PIISA

Piloting Innovative Insurance Solutions for Adaptation

D5.12 Project Data Management Plan – Version 3

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Keywords

PIISA, Data Management, FAIR-principles, Data identification, Data security, EU Data Act, Metadata

Abbreviations and acronyms

Acronym	Description
DMP	Data Management Plan
DOI	Digital Object Identifier
FAIR	Findable, Accessible, Interoperable, Reusable
FMI	Finnish Meteorological Institute
KPI	Key Performance Indicators
NBS	Nature Based Solutions
PID	Persistent Identifier
Polimi	Politecnico di Milano
WP	Work Package

Glossary

Data identification. Identifier for the data set to be produced.

Data set description. Descriptions of the data that are being generated or collected, its origin (in case it is collected), nature and scale and to whom it could be useful, and whether it underpins a scientific publication. Information on the existence (or not) of similar data and the possibilities for integration and reuse.

Metadata. Metadata is providing information about one or more aspects of the data; it is used to summarize basic information about data that can make tracking and working with specific data easier. “Data about the data”.

Data sharing. Description of how data is being shared, including access procedures, embargo periods (if any), outlines of technical mechanisms for dissemination and necessary software and other tools for enabling re-use, and definition of whether access is being widely open or restricted to specific groups. In case the dataset cannot be shared, the reasons for this should be mentioned (e.g. ethical, rules of personal data, intellectual property, commercial, privacy-related, security-related).

Archiving and preservation (including storage and backup). Description of the procedures that are being put in place for long-term preservation of the data. Indication of how long the data should be preserved, what is its approximated end volume, what the associated costs are and how these are planned to be covered.

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Data Ownership. Identification of the individuals or entities that own the data and any associated intellectual property rights. Clarification on how ownership may affect data sharing and access.

Data Quality Assurance. Description of the measures and procedures in place to ensure data accuracy, consistency, and reliability. This can encompass data validation, error-checking, and quality control processes.

Data Security. Explanation of data security measures to protect sensitive or confidential information. This may involve encryption, access controls, and data anonymization techniques.

Data Lifecycle. A comprehensive overview of the data's lifecycle, including its creation, storage, usage, sharing, and eventual disposal or archiving. This helps ensure proper management at each stage.

Data Citation. Guidelines on how to cite the dataset in publications or other research outputs. This should include information such as dataset title, creator(s), publication date, and a persistent identifier (e.g., DOI).

Data Documentation. Detailed documentation about the dataset, including data dictionaries, codebooks, and other explanatory materials that aid in understanding the data's structure, variables, and context.

Data Licensing. If applicable, information about the licensing terms under which the data can be used, shared, and modified. Specify whether open licenses (e.g., Creative Commons) or custom licenses are being used.

Data Ethics and Compliance. Detailed information on how the data management plan adheres to ethical guidelines, legal requirements, and institutional policies, particularly when dealing with sensitive data or human subjects.

Data Disposal. Procedures for securely disposing of data when it is no longer needed, including data destruction methods and compliance with relevant data protection regulations.

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1 Introduction

PIISA stands for "Piloting Innovative Insurance Solutions for Adaptation", and it was a 3-year Research and Innovation Action funded under the Horizon Europe program within the call "HORIZON-MISS-2022-CLIMA-01". The partnership brought together 12 organisations from 5 European countries, and co-developed climate resilient insurance portfolios, as well as solutions for sharing losses and climate risk data. PIISA aimed to develop and deploy a range of insurance innovations to cover at least 50% of losses attributable to climate change effects in Europe. The project results aim to support households, firms, and public authorities in promoting adaptation also after the project conclusion. The project is described in more detail on the PIISA website.

The purpose of the data management plan (DMP) and its subsequent versions is to document how the data generated by the PIISA project is handled during and after the project. The DMP outlines the core principles and procedures governing data management in the project, including standards for data documentation at both discovery and dataset levels, as well as practices for data sharing, curation, preservation, and long-term stewardship. The DMP specifies the types of data used and produced in the PIISA project, the standards and metadata frameworks applied, and the processes through which data are exploited, made accessible for verification and re-use, securely stored, and preserved over time.

The PIISA DMP is made based on the EU Grants Data Management Template since it is recommended for Horizon Europe beneficiaries (HORIZON_EUROPE_Data-Management-Plan-Template.pdf (openaire.eu). In completing the template sections, we address the requirements for research data management of Horizon Europe as described in Article 17 and analysed in the Annotated Grant Agreement. PIISA is following the principles outlined by the Open Research Data Pilot and The FAIR Guiding Principles for scientific data management and stewardship (Wilkinson et al. 2016). The DMP is also following the OpenAIRE guidelines (How to create a Data Management Plan (openaire.eu)).

This is the final version of the data management plan for PIISA, providing an updated outline of the PIISA project policies for data management and data produced in PIISA. As an update, the D5.12 *Project Data Management Plan – Version 3* includes a **table of the datasets produced** by PIISA (Appendix A), section 5.1 Maintenance and ownership of the Tools after PIISA as well as section 2.3 PIISA Tools and Datasets, presenting the main outputs and providing links to the tools, indices and deliverables produced by PIISA, also linked here:

PIISA Tools:

- Home Risk Assessment in France
- Green Roofs Insurance in the Netherlands
- Co-Designing Parametric Agriculture Insurance
- Seasonal Forecasts for Farmers
- Impact Data Catalogue

PIISA indices: Risk Data Hub / Hosted projects / PIISA

PIISA Deliverables and other results: Zenodo / PIISA project

PIISA Website / Dashboard: PIISA project

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2 Data Summary

To achieve its aims and objectives, the PIISA project used and generated data on climate-related risks in the financial and insurance sectors to support adaptation to the impacts of climate change. This included data on user preferences for insurance services collected through interviews and surveys, as well as datasets of environmental and climate observations across the European region. In addition, WP2 produced catalogues of empirical and modelled data on climate-related risks, damages, and losses. In summary, PIISA compiled information from surveys, climate risk assessments, and loss records to support stakeholders in strengthening climate adaptation and resilience.

2.1 WP-specific data descriptions

The updated description is provided by each WP Leader with help from partners. An overview of all datasets produced in PIISA is provided in Appendix A.

2.1.1 WP1 Innovation in insurance solutions

WP1 reviews the current state of the market for climate risk insurance and analyses the challenges and opportunities to overcome market barriers through innovation in the design and delivery of insurance products and services. WP1 produces literature reviews to identify gaps between the users' needs and the insurance sector in a changing climate, as well as the established practices for actuarial modelling. The objectives of WP1 draw upon data from the EIOPA (European Insurance and Occupational Pensions Authority) Dashboard on the insurance protection gap for natural catastrophes, as well as findings reported in scientific, grey, and white literature. WP1 shares the data extraction matrices from the literature reviews of D1.1 *Role and potential of insurance in accelerating climate adaptation in Europe* and D1.2 *Advancements in actuarial risk modelling*, in open access repositories (such as Zenodo) together with the code to ensure the reproducibility of the analysis, upon publication in peer-reviewed journals of the scientific papers based on the deliverables. All WP1 deliverables can be found on Zenodo and PIISA's website.

Note: Results from the survey conducted and funded by Politecnico di Milano (Polimi) are utilised in the D1.4 *Focused market reviews in WP3 pilot sectors/areas* but the data is not open-access.

2.1.2 WP2 Innovations in adaptation and climate services for insurance

WP2 is dedicated to co-designing and co-developing climate (risk) indices for the services and tools piloted in WP3. WP2 transforms the needs of the insurance sector for creating innovative products, as identified in WP1, into enhanced data and climate indicators, e.g., high-resolution gridded data and climate indices for parametric insurance, return period services, microclimatic solutions, etc. These solutions are further developed in partnership with WP3 through a collaborative process informed by feedback from the PIISA pilot activities.

WP2 identifies and develops a set of climatic indicators, considering the role of extreme events and compound extreme events. These indicators are obtained from various sources of climate information: from weather predictions, through seasonal predictions to climate change projections. A significant portion of the data used is sourced from the open datasets provided by the Copernicus Climate Change Service, ensuring the comprehensiveness and reliability of our climate data inputs. In addition to the Copernicus datasets, WP2 also incorporates data and projections from the CMIP6 - Coupled Model Intercomparison Project by CMCC.

WP2 also integrated 10 novel piloted open-source risk datasets into the Risk Data Hub (RDH) of the European Commission's Disaster Risk Management Knowledge Centre (DRMKC). The RDH is a pioneering platform designed to centralise and standardise risk, damage and loss data at a pan-European level. All indices developed by PIISA will be available in June 2026 under the *Hosted Projects* page, and they are associated with specific climate risks in order to quantify the composite physical risk. This information can be used either for pricing or to produce hazard maps for underwriting policies, to ensure the profitability of the products, but also in terms of prevention and awareness of end-users. More information about the indices and datasets is provided in the WP2 deliverables D2.1 and D2.3. which are found in Zenodo and PIISA's website. The novel risk indices integrated into the DRMKC's Risk Data Hub are presented below.

Table 1: The novel open-source risk indicators integrated into the Risk Data Hub.

Index	Brief description	Partner(s)	Data sources	Use of index
Climate Dryness Index (CDI)	Predicts the risk of droughts, heatwaves, and their combination for shrink-swell clay soils.	Amigo	Climate Projections (e.g. CMIP6)	Household insurance
Standardised Windstorm Index (SWI)	Standardized index that uses maximum daily wind speeds to map storm/cyclone footprints and predict severe windstorms events.	Amigo	Reanalysis (ERA5, ERA5-Land, CERRA), Seasonal forecasts	Forest insurance
Hail index	Hail probability in terms of hail days per month in a given grid point.	CMCC	Reanalysis (ERA5)	Forest and agriculture insurance
Thunder Day index	Seasonal (May-September) number of thunder days based on thunder day index	FMI	Reanalysis (ERA5)	Risk Data Hub
Severe Thunder Day index	Seasonal (May-September) number of severe thunder days based on severe thunder day index	FMI	Reanalysis (ERA5)	Risk Data Hub
Yield Loss Drought index	Measure deficit in crop evapotranspiration potential without irrigation	FMI	Reanalysis (ERA5), Climate model (CORDEX)	Agriculture insurance
Standardised Precipitation and Growth Index (SPGI)	Standardised compound drought index based on precipitation and growing season length	FMI	Reanalysis (ERA5), Climate model (CORDEX)	Agriculture insurance
Wildfire catalogue	Probabilistic representation of fire occurrence based on key drivers (fire weather conditions, ignition likelihood and fuel characteristics	AXA Climate		Wildfire and forest insurance
Wind Power Exposure Index (WPEI)	Proxy of wind power based on a combination of hourly wind speed, wind direction, and storm duration	AXA Climate	Reanalysis (ERA-land5)	Windthrow forest insurance
Three-Month Dry Accumulation Probability Index (DAP150)	Likelihood that rainfall over three consecutive months will stay below 150 mm (i.e. meaning drier-than-usual conditions).	BSC-CNS	ECMWF SEAS5.1 (and ERA5 for calibration)	Index-based climate insurance for agriculture sector

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2.1.3 WP3 Pilots

WP3 focuses on the development of new innovative concepts, advanced products, and services through piloting. The five themes explored in the PIISA pilots are:

- Pilot 1 - Green Roof Insurances
- Pilot 2 - Addressing soil stability risks for homeowner insurance holders
- Pilot 3 - Insurance Services for Agriculture
- Pilot 4 - Forest Insurances against selected biotic and abiotic risks
- Pilot 5 - Wildfire insurance enhancing adaptive actions

Within WP3, partners are engaged in the generation and analysis of various types of data that serve the development of insurance pilots. In general, WP3 produced (end of loop) surveys, conducted interviews and workshops to find out customers' preferences related to different designs of insurance, including parametric insurance and stakeholders' views on adverse weather phenomena, and how to measure them (e.g. LIKERT scale opinion polls and embedded choice experiments). WP3 team identified and processed the required data input for index-based insurance products and forecast-based finance mechanisms. For example, WP3 evaluated the strategy of an insurance company (Interpolis) in stimulating the adoption of nature-based solutions (NBS) by its policyholders and the outcomes of the choice experiment that valued the relevant (co-)benefits of NBS and fed into a cost-benefit analysis. This data may be especially useful for insurance companies, researchers and policymakers.

To develop and improve pilots, WP3 used a selection of open weather, satellite, yield and land use data from public sources such as:

- MODIS | Earthdata (nasa.gov) (for the burned area),
- Sentinel Online - ESA - Sentinel Online (for burn severity index),
- Fire Weather Index | Copernicus,
- Copernicus Land Monitoring Service (for land use data),
- Global Forest Watch,
- ERA5-Land | ECMWF,
- GIS data (Sentinel 1: polarisation HH, HV, VV & Sentinel 2 level 2A (hyperspectral) to extract features for modelling)
- FORWIND (European dataset for comparing ground truth data of wind throw damages)

For example, Pilot 4 (Task 3.4.2), used modelled and observed data. Modelled data are built from simulations of wildfire spread in different scenarios to assess the impact of risk mitigation actions in decreasing the wildfire risk. Observed data is retrieved from **open-source satellites** and used in the parametric insurance framework to trigger the payout of a wildfire event. In addition, the pilot explored data facilities and simulations of the **Destination Earth Climate Digital Twins** (DestinE) to be utilised in wildfire risk assessments.

2.1.4 WP4 Dissemination, exploitation and communication

WP4 focused on communication, dissemination, and exploitation of the PIISA project's activities and results. They targeted relevant audiences, fostered dialogue with key stakeholders, and supported the uptake and exploitation of project outcomes. Activities and data created in WP4 served all other work packages as well as visibility and dissemination of the project outcomes. To strengthen dissemination and public engagement, WP4 led the project's external communication activities, including producing content for the newsletter and creating continuous social media

engagement (website and LinkedIn). Data on website visitors and social media engagement (followers, likes, and shares) was collected and analysed to monitor key performance indicators (KPIs) and assess the project's visibility. Content for the newsletter and social media platforms was sourced from PIISA events, case studies, external engagement tasks and other research done within PIISA. As part of these tasks, WP4 created a registry for stakeholders, events and newsletter subscribers (not publicly shared):

- **Stakeholder registry** includes data on stakeholders: name, organization, email, country, stakeholder type, level of collaboration, geographic coverage, potential role and WPs associated, who added the information and date of adding the information. The registry is in the PIISA Teams WP4 folder. It was used to plan stakeholder collaboration activities especially in WP4, but also in other work packages.
- **Events registry** includes data on the (PIISA) events and the partners registered and attended. The data includes dates, event name, location, description, target audience, strategic level, size of the event, names of attendees from PIISA, poster or oral presentation, and event web page. The registry is in the PIISA Teams WP4 folder. It was used to follow the KPI for event attendance, to coordinate event attendance and to coordinate and report PIISA events.
- **Newsletter subscribers registry** includes the contact details of the persons subscribed to the PIISA newsletter. It was used to send out the newsletter as well as to follow the KPI. The data on subscribers of the newsletter is only accessed by LGI Consulting.

Moreover, WP4 has collected data on stakeholder expectations and feedback from pilots in each loop. The surveys are administered via the **EUSurvey** platform, following the questions defined in D4.10 *Survey for mapping Loop feedback for collecting iteration needs – Version 1*. The surveys included information on the respondents' role in the pilot and their expectations for the pilot. The results were used to monitor and enhance the service development. WP4 also completed partner interviews and established an IP Repository documenting project intellectual property and exploitation routes.

2.1.5 WP5 Project Management

WP5 is responsible for administration and overall coordination of the project. WP5's documents and guides for managing the project aim to ensure efficient, timely and seamless project coordination and collaboration between partners. Project management helped with organising, guiding and managing all the processes, events and information shared in the PIISA project. WP5 set up the Teams page and produced deliverables according to the Gantt. The deliverables of WP5 are mainly intended to support the administration and management of work, timeline, risks, ethics, equality, collaboration and data within PIISA. Thus, some deliverables are not intended to be published outside the PIISA project because they are only relevant for internal use.

2.2 Data utility

Results and tools developed by the PIISA project can have significant utility and relevance to various stakeholders and organizations outside the project, including insurance companies, government agencies, environmental organisations, academia, businesses, investors, local communities, homeowners and other citizens. New innovative solutions in the insurance sector are contributing to a more informed and coordinated approach to addressing climate change and its associated risks. Sharing this data can foster collaboration and support evidence-based decision-making in the face of climate adaptation and resilience. Potential beneficiaries and ways in which the data can be useful and valuable:

- Insurance companies: insurance companies can benefit from the data to improve their risk assessment models, develop climate-resilient insurance products, and help them better understand and price climate-related risks.
- Government agencies: national and regional government agencies responsible for climate adaptation and disaster management can use the data to inform policy decisions, allocate resources, and develop strategies for mitigating the impacts of climate change.
- Environmental organisations: environmental NGOs and research institutions can leverage the data for climate research, advocacy, and public awareness campaigns. It can provide valuable insights into the real-world impacts of climate change.
- Academic and research institutions: researchers and scholars working in climate science, economics, and related fields can use the data for academic studies, modelling, and to advance our understanding of climate-related risks and adaptation strategies.
- Businesses and industry sectors: companies in various sectors, such as agriculture, construction, and real estate, can benefit from the data to assess and manage climate risks in their operations, supply chains, and infrastructure investments.
- Investors and financial institutions: investors and financial institutions can use the data to evaluate climate-related risks associated with their portfolios and investments. It can help them make more informed decisions and allocate resources accordingly.
- Local communities: the data can be valuable for local communities, helping them understand their vulnerability to climate change and make informed decisions about adaptation measures.
- General public: developing user-friendly tools and services to raise awareness about the impacts of climate change can lead to more risk-aware behaviour and increase resilience.

2.3 PIISA Tools and Datasets

PIISA developed five user-friendly tools designed for insurance users and providers to support climate change adaptation and awareness. Here you can find links directing to the tools, indices, deliverables and other main results produced by PIISA.

PIISA Tools:

Home Risk Assessment in France

Clay shrink–swell (CSS) events pose an under-recognised but increasingly material risk to buildings and infrastructure. These events occur when clay-rich soils contract during dry periods and expand again when moisture returns, causing ground movement that can lead to cracking and structural damage. Climate change is projected to significantly increase the frequency and severity of meteorological conditions associated with CSS events. CSS online tool communicates to homeowners in France various information about the financial (and other) risks they face from inadequate insurance cover for property damage caused by CSS events.

Green Roofs Insurance in the Netherlands

This is an awareness tool for insurers about the risks of extreme rainfall in urban areas and the damage-reducing potential of nature-based solutions, particularly green roofs. It provides information on climate risks, damage statistics, and preventive measures, and highlights how insurers can use their expertise, products, and influence to encourage households to adopt climate adaptation measures.

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Co-Designing Parametric Agriculture Insurance - CoDepi

CoDepi is a participatory tool to support the design of an index-based climate insurance solution for agriculture. Shiny App allows farmers, researchers and insurers to jointly define insurance trigger thresholds using farmer-identified "bad" years and cross-verification with independent climate data. The tool enables users to test climate thresholds, contract periods and payout structures and evaluate how specific configurations of the base index parameters affect historical payouts and verify the results using different climate data sources. By aligning insurance triggers with farmers' experiences, CoDepi helps reduce basis risk and supports the development of more transparent and demand-driven parametric insurance solutions.

Seasonal Forecasts for Farmers

The seasonal forecast application in the Shiny App supports farmers in adapting to climate risks by providing access to bias-adjusted probabilistic forecasts for selected climate variables and thresholds. The tool allows users to visualise forecast probabilities and examine associated forecast skill metrics. Forecasts are ensemble-based and expressed as probabilities of events (e.g., precipitation below a specified threshold). They are bias-adjusted using established post-processing methods. Forecast performance is assessed using hindcast data for the period 1993–2016 and evaluated with the Ranked Probability Skill Score (RPSS). The seasonal forecast application can be further upscaled to provide relevant climate information for other regions important to the sector, such as across Mediterranean countries. The tool can also be extended to other sectors by selecting appropriate climate variables and indicators that support decision-making and help reduce vulnerability to specific climate risks.

Impact Data Catalogue

From the point of view of adaptation and insurance, not only are hazard data important, but also data on impacts. Natural hazards trigger a cascade of impacts that begin in the geophysical realm, altering hydrologic cycles and soil conditions. These alterations cause ecosystem changes, affecting, for example biomass production and essential ecosystem services. Ultimately, the environmental changes impact the man-made environment, for example, damaging infrastructure and agriculture, or human beings, for example, through health effects. Any effect following from the original hazard can be termed an impact. Different experts and actors apply different distinctions between hazards and impacts. For a climate scientist, a change in river discharge can be understood as an impact, whereas for an insurer, a change in the probability of exceedance of certain water levels in flood prone areas or a change in value at risk is an impact. The Impact Data Catalogue distinguish these several levels of impact.

PIISA Risk indices: Risk Data Hub / Hosted projects / PIISA

PIISA Deliverables and other results: Zenodo / PIISA project

PIISA Website / Dashboard: PIISA project

For all risk indices integrated into Risk Data Hub, see Table 1, and for the full list of datasets produced by PIISA, please see Appendix A.

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3 FAIR Data

Horizon Europe emphasizes the management of data and other outputs in accordance with the FAIR principles, which means making data Findable, Accessible, Interoperable, and Reusable.

3.1 Making Data Findable

In the PIISA project, ensuring data findability is paramount, both during and after the project's duration. To achieve this, we employ the use of Persistent Identifier (PID) or Digital Object Identifier (DOI[1]) for the datasets and deliverables generated. PIDs and DOIs provide a unique and persistent reference for data, making them easily discoverable even beyond the project's scope. For public deliverables, DOI is created by uploading it to PIISA's Zenodo community. For scientific articles, the DOI is received by the publishing Journal.

Data and metadata should be easy to find for both humans and computers. To facilitate efficient data discovery, findability, and reuse, we will provide essential metadata alongside the datasets. This metadata will include codebooks, readme files, and netCDF files with metadata information in the attributes section. It will also comprehensively describe data sources, characteristics, and extraction methods. All public datasets, deliverables, info cards and presentations produced in PIISA will be uploaded to Zenodo / PIISA project and receive a DOI number.

3.1.1 Naming of the files

To ensure document and data control, each document and dataset shall be uniquely identifiable and associated with a unique document name. The tag PIISA, and the deliverable number and name must be used in the deliverable filename. The data filename for publication shall be in the format: PIISA_Deliverable number_Name of the data. With WP4 and WP5 living documents, the version number at the end is also suggested (see example).

Example: PIISA_D5.12_ Project Data Management Plan_Version 3

When re-using open data e.g. from the Climate Data Store or the JRC Risk Data Hub the data (usually) already has a PID. Also, the metadata is already provided on the websites enabling the downloading of this data. This kind of observed data is going to be referenced as documented in the original source. Whenever reusing datasets, a reference to the original data source must be included. If the data produced is sensitive or not meant for sharing, metadata isn't provided alongside the data. For example, documents produced in WP5 won't be made available for harvesting by web browsers and search engines. Also, the feedback from stakeholders and some user surveys collected in WP3 and WP4 are not for widespread distribution and dissemination.

Note: To ensure that the data don't get abandoned if the project doesn't have a future after the EU-funded phase, PIISA suggests that the PID (or DOI) for the generated data is provided by each data producer since it's the best way to prevent this. Another option is to use PIISA's Zenodo repository to indicate the unique DOI number for future reference and preservation.

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3.2 Making Data Accessible

Once the user finds the required data, they need to know how the data can be accessed, possibly including authentication and authorisation. This chapter is sectioned for information about the repository, data and metadata.

3.2.1 Repository

The repository will ensure that data is stored safely and securely and in full compliance with European Union data protection regulations. The public data produced in the project will be deposited in a dedicated PIISA project community in **Zenodo** (Zenodo / PIISA project) and **PIISA website**. Zenodo is a trusted and suitable repository for the PIISA project for the following reasons:

- **Open access**: Zenodo is an open-access platform, which means that anyone can access and download the data you deposit without any restrictions or paywalls. This is important for promoting the sharing of research data and making it available to the wider scientific community and the public.
- **Long-term preservation**: Zenodo is operated by CERN, the European Organization for Nuclear Research, and supported by the European Commission. This backing ensures the long-term preservation and sustainability of the platform. It's designed to store and provide access to research outputs for the long haul.
- **Interdisciplinary**: Zenodo is not limited to a specific field or discipline. It accepts and hosts research data and other research outputs from a wide range of fields, making it a versatile option for researchers in various domains.
- **Integration with ORCID**: Zenodo allows you to link your ORCID iD to your Zenodo account, which can help increase the visibility and impact of your research outputs.
- **Version control**: Zenodo provides version control for your data, ensuring that you can update or revise your datasets as needed while keeping previous versions accessible.
- **Metadata and DOI**: Zenodo assigns a Digital Object Identifier (DOI) to each deposited dataset, which makes it easy to cite and reference your data. Additionally, you can provide detailed metadata for your datasets, enhancing discoverability and usability.
- **Integration with other services**: Zenodo is integrated with other research platforms and services, such as GitHub, making it easier to link your code and data together. This can enhance the transparency and reproducibility of your research.
- **Free to use**: Zenodo is free to use, which is especially important for researchers and organizations with limited budgets.

Website: The PIISA website acts as the final dashboard for the project results. Initially, after the project ended, the PIISA website was intended to be simplified into a landing page in order to reduce the website's carbon footprint. However, PIISA's website developer modified the website code in a low-carbon format, which ensures that the website, including all tools, resources, and links, can remain online in its current form, with full content availability guaranteed for **at least five years after the project's end**. LGI is responsible for the management of the PIISA project website.

1) The use of Zenodo also aligns with the new European Commission's regulation 'Data Governance Act' which entered into application on 24th of September 2023. The Data Governance Act aims to create a safe environment for sharing data across sectors and Member States to benefit society and the economy. To read more information, please visit: https://digital-strategy.ec.europa.eu/en/policies/data-governance-act-explained.

3.2.2 Data

All data that can be publicly shared is openly available and stored in PIISA's website and Zenodo, and most of the processed data is available at the Risk Data Hub. Datasets required for project purposes but not currently openly accessible, even though the data license permits open access, will be temporarily cached by the Finnish Meteorological Institute (FMI) during the project's duration. These datasets will be made available to both internal and external potential users. Selected datasets will be preserved for future reference by FMI, and discovery metadata, as well as online access will be provided for these datasets. FMI complies with the EU data legislation.

In case certain datasets cannot be shared or need to be shared under restricted access conditions (they contain personal information and/or are collected for PIISA internal use only), they are handled accordingly. Access to documents and guidelines meant for internal use within PIISA will be facilitated through Teams and SharePoint. Sensitive data stemming from surveys and interviews will be securely stored in a non-open-access repositories. Legal and contractual reasons for intentional restrictions on data sharing will be clearly separated and stated regarding the sensitive data.

Note: in multi-beneficiary projects, it is also possible for specific beneficiaries to keep their data closed if opening their data goes against their legitimate interests or other constraints as per the Grant Agreement. In the case of PIISA, Polimi conducted a survey with its own money and holds the right to the data. Conversely, results are utilised in PIISA deliverables.

3.2.3 Metadata

Produced data will be provided along with metadata and it will be made openly available and licenced under a public domain dedication CC0[2], as per the Grant Agreement. PIISA will support partners in providing metadata which contains information to enable the user to access the data. The metadata will be available for re-use through the PIISA website where the deliverables and results are stored and published on CORDIS[3]. Metadata will be made available for harvesting by web browsers and search engines. If documentation or a reference to software is required to access or read the data, relevant software (e.g. open source) is included. The aim is to preserve the data in Zenodo as long as it might be useful, valid or valuable for research use and/or the general public. Metadata will remain available after the data is no longer available. Metadata vocabulary (hashtags and keywords) is used for all publications and social media communications.

The datasets integrated into Risk Data Hub follow the metadata requirements of the RDH. This means providing comprehensive metadata in accordance with the Risk Data Library Standard (RDLS) developed by GFDRR and the World Bank (GFDRR, 2023). The RDLS is an open metadata standard specifically designed for describing risk datasets used in climate and disaster risk assessments. Its primary objective is to facilitate risk reduction and resilience building by simplifying the process for both risk data publishers to describe their datasets and for risk data users to identify and utilise the datasets in their work.

2) CC0 (Creative Commons Zero) is a public domain dedication tool that removes legal doubt about whether researchers can use data in their projects. For more information see CC0 - Creative Commons.

3) CORDIS (Community Research and Development Information Service) is the European Commission's primary source of information on research and innovation activities funded by the European Union (EU). CORDIS provides a comprehensive online platform that offers access to a wealth of information related to EU-funded research projects, programs, and initiatives.

3.3 Making Data Interoperable

In research, the data usually need to be integrated with other data. To support the reuse of data, combining information and datasets needs to be easy. Best way to ensure data compatibility and comprehensibility for other researchers and systems is to provide the data in a standardized and well-documented manner. In most cases, this means that the APIs/interfaces must be machine-readable, and as automated as possible so that formats are interoperable. Interoperability of data makes it more easily accessible for analysis and research objectives.

To ensure interoperability, PIISA requires that data generated in the project are published in a repository that allows machine access using standard interfaces and information objects for discovery of metadata. Zenodo provides machine access to data and metadata through standard interfaces and information objects. Zenodo supports the use of well-established protocols and formats for data discovery, making it accessible for automated access, searching and retrieval. Some of the key features and standards used for machine access in Zenodo:

- OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting): Zenodo supports OAI-PMH, which is a widely recognised protocol for harvesting metadata from repositories. This allows automated systems and search engines to discover and harvest metadata from Zenodo for indexing and discovery purposes.
- API (Application Programming Interface): Zenodo offers a RESTful API that enables programmatic access to its data and metadata. Researchers and developers can use this API to search for content, upload data, and retrieve metadata. The API is well-documented, making it easier to integrate with other systems.
- Standard metadata formats: Zenodo uses standard metadata formats such as Dublin Core, DataCite, and others, ensuring compatibility with established metadata standards used in the scholarly and research community.
- DOIs (Digital Object Identifiers): Zenodo assigns DOIs to each dataset and research output. DOIs are a recognized and persistent means of identifying and citing digital objects, which enhances the discoverability and citation of the data.
- Creative Commons Licensing: Zenodo allows researchers to specify Creative Commons licenses for their data, making it clear how the data can be used and reused by others. This licensing information is embedded in the metadata.
- Structured metadata: Zenodo provides structured and comprehensive metadata for deposited content. This metadata includes information about the dataset, contributors, funding sources, and more, making it easier for machines to understand and process.

In addition, the data needs to interoperate with applications or workflows for analysis, storage, and processing. This part is particularly relevant for machine actionability, the ability of machines to "understand" information that is consistently structured. Machine-readable metadata is essential for the automatic discovery of datasets and services, so this is an essential component of the FAIRification process.

To ensure data interoperability across PIISA pilots and with external platforms, data providers applied harmonised methodologies for data creation, processing, and management. Advanced climate analysis methods such as bias correction, downscaling, and extreme-event identification, developed in previous H2020 climate services projects, were reused to ensure methodological consistency. Interoperability was further supported through standardised data processing workflows using widely adopted tools (Python, QGIS, Excel, and standard statistical software), the integration of machine-learning algorithms, and the implementation of scenario simulations.

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3.4 Making Data Reusable

The end goal of FAIR is to optimize the reuse of data. To achieve this, data and metadata should be standardised and well-described so that they can be found and replicated and/or combined in different settings. To ensure this, PIISA partners followed a documentation to validate data analysis and facilitate data re-use by readme files with information on methodology, codebooks and the netCDF files. For the reuse of the results, data quality assurance is also important.

Data quality assurance in PIISA was ensured through the following processes and actions:

- Data validation: Automated validation checks and predefined rules were implemented to verify data accuracy, consistency, value ranges (e.g. meteorological values), and geographic positioning.
- Data cleaning: Data were systematically checked to identify and correct errors, inconsistencies, missing values, and outliers, following established standards used in the relevant scientific fields.
- Data standardisation: Standardised data formats, units, and naming conventions were applied to improve consistency and interoperability across datasets.
- Data documentation: Comprehensive metadata and documentation were maintained to describe data sources, processing steps, transformations, and underlying assumptions.
- Data profiling: Data characteristics, distributions, and patterns were analysed to identify potential data quality issues.
- Data auditing and regular checks: Periodic data audits and regular check-ups of data submitted by partners were conducted to ensure ongoing data quality.
- Internal review: An internal review process, including technical reviews, was applied, with all deliverables reviewed by three internal reviewers to minimise errors.

Licensing: Data needs to be accompanied by a clear, machine-readable license. You can use tools such as Creative Commons (for data and publications) or GitHub - Public license selector (for software) to choose a suitable license. Permissive licences (such as CC0 or CC BY) are preferred in Horizon Europe, wherever possible. However, data should be 'as open as possible, as closed as necessary': if there are intellectual property rights on data, as well as sensitive or classified data they must be kept close (e.g., through access control mechanisms) and the reason must be clearly explained. In PIISA, partners indicated to release the data under the MIT, CC0 (1.0) and CC BY (4.0) licenses. Potential users are expected to adhere to the Terms of Use of the repository. By contacting PIISA management via the website, a third party can request access to datasets if there are restrictions on use. PIISA will ensure that all data requests will be subject to scrutiny under GDPR and that no data which can identify individual sources or technology will be released.

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4 Other Data Outputs

To support the research in the PIISA project and especially the work in the WP3 Green Roof pilot, **Polimi** conducts a survey targeting a sample of adult citizens from six European countries (Finland, France, Germany, Italy, the Netherlands, and Spain) to assess the level of awareness and adoption of green roofs as well as the incentives to wider adoption. The survey collects data about:

- **Demographic data**: country, age, gender, education level, wealth level, living situation, housing situation, financial and insurance expertise
- **Green-roof data**: knowledge, adoption, willingness (with and without economic expense), incentives
- **Other data:** climate change awareness, insurance knowledge and insurance situation

The survey is funded by Polimi's own resources and thus the raw data is not openly available for all partners (see more in Allocation of Resources). The results of the survey will be available for collaborating partners and findings will be used and presented, for example, in the D1.4 *Focused market reviews in WP3 pilot sectors/areas*.

In addition, the publication committee suggested establishing a **shared literature repository on Zotero**. The aim was that this repository would serve as a centralised resource for collecting, organising, and sharing essential references and literature among project members. By consolidating resources in one accessible platform, partners could enhance collaboration, streamline access to key materials, and improve the efficiency of research and project development. Establishing a shared literature repository was discussed with all partners in the fourth General Assembly (13.-15.11.2024) of PIISA and it was decided that **due to GDPR and copyright matters the shared literature repository will not be enabled.**

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5 Allocation of Resources

Overall responsibility for the data management lies with WP5 which has allocated resources for cataloguing, serving and preserving data within the project period. Project-leading affirmation FMI and WP5 Project Management have appointed the data manager (Kaisa Juhanko), in collaboration with consortium partners, to manage the data generated during the project. Any extra costs associated with sharing data with external partners or stakeholders will be clearly identified and discussed with the involved parties to ensure transparency and alignment. WP5 is responsible for disseminating this DMP to all project partners and each project partner is responsible for managing their data, metadata, and ensuring their data meets the quality standard set out in this DMP.

Funding of scientific publications, maintaining a project website and open-access data repositories are included within the PIISA budget as eligible costs. The activities related to making the research outputs open-access and FAIR are covered within the allocated budget for each partner. Zenodo is a free repository by CERN which is one reason the PIISA Consortium decided to use Zenodo.

Polimi's independent survey to assess the uptake of green roofs in six European countries **is fully funded by Polimi's own resources** (not by PIISA) and thus, its initial raw data is unavailable to other partners. However, the results of the survey are open and accessible to all collaborating partners, and the findings will be used in PIISA's publications. The Green Roof pilot surveys funded by PIISA:

- **Vrije Universiteit Amsterdam (VU)**: Green Roof survey with Dutch households (co-benefits of green roofs, barriers to adoption, the effectiveness of insurance and other incentives).
- **STICHTING Climate Adaptation Service (CAS)**: Nature Based Solutions (NBS) survey with Dutch insurance companies.

5.1 Maintenance and ownership of the Tools after PIISA

Clay Soil Shrink (CSSBDA) Tool: hosting cost of approximately USD 130/month is provided by Sustainable Observatory Finance (SOF). Maintenance requirements are minimal, provided that the underlying datasets remain unchanged. No dedicated personnel are required, except for occasional content updates. A formal business model has not yet been defined. To ensure continuity, potential connections with the other resilience projects need to be explored.

Green Roof Tool: hosting and maintaining of the Green Roof Tool is secured for the next ten years by Climate Adaptation Services (CAS), with only occasional updates expected. The tool could be integrated into future projects by building on its existing content, but formal business model has not yet been defined.

Agriculture Tools: CoDePi Tool and Shiny App are hosted by Barcelona Supercomputing Center (BSC). The CoDePi tool is static, indicating low hosting and maintenance costs, limited mainly to occasional reviews or content updates. The Shiny app is dynamic, which entails higher hosting and infrastructure requirements, as well as ongoing technical maintenance to ensure functionality and data validity. BSC intends to continue resourcing the tools, ensuring their sustained operation and availability beyond the duration of the PIISA project.

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6 Data Security

PIISA requires partners to comply with the EU data policy and the General Data Protection Regulation (GDPR) (Data protection under GDPR - Your Europe (europa.eu)). This includes guidelines on data recovery as well as the secure storage/archiving and transfer of sensitive data. By following these guidelines, we can ensure that data collection within the PIISA project is conducted in a manner that respects EU data policy, protects the rights of participants, and maintains data security and compliance. These practices are informed by legal requirements and widely accepted data privacy and security standards in the European Union.

The PIISA consortium's primary private file-sharing folder is located on SharePoint within the Microsoft Teams service and it is used for information sharing and co-working during the project. Access is restricted to PIISA partners only. This enables secure data sharing among partners and the archiving of all the documentation produced along the project lifespan. Within PIISA all data is stored electronically on password-protected computers. Electronic data is backed up periodically. The SharePoint repository is preserved indefinitely and there is no expected extra costs associated with its preservation. For sharing large files with other PIISA partner(s), we recommend using the Funet FileSender or SURFfilesender. Both platforms are secure ways to share large files. If individual partners also store and archive data in their internal cloud storage, they are responsible for ensuring that the data is stored safely and securely internally. Partners indicated that the data is going to be backed up in a safe environment such as local storage (Private Corporate Cloud), SURFdrive, OneDrive, Amazon Web Services (AWS) and by using automated saving and online sharing platforms, such as Teams.

At the end of the project, the aggregated non-sensitive data and research outputs will be safely stored in Zenodo for long-term preservation and curation. Data from surveys, interviews and workshops that could be sensitive by nature will not be publicly available. The project partners are obliged to protect the results where these can be expected to be commercially or industrially exploited. In compliance with the General Data Protection Regulation (GDPR), all data processed by our software is anonymised and aggregated to prevent identification of individual consumers, thereby respecting privacy and eliminating any risks related to personal data handling. In the event of a data breach, we have a robust incident response plan to identify and mitigate the impact swiftly. Lastly, we conduct regular data protection impact assessments to identify and reduce data protection risks, ensuring our compliance with GDPR.

Note: For example, The PIISA website operates without the use of cookies and does not collect any personal data, such as email addresses or IP addresses. For the newsletter subscribers explicitly consent to the use of their information (including name, email address, and organization) solely for receiving the PIISA newsletter.

7 Ethics

Most of the data used and produced in PIISA is openly available and doesn't have ethical or legal restrictions for sharing. Ethical or legal issues that may have an impact on data sharing include confidential data from third parties and personal data (if it cannot be anonymised).

Sensitive information from surveys, interviews and workshops is handled in a separate system adhering to the ethical and legal regulations for such data. When collecting data from surveys, interviews and workshops, it's important to address constraints and instructions on data collection, storage and security to ensure that the processes are in compliance with EU data policy and the PIISA data management plan. When collecting sensitive data, considering these is necessary:

- EU Data Policy Compliance: all data collection and storage processes must be fully compliant with EU data policy regulations, such as the General Data Protection Regulation (GDPR) to protect the privacy and rights of survey participants.
- Data minimisation and limitation: data collection tools should be designed to collect the minimum amount of data necessary for the survey's purpose. This aligns with the GDPR principle of data minimisation, which discourages the collection of excessive or unnecessary personal information.
- Informed consent: administrations need to obtain clear and informed consent from survey participants before collecting any data. Participants must be fully aware of the purpose of data collection, how their data will be used, and their rights regarding data protection.
- Anonymisation and pseudonymisation: use of anonymisation and pseudonymisation will protect the identities of survey participants and is recommended when sensitive or personal data isn't valuable to the objective of the survey.
- Secure data collection tools: use of secure survey tools that comply with EU data protection regulations is recommended. Ensure that the chosen tools have appropriate security measures in place to protect the data collected, including encryption and access controls. Access to survey data should be restricted to authorised personnel only.
- Data encryption: choose data collection tools that support data encryption both during transmission and while at rest. Encryption ensures that data is protected against unauthorised access, reducing the risk of data breaches and complying with EU data policy requirements.
- Data retention and deletion policies: clear data retention and deletion policies ensure that Data is not retained longer than necessary for the survey's purpose, and when it is no longer needed, the data is securely deleted.
- Documentation and record-keeping: maintaining records of data processing activities is a GDPR requirement. The tools should facilitate the creation and maintenance of records that document data processing activities. GDPR requires data controllers to maintain records of data processing for compliance purposes.
- Secure data storage and access control: select data storage solutions that offer robust security features, including access controls, authentication, and encryption. These tools should comply with GDPR standards for secure data storage and access.

By following these guidelines, we ensured that data collection within the PIISA project was conducted in a manner that respects EU data policy, protected the rights of participants, and maintained data security and compliance. The information provided is based on generally recognised best practices and guidelines for ensuring compliance with EU data policy and the General Data Protection Regulation (GDPR) when dealing with personal and non-personal data. These best practices are informed by legal requirements and widely accepted data privacy and security standards in the European Union. To find more official and up-to-date information from

the EU Commission on data protection and GDPR compliance, please visit the EU Commission's Data Protection page: Data protection under GDPR - Your Europe (europa.eu).

Note: Compliance guidelines can vary depending on the nature of the survey, the tools and technologies being used, and the organisation's data protection policies. Therefore, while the information provided reflects common practices, it should be adapted to the specific context and requirements of the organisation and its survey activities. When dealing with data protection and privacy matters, it's advisable to consult with legal experts or data protection officers to ensure full compliance with relevant regulations and guidelines.

7.1 Responsible use of AI in research

The European Commission, together with the European Research Area countries and stakeholders, has put forward a set of guidelines to support the European research community in their responsible use of generative artificial intelligence (AI). PIISA partners were obligated to follow these guidelines for the responsible use of generative AI in research. Key takeaways from the guidelines include:

- **Researchers** refrain from using generative AI tools in sensitive activities such as peer reviews or evaluations and use generative AI respecting privacy, confidentiality, and intellectual property rights.
- **Research organisations** should facilitate the responsible use of generative AI and actively monitor how these tools are developed and used within their organisations.
- **Funding organisations** should support applicants in using generative AI transparently

Generative AI can hugely boost research, but its use demands transparency and responsibility. As generative AI is constantly evolving, the EC/ERA guidelines will be updated with regular feedback from the scientific community and stakeholders. PIISA's data management will follow these updates to keep abreast of recent guidance.

PIISA's Consortium members agreed to include a disclaimer in PIISA's deliverable template about the utilization of generative AI tools to enhance clarity and quality (e.g. translation). The common disclaimer in PIISA documents to promote transparency states as follows:

"AI was used to enhance the clarity of certain aspects in this document. The AI tool(s) used in this document is/are... (*write here the name of the AI tool and version used*). AI was used in sections… (*write here the chapters/sections*). The purpose was to… (*write here the reason for use*). The authors retain full accountability for the content and its accuracy."

Authors are obligated to fill in the disclaimer with the information about the specific AI tool (and its version) used, certain sections where the AI tools were used (if the use of AI concerns clearly referable sections of the document) and the reason for utilising AI.

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8 Other issues

The lead partner is subject to the Data Protection Act; Freedom of Information Act and General Data Protection Regulation. All data must be collected, stored and disseminated in accordance with these Acts. Other issues will be updated later if needed.

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References

Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. (2016) The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018. https://doi.org/10.1038/sdata.2016.18

Global Facility for Disaster Reduction and Recovery (GFDRR) & World Bank. (2023). *Risk Data Library Standard (RDLS): Guidance for disaster risk data management and sharing*. World Bank Group. Risk Data Library Standard - Risk Data Library

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Appendix A: Datasets

Table 2: Overview of datasets generated by PIISA.

#	Dataset	Description	Format	Coverage/Resolution	Generated	Access
1	Climate Dryness Index (CDI)	Predicts the risk of droughts, heatwaves, and their combination for shrink-swell clay soils.	netcdf	France / 9 km	Amigo	Risk Data Hub
2	Thunder Day Index	Seasonal (May-September) number of thunder days based on thunder day index	netcdf	Europe / 25 km	FMI	Risk Data Hub
3	Severe Thunder Day Index	Seasonal (May-September) number of severe thunder days based on severe thunder day index	netcdf	Europe / 25 km	FMI	Risk Data Hub
4	Standardised Windstorm Index (SWI)	Indicator designed to quantify extreme wind events and associated windstorm risk.	netcdf	Austria, France / 9 km	Amigo	Risk Data Hub
5	Hail Index	Hail probability in terms of hail days per month in a given grid point.	netcdf	Italy / 25 km	CMCC	Risk Data Hub
6	Yield Loss Drought Index	Measure deficit in crop evapotranspiration potential without irrigation	netcdf	Finland / 25 km	FMI	Risk Data Hub
7	Standardised Precipitation and Growth Index (SPGI)	Standardised compound drought index based on precipitation and growing season length.	netcdf	Europe / 25 km	FMI	Risk Data Hub
8	Wind Power Exposure Index	Proxy of wind power based on a combination of hourly wind speed, wind direction, and storm duration.	netcdf	Europe / 11 km	AXA Climate	Risk Data Hub
9	Wildfire Catalogue	Probabilistic representation of fire occurrence based on key drivers such as fire weather conditions, fuel characteristics, and ignition likelihood	netcdf		AXA Climate	Risk Data Hub
10	Three-Month Dry Accumulation Probability Index (DAP150)	Likelihood that rainfall over three consecutive months will stay below 150 mm (i.e. meaning drier-than-usual conditions).	netcdf		BSC	Risk Data Hub

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11	Impact Data Catalogue	Levels of impact data and overview of selected impact data sets	HTML		Tyrsky	PIISA Website
12	Stakeholder registry	Includes data on stakeholders.	xlsx		Tyrsky	No public access
13	Events registry	Includes data on the events organized by PIISA, and the events the partners attended.	xlsx		Tyrsky	No public access
14	Newsletter subscribers registry	Includes the contact details of the persons subscribed to the PIISA newsletter. The data on subscribers of the newsletter is only accessed by LGI Consulting.	xlsx		LGI	No public access
15	Literature on insurance demand, supply and innovation	Includes the documents reviewed as part of D1.1 the factors influencing insurance demand and supply, and the opportunities of innovation. It also reports the information extracted from the selected documents.	xlsx		CMCC	Zenodo
16	Characteristics of national NATCAT insurance regimes and penetration rates	Includes the characteristics of all national NATCAT insurance regimes reported in D1.1, and the penetration rates for households and businesses for coastal flooding, inland flooding, wind, wildfire, derived based on the EIOPA dashboard and the reviewed literature.	xlsx		CMCC	Upon request
17	Literature on climate risk insurance modeling	Includes the documents reviewed as part of D1.2 on climate risk and insurance modelling. It also reports the information extracted from the selected documents.	docx		IVM	Annals of the NY Academy of Sciences
18	Interviews with insurers	Includes the transcripts of the interviews conducted with Dutch insurers as part of D1.2			IVM	Upon request
19	Forest vulnerability index	Classification of the Arco Zinnerberg's forest into three classes of vulnerability, based on forest characteristics, soil, and topography info.	Shapefile	Germany	AXA Climate	Upon request

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