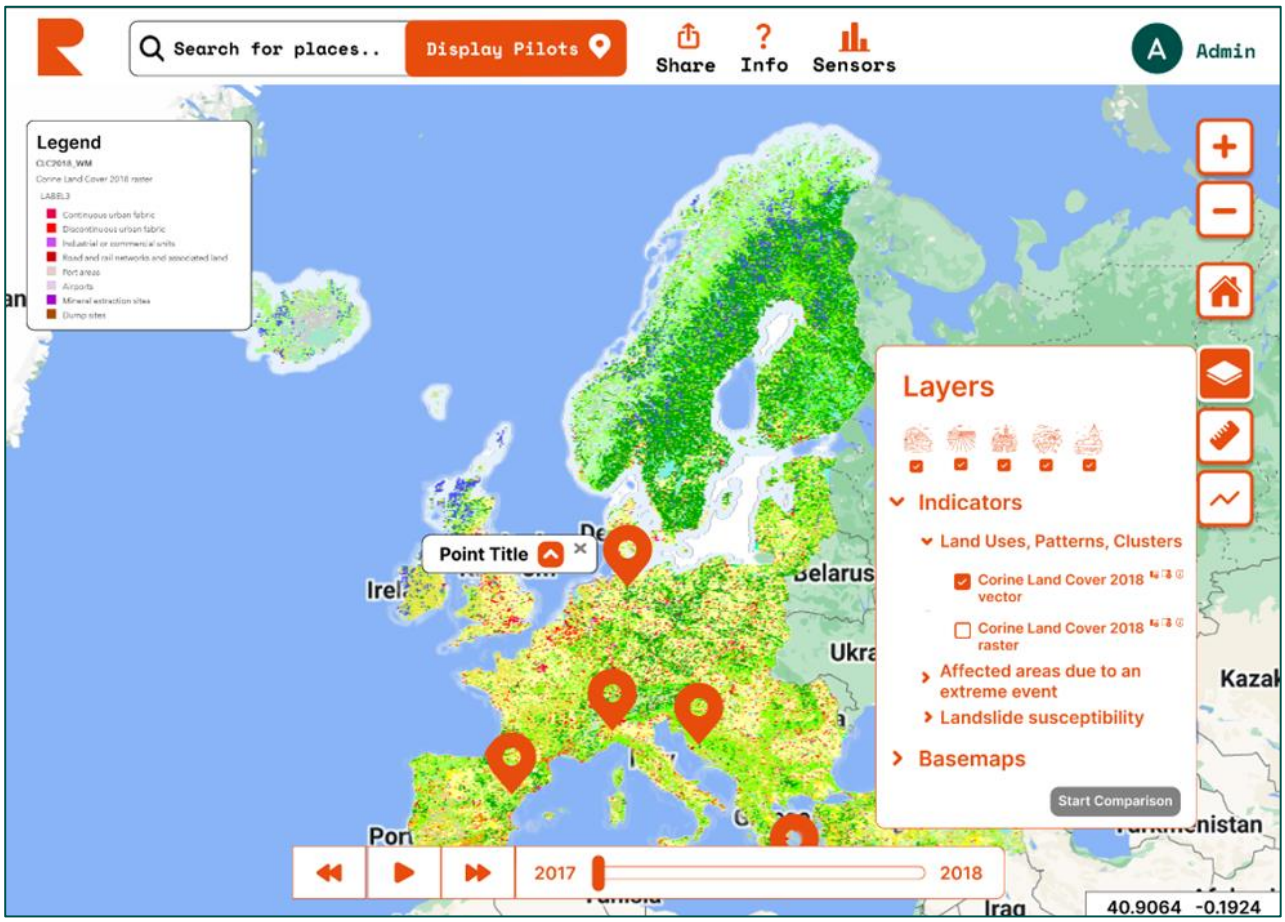


Figure 12 - RescueME Geospatial data intelligent platform mock-up

As development is only just starting at the time of writing, it is possible that some technical information may slightly change.
Table 8 summarises the technical specifications of the Geospatial data intelligent platform:

SOLUTION	GEOSPATIAL DATA INTELLIGENT PLATFORM
ID	**TL05_DRAXIS-A**
Type of the solution	Platform
Solution description	A geospatial gateway for data collection, processing, analysis, and geospatial visualization of the data used in the project.
WP	WP3
Task	T3.2 - ST3.2.3
Responsible	DRAXIS
Description	
Functional Description	**DRAXIS_ GDIP_001** Data collection **DRAXIS_ GDIP_002** Data processing **DRAXIS_ GDIP_003** Data analysis **DRAXIS_ GDIP_004** Data visualization **DRAXIS_ GDIP_005** supports the ingestion and visualization of data provided by external models and of existing systems available within the case studies. **DRAXIS_ GDIP_006** User interface
Technical Description	An end to end, web-based geospatial platform application that integrates spatial data with analytical tools and models, including Internet of Things (IoT) and imagery, to support decision-making processes. The system is designed to assist decision-makers in understanding and comparing spatial (and non-spatial) data and related patterns, to help them make informed decisions based on real-time and historical data. The system primarily incorporates data from a variety of sources, such as from the LINKS Data Lake, which collects the various disparate datasets from the project that is not already published openly, together with open data of interest to the R-Labscapes, such as data from the Copernicus Programme [18]. Key feature of the geospatial platform is the use of dashboard functionality that allows decision-makers to access and visualise real-time data in a user-friendly interface that is tailored to their specific needs. The dashboard can include interactive maps, charts, graphs, and

	other visualizations that enable decision-makers to quickly identify trends, patterns, and anomalies in the data.
Input	• Data from RescueME via the Data Lake (LINKS) and open data
Output	• Maps • Detailed information on areas of interest within the R-Labscape regions • Configurable dashboards with aggregated data for sensors • Data visualizations • Possibility of integration with weather forecasting platforms
Version	1.3.14 existing version 3.0.0 target version
License / Terms of use / SLA	The GDIP application falls under the GNU General Public License v3 (GPL-3) [19]. The current license may change in future versions.
Online documentation	No online documentation is available
Programming Language	• Python • JavaScript • Java
Usage description	
Frequency of use	This software is only used in pilots and has not been released yet. In case it is released in the upcoming future, a different installation than the one in the project will be used.
Execution time	Real time/near real time
System requirements	• 8 Cores CPU • 16 GB RAM • SSD (space according to project needs)
Interoperability aspects	
Related data models	Data in GDIP exist in three forms: • as JSON message in Kafka (semi-structured) • as measurement rows in PostgreSQL (structured) • as data grids in NetCDF format (structured)
Information exchange protocol	• RESTful API (over HTTP) • OGC WFS & WMS [17]
Available API	REST API under development
Integration aspects	

Installation requirements	GDIP is a fully "Dockerised"application. To install it, a Linux based system with Docker & Docker Compose is required (Docker version should be at least 20.10.7). The installation process is the following: • Collection of the required application Docker images • Preparation of Docker Compose files • Preparation of configuration files
Integration requirements	To integrate GDIP with another application, the latter should be able to communicate through HTTP and support of OAuth2 and OIDC specifications.
Software dependencies	• Django • Django Rest Framework • GDAL • VueJS • Vuetify • Axios • OpenLayers • ApexCharts
Technical dependencies	• Linux Server • Let's Encrypt Service • Docker / Docker Compose
Deployment requirements	For the deployment of GDIP an extra stack of Docker-based services is required. This stack consists of the following services: • nginx-proxy - A reverse HTTPS proxy • letsencrypt-nginx-proxy-companion - An accompanying service that manages the whole lifecycle of HTTPS certificates for the GDIP services This stack will function as the entry point to the GDIP application from the internet.
Example of existing integration	There have been various integrations of GDIP and other systems (mainly APIs from other applications), e.g.: • WeatherXM API • TomTom Traffic API • OpenAQ API • Foobot API • DRAXIS Weather API • SenseOne Database
Critical factors for the integration	• Sizing of the integrated data • Performance of the application

Connection to other tools	Data Lake **[TL02_LINKS-A]**
Security aspects	
Security issues to be covered	Currently GDIP resources are protected from public access, but everything is available to any logged-in user.
Integrated security solution	Keycloak Authorization Server
Existing security solution	No other existing security solutions
Data management	
Data sharing and access limitations	No restrictions foreseen
Data interoperability limitations	No restrictions foreseen
Standards used	OGC WMS and WFS [17]

Table 8 - Technical specifications of the RescueME Geospatial data intelligent platform

2.8 Generative AI

This tool's outcome will be a machine learning model that generates artworks representing R-Labscapes (see Figure 13 for some examples). The generation will take as input the users' emotions collected from the Social Media module and/or from the feedback collected from the AR Application users, and from the weather data of every R-Labscape (see Figure 14). The artworks will be made accessible for the AR Application to be shown inside the app.

Figure 13 – Examples of artworks generated by the RescueME Generative AI tool

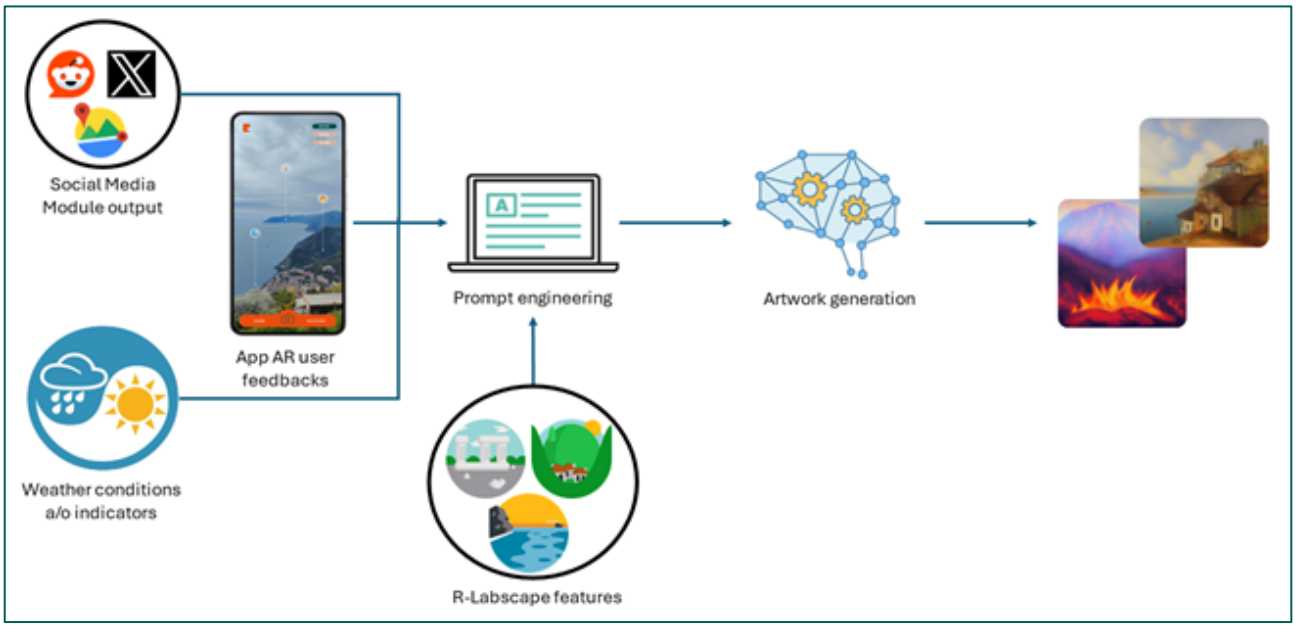


Figure 14 - Schema representing the flow of artworks generation with the RescueME Generative AI tool

Table 9 summarises the technical specifications of the Generative AI tool:

SOLUTION	SALLY
ID	**TL06_LINKS-D**
Type of the solution	Software component running on LINKS premises, providing images to be shown inside the AR Application.
Solution description	A machine learning model will be trained to generate artworks representing R-Labscapes based on the emotions/feedback collected from the Social Media or AR Application users and local weather data.
WP	WP3
Task	T3.2 - ST3.2.4
Responsible	Angelica Urbanelli angelica.urbanelli@linksfoundation.com
Description	
Functional Description	**LINKS_SALLY_001** generates images for each R-Labscapes based on sentiment collected from social media feed/ AR Application feedback/ weather data. **LINKS_SALLY_002** accesses images generated for each R-Labscape.
Technical Description	The solution is based on the State of the Art of computer vision deep learning models for the task of generating

	images. The models will be trained on images of the R-Labscapes. Those images will be collected from the web. Depending on the desired usage of those images, the models' outputs can be loaded in a shared database accessible from the AR Application. Otherwise, they could be made available through REST APIs. Images will be generated by the models based on sentiment detected from social media feeds, as well as feedback from users using App AR and possibly indicators related to weather conditions or other local indicators.
Input	Emotion collected from social media feed, extracted by the social media module, users feedback provided by the App AR, weather conditions/indicators.
Output	Image generated for the specific R-Labscape.
Version	-
License / Terms of use / SLA	TBD
Online documentation	N/A (it will be made available if needed)
Programming Language	Python
Usage description	
Frequency of use	This solution will be used to generate images for the R-Labscapes at fixed time intervals, for example, every day or once a week. The time interval can be decided by the R-Labscapes.
Execution time	Not needed, the tool will be used offline.
System requirements	RAM: 8GB GPU: 12GB minimum Could change when developing the tool
Interoperability aspects	
Related data models	N/A
Information exchange protocol	JSON
Available API	Will be provided when available.
Integration aspects	
Installation requirements	No specific requirements since it runs on LINKS premises.
Integration requirements	Access at the shared database or the REST APIs
Software dependencies	No need of specific dependencies since the software will be running on LINKS premises.

Technical dependencies	Shared database to insert the generated images to be accessed from the AR-Interface.
Deployment requirements	The needed amount of storage depends on the desired generation frequency.
Example of existing integration	N/A
Critical factors for the integration	No critical factors.
Connection to other tools	AR-Interface **[TL07_LINKS-E]**, Social Media Module **[TL10_LINKS-H]**
Security aspects	
Security issues to be covered	No security issues
Integrated security solution	Not needed
Existing security solution	N/A
Data management	
Data sharing and access limitations	Generated images are shared with Creative Common licences.
Data interoperability limitations	No proprietary formats are used.
Standards used	PNG

Table 9 - Technical specifications of the RescueME Generative AI tool

2.9 AR Mobile Application

The Augmented Reality-based interface is a tool developed for mobile devices aiming to raise awareness among citizens about climate change and its impacts on a local scale. The output becomes, in this way, an interactive information tool, in which the user can learn about a problem and tackle it in the field, becoming resilient.

The technology used is Augmented Reality (AR), which enables users to have an enhanced version of the real world just using an everyday instrument, the mobile phone. AR adds digital data to reality, anchoring them to the 3D space when a specific triggering event happens. These events could be a scan of QR Code or of static image targets through image recognition algorithms, a specific target location retrieved from the information coming from the device GPS, as well as the detection of planes and of 3D Objects. To integrate AR features, the cross-platform game development platform unity has been chosen because it offers a wide range of tools for designing, developing and distributing interactive 3D contents.

The AR Mobile Application is developed to give an easy and gamified way to visualise data and the following key features will be integrated:

- The visualization of paintings coming from generative AI algorithms, using for example AR artwork galleries (Figure 13).
- The visualization of information coming from Chatbot reports located at a certain distance from the user's location.
- The visualization of 3D maps with some territorial data, directly on a plane surface as Figure 15 shows.
- The visualization of data coming from social media posts

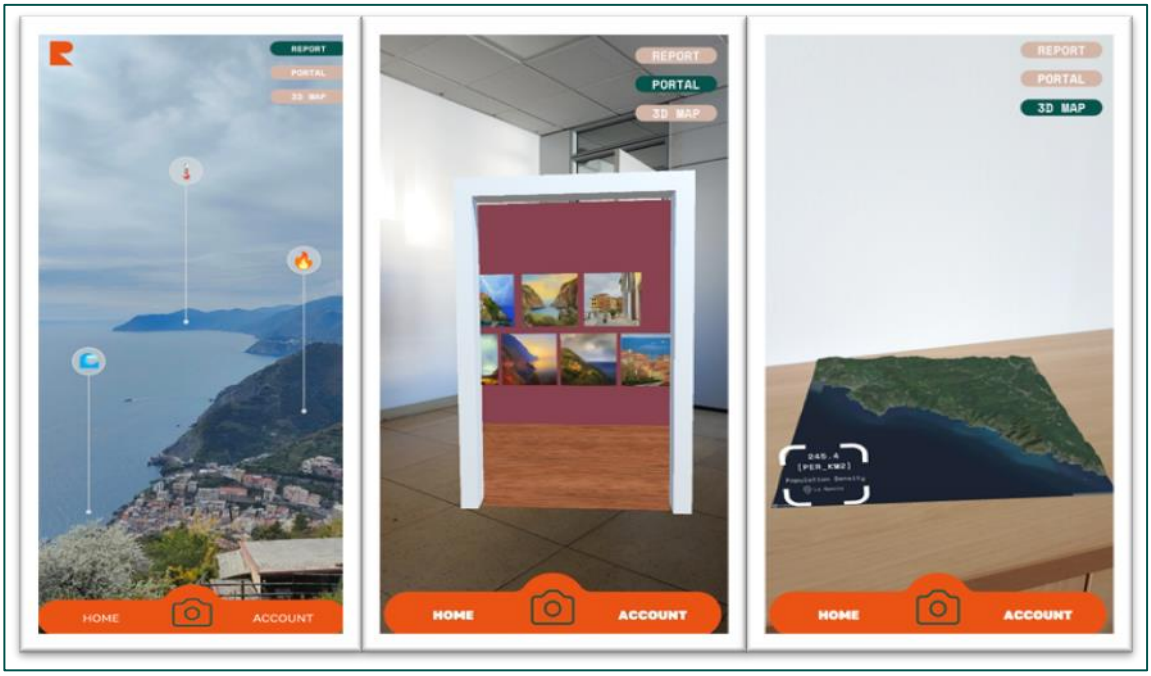


Figure 15 - Prototypes of RescueME AR visualization of Chatbot reports, Generative AI paintings and 3D maps

An authentication system is included, and it authorises the access for the user to the tool homepage, where every feature of the application can be found. The most important part is the AR Camera section, where all key features will be visualised accordingly using the potential of AR Technology. The use of AR is intended to support both an on-site and an off-site experience, to give direct access to data also when access to the site is not possible. In the on-site visualization, users have the possibility to view chatbot reports, social media outputs and territorial data in three different layers, to get more information about the geo-localised CL and about the surrounding places.
Table 10 summarises the technical specifications of the AI mobile application:

SOLUTION	AR MOBILE APPLICATION
ID	**TL07_LINKS-E**
Type of the solution	Software component
Solution description	The Augmented Reality-based interface will produce on-site visualization of territorial data, with the aim to support the communication of resilience strategies to citizens.
WP	WP3
Task	T3.2 - ST3.2.4
Responsible	Marina Nadalin marina.nadalin@linksfoundation.com (LINKS)
Description	
Functional Description	**LINKS_AR-APP_001** This application will use AR technologies to visualise paintings coming from generative AI algorithms. **LINKS_AR-APP_002** This application will use AR technologies to visualise and represent information coming from Chatbot reports, such as geospatial data, disaster report location, disaster description. **LINKS_AR-APP_003** This application will use AR technologies to visualise satellite maps. **LINKS_AR-APP_004** This application will use AR technologies to visualise and represent information coming from social media posts.
Technical Description	Information will be triggered, visualised and oriented according to user location. Inputs could be accessible using different types of triggering events: • QR code • GPS coordinates • Static image targets (through image recognition algorithms) • Plane detection Inputs will be anchored in the 3D space using the metadata coupled with the visualised information and the user location (GPS).
Input	Inputs here are data coming from Chatbot, Social Media, territorial data, satellite maps and generative AI algorithms.
Output	Mobile Application

Version	0
License / Terms of use / SLA	N/A
Online documentation	A link to user manual will be provided if needed.
Programming Language	C#
Usage description	
Frequency of use	The solution will be available every time the user wants to use it.
Execution time	Real time
System requirements	The preferred target device should have an Android System (running Android 7.0). The mobile device needed should have access to internet connection and GPS connectivity to ensure on-site visualization. Moreover, the device should support Google Play Services for AR to enable augmented reality experiences.
Interoperability aspects	
Related data models	N/A
Information exchange protocol	JSON
Available API	A link will be provided when available.
Integration aspects	
Installation requirements	The application will be available in apk format. The preferred device system is Android and should guarantee a stable internet connection.
Integration requirements	Access to REST API to retrieve input data such as Chatbot reports and Generative AI artworks.
Software dependencies	The application depends on ARCore SDK, and the device should support Google Play Services for AR, otherwise AR experiences would not be available.
Technical dependencies	N/A
Deployment requirements	Docker
Example of existing integration	N/A
Critical factors for the integration	N/A
Connection to other tools	Chatbot **[TL09_LINKS-G]**, Social media **[TL10_LINKS-H]**, Generative AI **[TL06_LINKS-D]**
Security aspects	

Security issues to be covered	Security issues are covered by an authentication, where the user should insert username and password.
Integrated security solution	The authentication system will be integrated using FusionAuth.
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	N/A
Standards used	FAIR principles [1]

Table 10 - Technical specifications of the RescueME AI mobile application

2.10 Mapping Models

This AI-based tool will allow users to get delineation maps (both in terms of extension and severity of the investigated hazards) from Copernicus data pre- and post- events. The events covered by the tool are namely floods, wildfires and landslides, but the tools itself can also be applied to get information about land cover-related scenarios. The basic input information required for the service are an Area of Interest and a time range, while the output will be typically geo-referenced raster images, to be visualised on the GDIP. Figure 16 shows some examples of RescueME Mapping Models output. From top to bottom: wildfire delineation and severity, flood delineation, landslide delineation (from pre- and post- event imagery):
Table 11 summarises the technical specifications of the Mapping Models:

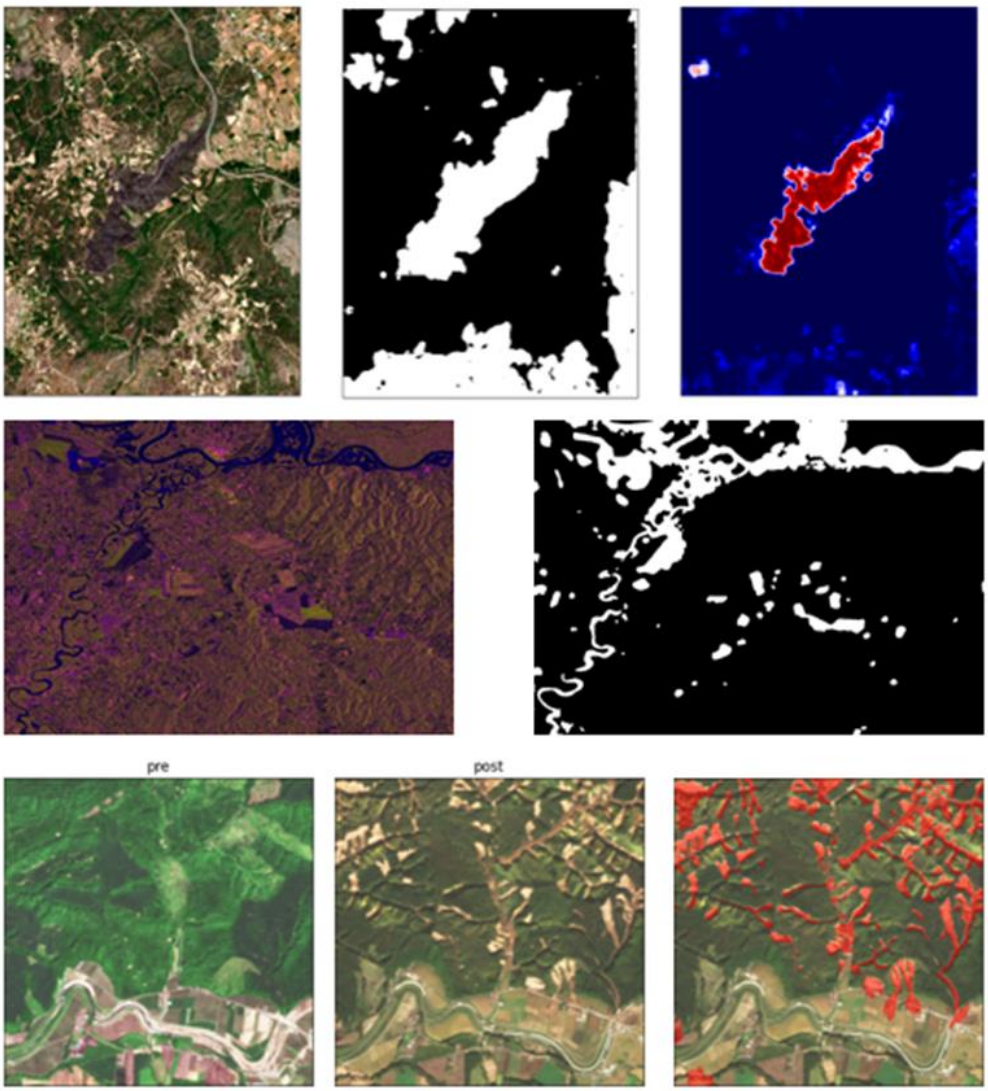


Figure 16 - Examples of RescueME Mapping Models output.

SOLUTION	MAPPING MODELS
ID	**TL08_LINKS-F**
Type of the solution	Software component
Solution description	This solution is composed of deep learning models trained to estimate the extension and the related severity of several natural hazards (e.g., fire, flood, landslide) starting from satellite imagery.
WP	WP3
Task	T3.3 - ST3.3.1
Responsible	Luca Barco luca.barco@linksfoundation.com
Description	
Functional Description	**LINKS_MAPPING-MODELS_001** Fire delineation and severity assessment **LINKS_MAPPING-MODELS_002** Flood delineation **LINKS_MAPPING-MODELS_003** Landslide delineation
Technical Description	The solution is based on the State of the Art of computer vision deep learning models for semantic segmentation. The models are trained on the activations present on Copernicus Emergency Management Service (CEMS) [20] and work on satellite imageries coming mainly from Sentinel. The models can be used through APIs, asking for an Area of Interest (AoI) and a time range for the specific natural hazard the user is interested in. The best suitable images will be retrieved and passed to the model to obtain the predicted map with the delineation and/or severity estimation.
Input	JSON containing: • AoI Coordinates • Time range (start date, end date) • Spatial resolution • Frequency • Mapping type (fire, flood, landslide)
Output	Geo-referenced raster (GeoTIFF), where each pixel contains the result of the model inference.
Version	-
License / Terms of use / SLA	N/A (will be provided when available)

Online documentation	N/A (will be provided when available)
Programming Language	Python
Usage description	
Frequency of use	The tool will be available for the whole project duration.
Execution time	The tool can be executed in real time.
System requirements	GPU: requires at least 2GB per model. RAM: 16GB CPU: Intel(R) Core (TM) i9-10900X CPU @ 3.70GHz
Interoperability aspects	
Related data models	JSON
Information exchange protocol	JSON
Available API	N/A (will be provided when available)
Integration aspects	
Installation requirements	The module will run inside a suite of docker containers.
Integration requirements	A message bus should be up and running.
Software dependencies	SentinelHub APIs [21] (to download satellite imagery in real time).
Technical dependencies	Any particular hardware dependencies.
Deployment requirements	Internet connectivity, docker.
Example of existing integration	SHELTER [3] and SAFERS [22] project.
Critical factors for the integration	Availability of processing units and number of requests in the subscription to SentinelHub to use its APIs.
Connection to other tools	Data Lake **[TL02_LINKS-A]**, Web Application/Frontend **[TL04_LINKS-C].**
Security aspects	
Security issues to be covered	N/A
Integrated security solution	N/A
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	N/A
Standards used	N/A

Table 11 - Technical specifications of the RescueME Mapping Models

2.11 Mobile Chatbot

The RescueMe Chatbot will be a conversational tool developed in the Telegram platform. It will enable a bidirectional communication channel between professional users or citizens and decision makers. As it is a crowdsourcing tool, it will gather useful information from the field in real-time and the users will be able to send geolocated report containing a textual description, multimedia objects (videos, photos, voice messages) and possibly additional details (e.g., specific measures). Meanwhile, the users will receive timely updates from the control centre/decision makers. Citizens will also have access to a gamification system, that rewards them for using the bot's functionalities, allowing them to gain points and win medals. The data collected through the chatbot will be stored and managed by the Crowdsourcing Intelligent Gateway and it will be shown in the Web Application/Frontend (ST3.2.2) as well as in the AR Mobile Application (ST3.2.4). To provide a filter over the data collection and limit an improper dissemination, the users will access the tool functionalities through an authentication system.

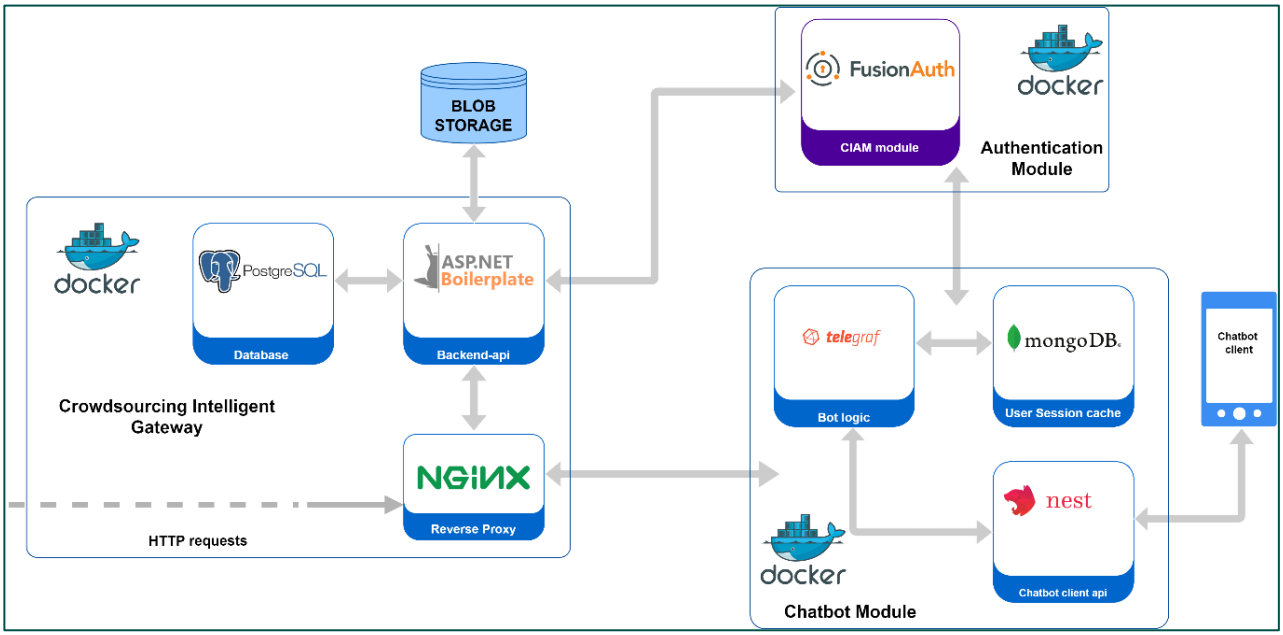


Figure 17 - The RescueME Mobile Chatbot architecture

Table 12 summarises the technical specifications of the Mobile Chatbot:

SOLUTION	CHATBOT
ID	**TL09_LINKS-G**
Type of the solution	Software component
Solution description	The solution will be a crowdsourcing tool developed as a Telegram bot. Professional users and citizens will use it to enable a bidirectional communication channel with decision makers. The corresponding KER is KR3.4: AI and crowdsourcing solutions for co-characterization of landscape values.
WP	WP3
Task	T3.3 - ST3.3.2
Responsible	Angelica Urbanelli angelica.urbanelli@linksfoundation.com Luca Bruno luca.bruno@linksfoundation.com
Description	
Functional Description	**LINKS_CHATBOT_001** shares the user's location, status and activity **LINKS_CHATBOT_002** receives and reads updates. **LINKS_CHATBOT_003** receives and manages missions. **LINKS_CHATBOT_004** sees and sends reports. **LINKS_CHATBOT_005** reviews reports. **LINKS_CHATBOT_006** changes settings. **LINKS_CHATBOT_007** gamification for citizens.
Technical Description	The solution will be composed of two main modules: • the Crowdsourcing Intelligent Gateway (CIG) • the chatbot application The CIG is directly connected with the Chatbot application. It stores and manages all the information generated with the Chatbot and acts as a proxy for all the requests coming from external clients. The Chatbot application will be a bot developed on the Telegram platform, implemented as a Nest application interacting with Telegram REST APIs.
Input	Input data is in JSON format.
Output	Output data is in JSON format.
Version	The last version developed for the SHELTER project [3] and used here as start solution is v2.7.2.
License / Terms of use / SLA	TBD

Online documentation	A user manual will be provided. The link will be provided when available.
Programming Language	Typescript
Usage description	
Frequency of use	The solution will stay up and running for all the duration of the project. Users can use it whenever they need it.
Execution time	The tool will be used in real-time.
System requirements	CPU 2GB memory No GPU To use the tool, users will need a mobile device with Internet and GPS connectivity.
Interoperability aspects	
Related data models	Chatbot entities
Information exchange protocol	JSON
Available API	A link will be provided when available.
Integration aspects	
Installation requirements	To use the tool, the users will need to install the Telegram app, a well-known messaging application.
Integration requirements	Availability to call APIs
Software dependencies	N/A
Technical dependencies	N/A
Deployment requirements	Docker
Example of existing integration	The starting solution is a part of SHELTER project [3].
Critical factors for the integration	N/A
Connection to other tools	Web application/ frontend **[TL04_LINKS-C]**, AR-Interface **[TL07_LINKS-E].**
Security aspects	
Security issues to be covered	User authentication with username/email and password
Integrated security solution	The solution is already integrated with FusionAuth.
Existing security solution	N/A
Other information	-
Data management	

Data sharing and access limitations	N/A
Data interoperability limitations	No proprietary formats are used.
Standards used	N/A

Table 12 - Technical specifications of the RescueME Mobile Chatbot

2.12 Social Media Module

The social media module will function as a pipeline, first collecting relevant social media content from various platforms through targeted searches and filtering. It will then clean and analyse this data, using AI based techniques (e.g., Sentiment Analysis and Topic Extraction) to gauge the users' perception to characterise specific CH assets within each R-Labscape. A predefined taxonomy will categorise these assets, while topic modelling uncovers the underlying themes discussed in relation to them. This will offer the stakeholders a comprehensive picture of public engagement with the R-Labscape's CH. Figure 18 reports the general architecture of the social media module.

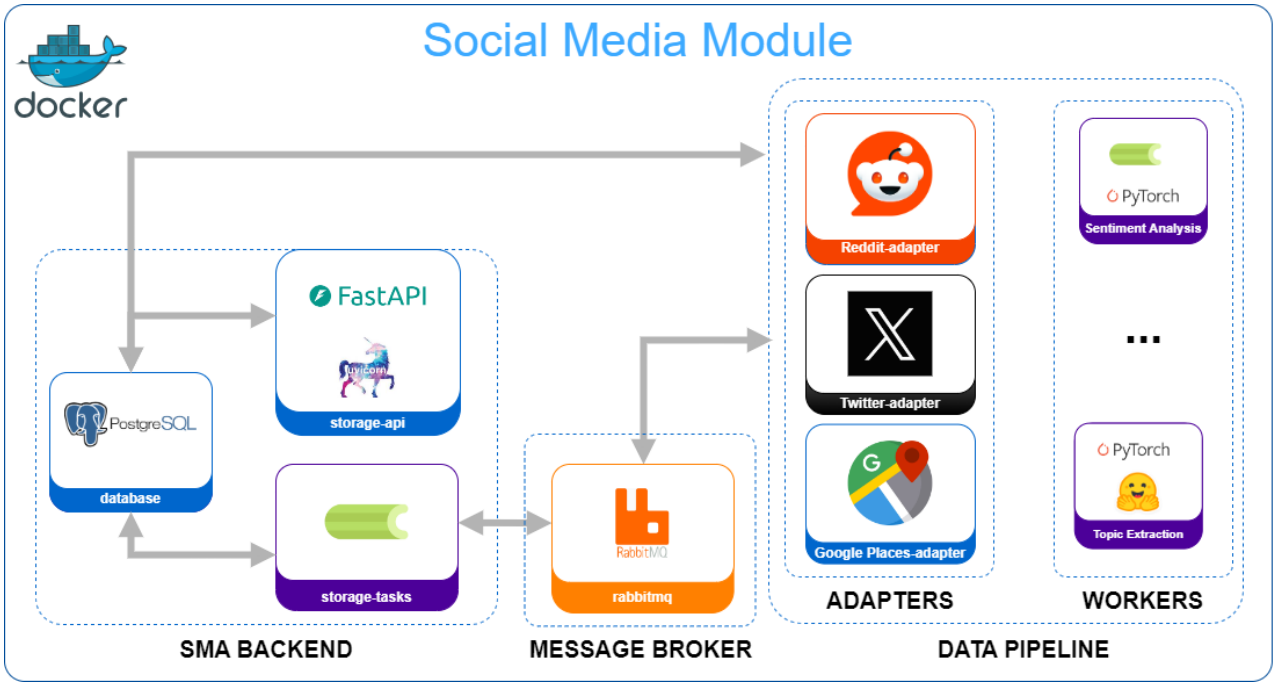


Figure 18 - The RescueME Social Media module architecture

Table 13 summarises the technical specifications of the Social Media module:

SOLUTION	SOCIAL MEDIA MODULE
ID	**TL10_LINKS-H**
Type of the solution	Software component
Solution description	The Social Media module analyses social media posts based on a specific classification system that represents the primary CH assets. Each asset will be evaluated over time across various dimensions to provide an overview of the CH, as it is reflected on social media, which also involves assessing the sentiment on the identified topics in order to characterise the landscape values.
WP	WP3
Task	T3.3 - ST3.3.2
Responsible	Fabio Caffaro fabio.caffaro@linksfoundation.com
Description	
Functional Description	**LINKS_SOCIAL_001**: Coordination and management of multiple social media sources **LINKS_SOCIAL_002**: Extraction, cleaning, and preprocessing of social media data **LINKS_SOCIAL_003**: Topic extraction and sentiment analysis for social media content **LINKS_SOCIAL_004**: Multilevel evaluation and characterization of cultural heritage assets
Technical Description	The solution will be composed of the following main sub-components: • a stream data manager that automates data gathering. • a content categorization and information extraction component. • a data layer for data storage and retrieval.
Input	Social media data stream (e.g., Twitter data stream as JSON)
Output	Results of the analysis in a textual format (e.g. JSON)
Version	v1
License / Terms of use / SLA	N/A
Online documentation	Documentation will be made available if needed.
Programming Language	Python
Usage description	

Frequency of use	The solution will stay up and running for all the duration of the project.
Execution time	The tool can be executed in real-time.
System requirements	Quad Core CPU 16GB of RAM
Interoperability aspects	
Related data models	Taxonomy of valuable assets for each R-Labscape.
Information exchange protocol	JSON
Available API	The link will be provided when available.
Integration aspects	
Installation requirements	No specific requirements since it runs on LINKS premises.
Integration requirements	-
Software dependencies	No need of specific dependencies since the software will be running on LINKS premises.
Technical dependencies	N/A
Deployment requirements	N/A
Example of existing integration	SHELTER [3] and SAFERS [22] project
Critical factors for the integration	N/A
Connection to other tools	AR-Interface **[TL07_LINKS-E]**, Generative AI **[TL06_LINKS-D]**, Web Application/Frontend **[TL04_LINKS-C]**
Security aspects	
Security issues to be covered	• User authentication • Authentication proxied by the id server
Integrated security solution	N/A
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	No proprietary formats are used.
Standards used	N/A

Table 13 - Technical specifications of the RescueME Social Media module

2.13 Incremental Spatial Decision Support System (ISDSS)

The objective of the RescueME Incremental Spatial Decision Support System (ISDSS) is to develop a dynamic web application tailored specifically for coastal sites. This intuitive tool facilitates comprehensive analysis across various use cases. Once users are familiar with the current scenario, they can seamlessly navigate through a catalogue of solutions, refining and prioritizing based on their specific needs.

With the ability to filter and prioritise solutions, users can pinpoint those most suitable for their situation. Moreover, the system empowers users to simulate these solutions, providing insights into how each proposed intervention impacts key project indicators.

In addition, users can create and save projects, allowing them to revisit and review their analyses at any time. This feature enhances usability and ensures that users can track their progress and revisit previous assessments with ease. This holistic approach enables informed decision-making, facilitating the selection of strategies that optimise risk management and enhance coastal resilience.

ISDSS will relate to the rest of the RescueME ecosystem, the web app will be accessible via One-Stop-Shop and via the ATLAS. Once inside the application, it will take data from the Importer & Mapper and from the Meta-repository via REST API and simulations will be made in the backend that implemented Predictive impact modelling in CL. The described connections are shown in Figure 2 and Figure 19.

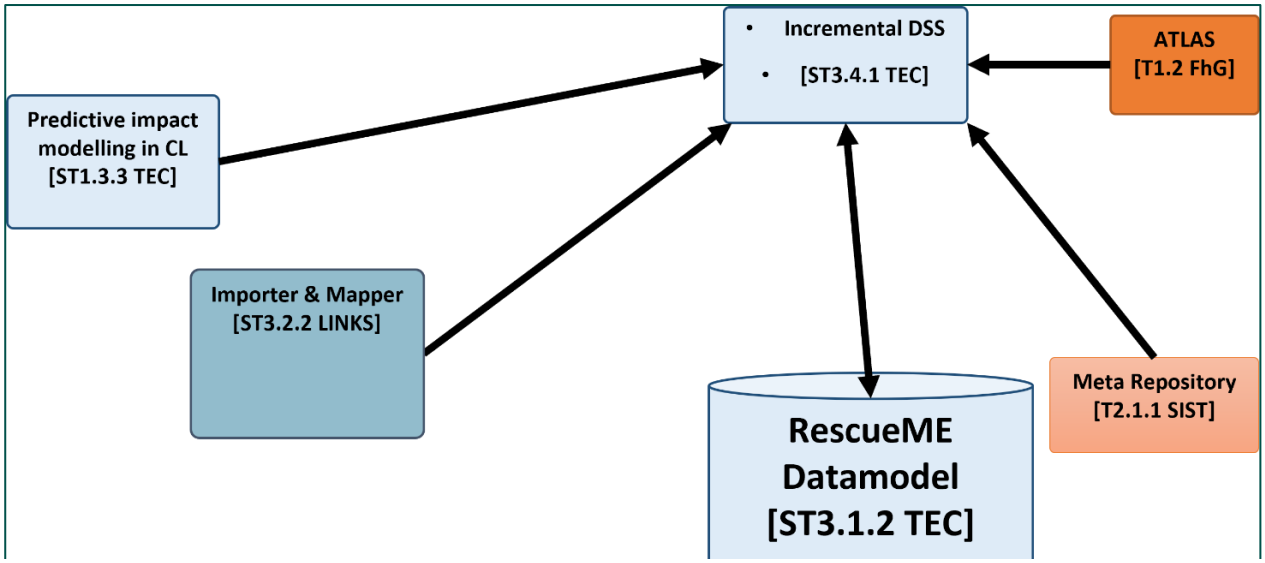


Figure 19 - Connection between the RescueME ISDSS, the Meta-repository and the ATLAS

Table 14 summarises the technical specifications of the ISDSS:

SOLUTION	INCREMENTAL SPATIAL DECISION SUPPORT SYSTEM
ID	**TL11_TEC-B**
Type of the solution	Software component
Solution description	Incremental Spatial Decision Support System (ISDSS) for the design and monitoring of Transformative pathways. The ISDSS will implement different levels of decision making with different levels of information requirements. The entry point will be the ATLAS of impacts. The CL typologies will be linked with the solution of the Meta-repository **[TL01_SIST-A]** to offer an early-stage decision making. The ARCH RAD and SHELTER resilience indicators will be used as first self-assessment tool. In higher levels of decision making, the solutions and measures will be linked with specific indicators to visualise a dynamic monitoring of the changing adaptive space and performance of the resilience solutions and propose new strategies when tipping points are reached.
WP	WP3
Task	T3.4 – ST3.4.1
Responsible	Asel Villanueva (TEC)
Description	
Functional Description	**TEC_ISDSS_001** Analyze baseline: the tool will allow to visualise, filter, and query the baseline information of the pilot, the user could analyze the baseline situation. **TEC_ISDSS_002** Launch Simulation: the tool will relate to a simulation system that could be launched and visualise the results. **TEC_ISDSS_003** Multicriteria Analysis: a user friendly multicriteria analysis will be implemented, enabling the possibility of prioritizing some indicators over others. **TEC_ISDSS_004** Solution portfolio: ISDSS will be directly connected with the Meta-repository, the solutions will be displayed in table mode, and can be filtered and sorted. **TEC_ISDSS_005** Solution Simulation: the solutions selected by the user will be simulated in the tool, recommending the best solution.

	TEC_ISDSS_006 Project Management: projects created by the user could be saved and loaded again to check the project created.
Technical Description	A web application will be implemented as a SPA (Single Page Application). Different javascript libraries will be used, such as CeisumJS or Strapi client, and some TEC internal libraries like CityMirrorViewer or ResilientScape. The final solution will have login and petitions will require a valid token for working.
Input	City Information Meta Repository
Output	JSON with Results
Version	• CityMIrror Viewer: 24.5.1 • CityMirror: 24.5.1 • ResilientScape:24.5.1
License / Terms of use / SLA	• CityMIrror Viewer (registered) • CityMirror (registered) • ResilientScape (registered)
Online documentation	A link will be provided when available.
Programming Language	Javascript
Usage description	
Frequency of use	The solution will be deployed in a server and will be available during the duration of the project.
Execution time	The application response will be real-time, the simulations will take some minutes to execute.
System requirements	CPU with 2.4 GHz 4GB RAM GPU desirable but not mandatory
Interoperability aspects	
Related data models	CityGML, 3DTiles, GeoJSON, JSON.
Information exchange protocol	REST API
Available API	A link will be provided when available.
Integration aspects	
Installation requirements	The solution will be provided as a docker container, it can be deployed in any server with docker.
Integration requirements	N/A
Software dependencies	N/A
Technical dependencies	N/A

Deployment requirements	N/A
Example of existing integration	The starting solution is a part of SHELTER project [3]
Critical factors for the integration	N/A
Connection to other tools	Predictive impact modelling, Importer & Mapper **[TL03_LINKS-B]**, Meta-repository **[TL01_SIST-A]**, ATLAS **[TL00_TEC-A]**.
Security aspects	
Security issues to be covered	Authentication will be required for the application.
Integrated security solution	Register/Login system will be implemented.
Existing security solution	N/A
Data management	
Data sharing and access	N/A
Data interoperability limitations	N/A
Standards used limitations	N/A

Table 14 - Technical specifications of the RescueME ISDSS

2.14 One-Stop-Shop

The RescueME One-Stop-Shop will be realised as a website that acts as the entry point for end-users to all RescueME digital solutions as well as additional information and results of the RescueME project. As such, the One-Stop-Shop will act as a knowledge base, providing collections of relevant information, guidance, best practices, and other resources to answer questions like "*What is resilience in the context of cultural landscapes?*", "*What measures can be taken to build resilience in cultural landscapes?*", "*What are common risks for cultural landscapes in Europe?*", and more. Where possible, the One-Stop-Shop will directly link to RescueME solutions to support answering these questions.

The technical basis of the One-Stop-Shop will be WordPress [23], i.e., a content management system that allows to create web pages and store static information for information provision and visualization. The WordPress instance will be hosted using FhG's central webhosting services. This allows very easy maintenance, as the technical infrastructure is maintained as part of FhG's central IT services, while maintenance of the

content lies within the responsibility of the department conducting the project work[1]. If required, additional RescueME partners can act as content creators and maintainers.
Currently planned key features of the One-Stop-Shop are:

- Users can browse resilience solutions (handbooks, tools, etc.); they get detailed information for each tool (developer, license, target audience, access link, detailed description of functionality).
- User can filter solutions according to the RescueME Resilient Landscape Framework.
- User can browse best practices for resilience building.
- Users can filter best practices for resilience building (e.g. covered hazards, stressors, DRM phases, implemented resilience measures).
- Users get detailed information on resilience building for CLs (e.g., a step-by-step guide).

Additional key features and requirements will be gathered during the runtime of RescueME. Figure 20 shows a mock-up of an exemplary page of the RescueME One-Stop-Shop based on the ARCH HUB [25] of the ARCH [9] project.

[1] In case of RescueME, this is the Adaptive Reflective Teams department of the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS

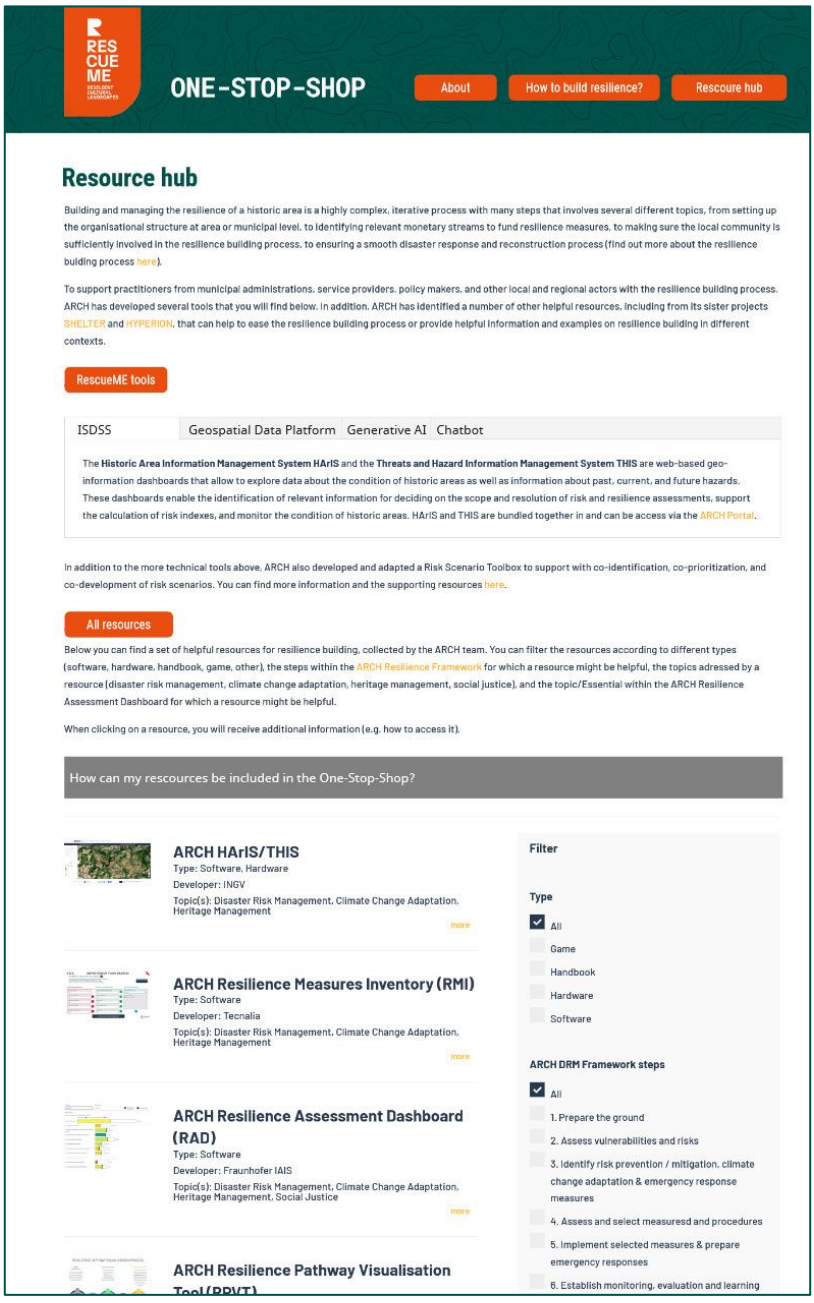


Figure 20 - Mock-up of an exemplary page of the RescueME One-Stop-Shop based on the ARCH Hub [25]

Table 15 summarises the technical specifications of the One-Stop-Shop:

SOLUTION	ONE-STOP-SHOP
ID	TL12_FHG-A
Type of the solution	Platform, i.e. WordPress website
Solution description	A website that allows users to browse information on resilience, how to build resilience, search for best practices and tools. Specifically, it will provide the single access point to other RescueME solutions via links.
WP	WP3
Task	T3.4 - ST3.4.2
Responsible	Daniel Lückerath (FhG)
Description	
Functional Description	**FHG_ONESTOPSHOP_001** Users can browse resilience solutions (handbooks, tools, etc.); they get detailed information for each tool (developer, license, target audience, access link, detailed description of functionality). **FHG_ONESTOPSHOP_002** User can filter solutions according to the RescueME Resilient Landscape Framework. **FHG_ONESTOPSHOP_003** User can browse best practices for resilience building. **FHG_ONESTOPSHOP_004** Users can filter best practices for resilience building (e.g. covered hazards, stressors, DRM phases, implemented resilience measures). **FHG_ONESTOPSHOP_005** Users get detailed information on resilience building for cultural landscapes (e.g. a step-by-step guide).
Technical Description	WordPress website hosted at the central Fraunhofer services.
Input	N/A, all input is done via the WordPress admin interface.
Output	N/A, it's a website with static texts and some filtering mechanisms.
Version	1.0 [25]
License / Terms of use / SLA	No license from end users necessary, as this is hosted by Fraunhofer.
Online documentation	https://wordpress.com
Programming Language	Html, css, ...
Usage description	
Frequency of use	On demand

Execution time	N/A
System requirements	N/A
Interoperability aspects	
Related data models	N/A
Information exchange protocol	N/A
Available API	N/A
Integration aspects	
Installation requirements	N/A
Integration requirements	N/A
Software dependencies	WordPress as well as multiple WordPress addons (e.g., Divi)
Technical dependencies	N/A
Deployment requirements	N/A
Example of existing integration	http://hub.savingculturalheritage.eu/
Critical factors for the integration	N/A
Connection to other tools	N/A
Security aspects	
Security issues to be covered	N/A
Integrated security solution	N/A
Existing security solution	N/A
Data management	
Data sharing and access limitations	N/A
Data interoperability limitations	N/A
Standards used	N/A

Table 15 - Technical specifications of the RescueME One-Stop-Shop

2.15 Summary and Categorization of Solutions

As anticipated in Section 2.1, the different tools and solutions described in the previous sections can be mapped towards some relevant steps of the data value chain:

- **Data narration**: thank to the One-Stop-Shop, the users can get introduced to concepts, data, best practices, guidelines, etc. and can be accompanied into tackling typical tasks and processes, to achieve the knowledge they need through proper data and tools.
- **Data interaction**: through the Geospatial Data Intelligent Platform, the Incremental Spatial Decision Support System, the ATLAS, the Meta-repository and the AR Application, the users can interact directly with the available content, data and tools, taking advantage of existing approaches or innovate them through iterative explorations.
- **Data elaboration**: the Mapping Models, the AI-generated images and the Social Media Module create and add new content and data, starting and elaborating on existing ones.
- **Data sources**: the Data Lake, the Chatbot, the Social Media Module and the Copernicus / In-situ data provider make available existing or newly created content and data.

3 Data Model Technical Specifications

In geospatial data domain, the choice of technologies for storing and sharing data has significant importance. This is because large amounts of data are needed, in very different formats and with a high level of detail. Herein lies the need to identify the requirements of the applications in a pre-development phase and define the formats in which they will work and how the data exchange between applications will be carried out.

In the given context, the initial step was to utilise the principles and guidelines outlined by the SHELTER project [3], an established framework or set of standards, to formulate a set of requirements. SHELTER's previous experience provided a basis to identify requirements that are adapted to the RescueME project context. These requirements cover the core features that the system needed to provide, aligned with the project's objectives and the needs of the involved stakeholders.
However, understanding that RescueMe project is dynamic and evolving, it is essential to say that the initial set of requirements is a starting point. It is understood that these requirements would be subjected to a validation and refinement process to ensure their accuracy, and alignment within the project context.
This validation process involves collaboration with diverse stakeholders, including domain experts, end-users, and project managers to identify potential gaps or overlaps, and refining the requisites to reflect how the system would work in the real world. Moreover, the validation and refinement process consider the specific contexts observed in the case studies within the RescueME project. These case studies provide a valuable understanding of the operational environments, and user needs, allowing to contextually fit and develop an appropriate set of requirements. This approach ensures that the requirements are not static but evolving with the project's progress.

During the project meetings and considering the experience in previous projects, the work has been carried out to identify the requirements presented by the applications so that once they are developed, the different data that will be collected in the project can be stored, both in format as for its correct sending to other services. The requirements have been differentiated at the application, geospatial and generic levels.

3.1 Application Domain Requirements

From the application point of view, the applications that are going to make use of the data, the way in which they are going to make use of them, and the different exchange protocols have been identified. To prevent any issue with the data models and their transfer during the

development phase, the application domain requirements have been collected and described in Table 16.

ID	REQUIREMENT	MANDATORY OPTIONAL
REQ_APP_1	It should be able to authenticate with the external Authentication server with AA Server	Optional
REQ_ APP_2	It should be able to hold information from the indicators	Optional
REQ_ APP_3	It should be able to hold information from the Serious Game tool	Optional
REQ_ APP_4	It should be able to display IoT information	Optional
REQ_ APP_5	RescueME data model must allow easy integration of new data/information sources (e.g., addition of new tools or IoT devices in case study areas)	Optional
REQ_ APP_6	RescueME data model should allow direct stakeholders to set automatic notifications or alerts when new relevant information is processed by the system	Optional
REQ_ APP_7	RescueME data model should record all direct stakeholder's actions, processing and decisions (Who, What, Where, When or Why) in an audit log file.	Optional
REQ_ APP_8	RescueME data model should be able to link the Meta-repository to the ISDSS	Mandatory

Table 16 - RescueME Application Domain Requirements for Data Models

3.2 Geospatial Requirements

Since geospatial data is usually generated once and does not change over time, the activities focusing on the geospatial section focus on the correct storage of data. In the possibility of a change, different types of data are used. To carry out the particularities of geospatial data and the interaction with applications, a table collecting these requirements has been developed (Table 17)

ID	REQUIREMENT	MANDATORY OPTIONAL
REQ_GEO_1	RescueME data model must allow representation of geometric information with different levels of detail	Mandatory
REQ_ GEO_2	The language or file format for the representation of geometric information should allow modelling and storing geographic information	Mandatory
REQ_ GEO_3	RescueME data model must be able to represent different natural elements as well as elements in human settlements of different scales such as	Optional

	buildings, public spaces, green areas or water bodies.	
REQ_ GEO_4	RescueME data model must store information of the geometry of natural and urban elements.	Mandatory
REQ_ GEO_5	The geometry of the elements modelled in RescueMe must be correctly referenced in altitude with respect to the elevation model.	Mandatory
REQ_ GEO_6	Spatial information can be represented in georeferenced vector or raster format	Mandatory
REQ_ GEO_7	The geometric information in vector format can be represented by pints, lines or polygons	Mandatory
REQ_ GEO_8	Linear geometry of a layer must not overlap with lines of the same entity	Mandatory
REQ_ GEO_9	The linear geometry must not overlap with itself	Mandatory
REQ_ GEO_10	The linear geometry of an entity must be a single part avoiding multipart features	Mandatory
REQ_ GEO_11	The interior of a polygon in a layer must not overlap. It is possible to share edges or vertices	Mandatory
REQ_ GEO_12	The geometric elements must have the same coordinate system, if not, they must be projected in the same system to be referenced equally in the same position	Mandatory
REQ_ GEO_13	For raster elements, the spatial resolution (pixel size) must be appropriately defined considering the display scale	Optional
REQ_ GEO_14	The geometric elements must have an adequate numerical precision for an exact cartographic and analytical representation	Optional

Table 17 - RescueME Geospatial Requirements for Data Models

3.3 Generic Requirements

Generic requirements refer to those requirements that, although they do not come directly from the project or functionality, are necessary for its correct functioning. Such requirements, collected and described in Table 18, must be considered by the R-Labscapes during the development of the project.

ID	REQUIREMENT	MANDATORY OPTIONAL
REQ_GEN_1	RescueME data model must support information at different scales, from building to cross-regional	Mandatory
REQ_GEN_2	RescueME data model must include geographic, 2D and 3D as well as semantic information	Mandatory
REQ_GEN_3	RescueME data model must include information on the different hazards to be analysed	Mandatory

REQ_GEN_4	RescueME data model must be based on standards to facilitate the interoperability	Mandatory
REQ_GEN_5	RescueME data model must include the information about the Resilience Indicators	Mandatory
REQ_GEN_6	RescueMe data model and all the elements included must be correctly georeferenced on a universal coordinate system in latitude, longitude and elevation	Mandatory
REQ_GEN_7	RescueME data model should be extensible in both, spatial extension and semantic information related to the elements in the model	Mandatory
REQ_GEN_8	RescueME data model geometric and semantic information must be divided in different layers to avoid coupling and promote it reuse	Optional
REQ_GEN_9	RescueME data model should be able to include information at least for the five case studies: Portovenere, Cinque Terre & the Island, Historical Irrigation System at l'Horta de València, Hamburg-Neuwerk in the National Park Hamburg Wadden Sea, Psiloritis UNESCO Global geopark, Defensive System of Zadar	Mandatory
REQ_GEN_10	RescueME data model must allow system administrators to easily update relevant content (for instance: areas affected by a hazard)	Mandatory
REQ_GEN_11	RescueME data model should contain information about CL elements and their status in the RHL	Optional
REQ_GEN_12	RescueME data model information must be secure	Mandatory
REQ_GEN_13	RescueME data model shall support the organization of the information collected to enable an effective consultation and analysis.	Optional
REQ_GEN_14	RescueME data model should include an Index or conceptual scheme of the information stored to facilitate data retrieving	Optional
REQ_GEN_15	It should be allowed to modify accessibility permissions of users at any moment	Mandatory
REQ_GEN_16	RescueME data model should allow to search for information/data by different parameters (e.g., keywords, multiple filters...)	Mandatory
REQ_GEN_17	RescueMe data model should be linked to historical information of CL	Mandatory
REQ_GEN_18	Administrators of RescueME data model should be able to audit past and present activity carried out by direct users	Optional
REG_GEN_19	Semantic information should be based on defined ontologies, standards, normative, directives or guidelines recognised by international experts and organizations	Mandatory

REQ_GEN_20	Semantic information should be linked to the corresponding geometric element	Mandatory

Table 18 - RescueME Generic Requirements for Data Models

3.4 Data Models

Table 19 summarises the technical specifications of the Data Models:

TITLE	DESCRIPTION
Name	CityGML
Short Description	CityGML is an international standard developed by the Open Geospatial Consortium (OGC) and is widely recognised in the geospatial and urban planning communities. It consists of an open data model and XML-based format used for the storage and exchange of 3D city models and urban geographic information.
Pros	• Standard • Contains most of the city parameters. • Extensible via ADE (Utility Network, Noise, Energy…)
Cons	• Not suitable for dynamic/real time data • Not contemplated data should be added as generic attribute.
Algorithm / process	Different data sources such as cadastre, Open Street Maps, city council and any city data are processed and converted for generating the city information model in CityGML format. CityGML is not directly consumed by any solution but is used to generate other formats like 3DTiles and WMS and to run processes against them.
Related Digital Solutions	• Data Lake **[TL02_LINKS-A]** • Importer & Mapper **[TL03_LINKS-B]** • ISDSS **[TL11_TEC-B]**

Table 19 - Technical specifications of RescueME CityGML Data Models

TITLE	DESCRIPTION
Name	3DTiles
Short Description	3D Tiles is a format and specification developed for the efficient streaming and rendering of 3D geospatial data, it is

	designed to support the visualization of complex 3D models.
Pros	• Optimal for big 3D Models • Via steaming, not blocking the app • Supported by most 3D Viewer such as Cesium • Fast for geospatial queries.
Cons	• Impossible to know if a model is loaded or not in the viewer. • The number of models loaded depends on the machine/screen.
Algorithm / process	3D Tiles is generated from the CityGML, generating a file for each of the city elements (buildings, trees, benches) … It could be updated to the application or served via service or via cesium web.
Related Digital Solutions	• Data Lake **[TL02_LINKS-A]** • Importer & Mapper **[TL03_LINKS-B]** • ISDSS **[TL11_TEC-B]**

Table 20 - Technical specifications of RescueME 3D Tiles Data Models

TITLE	DESCRIPTION
Name	GeoJSON
Short Description	Format for encoding geographic data using the JSON notation.
Pros	• Lightweight and easy to understand syntax. • Supports various geometries and properties. • Human-readable format.
Cons	• Limited support for complex geospatial operations. • Not suitable for large datasets. • No built-in compression mechanism.
Algorithm / process	Some GeoJSON are generated inside the project and others are directly available form data sources. In general, is used to exchange geographic information between application or services.
Related Digital Solutions	• Data Lake **[TL02_LINKS-A]** • Importer & Mapper **[TL03_LINKS-B]** • ISDSS **[TL11_TEC-B]**

Table 21 - Technical specifications of RescueME GeoJSON Data Models

TITLE	DESCRIPTION
Name	Web Map Service (WMS)
Short Description	Standard protocol for serving georeferenced map images over the internet.
Pros	• Provides on-demand map images that can be dynamically styled and overlaid. • Supports various coordinate systems and projections.
Cons	• Limited interactivity, as it only serves static images. • Performance may degrade with high server loads.
Algorithm / process	The shape files and generated maps are imported to the Geoserver or similar and make available via WMS.
Related Digital Solutions	• Data Lake **[TL02_LINKS-A]** • Importer & Mapper **[TL03_LINKS-B]** • ISDSS **[TL11_TEC-B]**

Table 22 - Technical specifications of RescueME WMS Data Models

TITLE	DESCRIPTION
Name	JSON
Short Description	Lightweight data interchange format
Pros	• Simple and easy to read/write. • Widely supported across programming languages and platforms. • Ideal for data interchange between systems.
Cons	• Lacks schema definition, leading to potential data integrity issues. • Not optimised for large datasets.
Algorithm / process	Directly generated by the services and applications, most common way of exchanging data.
Related Digital Solutions	• Meta-repository **[TL01_SIST-A]** • Data Lake **[TL02_LINKS-A]** • Importer & Mapper **[TL03_LINKS-B]** • Web Application/ Frontend **[TL04_LINKS-C]** • Geospatial Data Intelligent Platform **[TL05_DRAXIS-A]** • Generative AI **[TL06_LINKS-D]** • AR Mobile Application **[TL07_LINKS-E]**

	• Mapping Models **[TL08_LINKS-F]** • Mobile Chatbot **[TL09_LINKS-G]** • Social Media Module **[TL10_LINKS-H]** • ISDSS **[TL11_TEC-B]** • One-Stop-Shop **[TL12_FHG-A]**

Table 23 - Technical specifications of RescueME JSON Data Models

4 Datasets Categorization and Description

This chapter provides an in-depth analysis of the datasets utilised in the project. It categorises the datasets based on their relevance to cultural and natural heritage resilience for the five R-Labscapes and provides detailed descriptions of each dataset. Additionally, it discusses data sources, collection methods, and quality assurance processes, describing how data flows within the digital solutions, including its sources, destinations, formats, transformations, and any data mapping required between different systems or components.

4.1 Methodology for Data Description: The Data Mapping Form (DMF)

Within the RescueME project, ST3.1.3 identifies and maps all the actionable data sources, gathering and inserting the key local ones within the Data Lake (T3.3). A first version of this mapping has been delivered at M6 to inform the assessment framework in WP1. The activity started with the analysis of the data sources identified within the SHELTER project [3] and then it progressed with the collection from all partners (both developers and R-Labscapes) of existing available (or to be available) data-related information. In the next phases, an intensive process of information exchange and collaboration with all the partners was needed to reduce the lack of information still present in the vast collection of data. A set of sample data has been also made available through the project repository (Sharepoint) for initial evaluations by the tools' developers. Each dataset was verified and checked and, when needed, updated in coordination to the partner who provided the initial information.
To achieve its objectives, RescueME must deal with miscellaneous data products with quite different features (spatial and temporal resolution, scale, time-range...), ownerships, and usage restrictions. Such a degree of complexity makes it necessary to implement a rigorous methodology for metadata collection, so that none of the four FAIR principles [1] are affected. For this reason, RescueME extends the metadata collection methodology implemented in the SHELTER project. This methodology consists of the use of a data

description template, namely the Data Mapping Form (DMF) (see Annex I for a preview), an excel file, where all the information needed to describe the data is collected.
The SHELTER DMF has been updated to reflect the RescueME project requirements. Table 24 represents the RescueME DMF template version at the time of writing the present deliverable:

FIELD	DESCRIPTION
ID	Dataset unique identifier: - First digit = WP - Second digit = Task - Last 3 digits = progressive number
Description	Short description of the dataset
Existing/Foreseen data	Existing = datasets existing before the start of the project Foreseen = either for future release of the same datasets or for data that is planned to be generated
Type	Structured, semi-structured, unstructured or new generation big data
IoT	Data derived from IoT sources
Format	Data format
Size	Size occupied by the dataset when stored (total data size or size relative to 1 year of data)
Time coverage	The available data time range
Area coverage	Data geographic extension
Spatial resolution/scale	Data spatial resolution (for raster) or scale (for vector)
Temporal resolution	The amount of time needed to revisit and acquire data for the exact same location
Update frequency	How often the data is updated
License	License type (e.g. Creative Commons)
Ownership/author	Data ownership/author
Access mode	Data access type
Access restrictions	Info about data accessibility (with or without restrictions from copyright, patents or other mechanisms of control)
Access links	Link to websites/portals providing data access
Metadata	Metadata standards
Application field	Data domain/filed application
Hazard type	Hazard to which the data is related
DRM phase	DRM phase for which the data is useful
Comments	Any relevant comments
Data example	Link to the data example

Data examples download	The partner downloading the data example for the first time
Indicator ID	Unique identifier of the related indicator
Indicator calculation method	Description of the method used to retrieve the related indicator
Module	The RescueME module that is going to import the described dataset

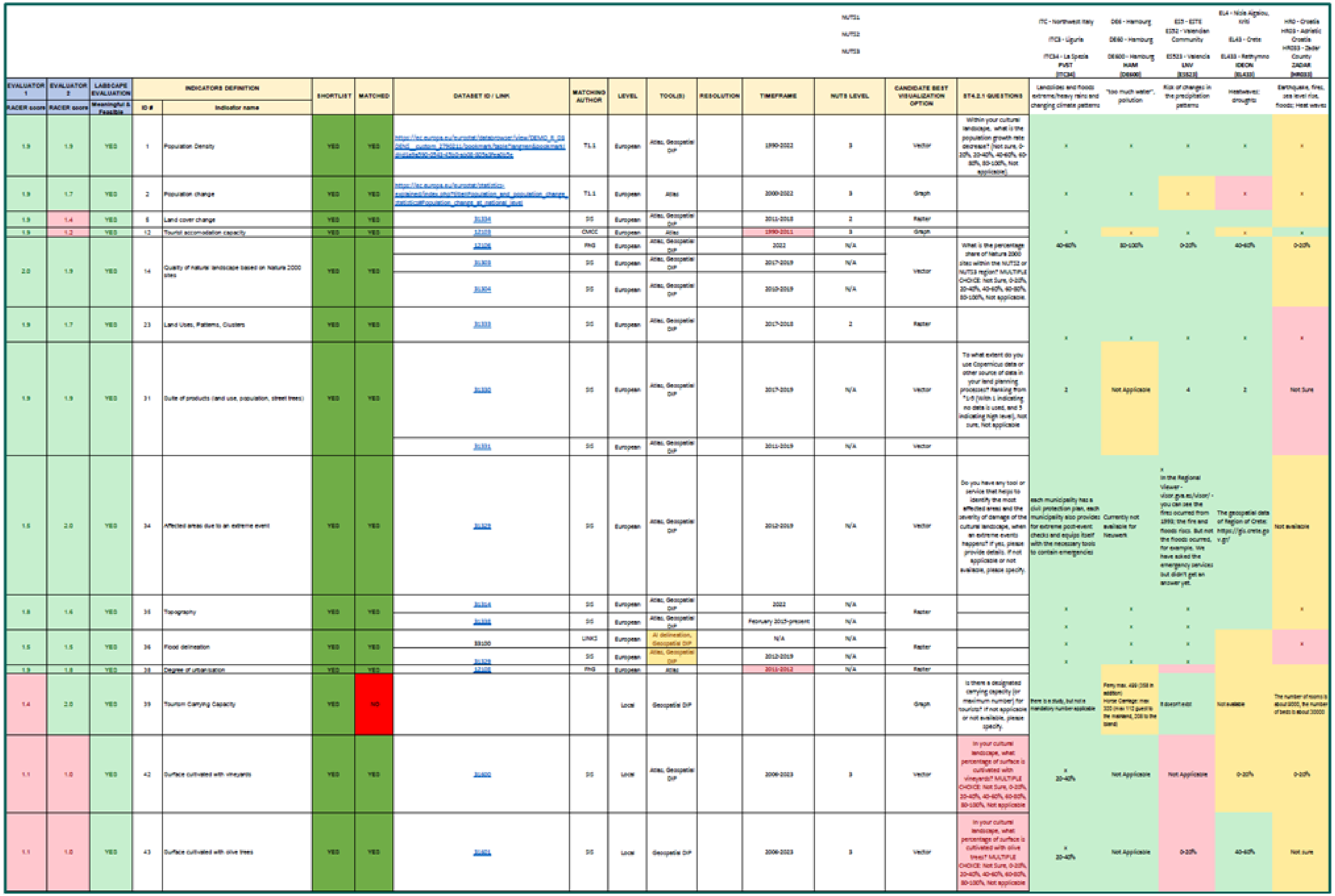
Table 24 - RescueME Data Mapping Form template

The detailed and structured description of the data collected and shared within the project represents the basis to design, implement and integrate the tools and solutions that will result from WP1, WP2 and WP3. Each tool developer can in fact take advantage of the DMF to analyze the different data sources and to learn about their possible use for the solutions to develop. Thanks to the information collected through the 'Spatial resolution/scale' field, for example, the datasets can be considered relevant for the Geospatial Data Intelligent Platform (TL05_DRAXIS-A) if categorised as 'Local data' or they can instead feed the ATLAS (TL00_TEC-A) if their scale is at European level.
Similarly, knowing the data format upfront allows the RescueME tools' designers to plan for any necessary transformations or conversions to ensure compatibility with other tools or systems. The available time range of the data is essential for temporal analysis as it helps in determining if historical data is available for trend analysis, forecasting, or training predictive models (e.g., Mapping Models - TL08_LINKS-F).
Moreover, understanding the data access mode (e.g., batch processing, streaming, real-time API) is crucial for the RescueME tool developers for designing an efficient data retrieval mechanism, as it influences decisions regarding data storage as well as data retrieval algorithms.
The following section describes the methodology used to perform a preliminary matching of the datasets described through the DMF with the indicators identified within Task 1.1.

4.2 Data Categorization and Data Matching with Indicators

When writing the present document, almost 300 datasets/products were mapped, described through the DMF, checked and are currently under verification. Next, to identify the data and sources more relevant for the R-Labscapes, a mapping procedure was performed towards a prioritised list of resilience indicators (from T1.1) and it will continue until M18.
The groundwork for this mapping activity is represented by the Actionable RHL framework designed within T1.1 that works as a metric system for measuring resilience across different CLs (see D1.1 - Actionable Resilient Historic Landscape Framework [2]). Given that indicators

have been developed with both European and local levels in mind, the present document includes descriptions of data at both scales, with particular focus on the data mapping for the ATLAS and the preliminary list of data selected at local scale by each R-Labscape.
During the next phases of the project, the WP1 will be focused on the definition of the different impact models for the R-Labscapes considering the specific hazards which characterise them and designing the final list of indicators. For this reason, the above-mentioned datasets/indicators matching represents just a preliminary activity to set the design and requirements for the implementation of the different solutions.
Starting from the initial set of indicators identified within T1.1 and the datasets described through the DMF in ST3.1.3, a new spreadsheet has been implemented to perform the above-mentioned datasets/indicators matching (see Figure 21 for a preview of the table, the corresponding excel file is delivered in a compressed folder with the present document)



EVALUATOR 1 RACER score	EVALUATOR 2 RACER score	LABSCAPE EVALUATION Meaningful & Feasible	ID #	Indicator name	SHORTLIST	MATCHED	DATASET ID / LINK	MATCHING AUTHOR	LEVEL	TOOL(S)	RESOLUTION	TIMEFRAME	NUTS LEVEL	CANDIDATE BEST VISUALIZATION OPTION	ST4.2.1 QUESTIONS	ITC - Northwest Italy; ITC3 - Liguria; ITC34 - La Spezia PVST [ITC34] — Landslides and floods extreme/heavy rains and changing climate patterns	DE6 - Hamburg; DE60 - Hamburg; DE600 - Hamburg HAM [DE600] — "too much water", pollution	ES5 - ESTE; ES52 - Valencian Community; ES523 - Valencia LNV [ES523] — Risk of changes in the precipitation patterns	EL4 - Nisia Aigaiou, Kriti; EL43 - Crete; EL433 - Rethymno IDEON [EL433] — Heatwaves; droughts	HR0 - Croatia; HR03 - Adriatic Croatia; HR033 - Zadar County ZADAR [HR033] — Earthquake, fires, sea level rise, floods; Heat waves
1.9	1.9	YES	1	Population Density	YES	YES	https://ec.europa.eu/eurostat/databrowser/view/DEMO_R_D3DENS__custom_[illegible]	T1.1	European	Atlas, Geospatial DIP		1990-2022	3	Vector	Within your cultural landscape, what is the population growth rate decrease? (Not sure, 0-20%, 20-40%, 40-60%, 60-80%, 80-100%, Not applicable)	x	x	x	x	x
1.9	1.7	YES	2	Population change	YES	YES	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Population_and_population_change_statistics#Population_change_at_national_level	T1.1	European	Atlas		2000-2022	3	Graph		x	x	x	x	x
1.9	1.4	YES	5	Land cover change	YES	YES	31334	SIS	European	Atlas, Geospatial DIP		2011-2018	2	Raster						
1.9	1.2	YES	12	Tourist accomodation capacity	YES	YES	12108	CMCC	European	Atlas		1990-2011	3	Graph		x	x	x	x	x
2.0	1.9	YES	14	Quality of natural landscape based on Natura 2000 sites	YES	YES	12106	PHG	European	Atlas, Geospatial DIP		2022	N/A	Vector	What is the percentage share of Natura 2000 sites within the NUTS2 or NUTS3 region? MULTIPLE CHOICE: Not Sure, 0-20%, 20-40%, 40-60%, 60-80%, 80-100%, Not applicable	40-60%	80-100%	0-20%	40-60%	0-20%
							31303	SIS	European	Atlas, Geospatial DIP		2017-2019	N/A							
							31304	SIS	European	Atlas, Geospatial DIP		2010-2019	N/A							
1.9	1.7	YES	23	Land Uses, Patterns, Clusters	YES	YES	31333	SIS	European	Atlas, Geospatial DIP		2017-2018	2	Raster		x	x	x	x	x
1.9	1.9	YES	31	Suite of products (land use, population, street trees)	YES	YES	31330	SIS	European	Atlas, Geospatial DIP		2017-2019	N/A	Vector	To what extent do you use Copernicus data or other source of data in your land planning processes? Ranking from "1-5 (With 1 indicating no data is used, and 5 indicating high level), Not sure, Not applicable	2	Not Applicable	4	2	Not Sure
							31331	SIS	European	Atlas, Geospatial DIP		2011-2019	N/A	Vector						
1.5	2.0	YES	34	Affected areas due to an extreme event	YES	YES	31328	SIS	European	Atlas, Geospatial DIP		2012-2019	N/A	Vector	Do you have any tool or service that helps to identify the most affected areas and the severity of damage of the cultural landscape, when an extreme events happens? If yes, please provide details. If not applicable or not available, please specify.	each municipality has a civil protection plan, each municipality also provides for extreme post-event checks and equips itself with the necessary tools to contain emergencies	Currently not available for Neuwerk	x In the Regional Viewer - visor.gva.es/visor/ - you can see the fires ocurred from 1993; the fire and floods risks. But not the floods ocurred, for example. We have asked the emergency services but didn't get an answer yet.	The geospatial data of Region of Crete: https://gis.crete.gov.gr/	Not available
1.8	1.6	YES	35	Topography	YES	YES	31314	SIS	European	Atlas, Geospatial DIP		2022	N/A	Raster		x	x	x		x
							31335	SIS	European	Atlas, Geospatial DIP		February 2015-present	N/A			x	x	x		
1.5	1.5	YES	36	Flood delineation	YES	YES	33100	UNIKS	European	AI delineation, Geospatial DIP		N/A	N/A	Raster		x	x	x		x
							31329	SIS	European	Atlas, Geospatial DIP		2012-2019	N/A			x	x	x		
1.9	1.8	YES	38	Degree of urbanisation	YES	YES	12108	PHG	European	Atlas		2011-2012	N/A	Raster						
1.4	2.0	YES	39	Tourism Carrying Capacity	YES	NO			Local	Geospatial DIP				Graph	Is there a designated carrying capacity (or maximum number) for tourists? If not applicable or not available, please specify.	there is a study, but not a mandatory number applicable	Ferry max. 499 (358 in addition) Horse Carriage: max 330 (max 110 guests to the mainland, 200 to the island)	It doesn't exist	Not available	The number of rooms is about 8000, the number of beds is about 20000
1.1	1.0	YES	42	Surface cultivated with vineyards	YES	YES	31400	SIS	Local	Atlas, Geospatial DIP		2006-2023	3	Vector	In your cultural landscape, what percentage of surface is cultivated with vineyards? MULTIPLE CHOICE: Not Sure, 0-20%, 20-40%, 40-60%, 60-80%, 80-100%, Not applicable	x 20-40%	Not Applicable	Not Applicable	0-20%	0-20%
1.1	1.0	YES	43	Surface cultivated with olive trees	YES	YES	31401	SIS	Local	Geospatial DIP		2006-2023	3	Vector	In your cultural landscape, what percentage of surface is cultivated with olive trees? MULTIPLE CHOICE: Not Sure, 0-20%, 20-40%, 40-60%, 60-80%, 80-100%, Not applicable	x 20-40%	Not Applicable	0-20%	40-60%	Not sure

Figure 21 - Spreadsheet elaborated to match the datasets described in the RescueME DMF and the set of resilience indicators from T1.1

Such a spreadsheet includes several information retrieved from D1.1 – Actionable Resilient Historic Landscape [2], such as:

- The results of the **RACER assessment** performed by two different evaluators: to check and assess the appropriateness of resilience indicators, the RACER (relevant, accepted, credible, easy and robust) criteria were selected, as a framework used to assess the soundness of scientific tools for their use in policy making [26].
- The **R-Labscapes evaluation**: to pursue a GLOCAL strategy (based on both Global and Local factors), as well as top-down and bottom-up approaches, the R-Labscapes have been asked to assess the meaningfulness and feasibility of the indicators in their specific locations, considering their type of landscapes and their challenges.
- The selection of **shortlisted indicators** (including their ID and names): both the RACER criteria framework and the R-Labscapes assessment were considered to select indicators, according to a certain number of principles (see D1.1 [2], section 1.10, page 50 for more details).
- The geographical level at which the data are available: European or local level (see D1.1 [2], Table 15, page 73 for more details)

The spreadsheet also contains the following fields inherited from the DMF:

- **Dataset ID/LINK**, containing the dataset ID or, alternatively, the link to access the dataset, in case this was identified (and already matched) within T1.1.
- **Tool(s)**, used to perform a preliminary analysis of the tools that will possibly expose the related indicator.
- **Resolution**, to report the spatial resolution of the data.
- **Time frame**, indicating the time frame at which the datasets are available.

In addition, the field '*ST4.2.1 questions*' contains inputs from ST4.2.1 (Local resilience baseline assessments for each R-Labscape), where the resilience baseline assessment, based on the RescueME indicator framework, aimed at evaluating local resilience by gathering and analyzing local data through a questionnaire answered by the R-Labscapes.
Finally, the following fields have been included to effectively describe how data should flow within the different digital solutions:

- **NUTS level** [27], indicating the Nomenclature of Territorial Units for Statistics (NUTS) for each dataset, which allows to categorise the different datasets (and the related matched indicators) according to this European standard.
- **Candidate best visualization option**, which contains a proposal in terms of how each indicator could be displayed through the tool that is going to expose it, considering 4 different options: raster, vector, stats, or graph. Following the criteria according to which the different visualization options have been assigned:
    - **Raster**: most of the indicators containing this option are matching datasets that are available in raster format.

- **Vector**: most of the indicators containing this option contain a geographical component in their definitions (e.g.: ID 34 - Affected areas due to an extreme event).
- **Graph**: this option is preferred whenever the indicator implies the use of a data time-series. Since this information is not available yet (at least not for all the indicators), an analysis of the '*Unit*' field in the list of resilience indicators (available in Annex III of D1.1 [2]) has been performed to go more in details of each indicator features (e.g.: it is expected to visualise a graph for the indicators that are expressed in %).
- **Stats**: if no data time-series are available, this is considered the best option, but, again, being this information not yet available, the value '*Stats*' has been assigned to the indicators that are expressed as numbers in the above-mentioned '*Unit*' field.

The choice between the 2 last options mainly depends on the temporal resolution assigned to each indicator: if a certain indicator must be calculated over a single year, visualizing it through a graph option would be less significant, unless there are different variables to associate with the indicator value, such as different regions, or further parameters.

In the context of the Actionable Resilient Historic Landscape framework defined earlier in the project, indicators were defined at European as well as at local level to describe CLs as socio-economic-technical system (SETS). Following more details are provided for what concerns the datasets selected at each scale.

4.2.1 Data at Local Scale

As already described in the previous sections, WP1 activities aim at developing predictive impact assessment models that could be linked with specific resilience measures and indicators. When writing the present deliverable, the RHL framework was delivered with a short list of indicators. T1.3 will deepen these concepts and provide a specific quantification in the R-Labscapes context, to better address specificities in data availability and overall context. For its objectives, T1.3 requires input and interactions with T1.1, for what concerns the list of indicators, and T4.2, for the local impact chains and local resilience assessment (see D4.3 - Local Resilience Baseline and Local Impact Chains for R-Labscapes [24]). ST3.1.3 role is to support WP1 partners in the preliminary identification of useful data. For this reason, several bi-lateral meetings with the five R-Labscape referents have been held and the result of such interactions is summarised in Annex II, where a list of datasets (and their attributes) considered useful for each R-Labscape is reported as a subset of the data described through the DMF.
This data also includes any R-Labscape local sensor data that may be available, including IoT data.

The interactions with the R-Labscapes have been iterated also for collecting each R-Labscape's area of interest, represented by a preliminary area that is going to be updated in the coming period.
The following subsections summarise the different hazards and fields of exposure for each R-Labscape as derived from the analysis performed within T4.2 (for more details see D4.3 - Local Resilience Baseline and Local Impact Chains for R-Labscapes [24]) and identify a preliminary list of data sources and datasets considered useful for T1.3 objectives.
The areas of interest reported for each R-Labscape derive from the first round of interactions. Their updated version (which should represent a higher resolution for developing the predictive impact assessment models in T1.3) is not available yet at the time of writing the present deliverable.

PSILORITIS

The area of the Eastern Mediterranean, where the island of Crete is located, is expected to suffer more from the effects of climate change than any other region in Europe. Heatwaves and rising temperatures, intensified by other factors such as water shortages, will threaten all economic and productive activities in the area, the health of residents and visitors, and the social cohesion and cultural continuity in this area. For these reasons, the focus of this R-Labscape is mainly towards heatwaves and temperature rise, with agriculture and tourism representing the most exposed fields.
Figure 22 shows the area of interest identified for this R-Labscape in the RescueME framework:

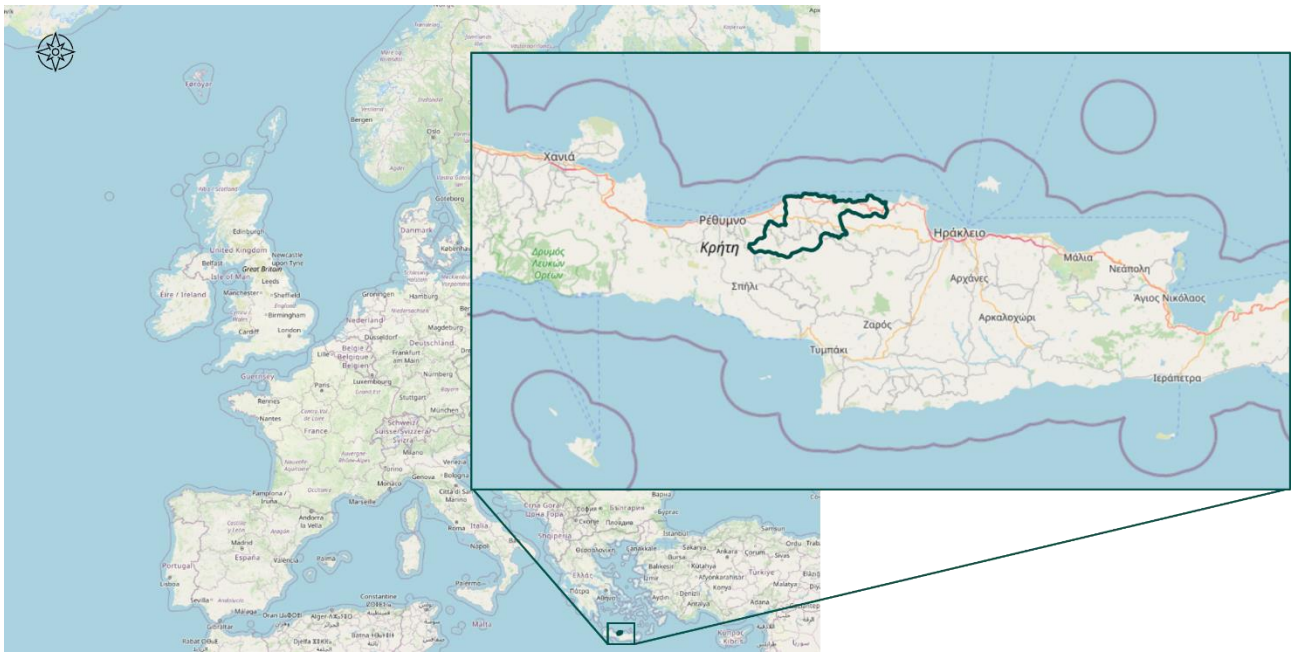


Figure 22 – Psiloritis R.Labscape area of interest for RescueME

To best monitor these two fields, the following data sources have been selected by the Psiloritis R-Labscape referent:

- Crete Geospatial Information Portal [28], from which many of the datasets described in Annex II are available as well as the following web applications:
  - Sentinel Hub Playground [29]
  - Longitudinal Image Comparison Application for Sentinel images [30]
  - Crete EO Browser [31]
- Psiloritis Geopark WebGIS App [32]

NEUWERK

The islands of Neuwerk, Scharhörn and Nigehörn and their surrounding tidal flats (constituting the area of the Hamburg Wadden Sea National Park) are exposed to the impacts of a climate change-related sea level rise as well as the increase in the occurrence and intensity of severe coastal storm events within the southern German Bight. Sea level rise poses a significant hazard to the Wadden Sea as it can lead to more and longer periods of coastal flooding of the foreshore areas. An increase in the water level together with a severe storm event can undermine the structural integrity of the coastal defense systems: rock revetments, wooden seawalls and a ring dyke that surrounds the buildings of the island of Neuwerk and the grazing areas. The islands of Scharhörn and Nigehörn are protected bird sanctuaries and are therefore uninhabited (apart from the bird warden on Scharhörn) while the island of Neuwerk has a small number of permanent residents and non-resident employees from the mainland. Considering these aspects, the focus of this R-Labscape is mainly towards the risk of "*too much water*" (considering both storm surge and sea level rise) and of pollution (e.g., oil spill). The exposure systems analyzed within T4.2 include: people, tourism, ecologically significant areas on Neuwerk, accessibility of the island, general flora and fauna, different infrastructure types, other systems such as the waterbody and the tidal flats, and the different economic sectors (tourism, shipping, use of pasture).

Figure 23 shows the area of interest identified for this R-Labscape in the RescueME framework:

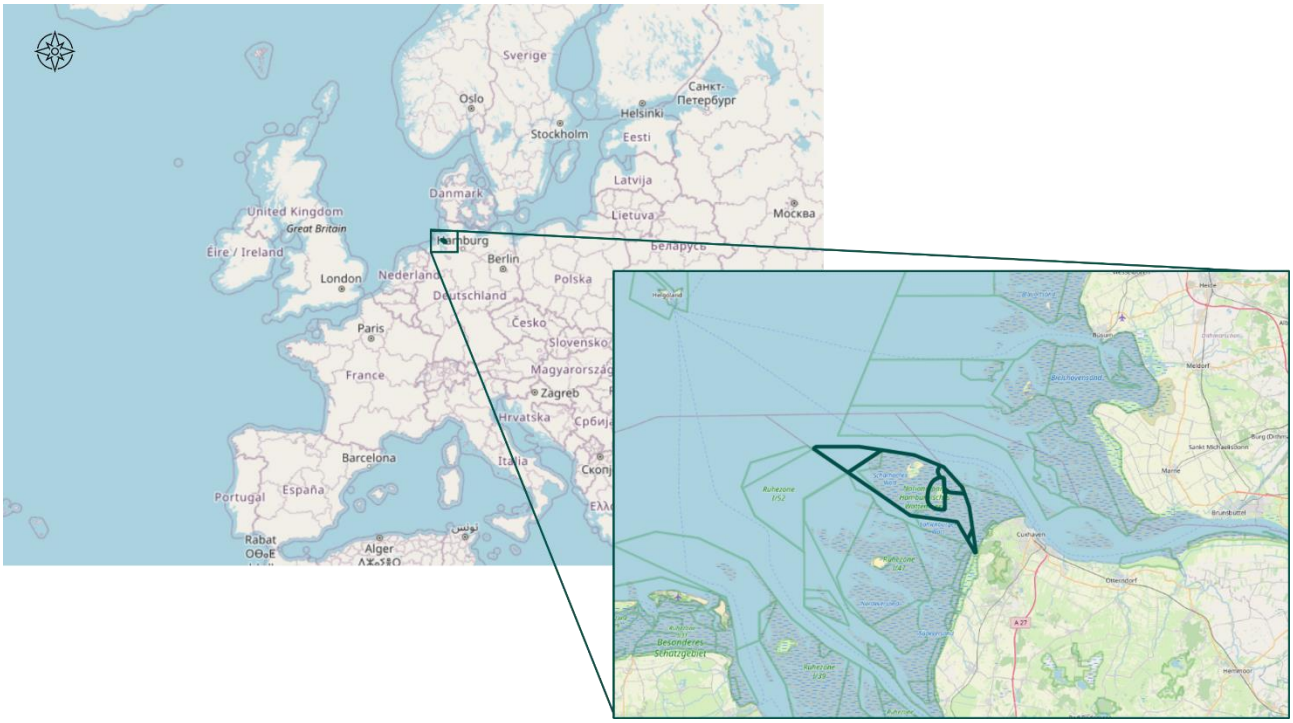


Figure 23 - Neuwerk R-Labscape area of interest for RescueME

The main data source for this R-Lascape are:

- the Hamburg Geoportal [33]
- EasyGSH-DB [34]

PORTOVENERE, CINQUE TERRE AND THE ISLANDS

Various parts of this UNESCO site are susceptible to slope and soil instability with dormant or active landslides widely present in the area. In addition to an increase in the amount of rain, deforestation and fires are also a cause for landslides. The climatic characteristics and the annual distribution of rainfall contribute to the increase in vulnerability of the territory. Human activity can also cause landslides: the alteration of areas by humans, often without prior consideration of the environment, can lead to land subsidence; in addition, the abandonment of agricultural activities and the deterioration and collapse of dry-stone walls can increase the vulnerability of the area. Consequently, agriculture, cultural heritage, people, and infrastructures are here the main exposure systems under observation.

Figure 24 shows the area of interest identified for this R-Labscape in the RescueME framework:

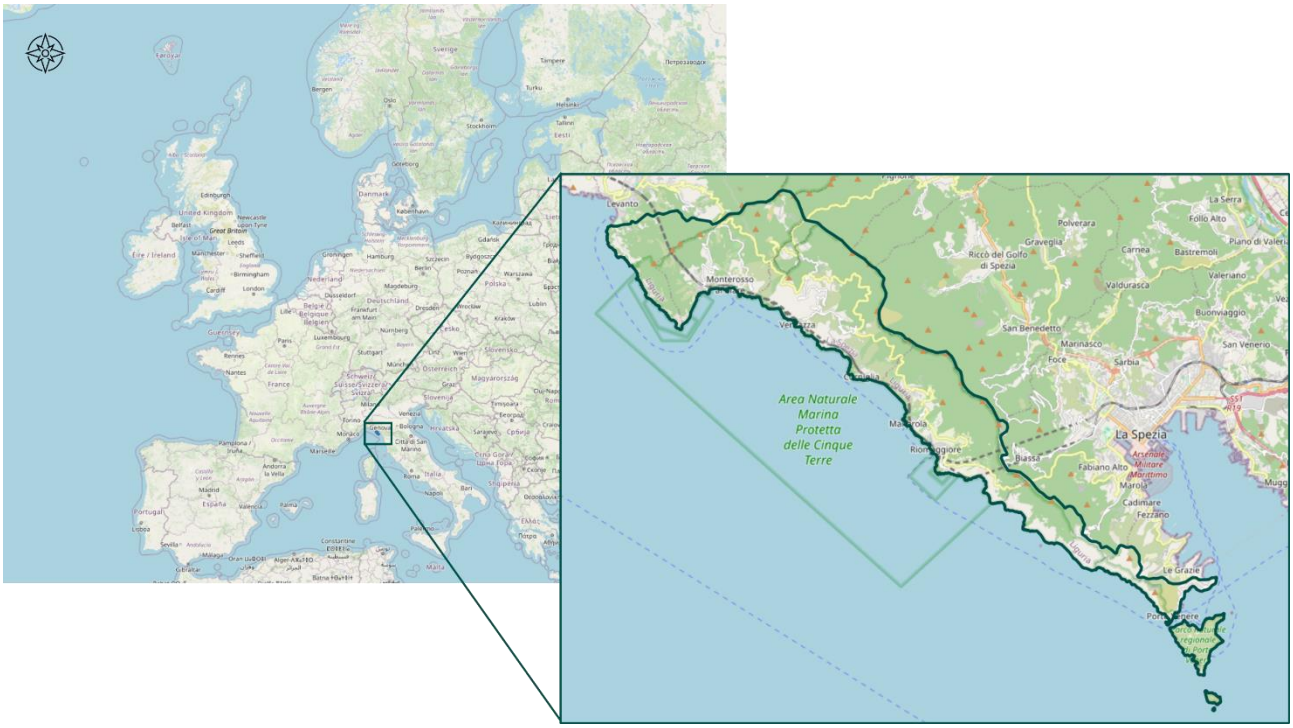


Figure 24 - Portovenere, Cinque Terre and the Islands R-Labscape area of interest for RescueME

Thanks to the knowledge built through several previous UNESCO projects (Management Plans, Disaster Risk Management Plan, several analyses on the territory, etc.) where LINKS was involved in, this R-Lascape is particularly advanced in terms of data availability and risk analysis, and for this reason it has been selected as the first area to be used for the tools' implementation. Moreover, this R-Labscape has shown interest in most of the solutions proposed by the technical partners.

This will allow on one side to start testing the different tools on a more mature system and on the other side to give the other R-Lascapes the necessary time to align themselves in the data retrieval process.

The following data sources have been selected as relevant for the scope of this R-Labscapes:

- Liguria Region Geoportal [35]
- Appennino Settentrionale Geodataserver [36]

L'HORTA DE VALÈNCIA

Drought periods getting longer, precipitation events occurring at various times than previously known and getting more extreme at the same time represent changes in the climate patterns that strongly impact this R-Labscape. Consequently, there is the risk of abandonment of agricultural and fishing activities which is a non-climatic hazard depending on urban expansion of the Valencia city, the expansion of urban infrastructures, as well as

the enlargement of the port infrastructures. Therefore, the exposure systems analyzed within T4.2 for this R-Labscape include cultural heritage, economic sectors, ecosystem services, infrastructure, soils, biodiversity, agriculture and fishery activities, as well as built environment.

Figure 25 shows the area of interest identified for this R-Labscape in the RescueME framework:

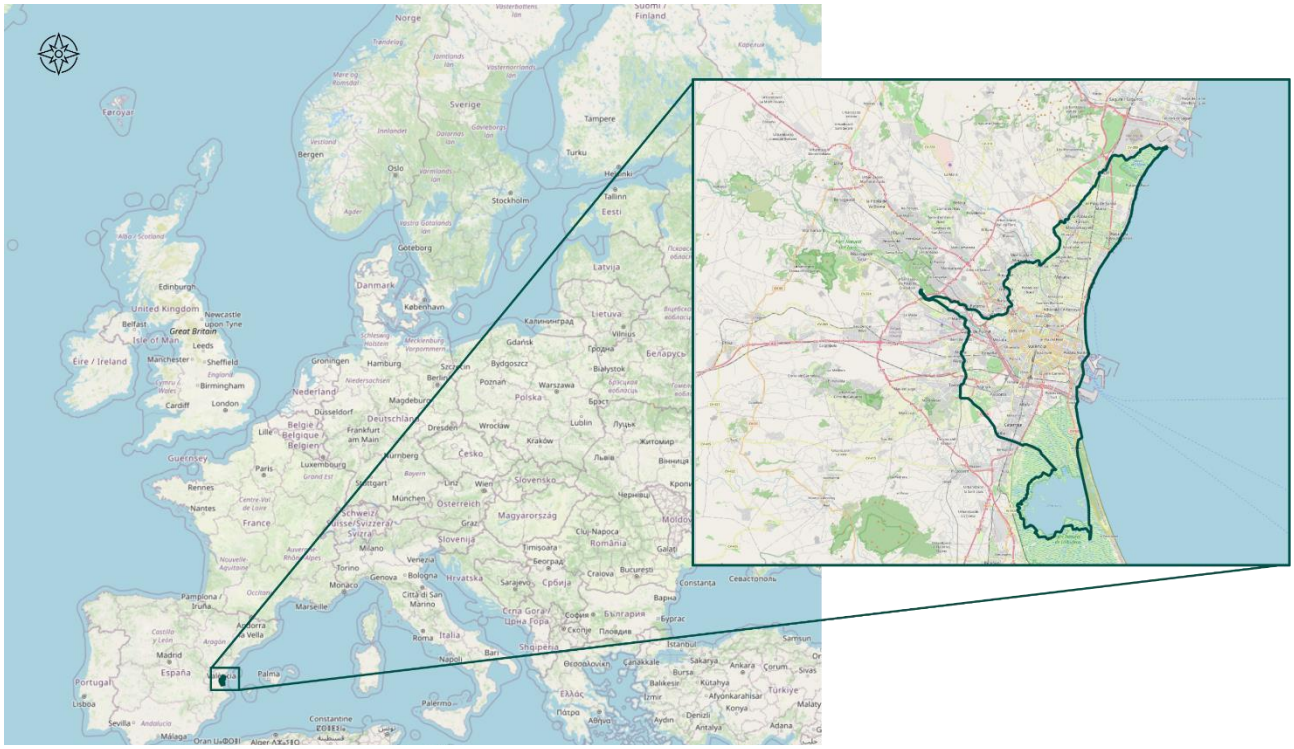


Figure 25 - L'Horta de Valencia R-Labscape area of interest for RescueME

The main data source for this R-Labscape are:

- Portal de Datos Abiertos del Ayuntamiento de València [37]
- IDEV (Infraestructura Valenciana de Dades Espacials) [38]
- Portal de Datos Abiertos de la Generalitat Valenciana [39]

ZADAR

Due to the climate and geographical position of the City of Zadar, heat waves are the most significant hazard that negatively affects various aspects of the local area – such as cultural heritage, tourism, agriculture, health of the residents etc. In recent years, the City of Zadar has faced an increase in periods of extreme heat waves during the summer season.

Pluvial flooding and storm surge events represent the second largest hazards that negatively impact the local area and the life of both residents and tourists, as well as cultural heritage and agriculture. Extreme storms, which occur regularly in the Zadar region, pose a particularly high risk as they consist of extreme wind speeds and heavy rainfall events that cause flooding.

For these reasons, the exposure systems collected within this R-Labscape are people, cultural heritage, buildings, ecosystems, infrastructure, business sectors (agriculture, tourism), and economy.
Figure 26 shows the area of interest identified for this R-Labscape in the RescueME framework:

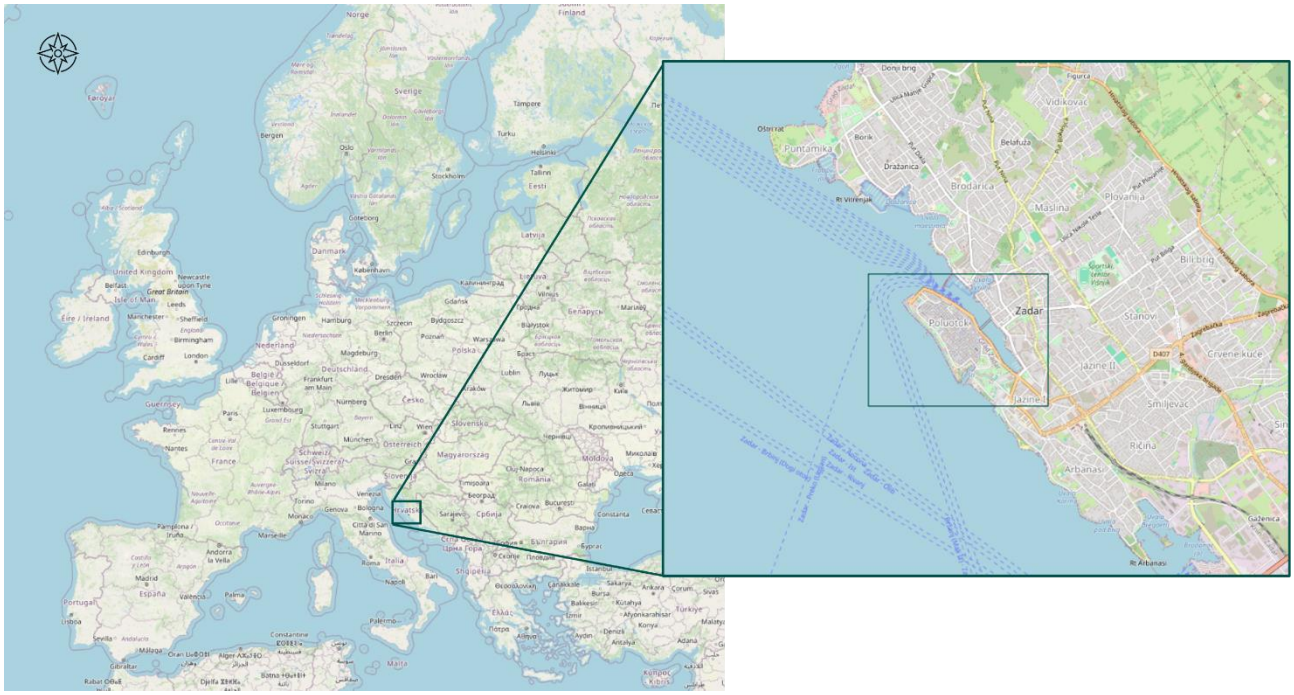


Figure 26 - Zadar R-Labscape area of interest for RescueME

The following data sources are considered useful for this R-Labscape:

- Geoportal kulturnih dobara [40]
- Croatian Meteorological and Hydrological Service [41]
- Bioportal [42]

4.2.2 Data at European Scale

By using indicators suitable for European scale identified in T1.1, T1.2 has conducted a risk assessment of the coastal landscapes across Europe, aligning it with climate scenarios. Within this task, data was collected for 513 European coastal NUTS3 regions. Subsequently, based on the work in T1.1, data on the identified indicators on the European NUTS3 level was gathered and processed. In addition, data on hazards and exposure was collected and processed. Among the most used data sources there are:

- EUROSTAT [43]
- Several services from the Copernicus Programme [18]:
    - Copernicus Land Monitoring Service (CLMS) [44]
    - Copernicus Atmosphere Monitoring Service (CAMS) [45]
    - Copernicus Climate Data Store (CDS) [46]

- Joint Research Center (JRC) [47]:
  - INCA Platform [48]
  - European Soil Data Centre [49]
  - Cultural gems [50]
  - Data Catalogue [51]
- German Aerospace Centre: Global Urban Footprint (GUF) [52]
- European Environment Agency (EEA) [53]
- European Commission – Culture and Creativity [54]
- OpenStreetMap ® (OSM) [55]
- UNESCO World Heritage Convention [56]

Data processing involved filling data gaps with older data, ensuring backward compatibility of EUROSTAT [43] data in case of adjustments of the delineation of the NUTS3 regions, mapping NUTS2 data on NUTS3 level in case of data only available at a higher level, GIS-analysis of satellite-born data including Copernicus data, analysis of climate data for the reference period and the future scenarios and providing the respective information for the DMF (T3.1).

Based on the above-mentioned data processing activity, in total 130 indicators have been made available at NUTS3 level. The list of datasets used as input to calculate such indicators is available in Annex III.

4.2.3 New Data

When writing the present document, the following tools are expected to generate new data for the scope of the project:

- The Generative AI tool, which generates artworks related to and representing R-Labscapes, taking as input the data generated from the Social Media module and/or from the users' interactions with the AR application, as well as from the weather data available for each R-Labscape.
- The Mapping Models tool, that generates delineation maps from Copernicus data pre- and post- events, namely floods, wildfires and landslides. The tool itself can also be applied to get information about land cover-related scenarios.
- The Chatbot, as a crowdsourcing tool, which allows the users to create geolocated reports containing textual descriptions, multimedia objects (videos, photos, voice messages) and optionally additional details, so to gather useful information from the field.
- The Social Media module, that collects, extracts and analyzes relevant social media content from various platforms; it generates new data about the characterization of specific and categorised cultural heritage assets, and the related underlying themes and topics discussed on the platforms, so to provide a comprehensive picture of public engagement with the R-Labscape's cultural heritage

In addition, TECNALIA has developed several indexes which can be considered as new data generated within the project. The access to such data is restricted but they are made available through the ATLAS web interface, together with the above-mentioned indicators that T1.2 has used to perform the risk assessment of the coastal landscapes across Europe. The list of indexes generated by TECNALIA is available in Annex IV.

Annex V contains a non-comprehensive list of data examples that are going to be generated by RescueME.

5 Natural Language Processing (NLP) for heritage characterization

Within ST3.1.3 a review of existing methodologies based on Natural Language Processing (NLP) was performed to identify innovative ways to characterise heritage values. One of the big challenges has been to identify structured databases with enough information to train a model for these purposes. After evaluating the possibilities collected in the DMF regarding the local databases, it has been decided to use the Official World Heritage List (WHL) from UNESCO [56] for its universal acceptance and the clarity of the criteria. To be included on the WHL, sites must possess outstanding universal value and meet at least one of ten specific selection criteria. The criteria include representing a masterpiece of human creative genius, demonstrating a significant interchange of human values, providing exceptional testimony to a cultural tradition or civilization, exemplifying a significant stage in human history through architecture or landscape, showcasing traditional human settlement or land use, and being associated with events or traditions of outstanding universal significance.
The first step was to meticulously analyse and structure the information contained in the database to facilitate further analysis. Utilising a sophisticated model, heritage-related statements have been successfully detected and classified within the available information. Additionally, another model was used to conduct sentiment analysis on those identified heritage-related statements. The WHL descriptions were used to correlate site descriptions with World Heritage criteria, employing NLP to discern the relationship between specific words and these criteria. Ultimately, an NLP model has been developed capable of automatically classifying or assigning heritage criteria to new heritage items.

This effort is related to the exercise developed in WP1 regarding an NLP-based solution for the automatic retrieval of keywords from cultural heritage canonical texts that was already explained in D1.1 - Actionable Resilient Historic Landscape Framework [2].

5.1 State of the art

There is a limited amount of literature available on this topic: Sporleder's work (2010) [57] is one of the earliest approaches to NLP in the domain of CH. They highlight that corpora are traditionally "*pen-and-paper businesses*" entirely coded by hand, which makes information extraction a difficult task (not referring to NLP's IE).

In the data and metadata section, they refer to three types of data:

- Primary data: in the context of CH, these are the objects in a collection, such as archaeological excavations, manuscripts, audio recordings, books, etc.
- Secondary data or metadata: In CH, metadata constitutes all information providing context about a collection object, such as library catalogs.
- Metadata can be generated automatically through computerized systems or created manually by humans. From a technological standpoint, this work is outdated. It deals with tasks like IE, ER, etc., but with techniques that have been largely surpassed. At a glance, I was unable to recognise any referenced dataset.

On the other hand, Bai, Luo, Nourian, and Pereira Roders' work (2021) [58] is closer to what we are seeking in RescueME. Their main research focus centers on:

- Assisting in the inscription process in the WHL by checking the coherence and consistency of the Statements of Outstanding Universal Value (SOUV), and
- Identifying heritage values through multiple data sources (e.g., social networks).

More specifically, in their work, they propose a classifier that establishes the relationship between a natural language sentence and one of the 10 criteria used in constructing the WHL. This dataset is interesting for the RescueME objectives, as it contains "object"/"description" pairs that can be used to train a generative model.

5.2 Preliminary steps

As a preliminary step, various pieces of information related to heritage were collected from multiple documents containing free text. The information within these documents was pre-processed to extract and format the relevant textual data.

Initially, a *distilbert-base-uncased* model [59], based on Bidirectional Encoder Representations from Transformers (BERT) architecture [60], fine-tuned with heritage-specific data, was employed to perform sequence classification tasks. This model's primary use was to classify sentences as either pertaining to heritage or not. This step ensured that only relevant heritage-related sentences were identified for further analysis.

In the subsequent step, the sentences classified as heritage-related were processed using a second model to perform sentiment analysis. For this secondary task, we utilised the *twitter-roberta-base-sentiment-latest* model [61], which is based on the RoBERTa architecture [62] and trained on a Twitter dataset tailored for sentiment analysis. This model was selected for its robustness in analyzing the sentiment conveyed in the text, enabling to classify the heritage-related sentences according to their sentiment.

By combining these two models, the research aims to not only identify heritage-related content but also understand the sentiment associated with it. This dual approach enhances the capability to analyze and interpret heritage texts, providing valuable insights into the emotional undertones present in such documents. The integration of these models facilitates a comprehensive analysis, ensuring that both the relevance and sentiment of the content are accurately captured and categorised.
Figure 27 illustrates the process by which sentences are identified as either heritage-related or non-heritage-related and subsequently classified based on their sentiment analysis.

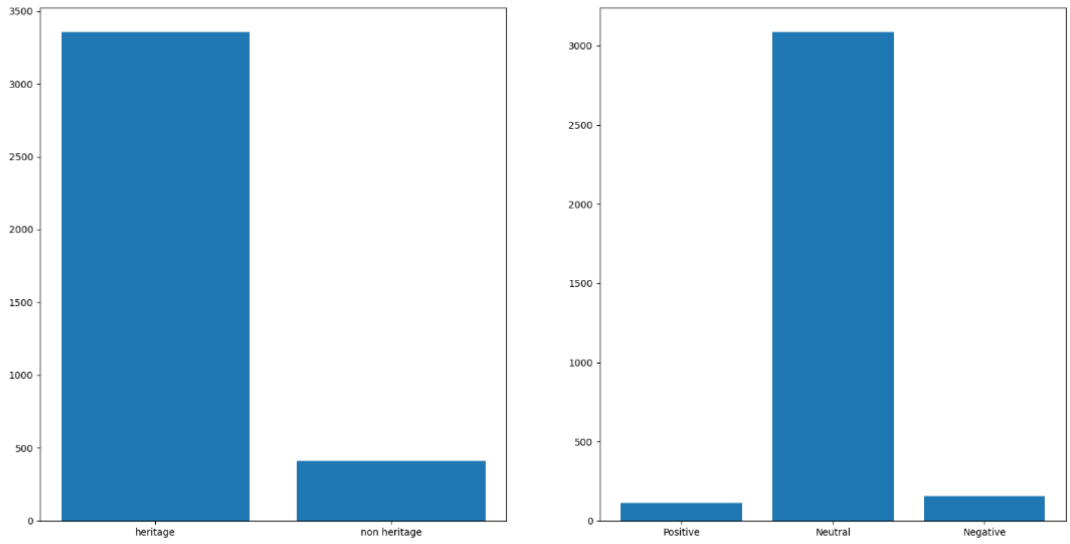


Figure 27 - Process by which sentences are identified by the RescueME NLP model

5.3 Characterizing heritage values through canonical texts

Understanding what constitutes CH is a challenging task, even for humans, and even more so for computerised systems. One way to discover the characteristics of items considered CH is to examine the context in which they appear and cast it as a probabilistic framework.

Certain approaches prove particularly appealing for automatically retrieving key words from a given corpus.

Keywords, also referred to as salient words are typically defined as a set of words that summarise or characterise the content of a document. From a mathematical perspective, however, keywords can be seen as the set of words that appear in high frequencies in a small set of documents and low frequencies across a corpus comprising n documents.

In the context of CH, keywords may provide insights into the decision-making process established by a document for considering an item as CH or not. In this sense, this task aims to explore the ability of certain NLP approaches to extract keywords for the CH domain.

On the one hand, a small corpus consisting of 31 documents[†] considered as canonical for CH field has been created. These documents have been processed to extract clean text prior to passing it through the processing pipeline. The pipeline consists of three keyword retrieval methods. To establish a baseline, tf-idf has been used to rank words using the mathematical formalization described above. It is a completely token-based probabilistic approach widely used in many information retrieval systems. Lemmatization has been employed to infer the base form of tokens prior to executing tf-idf.

However, tf-idf lacks the lexical-semantic information encoded in the actual sentences. Representation learning techniques have been then utilised to embed word tokens in a latent space that captures lexical-semantic information. Typically, encoder architectures such as BERT-based models [60] Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2019) are used for this task. They model the representations of words according to the distributional hypothesis and can weigh the token representations according to the context in which they appear. “Keybert" has been used for ranking the representations. Keybert uses cosine similarity to rank the embeddings of n-gram word/phrases against the embeddings of documents. The top n-grams are then selected as keywords.

5.4 Characterizing heritage values through UNESCO’s WHL

UNESCO’s word heritage list is a first-class information resource for CH that can be used as corpus for several NLP tasks. UNESCO offers a pre-processed “whc-sites-2023" dataset consisting of sites names, descriptions, justifications, locations, and matching criteria in

[†] See D1.1 - Actionable Resilient Historic Landscape Framework [2] for more details about the selected texts

natural language. With the goal of studying the capabilities of off-the-self language models in the CH domain, two methods have been developed to map from sites descriptions into criteria. The first approach learns a classifier from representations from encoders, whilst the second one leverages generative pretrained transformers [63] to do the tasks by using in-context learning.

5.4.1 Encoders

To map descriptions to criteria by using encoders, the roberta-large model will be employed [62], an advanced variant of the model [60], designed for NLP tasks. This model will be repurposed for sequence classification tasks by training it with the information from the UNESCO file. Specifically, the model's architecture will be slightly modified by adding a classification layer and fine-tuning its parameters to ensure that the descriptions result in the appropriate categories.

Through this approach, when a free-text description is input, the model will produce a set of categories that accurately reflects the content and characteristics of the text. This method leverages the robust capabilities of roberta-large to understand and classify complex textual data, enhancing the precision and utility of heritage site categorization based on detailed descriptions. By utilizing this advanced model, RescueME aims to improve the efficiency and accuracy of categorizing heritage information, thus contributing to more effective data management and analysis in the field of CH.
Figure 28 illustrates the performance of the NLP model in correlating descriptions with World Heritage (WH) criteria. The achieved F1 score of 72% reflects the model's capability to effectively classify free-text descriptions according to the specified WH criteria. This level of accuracy suggests that the model is robust in handling various types of textual data and can reliably identify the relevant heritage criteria from the descriptions provided. Furthermore, it indicates significant progress in the application of advanced NLP techniques for CH management and underscores the potential for further refinement and optimization.

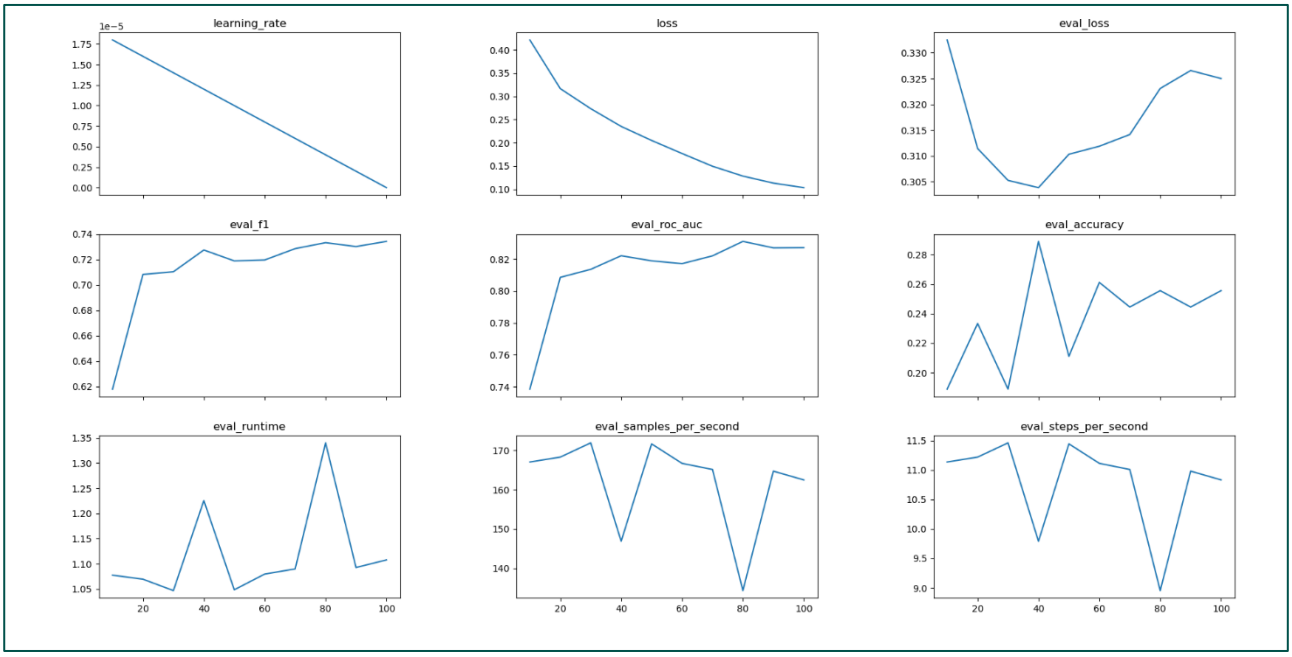


Figure 28 - Performance of the RescueME NLP model

Overall, these results highlight the promising capabilities of NLP models and techniques in enhancing the categorization and analysis of heritage data. The ability to accurately and efficiently classify heritage-related information is crucial for effective heritage documentation and preservation efforts. The findings suggest that with continued development and fine-tuning, such models can play a pivotal role in automating and improving the management of CH information. This advancement not only aids in the preservation of historical and cultural assets but also facilitates more comprehensive and accessible heritage records for future research and public engagement.

5.4.2 In-context learning

Opposite to encoders, where parameters are learned via fine-tuning over the UNESCO dataset, the use of generative models (large language models - LLMs) has also been explored to perform the same task by using in-context learning.

More in detail, in-context learning is a technique that essentially modifies the output distribution of tokens of language models by inserting context as input to the model. Typically, when using instruction-tuned models (such as Llama, Gemini, PHI, or even OpenAI's GPT models), the context is a set of instructions or prompts that model the desired task the language model should perform. One positive aspect of this approach is that it does not require changing the model's parameters, since no active learning is performed. This means that there is no need for a labeled dataset to train the model, since the context is

sufficient to model the task. However, the performance of the model is highly sensitive to the quality of the context and to the corpus it was pre-trained on.

Currently, some LLMs are proficient in several NLU tasks, as reported by the Massive Multitask Language Understanding (MMLU) benchmark. Although MMLU does not specifically target the CH domain, it is arguably a good indicator of the capabilities of LLMs in general. Nowadays, Llama-3 variants and Qwen constitute one of the best alternatives in terms of performance and parameter size as far as public models are concerned.

To provide the context to the model, a combined n-shot and chain of thought approach has been followed. On the one hand, n-shot templating, a generalization of few-shot templating with n examples, is a technique that allows the model to learn from a set of examples. In this case, the UNESCO dataset has been used to provide the model with examples of descriptions and their corresponding criteria. On the other hand, a chain of thought has been used to force the model to generate justification when a criterion is matched. This is done by chaining the criterion with the description, so that the model can generate the justification in a single pass.

Overall, the context consists of the following elements: the site name, the description, and one of the 10 criteria to be matched. Then the model is prompted to justify if the item matches the criterion or not by generating a justification based on the provided description and its internal knowledge of the site. The context also includes examples of other sites matching the same criterion, so that the model easily understands the task to be performed.

Experiments were conducted with the Llama3-8b, Llama3-70b, and Qwen-1.5-70b models, using different n-shot settings (5, 2, and 10). The results were measured in terms of F1-score, precision, and recall across 10 criteria (C1 to C6 and N7 to N10).

Qwen, with 5-shot learning, achieved an overall micro-avg f1-score of 0.57, macro-avg f1-score of 0.59, and weighted-avg f1-score of 0.62. LLaMA3-8b, with 5-shot learning, performed better with a micro-avg f1-score of 0.62, macro-avg f1-score of 0.61, and weighted-avg f1-score of 0.65. The precision and recall scores were generally consistent across models and n-shot settings, with some variations in individual criteria.

Overall, the performance did not vary between models and the number of examples provided (n-shot). Upon further analysis, it has been observed that the models struggled with criteria that required more nuanced understanding of the site's cultural significance and historical context. Also, the models' tendency to match the criterion with only the short description provided, rather than considering the internal knowledge of the site. In case the description was not broad enough, the model would often reply that the given description is not enough

to determine if the site matches the criterion or not. Finally, we observed that all models present a high recall and moderate precision, suggesting that few-shot learning is biasing the models towards predicting that a given site matches the criterion.

These problems could be addressed by: 1) providing longer descriptions to the model (they are available on their website, but they were not provided in the public dataset), to prevent the model from relying solely on the short description, and 2) including examples where the site does not match the criterion and a corresponding justification, to prevent biasing the model towards predicting that a site matches the criterion. This will balance the recall in favor of precision.

5.5 Outcome

In conclusion, LLMs can be used to perform the task of matching descriptions to criteria in the CH domain with a moderate level of success.
On the one hand, it is possible to use pretrained encoders such as BERT to perform multiclass classification given a limited amount of data. As they have been pretrained on general text on the Masked Language Model objective, they need to be fine-tuned for this specific task. On the other hand, generative LLMs can perform any general domain task by providing the right context without the need of fine-tuning its parameters (in-context learning). However, the models' performance is highly dependent on the few-shot learning configuration, the quality of the context provided, as well as the pretraining and instruction tuning corpora. These experiments suggest that fine-tuning an encoder model is a more reliable and robust approach for this task as compared to the latest generative LLMs (qwen 80B, llama3-8B, llama3-70B), although generalization to other domains outside the world heritage list may be limited. It is likely that future LLMs with higher capabilities would outperform encoders.

Moreover, ethical considerations must be considered when deploying these models. The potential biases in pretrained models can lead to skewed results, particularly in culturally sensitive domains. Ensuring the diversity and representativeness of training data is crucial to mitigate these biases. As the field progresses, the development of transparent and explainable models will be essential to foster trust and reliability in AI-driven cultural heritage applications.

In summary, while LLMs show promise in the CH domain, their optimal application requires a balanced approach that leverages both fine-tuning and contextual enhancements. Future advancements in LLM technology, combined with careful attention to ethical and practical considerations, will likely lead to even more effective and equitable solutions for preserving and understanding our CH.

6 Conclusion

The present deliverable aims at collecting all the relevant information useful for supporting the RescueME tools design and implementation as well as the selection of the datasets considered relevant for each R-Labscape objective. Since the information contained in this document reflects the status of the activities at M18 of the project, some changes in both the technical specifications and the data selection are expected.
The interactions between the five R-Labscapes and the technical partners will continue to allow the completion and the optimization of the WP3 tasks.
Starting from the identified use case and technical requirements, the RescueME technical partners will start implementing the different solutions using the Portovenere, Cinque Terre and the Island R-Labscape as initial use case reference to then expand the implementations to the rest of the R-Labscapes. This is because such R-Labscape is particularly advanced in terms of data availability and risk analysis and has shown interest in most of the solutions proposed by the technical partners.

7 References

REF	NAME OF DOCUMENT/LINK
1	Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018 (2016). https://doi.org/10.1038/sdata.2016.18
2	Gandini, A., Egusquiza, A. RescueME D1.1 - Actionable Resilient Historic Landscape Framework (2023). Available at: https://resilientculturallandscapes.eu/resource?t=D1.1%20ACTIONABLE%20RESILIENT%20HISTORIC%20LANDSCAPE%20FRAMEWORK.
3	SHELTER project funded under the European Union's Horizon 2020 research and innovation programme, grant agreement No 821282. https://doi.org/10.3030/821282
4	I-REACT project funded under the European Union's Horizon 2020 research and innovation programme, grant agreement No 700256. https://doi.org/10.3030/700256
5	ResCult project funded by the European Commission DG ECHO under the Call for proposals 2016, grant number ECHO/SUB/2016/742499/PREV12. https://doi.org/10.1016/j.culher.2024.02.013

6	GEO Data Management Principles Task Force. GEOSS Data Management Principles. April 28, 2015. https://www.earthobservations.org/documents/dswg/201504_data_management_principles_long_final.pdf
7	European Commission. INSPIRE metadata directive. https://inspire.ec.europa.eu/metadata/6541
8	Klose, A., Abajo, B., Lopez de Aguileta, A., Gandini, A., Egusquiza, A., Usobiaga, E., Benedito, M., Zubiaga, M., Simon, A., Santangelo, A., Salpina, D., Manojlovic, N., Durrant, L. RescueME D1.2 - Atlas of EU Coastal Heritage Landscape Typologies and CC Impacts (2024). Available at: https://resilientculturallandscapes.eu/resource?t=D1.2:%20ATLAS%20OF%20EU%20COASTAL%20HERITAGE%20LANDSCAPE%20TYPOLOGIES%20AND%20CC%20IMPACTS
9	ARCH project funded under the European Union's Horizon 2020 research and innovation programme, grant agreement No 820999. https://doi.org/10.3030/820999
10	RURITAGE project funded under the European Union's Horizon 2020 research and innovation programme, grant agreement No 776465. https://doi.org/10.3030/776465
11	CKAN tool. https://docs.ckan.org/en/2.9/
12	Azure Blob Storage https://azure.microsoft.com/en-us/products/storage/blobs
13	FusionAuth https://fusionauth.io/docs/
14	GEOSS standards https://old.earthobservations.org/geoss.php
15	ISO 19115 metadata standard https://www.iso.org/standard/53798.html
16	CKAN v.2.10.0 2023-02-15 change log https://docs.ckan.org/en/2.10/changelog.html#v-2-10-0-2023-02-15
17	Open Geospatial Consortium (OGC) standards https://www.ogc.org/standards/
18	Copernicus Programme https://www.copernicus.eu/en
19	GNU General Public License v3 (GPL-3) https://www.gnu.org/licenses/gpl-3.0.html
20	Copernicus Emergency Management Service (CEMS) https://emergency.copernicus.eu/
21	SentinelHub APIs https://www.sentinel-hub.com/develop/api/

22	SAFERS project funded under the European Union's Horizon 2020 research and innovation programme, grant agreement No 869353. https://doi.org/10.3030/869353
23	WordPress https://wordpress.com/de/
24	Wischott, V., Ugalde, I., Pirazán-Palomar, L., Angelone, S., Milde, K., Lückerath, D., Klose, A. RescueME D4.3 - Local Resilience Baseline and Local Impact Chains for R-Labscapes
25	ARCH HUB https://websites.fraunhofer.de/arch/
26	Eisenmenger, N., Giljum, S., Lutter, S., Marques, A., Theurl, M.C., Pereira, H.M. and Tukker, A. (2016), "Towards a conceptual framework for social-ecological systems integrating biodiversity and ecosystem services with resource efficiency indicators", Sustainability (Switzerland), Vol. 8 No. 3, available at : https://doi.org/10.3390/su8030201
27	Nomenclature of Territorial Units for Statistics https://en.wikipedia.org/wiki/Nomenclature_of_Territorial_Units_for_Statistics
28	Crete Geospatial Information Portal https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
29	Sentinel Hub Playground https://gis.crete.gov.gr/sdi/modules/sentinelhubmonitoring/monitoring/
30	Longitudinal Image Comparison Application for Sentinel images https://gis.crete.gov.gr/sdi/modules/sentinelhubmonitoring/monitoring/#x=2745673%2By=4182077%2Bs=12%2Blayers=WILDFIRES-RETHYMNO%2Bmaxcc=20%2Bgain=1%2Btime=2024-05-04/2024-06-04%2Bmode=compareMode%2Bdate1=2021-07-01%2Bdate2=2022-07-18
31	Crete EO Browser https://gis.crete.gov.gr/sdi/eobrowser/?zoom=9&lat=35.30309&lng=24.27045&themeId=DEFAULT-THEME
32	Psiloritis Geopark WebGIS App https://tours.nhmc.uoc.gr/geo/psiloritis/en/
33	Hamburg Geoportal https://geoportal-hamburg.de/geo-online/?lng=de
34	EasyGSH-DB https://trilawatt.eu/daten/datenprodukte/
35	Liguria Region Geoportal https://geoportal.regione.liguria.it/catalogo/mappe.html

Available on the European Commission web portal

36	Appennino Settentrionale Geodataserver https://geodataserver.appenninosettentrionale.it/portal/apps/webappviewer/index.html?id=5df4e2dc9f79431ea89eef064912c45a
37	Portal de Datos Abiertos del Ayuntamiento de València https://estadisticavlc2.shinyapps.io/Areas_Vulnerables_2022/
38	IDEV (Infraestructura Valenciana de Dades Espacials) https://idev.gva.es/va/
39	Portal de Datos Abiertos de la Generalitat Valenciana https://portaldadesobertes.gva.es/es
40	Geoportal kulturnih dobara https://geoportal.kulturnadobra.hr/welcome.html?lang=eng#/
41	Croatian Meteorological and Hydrological Service https://meteo.hr/index_en.php
42	Bioportal http://www.bioportal.hr/
43	EUROSTAT https://ec.europa.eu/eurostat/web/main/data/database
44	Copernicus Land Monitoring Service (CLMS) https://land.copernicus.eu/en
45	Copernicus Atmosphere Monitoring Service (CAMS) https://atmosphere.copernicus.eu/
46	Copernicus Climate Data Store (CDS) https://cds.climate.copernicus.eu/#!/home
47	Joint Research Center (JRC) https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/joint-research-centre_en
48	Joint Research Centre : INCA Platform https://ecosystem-accounts.jrc.ec.europa.eu/
49	Joint Research Centre : European Soil Data Centre https://esdac.jrc.ec.europa.eu/
50	Joint Research Centre : Cultural gems (© European Union and Cultural gems contributors) https://cultural-gems.jrc.ec.europa.eu/
51	Joint Research Centre : Data Catalogue https://data.jrc.ec.europa.eu/dataset
52	German Aerospace Centre : Global Urban Footprint (GUF) https://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-9628/16557_read-40454/
53	European Environment Agency (EEA) https://www.eea.europa.eu/en

54	European Commission – Culture and Creativity https://culture.ec.europa.eu/policies/culture-in-cities-and-regions/european-capitals-of-culture
55	OpenStreetMap ® https://www.openstreetmap.org
56	UNESCO World Heritage Convention https://whc.unesco.org/en/list/
57	Sporleder, C. (2010). Natural language processing for cultural heritage domains. Language and Linguistics Compass, 4(9), 750-768
58	Bai, N., Nourian, P., Luo, R., & Pereira Roders, A. (2022). Heri-graphs : a dataset creation framework for multi-modal machine learning on graphs of heritage values and attributes with social media. ISPRS International Journal of Geo-Information, 11(9), 469
59	Sanh, V., Debut, L., Chaumond, J., & Wolf, T. (2020). DistilBERT, a distilled version of BERT : smaller, faster, cheaper and lighter.
60	Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2019). BERT : Pre-training of Deep Bidirectional Transformers for Language Understanding.
61	Barbieri, F., Camacho-Collados, J., Neves, L., & Espinosa-Anke, L. (2020). TweetEval: Unified Benchmark and Comparative Evaluation for Tweet Classification.
62	Liu, Y., Ott, M., Goyal, N., Du, J., Joshi, M., Chen, D., Levy, O., Lewis, M., Zettlemoyer, L., & Stoyanov, V. (2019). RoBERTa: A Robustly Optimized BERT Pretraining Approach.
63	Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L., & Polosukhin, I. (2023). Attention Is All You Need

8 Annex I

RescueME Data Mapping Form (DMF)

ID	Description	Existing/Foreseen data	Type	IoT	Format	Size	Time coverage	Area coverage	Spatial resolution/scale	Temporal resolution	Update frequency	Collection	Licence	Ownership/author	Access mode	Access restrictions	Access links	Metadata	Application field	Hazard type	DRM phase	Comments	Data example	Data example download	Indicator ID	Indicator calculation method	Module	to be imported
33200	Geolocated picture with metadata (report) from Chatbot	Foreseen	Structured	No	JSON or geoJSON	300k-4MB	timestamp	Point	Mobile phone positioning	Timestamp	Variable	users	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Hazard and risk monitoring, impact mapping	Multihazards	Response	Multihazards: all hazards These are crowdsourced reports that will be shared to other modules via APIs; For what concerns Hazard type the most impacting one will be selected	35001_LINKS_Chatbot_Report_20201103T1000002_20201103T1000002_IT				API tool	x
33201	Event detected thought social media	Foreseen	Structured	No	JSON or geoJSON	100-500k	days	BBOX depending on the event	na	na	15 min	Twitter	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Event detection, hazard and risk monitoring, impact mapping	Multihazards		Extra with respect to DoA					Bus	x
33202	Event report extracted from social media	Foreseen	Structured	No	JSON or geoJSON	100-500k	days	BBOX depending on the event Area of Interest	na	na	15 min	Twitter	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Event detection, hazard and risk monitoring, impact mapping	Multihazards		Extra with respect to DoA	35003_LINKS_socialmedia_events_20210630T1500002_20201028T1000002_IT				API tool	x
33203	Relevant Tweet in a specific spatio-temporal window, language and hazard	Foreseen	Structured	No	JSON or geoJSON	depends on request	days	BBOX depending on the event Area of Interest	na	na	15 min	Twitter	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Event detection, hazard and risk monitoring, impact mapping	Multihazards		Multihazards: all hazards For what concerns Hazard type the most impacting one will be selected	35004_LINKS_socialmedia_tweets_20201028T1500002_20210628T1500002_IT				API tool	x
33204	Message from Data Resilience Dashboard to Chatbot users	Foreseen	Structured	No	JSON or geoJSON	100-500k	days	BBOX depending on the Area of Interest of the Communication	na	na		users	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Hazard and risk monitoring, impact mapping	Multihazards	Response	Multihazards: all hazards These are crowdsourced reports that will be shared to other modules via APIs; For what concerns Hazard type the most impacting one will be selected	35005_LINKS_Chatbot_Communication_20210630T1500002_20210630T1500002_IT					x
33205	Mission from Data Resilience Dashboard to Chatbot professional users	Foreseen	Structured	No	JSON or geoJSON	100-500k	days	BBOX depending on the Area of Interest of the Mission	na	na		users	TBD	LINKS	Web-based API	OAuth 2.0 - login with user-pass or API key	TBD	no	Hazard and risk monitoring, impact mapping	Multihazards	Response	Multihazards: all hazards These are crowdsourced reports that will be shared to other modules via APIs; For what concerns Hazard type the most impacting one will be selected	35006_LINKS_Chatbot_Mission_20210630T1500002_20210630T1500002_IT					x
33100	Flood delineation Map	Existing	Structured	No	geoTIFF	depend on Area of Interest	timestamp	BBOX depending on the event Area of Interest	20m per pixel	na	on demand, 3-6 days if Sentinel is used	Sentinel	Private	LINKS	WMS layer, API for metadata	OAuth 2.0 - login with user-pass or API key	TBD	yes, INSPIRE compliant	Impact mapping	Floods			32001_LINKS_flood_delination_20190515T0501002_20190515T0501002_EIA		36		Data Lake	v
33101	Burned area delineation Map	Existing	Structured	No	geoTIFF	depend on Area of Interest	timestamp	BBOX depending on the event Area of Interest	10m per pixel	na	on demand, 3-6 days if Sentinel is used	Sentinel	Private	LINKS	WMS layer, API for metadata	OAuth 2.0 - login with user-pass or API key	TBD	yes, INSPIRE compliant	Impact mapping	Wildfire			32002_LINK_burned_area_delineation_20170828T080300Z_20170828T0803002_GE				Data Lake	v
33102	Burned area severity map	Existing	Structured	No	geoTIFF	depend on Area of Interest	timestamp	BBOX depending on the event Area of Interest	10m per pixel	na	on demand, 3-6 days if Sentinel is used	Sentinel	Private	LINKS	WMS layer, API for metadata	OAuth 2.0 - login with user-pass or API key	TBD	yes, INSPIRE compliant	Impact mapping	Wildfire							Data Lake	v
33103	Flood area geospatial image	Existing	Structured	No	geoTIFF	depend on Area of Interest	timestamp	BBOX depending on the event Area of Interest	20m per pixel	na	on demand, 3-6 days if Sentinel is used	Sentinel	Private	LINKS	WMS layer, API for metadata	OAuth 2.0 - login with user-pass or API key	TBD	yes, INSPIRE compliant	Impact mapping	Floods							Data Lake	v
33104	Burned area geospatial image	Existing	Structured	No	geoTIFF	depend on Area of Interest	timestamp	BBOX depending on the event Area of Interest	10m per pixel	na	on demand, 3-6 days if Sentinel is used	Sentinel	Private	LINKS	WMS layer, API for metadata	OAuth 2.0 - login with user-pass or API key	TBD	yes, INSPIRE compliant	Impact mapping	Wildfire							Data Lake	v

Figure 29 - An example of data description from the LINKS sheet in the RescueME Data Mapping Form (DMF)

9 Annex II

Local data description of the RescueME R-Labscapes

PSILORITIS

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
31400	**Roads**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31401	**Waterways**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31402	**River basins**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31403	**Infrastructures**	shapefile	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/ Data are not available for downloading (stored in IDEON premises)
31404	**Landslide risk areas**	shapefile	N/A	Crete	N/A	N/A	N/A	EMERIC Proj./NHMC	Data are not public (stored in IDEON premises)
31405	**Nature 2000**	shapefile	N/A	Crete	N/A	N/A	N/A	Ministry of Environment	Data are not public (stored in IDEON premises)
31406	**Cultural sites**	shapefile	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/ Data are not available for downloading (stored in IDEON premises)
31407	**Elevation**	shapefile	N/A	Crete	20 m	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)

31408	**Seismic zones**	shapefile	N/A	Crete	N/A	N/A	N/A	EMERIC Proj. /NHMC	Data are not public (stored in IDEON premises)
31409	**Geological sites**	shapefile	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/ Data are not available for downloading (stored in IDEON premises)
31410	**Settlements**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31411	**Geology**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31412	**Municipal boundaries**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31413	**Road network**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31414	**Hillshade**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31415	**Springs**	shapefile	N/A	Crete	N/A	N/A	N/A	NHMC	Data are not public (stored in IDEON premises)
31416	**CORINE Land use**	shapefile	N/A	Crete	N/A	N/A	N/A	N/A	Data are not public (stored in IDEON premises)
31422	**Local Precipitation data**	.xls	1919-2006	Crete	N/A	N/A	N/A	Region of Crete	N/A
31423	**Local temperature data**	.xls	1979-2006	Crete	N/A	N/A	N/A	Region of Crete	N/A
31424	**Local evaporation data**	.xls	1970-2006	Crete	N/A	N/A	N/A	Region of Crete	N/A
31425	**Regional Adaptation plan to the Climate change**	pdf / maps	2022	Crete	Regional	N/A	N/A	Region of Crete	https://crete.gov.gr/wp-content/uploads/2023/03/%CE%9C%CE%B5%CE%BB%CE%AD%CF%84%CE%B7-%CE%A0%CE%95%CE%A3%CE%A0%CE%9A%CE%91-%CE%91%CF%8D%CE%B3%CE%BF%

									CF%85%CF%83%CF%84%CE%BF%CF%82-2022.pdf
31426	**Earthquake catalogue of Crete**	book	since 2008/01/01	Crete	National	N/A	N/A	G. Papadopoulos (auth)	https://bbnet.gein.noa.gr/HL/databases/database
31427	**River basin management plans**	csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Ministry of Environment	https://wfdver.ypeka.gr/wp-content/uploads/2017/04/FEK_570.B.2015_GR13-1.pdf
31428	**River basin management plans**	Pdf / law	N/A	Crete	N/A	N/A	N/A	Ministry of Environment	https://wfdver.ypeka.gr/wp-content/uploads/2017/04/FEK_570.B.2015_GR13-1.pdf
31429	**Greek Tourism and climate change: Adaptation policies and new development strategy**	pdf	N/A	Greece	N/A	N/A	N/A	Bank of Greece	https://www.bankofgreece.gr/RelatedDocuments/EMEKA_tourismos_2014_.pdf
31430	**The environmental, economic, and social impact of Climate Change in Greece**	pdf	N/A	Greece	N/A	N/A	N/A	Bank of Greece	https://www.bankofgreece.gr/Publications/%CE%A0%CE%BB%CE%B7%CF%81%CE%B7%CF%82_%CE%95%CE%BA%CE%B8%CE%B5%CF%83%CE%B7.pdf?mode=preview
31431	**Geosites**	viewer	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/ Data are not available for downloading (stored in IDEON premises)
31432	**Activities**	viewer	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/ Data are not available for downloading (stored in IDEON premises)
31433	**Geopark stakeholders**	viewer	N/A	Crete	N/A	N/A	N/A	Psiloritis geopark	https://tours.nhmc.uoc.gr/geo/psiloritis/en/

									Data are not available for downloading (stored in IDEON premises)
31434	**Infrastructure - Rethymnon settlements**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31435	**Infrastructure - Rethymnon expropriations of provincial road network**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31436	**Infrastructure - Rethymnon National Road network**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31437	**Infrastructure - Rethymnon delimitations of streams (Gazette)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31438	**Infrastructure - Rethymnon delimitations of streams (Prefect's Decision or DTE)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31439 - 31448	**Satellite data – all available layers**	GeoTIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31449	**Certified Forest Map**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9

31450	**Post Forest Map Amendment 2022**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map1_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31451	**Archaeological sites P.E. Rethymnon**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31452	**Prohibition of traffic in fire danger index 4 & 5 P.e. Rethymnon**	DXF, csv, KML, pdf, shp, SVG, TIFF	2022	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31453	**Fire events – Burnt area in Ierapetra Agios Nikolaos (Forest map classification)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2024/04/04 - 11	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31454	**Fire events – Burnt area in Ierapetra Agios Nikolaos (Corine Land Cover)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2024/04/04 - 11	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31455	**Fire events – Burnt area in Melampes of Rethymnon (Forest map classification)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2022/07/15 - 20	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31456	**Fire events – Burnt area in Melampes of Rethymnon (Corine Land Cover)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2022/07/15 - 20	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9

31457	**Fire events – Burnt area in Preveli Rethymnon (Forest map classification)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2021/07/07	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31458	**Fire events – Burnt area in Preveli Rethymnon (Corine Land Cover)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2021/07/07	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31459	**Fire events – Burnt area in Preveli Rethymnon (Natura area)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2021/07/07	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31460	**Flood Map – Adelianos Kampos of Rethymnon (Additional incident information)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31461	**Flood Map – Adelianos Kampos of Rethymnon (Incident data)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31462	**Flood Map – Adelianos Kampos of Rethymnon (Elevation contour)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31463	**Flood Map – Adelianos Kampos of**	DXF, csv, KML, pdf,	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loade

	Rethymnon (Trace charts)	shp, SVG, TIFF							r_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31464	**Flood Map – Adelianos Kampos of Rethymnon (Land cover)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31465	**Flood Map – Adelianos Kampos of Rethymnon (Buildings)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31466	**Flood Map – Adelianos Kampos of Rethymnon (Road network)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31467	**Flood Map – Adelianos Kampos of Rethymnon (Area of interest)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31468	**Flood Map – Adelianos Kampos of Rethymnon (Hydrography - lines)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31469	**Flood Map – Adelianos Kampos of Rethymnon (Hydrography - polygons)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31470	**Flood Map – Adelianos**	DXF, csv, KML, pdf,	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loade

	Kampos of Rethymnon (Transport Network Infrastructures)	shp, SVG, TIFF							r_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31471	**Flood Map – Boleones of Rethymnon (Incident data)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4273151.0570441&zoom=9
31472	**Flood Map – Boleones of Rethymnon (Elevation contour)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31473	**Flood Map – Boleones of Rethymnon (Trace charts)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31474	**Flood Map – Boleones of Rethymnon (Land cover)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31475	**Flood Map – Boleones of Rethymnon (Buildings)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31476	**Flood Map – Boleones of Rethymnon (Road network)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31477	**Flood Map – Boleones of Rethymnon (Area of interest)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31478	**Flood Map – Boleones of**	DXF, csv, KML, pdf,	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loade

	Rethymnon (Hydrography - lines)	shp, SVG, TIFF							r_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31479	**Flood Map – Boleones of Rethymnon (Hydrography – polygons)**	DXF, csv, KML, pdf, shp, SVG, TIFF	2020/11/13	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31480	**Landslides – Seismotectonic map of Crete (TEE 1982)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31481	**Risk of landslides P.E. Rethymnon (Apok. Diok. Crete)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31482	**Landslides – Cracks (Republic Administration of Crete)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31483	**Ecclesiastical monuments P.E. Rethymnon**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map6_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
31484 - 31495	**Environment – all available layers**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map7_loader_public
31496 - 314107	**Spatial & Urban planning – all layers from the Regional Spatial Framework folder**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/?tab=viewport_maptab&loader=map8_loader_public&lon=2762663.5125719&lat=4201151.0570441&zoom=9
314108	**Sentinel Hub Vegetation Index**	jpeg	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/modules/sentinelhubplayground/playground

									/?source=DSS2&lat=35.2989871994 5333&lng=24.415740966796875&zo om=9&preset=5-VEGETATION-INDEX&layers=B04,B03,B02&maxcc= 20&gain=1.0&gamma=1.0&time=20 17-03-28%7C2021-04-17&atmFilter=&showDates=false
314109	**Sentinel Hub Normalized Snow Cover Index (NDSI)**	jpeg	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/modules /sentinelhubplayground/playground /?source=DSS2&lat=35.2989871994 5333&lng=24.415740966796875&zo om=9&preset=6-NDSI&layers=B04,B03,B02&maxcc=2 0&gain=1.0&gamma=1.0&time=201 7-03-28%7C2021-04-17&atmFilter=&showDates=false
314110	**Sentinel Hub Normalized Water Index (NDWI)**	jpeg	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/modules /sentinelhubplayground/playground /?source=DSS2&lat=35.2989871994 5333&lng=24.415740966796875&zo om=9&preset=7-NDWI&layers=B04,B03,B02&maxcc= 20&gain=1.0&gamma=1.0&time=20 17-03-28%7C2021-04-17&atmFilter=&showDates=false
314111	**Sentinel Hub Humidity Index**	jpeg	N/A	Crete	N/A	N/A	N/A	Region of Crete	https://gis.crete.gov.gr/sdi/modules /sentinelhubplayground/playground /?source=DSS2&lat=35.2989871994 5333&lng=24.415740966796875&zo om=9&preset=__FIS_8-MOISTURE-INDEX&layers=B04,B03,B02&maxcc= 20&gain=1.0&gamma=1.0&time=20 17-03-28%7C2021-04-17&atmFilter=&showDates=false
314112	**River basin Geoportal (all layers available over the AoI)**	DXF, csv, KML, pdf, shp, SVG, TIFF	N/A	Greece	N/A	N/A	N/A	Ministry of Environment and Energy	https://wfdgis.ypeka.gr/

314113	**National Observatory of Athens: Weather events with socio-economic impacts in Greece since 2000**	viewer, .pdf	2000 - 2024	Greece	National	Event-based	Event-based	National Observatory of Athens (EAA) Environmental Research Institute	https://www.meteo.gr/weather_cases.cfm

NEUWERK

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
31500	**Economic effect of tourism on the region of Neuwerk**	.pdf	2019-2021	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	Regional	N/A	none so far	National Park Authority Hamburg/BUKEA	Not publicly available yet
31501	**Geobasis Maps**	png, pgw	Last changed: 01.10.2022	Hamburg City	1:10.000	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31502	**Heritage areas**	csv, GeoJson, WMS	2014	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	N/A	N/A	four times per year	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de

31503	**Ground Monument: location**	csv, GeoJson, GML, WMS, WFS	Last changed: 09.11.2020	Hamburg City	N/A	N/A	as required	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31504	**INSPIRE Land use**	gml,xsd	Last changed: 15.07.2020	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	N/A	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31505	**Coastal Protection Structure (dykes)**	csv, GeoJson	Last changed: 26.06.2020	Hamburg City	N/A	N/A	as required	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31506	**Orthophotos**	tif	Last changed: 30.04.2022	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	20 cm	N/A	continuously	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31507	**Cadastral parcels (INSPIRE HH Flurstücke/Grundstücke ALKIS)**	gml	every 6 months since 2017	Hamburg City	1:5.000	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31508	**Location of buildings**	gml	Last changed: 24.07.2017	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	N/A	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31509	**INSPIRE HH Hydro-Physical Waterways (ALKIS Data)**	gml, WMS, WFS	Last changed: 14.07.2022	Hamburg	N/A	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de

31510	**INSPIRE HH Addresses House Coordinates**	gml, WFS, WMS, XSD	2020-07	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	N/A	N/A	updated every 6 months	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31511	**Landuse Coastal High Water Extreme events**	gml, xsd	22.12.2019	Hamburg City	N/A	N/A	continuously	BUKEA (City of Hamburg)	N/A
31512	**DEM**	ascii, png, WMS	Last changed: 24.04.2022	Island of Neuwerk	1 m	N/A	yearly	LGV (City of Hamburg)	https://geodienste.hamburg.de/HH_WMS_DGM1
31513	**Bathymetry**	WMS, WFS, WCS, shapefile	1996 - 2016	Hamburgs Wadden Sea National Park (including the island of Neuwerk)	5 m	N/A	N/A	Easy GSH	https://mdi-dienste.baw.de/terria_en/
31514	**INSPIRE Road area**	gml	Last changed: 26.10.2023	Hamburg City	N/A	N/A	twice yearly	LGV (City of Hamburg)	https://geoportal-hamburg.de/geo-online/?lng=de
31515	**Bathymetry EasyGSH**	shp	1996 - 2022	Coastal area of the German Bight	1 m	N/A	N/A	Easy GSH	https://trilawatt.eu/daten/datenprodukte/

PORTOVENERE, CINQUE TERRE AND THE ISLANDS

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
31607	**Terraced Areas / Land Use**	shp, GML, GeoPackage, KML, WMS, WFS	2000	Liguria Region	1:25000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31608	**Waterways**	shp, GML, GeoPackage, KML, WMS, WFS	2023	Liguria Region	1:10000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31609	**Pedonal paths**	shp, GML, GeoPackage, KML, WMS, WFS	2023	Liguria Region	1:25000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31610	**Elements exposed to flood risk**	shp, gpkg, WMS	2024	Liguria Region	1:10000	N/A	N/A	LINKS	https://geodata.appenninosettentrionale.it/geoserver/adbarno/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=adbarno:PIANIFICAZIONE.SIT.PGRA_ITC_FLUVIAL&outputFormat=SHAPE-ZIP
31611	**Landslides**	shp, GML, GeoPackage, KML, WMS, WFS	2014	Liguria Region	1:10000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31612	**Flooded areas**	shapefile, WMS	2015-2022	Liguria Region	N/A	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31613	**Seismic zones**	shp, GML, GeoPackage, KML, WMS, WFS	2018	Liguria Region	1:5000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html
31614	**Seismogenic zones of Liguria Region**	shp, GML, GeoPackage,	2021	Liguria Region	1:5000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html

		KML, WMS, WFS							
31615	**Map of homogeneous microzones in seismic perspective (M.O.P.S.)**	shp, GML, GeoPackage, KML, WMS, WFS	2021	Liguria Region	1:5000	N/A	N/A	LINKS	https://geoportal.regione.liguria.it/catalogo/mappe.html

L'HORTA DE VALENCIA

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
31700	**Social Vulnerability areas in the city of Valencia. Socioeconomic indicators.**	.xlsx	2022 (1 year)	Local (City of Valencia)	N/A	N/A	Annual	Statistic Office of the City Council of Valencia	https://estadisticavlc2.shinyapps.io/Areas_Vulnerables_2022/
31703	**CO2 stock**	TIF	Created on June 2021	Regional (Valencian Community)	5 m	N/A	N/A	N/A	https://catalogo.icv.gva.es/geonetwork/srv/eng/catalog.search#/metadata/spaicv_orde_sertem_cambio_climatico_stockCO2
31704	**Cartography of critical soils for aquifer recharge**	SHP	Created on 29/03/2020	Regional (Valencian Community)	1/50000	N/A	Updated 4 months ago (may 2023)	N/A	https://geocataleg.gva.es/#/search?uuid=spa_icv_orde_sertem_cambio_climatico_acuiferos
31705	**Soil permeability**	SHP	Created on 29/03/2020	Regional (Valencian Community)	1/50000	N/A	Updated 4 months ago (may 2023)	N/A	https://geocataleg.gva.es/#/search?uuid=spa_icv_orde_sertem_cambio_climatico_permeabilidad
31706	**Marine intrusion**	SHP	Created on 29/03/2020	Regional (Valencian Community)	1/50000	N/A	Updated 4 months ago (may 2023)	N/A	https://geocataleg.gva.es/#/search?uuid=spa_icv_orde_sertem_cambio_climatico_intrusion_mar

31707	**Annual carbon dioxide fixation**	TIFF	Created on 17/06/21	Regional (Valencian Community)	5 m	N/A	Updated 4 months ago (may 2023)	S.D.G. for Land Planning and Landscape Management - Regional Ministry of Environment, Water, Infrastructures and Territory - Generalitat Valenciana.	https://geocataleg.gva.es/#/search?uuid=spaicv_orde_sertem_cambio_climatico_fijacionCO2
31708	**PATRICOVA – Sectoral territorial action plan on flood risk prevention in the Valencian community**	Maps, documents, application guide	created 2003; reviewed 2015; application guide 2019	Regional (Valencian Community)	N/A	N/A	Last update: 2015	D.G. for Land Policy and Landscape - Regional Ministry of Territorial Policy, Public Works and Mobility - Generalitat Valenciana	https://mediambient.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/patricova-plan-de-accion-territorial-de-caracter-sectorial-sobre-prevencion-del-riesgo-de-inundacion-en-la-comunitat-valenciana
31709	**PATIVEL - Territorial Action Plan for Coastal Green Infrastructure.**	Maps, documents.	created 2018.	Regional (Valencian Community)	N/A	N/A	N/A	D.G. for Land Policy and Landscape - Regional Ministry of Territorial Policy, Public Works and Mobility - Generalitat Valenciana	https://mediambient.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/plan-de-accion-territorial-de-la-infraestructura-verde-del-litoral
31710	**Territorial Action Plan for L'Horta**	Maps, documents.	Approved 2018.	Supramunicipal (Horta territory)	N/A	N/A	N/A	D.G. for Land Policy and Landscape - Regional Ministry of Territorial Policy, Public Works and Mobility - Generalitat Valenciana	https://mediambient.gva.es/es/web/planificacion-territorial-e-infraestructura-verde/pat-horta-de-valencia https://catalogo.icv.gva.es/geonetwork/srv/cat/catalog.search#/metadata/spa_icv_orde_pathuerta_amb_estricto

31711	**PATFOR - Territorial forestry action plan of the Region of Valencia**	Maps		Regional (Valencian Community)	N/A	N/A	N/A	S.D.G. for Land Planning and Landscape Management - Regional Ministry of Environment, Water, Infrastructures and Territory - Generalitat Valenciana.	https://geocataleg.gva.es/#/results/forestal
31712	**Open data portal of València: Atmospheric data from 5 meteorological stations in the Valencia city**		Real-time	Valencia city	N/A	N/A	N/A	Regional Ministry of Environment, Water, Infrastructures and Territory - Generalitat Valenciana.	https://valencia.opendatasoft.com/explore/dataset/estacions-atmosferiques-estaciones-atmosfericas/table/?location=12,0.00902,0.02622&basemap=e4bf90
31713	**Open data portal of València: Pollution data from 11 atmospheric stations in the Valencia city**	csv, json, xls, GeoJSON, shp, KML, FlatGeobuf, GPX, GeoParquet, API	Real-time	Valencia city	N/A	N/A	N/A	S.D.G. for Land Planning and Landscape Management - Regional Ministry of Land and Urban Planning - Generalitat Valenciana.	https://valencia.opendatasoft.com/explore/dataset/estacions-atmosferiques-estaciones-atmosfericas/table/?location=12,0.00902,0.02622&basemap=e4bf90
31714	**Open data portal of València: Air quality historical for the Valencia city**	csv, json, xls, GeoParquet, API	2004 - 2022	Valencia city	N/A	Daily	Last processing 28 February 2024	Regional Ministry of Housing, Public Works and Vertebration of the Territory	https://valencia.opendatasoft.com/explore/dataset/rvvcca/table/
31715	**Daily measures of atmospheric pollutants and ozone from**	csv, tsv, json, xml, API	1994 - 2024	Valencian Community	Regional	Daily	Monthly (last update May 5, 2024)	Regional Ministry of Environment, Water, Infrastructures and	https://dadesobertes.gva.es/es/dataset?q=contaminaci%C3%B3n&groups=medio-

	Conjuntos de datos - Generalitat Valenciana							Territory - Generalitat Valenciana.	ambiente&sort=metadata_modified+desc&page=4
31716	**Vulnerable areas due to nitrates in the Valencian Community**	csv, tsv, json, xml, API	N/A	bbox-east-long: 0.4989 bbox-north-lat: 41 bbox-south-lat: 37.8483 bbox-west-long: -1.6	Regional	N/A	N/A	Ajuntament de València - Dades Obertes	https://dadesobertes.gva.es/es/dataset/zonas-vulnerables-por-nitratos-en-la-comunitat-valenciana
31717	**Sistema Automatico de Informacion Hidrologica (S.A.I.H.)**	.xlsx, .pdf	From last year to last 5 minutes	Valencian Community	Regional	yearly, monthly, weekly, daily, 8-hours, 5-min	Real-time	Confederación Hidrográfica del Júcar	https://saih.chj.es/chj/saih/glayer?t=e
31718	**Portal Agrari (agricultural statistics in the Valencian Community)**	.xlsx	2002 - 2022	Valencian Community	Regional	yearly	yearly	Generalitat Valenciana	https://portalagrari.gva.es/va/

ZADAR

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
31801	**Geoportal kulturnih dobara**	.xlsx, WMS, WFS	Last update 2024	Croatia	National	N/A	N/A	Republic of Croatia Ministry of Culture and Media	https://geoportal.kulturnadobra.hr/geoportal.html?lang=eng#/

31802	**Sea bathing water quality in Croatia**	viewer	2009-2023	Croatia	N/A	N/A	N/A	Institute of Public Health Zadar	https://vrtlac.izor.hr/ords/kakvoca/kakvoca_detalji10
31803	**Climate monitoring**	viewer	2014-2024	Croatia	N/A	N/A	N/A	DHMZ - Meteorological and Hydrological Service	https://meteo.hr/klima_e.php?section=klima_pracenje&param=klel
31804	**Nature and environmental protection information system**	viewer	N/A	Croatia	N/A	N/A	N/A	Ministry of Economy and Sustainable Development	https://www.haop.hr/hr/informacijski-sustavi/informacijski-sustav-zastite-prirode/zasticena-podrucja
31805	**Register of cultural assets of the Republic of Croatia**	webpage	N/A	Zadar	City	N/A	N/A	Ministry of Culture and Media	https://registar.kulturnadobra.hr/#/details/Z-3409
31806	**Cartographic representation and data on the ecological network Natura 2000**	.csv, .xls	Depending on the dataset	Croatia	National	N/A	N/A	Ministry of Environmental Protection and Green Transition / Institute for Environmental and Nature Protection	https://bioportal.hr/gis/

10 Annex III

Description of data at European scale relevant for RescueME

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
12100	**Employment (Total - all NACE activities)**	.xlsx	2018-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database

12101	**Gross Domestic Product attributable to private and formal cultural production (million euro)**	.xlsx	2000-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12103	**Bed-places in tourist accommodation**	.xlsx	1990-2011	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12105	**Employment (Arts, entertainment and recreation; other service activities)**	.xlsx	2012-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/nama_10r_3empers__custom_8159593/default/table
12106	**Natura 2000 sites**	.gpkg	2021	EU27	N/A	N/A	annual	EEA	https://www.eea.europa.eu/data-and-maps/data/natura-14
12107	**Landslide susceptibility map**	.shp	2018	All European Union member states except Malta, in addition to Albania, Andorra, Bosnia and Herzegovina, Croatia, FYR Macedonia, Iceland, Kosovo, Liechtenstein, Montenegro, Norway, San Marino, Serbia, and Switzerland	cell size 200 m	N/A	N/A	JRC	https://esdac.jrc.ec.europa.eu/content/european-landslide-susceptibility-map-elsus-v2

12108	**Degree of urbanisation**	.tif	2018	Kosovo (UNSCR 1244/99), Albania, Serbia, EFTA4, Montenegro, North Macedonia, Bosnia and Herzegovina, EU28 (2013-2020)	cell size 1 km	N/A	not planned	EEA	https://www.eea.europa.eu/en/datahub/datahubitem-view/a5857b35-9d27-4d42-94b7-4d141ee5b550
12109	**Precipitation variation**	.xlsx	1970-2021	Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Liechtenstein, Norway, Switzerland,	NUTS0	annual	annual	EUROSTAT	https://ec.europa.eu/eurostat/databrowser/view/env_wat_res/default/table?lang=en

				United Kingdom, Bosnia and Herzegovina, North Macedonia, Albania, Serbia, Türkiye, Kosovo (under United Nations Security Council Resolution 1244/99)					
12110	**Nature Based recreation potential**	.gpkg	2000/2006/ 2012	Europe	cell size = 1km	N/A	every 6 years	JRC	https://ecosystem-accounts.jrc.ec.europa.eu/map
12111	**Habitat and species maintenance**	.tif	2000/2006/ 2012/2018	Europe	cell size = 1km	N/A	every 6 years	JRC	https://ecosystem-accounts.jrc.ec.europa.eu/map
12112	**Global climate regulation - Carbon sequestration**	.tif	2000/2006/ 2012/2018	Europe	cell size = 1km	N/A	every 6 years	JRC	https://ecosystem-accounts.jrc.ec.europa.eu/map
12113	**Number of fire events**	.csv	2006-2022	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary,	NUTS0	average 2006-2022, number in 2023	irregular	JRC	https://effis.jrc.ec.europa.eu/apps/effis.statistics/estimates

				Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden					
12114	**Fire-ridden areas**	.csv	2006-2022	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden	NUTS0	average 2006-2022	irregular	JRC	https://effis.jrc.ec.europa.eu/apps/effis.statistics/estimates
12115	**Nationally designated areas (protected**	.gpkg	2023	Europe	N/A	N/A	N/A	EEA	https://www.eea.europa.eu/en/datahub/datahubitem-view/f60cec02-6494-4d08-b12d-17a37012cb28

	areas <> Natura 2000)								
12116	**Available beds in hospitals**	.xlsx	1993 - 2022	EU27+x	NUTS2	annual	annual	EUROSTAT	https://ec.europa.eu/eurostat/web/main/data/database
12117	**Historical building stock**	.xlsx	2011	EU27+x	NUTS3	single year	next update 2024	EUROSTAT	https://ec.europa.eu/CensusHub2/selectHyperCube?clearSession=true
12118	**Households with internet access**	.xlsx	2006-2022	Europe (38 countries)	NUTS2	annual	annual	EUROSTAT	https://ec.europa.eu/eurostat/databrowser/explore/all/all_themes?lang=en&display=list&sort=category
12119	**Classification as inner periphery**	.xlsx	2013	EU27+x	NUTS3		not planned	ESPON	https://database.espon.eu/project-data-package/985/
12120	**Physicians per 100000 Inhabitants**	.xlsx	1993-2022	EU27+x	NUTS2	annual	annual	EUROSTAT	https://ec.europa.eu/eurostat/databrowser/view/hlth_rs_physreg/default/table?lang=en
12121	**UNESCO World Heritage Sites**	.xlsx	2023	World	point data	N/A	N/A	UNESCO	https://whc.unesco.org/en/syndication
12122	**Endangered UNESCO World Heritage Sites**	.xlsx	2023	World	point data	N/A	N/A	UNESCO	https://whc.unesco.org/en/syndication
12123	**Energy consumption data**	.xlsx	2002, 2012, 2018	EU27+x	NUTS3	irregular	irregular	ESPON LOCATE	https://database.espon.eu/project-data-package/971/
12124	**Arrivals at tourist accommodation establishments**	.xlsx	2012-2022	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12125	**Seasonality in tourism**	.xlsx	2011	EU	NUTS3	-	N/A	ESPON TEVI	https://www.espon.eu/sites/default/files/attachments/TEVI_territorial_evidence_reports.pdf

12126	**Economic damage due to four natural hazard**	.xlsx	1995-2017	EU	NUTS3	average (1995-2017)	N/A	ESPON	https://www.espon.eu/natural-disasters
12127	**Annual income**	.xlsx	1995-2021	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/nama_10r_2hhinc__custom_8726683/default/table
12128	**Environmental protection investments of total economy**	.xlsx	2006-2021	EU	NUTS0	annual	annual	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/env_ac_epite__custom_8731595/default/table
12129	**Total number of agricultural holdings**	.xlsx	2000-2007	EU	NUTS3	annual	N/A	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/ef_r_nuts__custom_8733557/default/table
12130	**Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage**	.xlsx	2018-2021	17 european countries	NUTS0	annual	annual	UNESCO stat office	http://data.uis.unesco.org/Index.aspx?DataSetCodeEDULIT_DS&popupcustomisetrue&langen#
12131	**House price index - quarterly data**	.xlsx	2006-2023	EU	NUTS0	quarterly data	quarterly	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/tipsho40__custom_8775429/default/table?lang=en
12132	**Unemployment rate**	.xlsx	2011-2022	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12133	**Population density**	.xlsx	2017-2022	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database

12135	**Population change**	.xlsx	2000-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12136	**Land use change between 2012 and 2018**	.tif	1998 - 2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12137	**Proportion of population aged 20-39 years**	.xlsx	2018-2022	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12138	**Proportion of population aged 65 years and more**	.xlsx	2018-2022	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12139	**Young-age dependency ratio (population 0 to 14 years to population 15 to 64 years)**	.xlsx	2018-2022	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12140	**Net migration**	.xlsx	2017-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12141	**Employed persons with tertiary education (15-64 years)**	.xlsx	2018-2022	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12142	**Early leavers from education and training**	.xlsx	2000-2022	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12143	**Land use (urban, agricultural, forest, land+water)**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en

12144	**Imperviousness (sealed area)**	.tif	2018	EU	cell size = 100m	-	-	COPERNICUS	https://land.copernicus.eu/en
12148	**NUTS0 - availability of national action plan (NAP) or national adaptation strategy (NAS)**	.xlsx	2005-2018	EU	NUT0	annual	annual	EEA	https://www.eea.europa.eu/airs/2018/environment-and-health/climate-change-adaptation-strategies
12149	**Elevation breakdown based on EU-DEM**	.tif	-	EU	cell size 1 km	-	-	EEA	https://www.eea.europa.eu/en/datahub/datahubitem-view/869d38c9-79e2-44c6-9de1-8966f4753f7c
12153	**Size of build-up area**	.tif	2016	Worldwide		-	-	DLR	https://www.dlr.de/eoc/desktopdefault.aspx/tabid-9628/16557_read-40454/
12154	**Agricultural area**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12155	**Share of holders > 65 years old**	.xlsx	2000-2007	EU	NUTS3	annual	N/A	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/ef_r_nuts__custom_8733557/default/table
12156	**Share of holdings with a full-time manager**	.xlsx	2000-2007	EU	NUTS3	annual	N/A	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/ef_r_nuts__custom_8733557/default/table
12157	**Employment in agriculture, forestry and fishing**	.xlsx	2012-2021	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12158	**Land tenure system**	.xlsx	2000-2007	EU	NUTS3	annual	N/A	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/ef_r_nuts__custom_8733557/default/table

12159	**Diversification of agricultural activities - Agricultural area of holdings with Mixed crops - livestock**	.xlsx	2000-2007	EU	NUTS3	annual	N/A	Eurostat	https://ec.europa.eu/eurostat/databrowser/view/ef_r_nuts__custom_8733557/default/table
12160	**Arable land**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12161	**Parity in farm managers (% of female farm managers)**	.xlsx	2010-2020	EU	NUTS2	irregular	irrgular	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12162	**Cultural sites with international designation**	.geojson		Global (WHS) and EU (CC)	point data	annual	Yearly	UNESCO (WHS) and European Comission	https://whc.unesco.org/en/list/ https://culture.ec.europa.eu/policies/culture-in-cities-and-regions/european-capitals-of-culture
12163	**Protected natural and agricultural areas with international designation**	.shp		Global (WDPA) and Europe (Natura 2000)	Polygons	annual	Yearly	UNEP-WCMC and IUCN (2024), Protected Planet: The World Database on Protected Areas (WDPA) [Online], January 2024, Cambridge, UK: UNEP-WCMC and IUCN. Available at:	https://www.protectedplanet.net/en https://www.eea.europa.eu/en/datahub/datahubitem-view/6fc8ad2d-195d-40f4-bdec-576e7d1268e4

								www.protecte dplanet.net. European Environment Agency	
12164	**Number of PDO products allowed to be produced in this NUTS3 region**	.xlsx	2020	EU	NUTS3	-	-	Flinzberger, L., Zinngrebe, Y., Bugalho, M.N. et al. EU-wide mapping of 'Protected Designations of Origin' food products (PDOs) reveals correlations with social-ecological landscape values. Agron. Sustain. Dev. 42, 43 (2022). https://doi.org /10.1007/s135 93-022-00778-4	https://zenodo.org/recor ds/6483031
12165	**Gender employment GAP**	.xlsx	1999-2022	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eur ostat/web/main/data/da tabase
12166	**Number of strategic buildings**	.shp, 1 file per country	2023	Worldwide	point data	n/a	continuous	OpenStreetMa p	https://www.openstreet map.org/#map=7/51.33 0/10.453
12167	**Permanent cultivations surface (are of vineyards & olive groves)**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus. eu/en

12168	**Number of young farmers**	.xlsx	2010-2020	EU	NUTS2	irregular	irrgular	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12169	**Bio-energy produced by a NUTS region**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12170	**Green areas of high ecological quality**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12171	**Dispersion of urban areas**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12172	**Shannon Evenness Index**	.gpkg	2018	EU	Min. Mapping Unit = 25ha / 100m	-	6 years	COPERNICUS	https://land.copernicus.eu/en
12173	**Flood control service providing area**	.tif	2000/2006/ 2012	Europe	cell size = 1km	-	every 6 years	JRC	https://ecosystem-accounts.jrc.ec.europa.eu/map
12174	**Share of NUTS region with high travel time to regional centre**	.xlsx	2013	EU27+x	NUTS3		not planned	ESPON	https://database.espon.eu/project-data-package/985/
12175	**Participation rate in education and training**	.xlsx	2000-2022	EU	NUTS2	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12176	**Share of farmers with full or basic agricultural training**	.xlsx	2010, 2013, 2016, 2020	EU	NUTS2	irregular	irregular	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database
12177	**Cultural vibrancy - number of cultural sites**	.geojson		EU	Point data	annual	Yearly	Cultural gems: © European Union and Cultural gems contributors, with data from	https://cultural-gems.jrc.ec.europa.eu/map

								OpenStreetMap (openstreetmap.org) contributors	
12178	**Number of educational facilities**	.geojson		Global	Point data	annual	Yearly	TECNALIA (based on OpenstreetMap)	OpenStreetMap
12179	**Tourism turnover**	.xlsx		EU	NUTS3	annual	Yearly	TECNALIA (based on Eurostat data)	https://ec.europa.eu/eurostat/web/main/data/database
12180	**Tourist accommodation establishments**	.xlsx	1990-2011	EU	NUTS3	annual	annual	Eurostat	https://ec.europa.eu/eurostat/web/main/data/database

11 Annex IV

Description of the Risk Indexes generated by TECNALIA and exposed through the RescueME ATLAS

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link**
12181	**Hazard index of poor air quality on coastal cultural landscapes**	Geopackage	2016-2020	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	annual	N/A	TECNALIA	N/A
12182	**Exposure index of poor air quality on coastal cultural landscapes**	Geopackage	2016-2020	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	annual	N/A	TECNALIA	N/A
12183	**Vulnerability index of poor air quality on coastal cultural landscapes**	Geopackage	2016-2020	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	annual	N/A	TECNALIA	N/A
12184	**Risk index of coastal floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

** Data access links are not available as data are restricted

12185	**Hazard index of coastal floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12186	**Exposure index of coastal floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12187	**Vulnerability index of coastal floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12188	**Risk index of droughts on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12189	**Hazard index of droughts on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12190	**Exposure index of droughts on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12191	**Vulnerability index of droughts on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

12192	**Risk index of heatwaves on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12193	**Hazard index of heatwaves on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12194	**Exposure index of heatwaves on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12195	**Vulnerability index of heatwaves on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12196	**Risk index of landslides on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12197	**Hazard index of landslides on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12198	**Exposure index of landslides on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
12199	**Vulnerability index of**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

	landslides on coastal cultural landscapes			and United Kingdom (only coastal regions)					
121100	**Risk index of pluvial floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121101	**Hazard index of pluvial floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121102	**Exposure index of pluvial floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121103	**Vulnerability index of pluvial floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121104	**Risk index of river floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121105	**Hazard index of river floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121106	**Exposure index of river floods on coastal**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

	cultural landscapes			Kingdom (only coastal regions)					
121107	**Vulnerability index of river floods on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121108	**Risk index of wildfires on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121109	**Hazard index of wildfires on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121110	**Exposure index of wildfires on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121111	**Vulnerability index of wildfires on coastal cultural landscapes**	Geopackage	1981-2010; 2071-2100	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121112	**Possible future change of coastal floods risk classes**	csv	1981-2010; 2071-2100 (RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121113	**Possible future change of droughts risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

121114	**Possible future change of heatwaves risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121115	**Possible future change of landslides risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121116	**Possible future change of pluvial floods risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121117	**Possible future change of river floods risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A
121118	**Possible future change of wildfires risk classes**	csv	1981-2010; 2071-2100 (RCP 2.6, RCP 4.5, RCP 8.5)	EU-27 plus Iceland, Norway and United Kingdom (only coastal regions)	NUTS3 (2021)	30 years	N/A	TECNALIA	N/A

12 Annex V

Description of the new data that will be generated by RescueME

ID	Description	Format	Time coverage	Area coverage	Spatial resolution / scale	Temporal resolution	Update frequency	Ownership / Author	Access link
33200	**Geolocated picture with metadata (report) from Chatbot**	JSON or geoJSON	timestamp	Point	Mobile phone positioning	timestamp	variable	LINKS	N/A
33201	**Event/Topic detected through social media**	JSON or geoJSON	variable	BBOX depending on the event	N/A	N/A	variable	LINKS	N/A
33202	**Event/Topic report extracted from social media**	JSON or geoJSON	variable	BBOX depending on the event Area of Interest	N/A	N/A	variable	LINKS	N/A
33203	**Relevant posts in a specific spatio-temporal window, language and hazard/topic**	JSON or geoJSON	timestamp	BBOX depending on the event Area of Interest	N/A	N/A	variable	LINKS	N/A
33204	**Message from control center to Chatbot users**	JSON or geoJSON	days	BBOX depending on the Area of Interest of the	N/A	N/A	variable	LINKS	N/A

				Communicati on					
33205	**Mission from control center to Chatbot professional users**	JSON or geoJSON	days	BBOX depending on the Area of Interest of the Mission	N/A	N/A	variable	LINKS	N/A
33206	**Characterization of CH assets / Labscape topics**	JSON or geoJSON	variable	BBOX depending on single assets or overall R-labscape	N/A	N/A	variable	LINKS	N/A
33207	**Geolocated picture with metadata (AI-generated) from Sally**	JSON or geoJSON	variable	Point	N/A	N/A	variable	LINKS	N/A

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Contact us

www.resilientculturallandscapes.eu

MARIA LUISA QUARTA
quarta@meeo.it

MARCO FOLEGANI
folegani@meeo.it

STEFANO NATALI
natali@sistema.at

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