CLIMAAX
climate ready regions

Deliverable Phase 1 – Climate risk assessment

Climate Risk Assessment in Nicosia, Cyprus via the CLIMAAX Framework (CLIMAAX-NIC)

Cyprus, Nicosia Municipality

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Document Information

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Abbreviations and acronyms

Abbreviation / acronym	Description
A/C	Air conditioning
CRA	Climate Risk Assessment
CRM	Climate Risk Management
CYENS	CYENS Center of Excellence
ECP	European Cohesion Policy
GDP	Gross Domestic Product
ICC	Intelligent Cities Challenge
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LIFE	L 'Instrument Financier pour l' Environnement
M&E	Monitoring and Evaluation
RMP	Risk Management Plan
SSP	Shared Socioeconomic Pathways
UHIE	Urban Heat Island Effect
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

This report marks the successful completion of Phase 1 of the Climate Risk Assessment for the Municipality of Nicosia, conducted under the CLIMAAX initiative. Its main imperative is to pinpoint the most critical climate hazards now confronting the city, as well as those projected to arise within the next decade. Cyprus is already under the grip of a hot climate, with peak summer readings often surpassing 43 degrees Celsius; the intensity of the Urban Heat Island Effect in the capital intensifies the problem. These extreme conditions present serious public health challenges, particularly for at-risk groups, and drive spikes in energy demand that elevate greenhouse gas emissions. The present report is designed to furnish the Municipality of Nicosia with a solid, evidence-based foundation for recognizing, prioritizing, and integrating climate risks into both municipal and broader national policy agendas, ultimately supporting the development of more resilient governance.

Scoping and risk exploration, the first two steps of the CLIMAAX CRA Framework, were the primary focus of the activities carried out during this initial phase. To identify at least 100 local entities, a preliminary stakeholder mapping process was initiated after the project's goals and context were well-defined. River floods, heat waves, and droughts were the primary climate hazards of concern for Nicosia, and these were vetted and chosen for analysis. The CLIMAAX Handbook's corresponding risk workflows were chosen for use in the following stage. This preparatory work helps the project by providing a clear, organized framework for the quantitative Risk Analysis stage and guaranteeing that the evaluation is customized to Nicosia's unique requirements and climate.

Analysis using the CLIMMAX framework reveals compelling evidence that frequent extreme heat and drought incidents pose a serious and growing threat to the Municipality of Nicosia. These two pervasive climatic challenges have been long-standing primary concerns for the entire island of Cyprus, stemming from both the country's inherent climatic conditions and the escalating effects of climate change.

The key takeaway from Phase 1 is that climate change, especially extreme heat and drought, poses a real and immediate threat to Nicosia, with serious effects on public health and the environment. Successfully using the CLIMAAX Framework for assessing the imminent threads has laid the stepping stone for a full risk assessment study in Phase 2. Furthermore, this phase's completion is a major step towards giving the Municipality of Nicosia the tools required to come up with specific actions and solutions for effectively reducing and adapting to risks, which will make the region more climate-ready and resilient.

1 Introduction

1.1 Background

The IPCC has named the Eastern Mediterranean a climate change hotspot (IPCC, 2022). Nicosia, the capital of Cyprus, is in this area. Long, hot summers with temperatures that often go above 43 degrees Celsius are already part of the city's climate. This problem is made much worse by a strong UHIE, which means that the dense concentration of buildings, asphalt, and other urban surfaces holds and absorbs more heat than rural areas nearby.

Because of this intense and long-lasting heat, A/C systems and other cooling measures need to be used widely. These are very important for keeping people healthy and comfortable. But this heavy use of air conditioning causes a spike in energy use, which puts a lot of stress on the power grid during the hottest months and adds to greenhouse gas emissions. Also, extreme temperatures are a direct and serious threat to public health, especially for vulnerable groups like the elderly. These factors contribute to an urgent need to systematically look at these and other climate-related risks that are connected to each other in the municipality to make the city more resilient and sustainable in the future.

Adding to these challenges, Nicosia also suffers from moderate water scarcity. Besides Nicosia, the country of Cyprus in general already experiences the highest levels of water stress in Europe (European Commission, 2025). This situation is projected to worsen with declining rainfall due to climate change. Desalination plants located in the coastal areas of the country currently provide a crucial supply of potable water, but their energy-intensive operation further exacerbates the country's electricity demands and carbon footprint. This unfortunate interplay of heat, drought, and water scarcity necessitates integrated, forward-thinking strategies to safeguard Nicosia's future habitability and economic stability.

1.2 Main objectives of the project

The main goal of this project is to figure out what the biggest climate risks are for the city of Nicosia right now and in the next few years. With this full understanding, the Municipality of Nicosia will be able to make better, more evidence-based choices and create and carry out policies that effectively include climate risks in both local and national frameworks.

Based on our current knowledge, the municipality of Nicosia faces three important climate risks as dominant ones. These risks are:

a) flooding,

b) the urban heat island (UHI) effect and

c) damages to crops and plants caused by prolonged heat and drought.

The project aims to move beyond a general identification of risks to the development of specific, actionable solutions for efficient risk mitigation and adaptation. By applying the CLIMAAX Handbook and its harmonized CRA framework, the project expects to derive significant benefits, including:

- Providing a standardized, scientifically robust foundation for climate action planning.

- Identifying specific geographic hotspots and population groups most at risk.
- Facilitating the prioritization of adaptation measures based on a clear understanding of risk severity and urgency.
- Strengthening local capacity for ongoing climate risk management and resilience building within the municipal administration and among key stakeholders.
- Engaging key community stakeholders and citizens in the risk assessment process to ensure local knowledge and perspectives are integrated, fostering ownership and support for adaptation initiatives.
- Quantifying the socio-economic impacts of identified climate risks, providing data-driven insights into potential damage, costs, and disruptions to local livelihoods and services.
- Establishing a framework for continuous monitoring and evaluation of climate risks and the effectiveness of implemented adaptation measures, allowing for dynamic adjustments and long-term climate resilience.

In effect, a set of interventions may be chosen for Nicosia to deal with existing vulnerabilities and prepare for future climate hazards. This is based on an approach that emphasizes the development of tailored measures, improvements to infrastructure, preservation of natural assets, and protection of the welfare of citizens, while facilitating a resilient and sustainably built urban environment.

1.3 Project team

This project is a collaborative effort led by the CYENS (*CYENS Centre of Excellence*, 2025) in close partnership with the Municipality of Nicosia (*Nicosia Municipality*, 2025) . The project team combines the cutting-edge research and technical expertise of CYENS in areas such as data science, artificial intelligence, environmental monitoring, and smart city technologies with the local governance mandate, practical knowledge, and extensive stakeholder networks of the Nicosia Municipality. This synergistic partnership ensures that the scientific assessment is not only rigorous but also grounded in the local context, and that its outcomes are relevant, practical, and actionable for local policymakers, city planners, and the community at large.

CYENS has extensive R&D in environmental risk analysis, modelling the main natural risks of the real estate properties of the island (https://superworld.cyens.org.cy/project15.html), selling these analytics to local banks and insurance companies. CYENS created GAEA, a country-scale geospatial tool (https://superworld.cyens.org.cy/product3.html), which contains 27 environmental services (https://superworld.cyens.org.cy/product1.html) and aspires to become a digital twin of Cyprus. CYENS modeled risks at the hazard level, based on historical evidence, not touching upon vulnerability and exposure, and not employing concrete frameworks such as CLIMAAX. Nicosia Municipality and CYENS aspire to harmonize climate risk assessment, employing a wealth of data already available for Nicosia.

The authors of this report are Mrs Charis Theocharous (Coordinator, Municipality of Nicosia), as well as Dr. Savvas Karatsiolis, Dr. Chirag Padubidri and Dr. Andreas Kamilaris (Partners, CYENS Center of Excellence). The team from CYENS are members of the SuPerWorld research group (http://superworld.cyens.org.cy), which performs research in environmental monitoring and

modelling employing emerging technologies and AI. Dr. Savvas Karatsiolis and Dr. Chirag Padubidri have worked on the execution and adaptation of the CLIMAAX workflows for the region of interest (code modification, data collection).

1.4 Outline of the document's structure

This document is structured to follow the CLIMAAX deliverable template for the Phase 1 climate risk assessment, detailing the initial stages of the project. Section 2 details the execution of the initial steps of the CLIMAAX CRA Framework. Section 3 provides the main conclusions drawn from this first project phase. Section 4 evaluates the progress made and discusses the contribution of this phase to future project activities. Section 5 lists the supporting documentation, and Section 6 contains the references.

2 Climate risk assessment – phase 1

This analysis follows the steps outlined in the CLIMAAX Framework. The sections below are structured around the guiding questions from the CLIMAAX Handbook to detail the work undertaken in Phase 1.

2.1 Scoping

The scoping phase will define the assessment's objectives, context, and stakeholder involvement, establishing a clear foundation for all subsequent activities.

Considering the three most important climate risks of the municipality of Nicosia, the context of each risk is described below.

Regarding flooding, there has traditionally been a low risk. However, climate change has increasingly amplified the risks of flooding, due to intense rainfall events, urbanization that led to reduced green spaces and natural water-absorbing areas, as well as the city's infrastructure, particularly its drainage systems, which are outdated and underprepared for intense weather patterns. Flooding in Nicosia can cause infrastructure damage, especially to roads and transportation, as well as buildings. Heavy rain can flood roads, bridges, and underpasses, causing severe traffic disruptions. Nicosia's road network, particularly in low-lying areas or near old drainage systems, can be submerged, disrupting daily commuting and economic activities. Additionally, floodwater can infiltrate homes, businesses, and public buildings, resulting in structural damage. This can lead to expensive repairs and the displacement of residents. Furthermore, there is a risk of contaminating water sources, including both surface and groundwater, through sewage or pollutants. This can lead to the spread of waterborne diseases such as dysentery and other gastrointestinal infections, particularly if the city's sewage systems overflow.

Regarding the UHI effect, it is becoming a significant concern as climate change increases the already hot conditions in the city. The UHI effect refers to the tendency of urban areas to become significantly warmer than their rural surroundings due to human activities, infrastructure, and development patterns. Nicosia experiences hot Mediterranean summers with average daily temperatures exceeding 36°C (Department of Meteorology, Republic of Cyprus, 2025). Climate change is increasing the frequency and intensity of heatwaves, raising the overall temperature and magnifying the UHI effect. The extensive use of materials like concrete and asphalt intensifies the UHI effect by absorbing heat during the day and releasing it at night. The UHI effect increases the need for air conditioning and cooling systems in buildings, leading to a surge in energy consumption (KNEWS Newsroom, 2025) and higher greenhouse gas emissions. Rising temperatures, combined with the UHI effect, pose significant public health risks, particularly for vulnerable populations such as the elderly (Pyrgou & Santamouris, 2018).

Regarding the damage to vegetation risk, as the frequency and intensity of heatwaves and drought periods increase, natural vegetation faces multiple challenges that can significantly disrupt ecosystems and food production. Most crops have specific temperature ranges for optimal growth. Prolonged heat exposes plants to temperatures above their threshold, causing heat stress, which can reduce their ability to photosynthesize, grow, and produce yields. Crops like wheat, olives, citrus,

and vegetables, commonly grown in Cyprus, are highly susceptible to prolonged periods of high heat. Heat stress can cause wilting, reduced flowering, and lower fruit set, directly impacting yields (Lelieveld et al., 2020). Prolonged heat can cause crops to ripen prematurely, leading to poor-quality produce that may not meet market standards in terms of size, taste, or appearance (Agricultural Research Institute, Republic of Cyprus, 2025). Prolonged heat can create favorable conditions for pests such as aphids, mites, and whiteflies (Lelieveld et al., 2020).

The main **stakeholders** of the above risks, who need to become mobilized during the risk assessment and adaptation processes, are the following:

- Local citizens: The ones mainly affected by disasters have a significant role to play in supporting and implementing actions and initiatives.
- Department of Environment, Ministry of Agriculture: The body responsible for policies that relate to climate risks. The project outcomes will inform the strategic master plan, managed by the Department.
- Environmental NGOs: High sensitivity to climate change and its risks, willing to contribute to initiatives that mitigate those risks.
- Research institutes and academia: Supportive in high-quality research that provides new insights, following proper methodologies. Expected to embrace the CLIMAAX framework and collaborate to perform risk assessments and derive effective solutions.
- Commercial entities: They can contribute to activities with social exposure, e.g., afforestation actions or urban green area restoration efforts.
- Municipalities and local communities: Fully supportive, to deal with their climate risks as well. Multipliers of action.
- Farmers: Especially the ones cultivating crops, as the prolonged drought might have a high impact on their production and productivity. At the same time, livestock farmers might experience risks of animals dying from overheating or becoming sick due to prolonged heat.

2.1.1 Objectives

The primary objective of this CRA is to systematically identify, analyze, and evaluate the major climate risks the Municipality of Nicosia is facing now and in the future. The purpose is to build a robust evidence base that empowers the Municipality to make informed decisions, develop targeted, effective adaptation and mitigation strategies, and integrate climate resilience into all facets of urban planning and policy.

The specific objectives of the project are the following:

- Understand and characterize the risk of flooding in the municipality of Nicosia.
- Understand and characterize the risk of urban heat island (UHI) effect in the municipality of Nicosia.
- Understand and characterize the risk of damage to vegetation in the municipality of Nicosia.
- Employing the CLIMAAX framework to analyze the targeted risks, assessing their urgency, significance and potential impact.
- Employing the CLIMAAX framework to quantify the exposure and vulnerability of the risks in a spatiotemporal context.

- Investigate and assess specific actions and solutions to mitigate those risks or perform adaptation measures, shaping better policies for Nicosia specifically and for Cyprus in general.

By understanding the dominant risks in Nicosia, the municipality will make more informed decisions and shape better policies that incorporate climate risks into local policy frameworks and include specific actions and solutions to mitigate those risks or implement adaptation measures. By employing the CLIMAAX framework, the analysis of the targeted risks will better characterize them, assess their urgency, significance and potential impact, quantifying exposure and vulnerability in a spatiotemporal context. Based on the overall project vision, the main outcome of this study is a risk assessment report together with spatiotemporal risk maps, risk-estimation models, and a set of concrete actionable recommendations for policymakers. These results should serve an immediate purpose, being consulted on their own in the upcoming local and regional development plans. Specifically, the outcomes of this project will become an integral part of the Nicosia Municipality Sustainable Energy and Climate Action Plan 2021-2030 (Cyprus Energy Agency, 2016; Kolyvas et al., 2019), created to fight climate change, understand the sources of pollution and CO2 emissions, and more broadly, derive strategies related to public health, urban planning, energy-oriented policy, and disaster risk management. Unfortunately, right now this plan does not include information about climate risks; thus, it is urgent to run actions such as this one to assess the risks of the city and derive mitigation strategies. In parallel, the outcomes of the project will improve the existing strategic master plan of the Republic of Cyprus, named ZENON (Cyprus Civil Defence, 2025). While this plan currently contains a report on disaster risk management in Cyprus (https://tinyurl.com/vyw5nzps), this report only lists various physical risks and climate change-related impacts. The risk assessment performed for these risks is limited, outdated and the information provided about the methodologies followed is non-existent. CLIMAAX-NIC will enrich the risk assessment on the proposed risks, setting the bar for assessing the rest of the national risks in a similar method, promoting the use of the CLIMAAX framework.

Nicosia can be considered a region with limited resources to significantly increase its climate or disaster resilience. Nicosia, while not resource-poor, does face significant challenges and limitations in increasing its climate and disaster resilience. Several factors contribute to these limitations, including economic constraints, governance challenges, infrastructure gaps, and socio-economic vulnerabilities. Although Cyprus is a developed country with access to EU funding and support, there are still significant barriers to building resilience, particularly in Nicosia. A core problem with the Municipality of Nicosia (and the region in general) is the distribution of the existing funds, where climate and disaster resilience are not top priorities, even though Nicosia is considered highly vulnerable to climate change, and this is something everyone accepts and understands. Similar to other regions around the world, the local authorities act reactively and not proactively. In other words, we expect a big disaster to occur before taking measures. This attitude and mentality are common to South Europeans and it is unfortunately our main enemy in mitigating or adapting to climate change early enough.

Another limitation for this CRA is the current availability of high-resolution, localized data for vulnerability and exposure assessment. Phase 1 utilizes the pan-European datasets provided within the CLIMAAX workflows, which raises a severe issue of data unavailability, especially for small regions like Nicosia. The datasets provided do not contain data for small municipalities/regions for

almost every workflow available. This made our efforts very difficult because, to be able to run the methodologies provided, not only did we have to collect our own data, but we also had to substantially modify the available code. A key objective for Phase 2 is to overcome this boundary by integrating detailed local data to refine the analysis and increase its local relevance and accuracy.

2.1.2 Context

Until now, the assessment and handling of climate hazards in Nicosia have been largely fragmented and not based on a harmonized, multi-hazard risk assessment framework. The most **important policies and strategies** currently adopted by the Nicosia Municipality are the following:

- Cyprus has a National Adaptation Strategy (NAS) and a National Adaptation Plan (NAP) for climate change (Department of the Environment, 2024), both were developed with the support of the CYPADAPT project. NAS identifies key areas and specific adaptation actions across 15 priority sectors, e.g., water resources, maritime and coastal areas, biodiversity, forests, energy, and tourism. The Ministry of Agriculture, Rural Development and Environment monitors the implementation of adaptation measures.
- National Energy and Climate Plan (NECP): Cyprus also has an Integrated National Energy and Climate Plan (INECP) (Republic of Cyprus, 2024, pp. 2021–2030) which aligns with EU regulations on the Governance of the Energy Union and Climate Action.
- Nicosia Municipality Sustainable Energy and Climate Action Plan (SECAP) 2021-2030: This is a crucial local plan that integrates climate risks and aims for emissions reduction. It identifies strategic areas such as buildings and equipment, transport, local energy production, land use planning, public procurement, citizen cooperation, and climate change adaptation (*Nicosia Municipality Sustainable Energy and Climate Action Plan 2021-2030*, 2021, pp. 2021–2203).
- EU Mission Adaptation to Climate Change Charter: Nicosia's commitment to this charter signifies its pursuit of a green, digital, resilient, and sustainable future (*EU Mission: Adaptation to Climate Change*, 2025).
- Integrated Sustainable Urban Development Strategy and Integrated Spatial Development Strategy: These municipal strategies are complemented by initiatives like the Intelligent Cities Challenge (ICC) (*Nicosia: Intelligent Cities Challenge*, 2025), which provides support for Nicosia's green, digital, resilient, and sustainable future.

The Municipality of Nicosia operates within a **framework of regulations and directives**, largely influenced by national Cypriot law and broader European Union policies such as:

- EU Directives and Regulations: As an EU member state, Cyprus is subject to various EU climate policies, such as Directive 2023/959 (*Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme*, 2023), which established a new Emissions Trading System for fuels in buildings, road transport, and the light industry. National laws are enacted to transpose these EU directives.
- UNFCCC Reporting Guidelines: Cyprus also adheres to the reporting guidelines of the United Nations Framework Convention on Climate Change (UNFCCC) (Republic of Cyprus, 2023).

- Planning Permits and Building Permits: Local planning authorities (like the Planning Authority and the Ministry of Interior/EOA) issue permits that include spatial planning and environmental terms, which can integrate climate considerations (*Town Planning Services*, 2025).
- National Governance System for Climate and Energy: Established in 2017 (and evolved into the national governance system for the Green Deal in 2020), this system includes working groups for biodiversity conservation, circular economy, and zero pollution (Republic of Cyprus, 2024, pp. 2021–2030).
- Ministry of Agriculture, Rural Development and Environment: This ministry is responsible for monitoring the implementation of adaptation measures and submitting evaluation reports (*Ministry of Agriculture, Rural Development and Environment*, 2025).

In essence, Nicosia's climate risk assessment operates within a multi-layered governance structure, integrating national directives, local plans, and international collaborations, often leveraging European funding and technical expertise to enhance its resilience to climate change. This project addresses the problem of transitioning from a general awareness of risks to a systematic, data-driven understanding of climate vulnerability and risk across the municipality. The governance context for this CRA is the strong commitment of the Nicosia Municipality to enhance urban resilience, supported by the technical expertise of the CYENS Center of Excellence. The project aligns national strategies for climate adaptation and the EU Mission on Adaptation to Climate Change.

The Municipality of Nicosia, as a major urban center in Cyprus, has several key sectors that are particularly relevant when considering the impacts of climate change. Cyprus, being in the Eastern Mediterranean, is identified as a climate change "hotspot," experiencing warming at a faster rate than the global average and a trend towards drier conditions (Ali et al., 2022). **Key sectors relevant to this assessment** and potentially affected by climate change include:

- Public Health: Highly affected by heatwaves (heat stress, mortality).
- Energy: Affected by peak demand for cooling during heatwaves.
- Water Management: Affected by both droughts and flash floods.
- Urban Planning and Infrastructure: Affected by flooding, heat stress on materials, and the need for green infrastructure.
- Agriculture/Vegetation: Peri-urban agriculture and vital urban greenery are affected by heat and drought stress.
- Tourism and cultural heritage: Urban heat makes Cyprus city centers less popular for tourists.
- Economy and Livelihoods: High utility costs, energy prices, reduced productivity of employees.

In more detail, the impact of climate change to key sectors is as follows:

1. **Urban Infrastructure and Built Environment**: Nicosia has a dense urban fabric, including historic walled city areas, residential buildings, commercial centers, and critical infrastructure like roads, drainage systems, and public utilities. The constantly prolonging extreme heat waves experienced, which are exacerbated by the UHIE, lead to increased energy demand for cooling, higher operating costs, and stress on the power grid. While flooding is not a big issue for Nicosia since very rarely intense rainfall events occur, the city

proactively monitors potential flooding threats and adapts its plans and measures, especially against flash flood incidents. Such moderate-intensity incidents can cause significant damage to roads, bridges, underpasses, buildings (including structural damage to homes and businesses), and disrupt daily commuting and economic activities. The historic center, with its impermeable surfaces, is particularly vulnerable (Toumazis et al., 2007). High temperatures and extreme weather can accelerate the degradation of building materials and infrastructure components, leading to increased maintenance costs and higher costs for repair and maintenance of public and private infrastructure.

2. **Public Health and Well-being:** The health and safety of Nicosia's residents, especially vulnerable populations (elderly, chronically ill, young children), are paramount. Heat-related Illnesses and mortality are increasing in Nicosia (Pyrgou & Santamouris, 2018), which highlights the importance of preparing for potential heat-related health impacts escalation in Nicosia (and Cyprus in general) in the coming years. Increased frequency, intensity, and duration of heatwaves significantly raise the risk of heatstroke, heat exhaustion, and exacerbate pre-existing cardiovascular and respiratory conditions, leading to increased morbidity and mortality (Phan et al., 2022). Heat waves and drought raise the likelihood of wildfires, causing increased air pollution that worsens respiratory problems. Although Nicosia Municipality is primarily urban, it includes a notable national forest park (*Athalassa National Forest Park*, 2025) and is adjacent to a wildlife forest on the Troodos Mountain, which experiences wildfires almost every summer. Furthermore, flooding can contaminate water sources (surface and groundwater) via sewage overflow, leading to the spread of waterborne diseases.
3. **Water Resources:** Nicosia, like the rest of Cyprus, faces inherent water scarcity due to its semi-arid climate, relying heavily on rainfall and desalination. Decreased precipitation and increased evapotranspiration due to higher temperatures lead to reduced natural water availability, stressing existing water supplies. This can impact domestic consumption, agriculture, and other sectors. Higher temperatures drive increased water demand for cooling, irrigation (e.g., for urban green spaces), and domestic use. Cyprus addresses periodic water scarcity, which occurs every few years, by implementing water supply cutoffs in an effort to reduce water demand to essential daily needs (Cyprus Property News, 2025). This places significant stress on the population and leads to frustration, as well as revenue losses for businesses that depend on a consistent water supply, such as water parks and car wash stations. Water supply cutoffs combined with higher water temperatures can exacerbate water pollution in water bodies. This raises public health concerns and requires more frequent water quality checks and frequent water treatment and purification. Making the situation even worse, the water supply system in Nicosia is old and experiences breaks that lead to massive water loss (in-cyprus, 2022) and is more prone to contamination when the water flow is cut off for several hours. Furthermore, the sudden water pressure deviations caused by the cutoffs further stress the old water supply system. Tourism is a cornerstone of Cyprus' economy, contributing approximately 13.5% to 15% of the country's GDP, with more than 4 million tourists visiting Cyprus every year (Statistical Service of the Republic of Cyprus, 2024). This means that the island hosts 4 times more tourists than its local population, who come to Cyprus to enjoy the hot summers, its beaches and tourist facilities like water parks and nice hotels with private pools. The tourism sector is a significant source of employment, with estimates indicating that it accounts for more than 18% of total

employment in Cyprus (*Tourism Industries - Employment*, 2025). While being critical for the local economy, the tourism sector puts huge stress on the island's water supply, intensifying the already serious water stress problem. An effective, though very costly, way to increase the available water supply is through the use of desalination plants installed along the island's coast. The current capacity of the fixed desalination plants covers approximately 70% of national drinking water needs (~235,000 m³/day) (Cyprus Mail, 2025c). Cyprus is deploying four mobile desalination plants, each with a daily output of 30,000 m³, to cover the upcoming needs occurring due to a disabled plant. Expansion plans aim to raise total capacity to 510,000 m³ per day within a decade through additional fixed plants and scaled mobile facilities, enough to meet 100% of the island's drinking water demand, reserving dam water primarily for irrigation. Since severe water stress became a serious and recurring problem Cyprus has to face almost every Summer during the recent years, there is no solid national strategy that can proactively act and properly manage the on-time deployment of desalination plants and deploy contingency plans when one or more of these plants are disabled. Also, the cost of running these plants is huge (Cyprus Mail, 2025c) and each plant added to the water supply system burdens the electricity production plants that face similar technical problems that raise the production cost and the environmental pollution. Each desalination plant installed in Cyprus comes with an economic, environmental and technological cost for the country. Solving the water scarcity in Cyprus is a difficult problem that requires compromising uninterrupted water supply, economic/technological feasibility and environmental impact due to the huge electricity demand of the desalination plants. To make things worse, this balance needs to account for the availability of strategic reserves in emergencies, such as warfare or physical catastrophes. For example, the ongoing Middle East crisis led to an explosion of refugee flows into the island and humanitarian transportations carried out by Cyprus (UN High Commissioner for Refugees) (UNHCR), 2025). Also, the Ukrainian war, the increased cost of other tourist destinations, the rising quality in tourist services offered by Cyprus and other unpredictable factors led to an increased number of tourists visiting Cyprus during the last couple of years. Specifically in 2024, Cyprus welcomed an unprecedented number of tourists and this year local authorities expect to reach or overcome this number. While this contributes to the explosion of the tourism sector revenue, it also puts some extra stress on the water supply system capacity. To manage the problem, local authorities need reliable predictions for future demand, which could be split into two categories: the projection of the future needs based on the water offer and demand and the intensification of the problem due to climate change. The latter can render any projections to be off and have a catastrophic impact on the effectiveness of derived solutions if not accounted for. We aspire to deal with this uncertainty by applying and extending the CLIMAAX methodologies. The studies of drought and heat waves can provide valuable insights into how much water demand can be intensified by climate change.

4. **Tourism and Cultural Heritage:** Nicosia's historic center is a significant draw for cultural tourism, with museums, galleries, and unique architecture. Extreme heat during peak tourist seasons and especially during summer can make the city less appealing due to thermal discomfort, potentially reducing visitor numbers and impacting local businesses. As already discussed, water shortages could disrupt business operations and damage the tourists' experience during their visit to Nicosia. Also, higher temperatures cause higher energy costs for cooling, which leads hotels to increase accommodation prices. Extreme weather events

(intense rainfall, heat, increased humidity) can accelerate the decay or damage of historic buildings and artifacts. This is especially true for Nicosia, which is renowned for its long, exposed city wall that surrounds the old city, showcasing its layered history. This exposed city wall dates back to the Venetian period and stands as a testament to Nicosia's historical significance as a city that fought against many conquerors through time.

5. **Urban Green Spaces and Biodiversity:** Parks, urban trees and natural vegetation enhance the beauty of Nicosia, provide ecosystem services (e.g., cooling, air filtering), and contribute to the local biodiversity. Extended heatwaves and periods of drought can result in heat stress, stunted growth, and even mortality of urban trees and plants, which are then unable to shade and cool the city. This also increases the chances of urban wildfires. Changes in temperature and precipitation regimes can modify the presence of plant and animal species and may thus influence urban biodiversity. Higher temperatures can also mean more optimal conditions for pests that feed on plants.
6. **Economy and Livelihoods:** Nicosia is the economic and political center of Cyprus, with a diverse economy including services, retail, and a growing innovation and creative industries sector. Flooding, power outages, and infrastructure damage can halt business activities and supply chains. Already, businesses face higher utility costs (especially for cooling) that often threaten their viability. Energy prices in Cyprus are notably higher, making them a more prominent issue compared to other European nations. Due to the high energy demand, citizens in Nicosia also occasionally experience power outages that are caused by infrastructure damage or upgrades/modifications to withstand the ongoing demand increase. Heat stress can reduce worker productivity, particularly for outdoor labor. In Cyprus, the Ministry of Labor, Welfare and Social Insurance is responsible for enforcing the outdoor work ban during extreme heat, i.e., when the temperature is above 42° Celsius, especially during heatwaves in July and August. During recent years, these alerts have been issued more frequently, reaching an average of 18 per year (Cyprus Mail, 2024). The heatwaves not only disrupt economic activities, causing revenue loss, but also cause major discomfort to the population and become a serious health threat, especially for vulnerable population groups like the elderly and individuals with chronic illnesses. While heatwave-related deaths in Cyprus between 2004 and 2009 were estimated to be 32 per year, a European-wide study suggests that this number climbed to 1277 in 2022 (Ballester et al., 2023).

There are several **outside influences on the climate-related challenges** faced by Nicosia, stemming from regional, national, EU-level, and global initiatives. These external factors both shape and constrain how Nicosia approaches climate adaptation and water stress issues.

The CRA strategy of the Nicosia Municipality is influenced by the EU-level directives, especially through its constant participation in the EU Mission on Adaptation to Climate Change. By signing the European Union Mission Charter, the city has committed to climate resilience targets by 2030- an alignment of local priorities with European aspirations. By adopting the EU directives, Nicosia earns many concrete benefits. Direct funding, advanced analytical tools, and methodologies like CLIMAAX, all of which have very close access and rapport with Nicosia's CRA processes, are brought in through this partnership. The multi-level governance and system resilience focus of the European Union ensures that the local efforts in Nicosia are not merely ad-hoc projects but are harmonized

with wider continental strategies. Concretely, the climate agenda in Nicosia is relevant for local needs but is also thoroughly clothed in the EU's long-term resilience architecture.

ECP and its funding instruments affect the way the Nicosia Municipality does its strategic planning on climate change. Thus, the way its CRA will be instrumented is affected by the city's scope of involvement in EU-funded programs, such as the ICC, LIFE, and Horizon Europe. These initiatives espouse data-driven decision-making processes, climate-proof investments in urban development, and principles of smart governance. Consequently, the involvement in these programs fundamentally shapes both the methodological process and the overall scope of Nicosia's CRA efforts. Cyprus, and thus its capital, Nicosia, is firmly committed to its international obligations under the UNFCCC and the European Union's climate targets within the framework of the Paris Agreement (Republic of Cyprus, 2023). These national and EU-level commitments profoundly influence climate monitoring efforts, the specific requirements for climate risk reporting, and the accessibility of funding that Nicosia can leverage for its CRA initiatives and broader resilience-building projects. As a result, Nicosia's local actions are integral to Cyprus's ability to meet its global climate responsibilities. Nicosia, situated in the Eastern Mediterranean, faces the stark realities of a climate change "hotspot." This region is experiencing significant vulnerability to climate change consequences, marked by expanding desertification, pronounced temperature anomalies, and persistent water scarcity. This shared environmental reality creates transboundary risks that extend beyond individual national borders, encompassing large-scale regional droughts and a growing energy interdependence. These challenges raise crucial opportunities for collaboration, a fact that is seemingly well understood by the countries involved, which recently began negotiating several energy agreements. The region is actively fostering initiatives in climate diplomacy and working to develop shared early warning systems. A prime example of this regional cooperation is the ongoing effort to establish an electrical connection, notably the EuroAsia Interconnector, connecting nations such as Greece, Cyprus and Israel (*Great Sea Interconnector*, 2025). This vital undertaking is designed to bolster regional energy security and cultivate collective resilience against the common climate challenges that affect the countries. While several treaties regarding economic, investment, climate, energy and migration aspects have been signed between these neighboring countries, impactful agreements on energy matters have been slowly progressing and often postponed due to disagreements regarding the exploitation plans discussed.

The protracted division of Cyprus, as a result of the Turkish occupation of its northern part since 1974, poses a unique and complex challenge to the implementation of a unified and comprehensive climate change strategy across the city of Nicosia in its entirety. Thus, the unique geopolitical status of Nicosia, being a divided capital, introduces a significant complexity to the Municipality's efforts towards designing and implementing an effective climate change strategy. The city's division compromises the efforts of building a holistic understanding and managing critical climate risk factors specific to the urban fabric of Nicosia, such as the comprehensive mapping of UHIE or the coordinated planning of drainage systems that ideally should function across the entire city's continuum. Furthermore, achieving unified data collection on climate variables, planning interconnected green infrastructure, or establishing early warning systems for the entire Nicosia urban area becomes challenging, potentially limiting the overall effectiveness and resilience-building capacity of the climate adaptation and mitigation efforts. On the other hand, this unfortunate situation could raise an opportunity for collaboration, where climate action, being a shared existential threat, might serve as a neutral ground for fostering dialogue and practical cooperation between the Greek and Turkish Cypriot communities across the divide. Addressing shared

environmental challenges like urban heat, flood management and water stress could build trust between the two communities and demonstrate the mutual benefits of working together for a more resilient Nicosia. Also, the two communities could greatly benefit from sharing experiences, information and effective solutions to identical climate change problems that both face by living in the same geographical area.

As temperatures rise, **proactive urban planning and adaptation strategies** will be critical to minimizing these impacts and protecting public health. Potential adaptation actions include:

- Creating cool urban environments through nature-based solutions: Cool urban environments, increase green spaces (tree planting, urban parks), improve energy efficiency of buildings, shading structures, solar panels for shading, cool materials, green roofs, etc.
- Increased Green Spaces: Expanding parks, green roofs, and tree coverage in the city can help absorb heat and provide cooling effects. These spaces also promote biodiversity and enhance residents' quality of life. The mayor of Nicosia promised to plant 100,000 trees inside the city strategically to mitigate the problem.
- Sustainable building practices, i.e., adapting present and future architectural designs to mitigate the effects of heat absorption by materials and increase the area of vertical reflective surfaces: Using cool roofing materials, reflective pavements, and better building designs can help reduce the heat absorption of structures. These can significantly reduce the UHIE.
- Smart Urban Planning: Designing cities with wind corridors, expanding vegetation, and encouraging the use of light-colored materials that reflect rather than absorb heat are effective UHI mitigation strategies.
- Widening riverbanks and upgrading drainage systems to manage flooding: Widen banks of the Pediaios river, upgrade drainage system capacity, green infrastructure to absorb rainwater, subsidence for flood-proof buildings, flood barriers, etc. The city's infrastructure needs updating to accommodate new rainfall patterns and prevent urban flooding.
- Promoting the use of drought-tolerant native plants in urban landscaping: Adaptation strategies, including the use of heat-tolerant crops and water-efficient irrigation, will be critical to reducing the impacts of prolonged heat on agriculture. Drought-tolerant plants/crops, water management, heat-resilient landscaping, urban planning prioritizing green infrastructure, etc.
- Other actions to be studied through Phases II and III of the project.

At the same time, public awareness campaigns must be conducted for all stakeholders and all risks, so that citizens can be mobilized, first by understanding the significance of those risks and then by examining potential actions that can be implemented at the local level.

2.1.3 Participation and risk ownership

Here, we elaborate more on the general list of stakeholders provided in Section 2.1 (Scoping), as well as their proposed involvement.

- Public sector stakeholders: This includes the members of the actual Nicosia municipality, i.e., the city council, mayor's office, municipal departments, especially the ones related to environment, waste management, urban planning and Research & Innovation (R&I). Then, it includes regional and national authorities, especially regional environmental agencies,

coastal zone management authorities and the national climate adaptation body, coordinated by the Deputy Ministry of Research and Innovation. Moreover, it includes public utilities and services, especially the ones related to water management (Nicosia Water Board), public transport operators and our governmental energy utility (Electricity Authority of Cyprus). Finally, relevant stakeholders include research and public academic institutions such as the University of Cyprus, which is located in Nicosia, plus the Cyprus Institute, which is a local research center of excellence doing research on climate change.

- Municipalities and local communities around Cyprus and Europe, because more than 120,000 regional authorities exist in Europe. Cities engaged via the EU Mission on Adaptation to Climate Change are prioritized to network with.
- Private sector stakeholders: Mostly from the local industry who need to become more sustainable and adapt to climate change. The list includes companies from the tourism and hospitality industry, i.e., hotels, resorts, restaurants, clubs, companies from the real estate and construction industry, i.e., developers, architects, engineering companies, especially ones focusing on climate-resilient infrastructures, plus local small and medium enterprises (SMEs) and the Cyprus Chamber of Commerce and Industry (CCCI).
- Civil Society and NGOs: Including mainly environmental NGOs (e.g., TerraCypria, BirdLife Cyprus, UrbanGorillas), community groups and associations, youth and education networks (e.g., CSI Cyprus, CARDET, Citizens in Power), schools, student organizations, and climate activist groups.
- EU Bodies and global organizations: The list includes EU Climate Programs, European Environment Agency, transnational networks such as C40 Cities, Eurocities, Mediterranean Climate Change Adaptation Initiative, etc.
- Media and communication channels: Local and regional media, i.e., newspapers, radio, TV stations, plus digital and social media key players, i.e., online pages and groups, bloggers, sustainability advocates, science communicators.

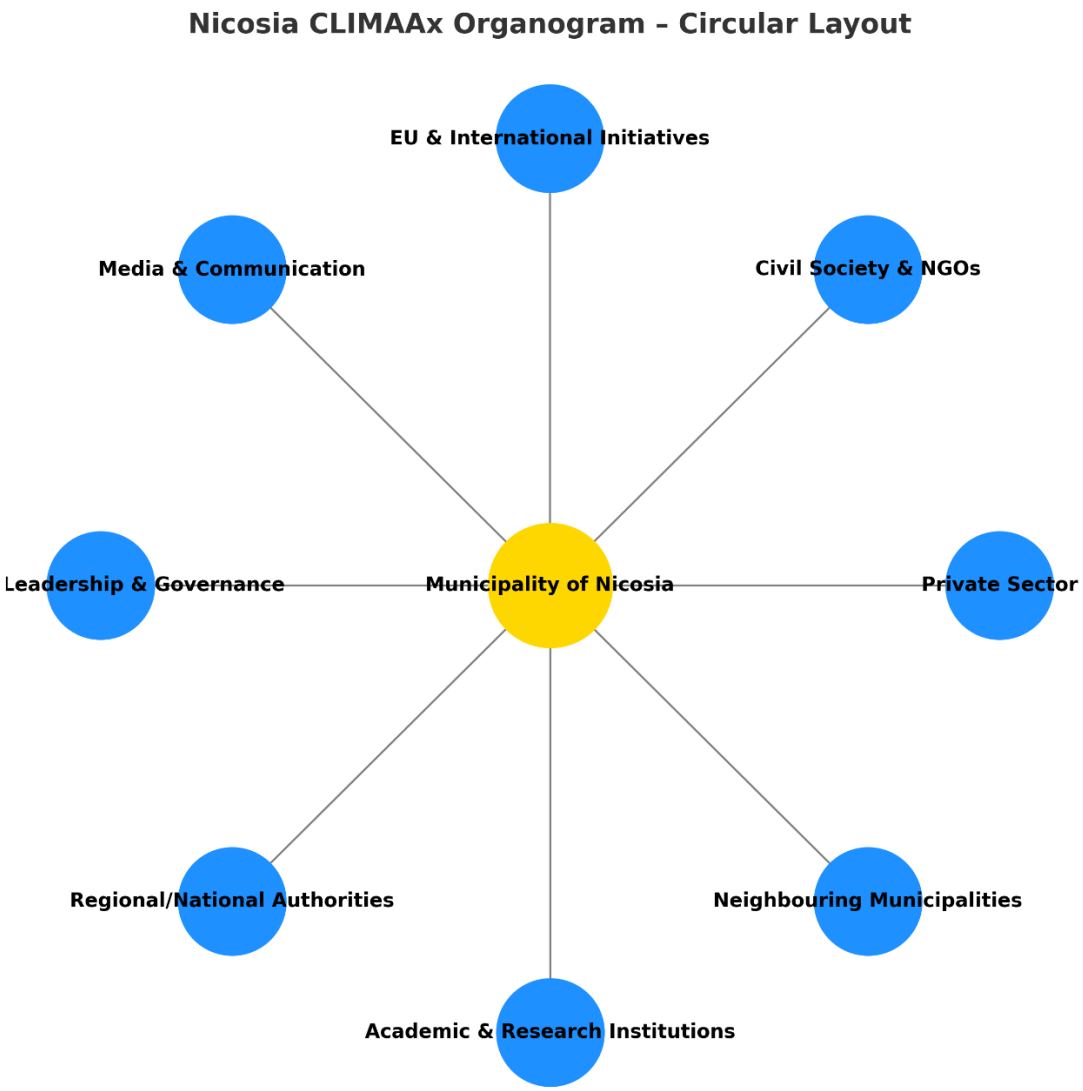

Figure 2-1.Nicosia CLIMAAX Organogram – The Municipality of Nicosia (center) coordinates climate adaptation efforts across multiple stakeholder groups. As the capital city and administrative centre of Cyprus, and now the largest municipality of the country following the 2024 local government reform, Nicosia is well placed to facilitate collaboration on climate resilience. However, the city's ability to deliver adaptation actions depends strongly on cooperation with national authorities, neighbouring municipalities, civil society, and international partners, as well as on sustained access to EU and external funding. The organogram illustrates this governance ecosystem, highlighting Nicosia's role as a connector rather than a stand-alone actor.

The current draft plan for the city of Nicosia dedicates some parts specifically on the aspect of **climate justice and vulnerable groups**, providing a geographic and social focus for certain projects that need to be prioritized due to their significance or impact in terms of sustainability and climate resilience. The geographic focus relates to areas that are most impacted by climate change and are exposed to large numbers of citizens, while the social focus prioritizes "the pushed-away and left-behind (those who must benefit most from a climate transition; vulnerable: affected by change, through various reasons unable to adapt without support)". Also, in the case of public funding and subsidies for climate actions, a social lever has been announced for creating direct benefits for vulnerable households. A current example is the financial support scheme for the installation of net-metering PV systems in houses of vulnerable consumers, who are defined as low-income families and disabled persons. This subsidy targets the goal of eliminating energy poverty, bringing equity

and inclusion in energy access. It is part of a priority action to engage marginalized groups, low-income communities, and vulnerable populations towards energy justice. Moreover, in the listing of systemic barriers for climate neutrality, it has been recognized that migrant groups may be vulnerable to environmental threats due to less education and access to knowledge than other social groups. Further, the particular emphasis on vulnerable groups is mentioned in multiple aspects of social innovation required during the transition to climatic resilience, including democracy and participation in decision-making, access to collaborative platforms, as well as fair inclusion in governance and policies.

In our city, technical and administrative capacity gaps and limitations hinder efficient project implementation and execution of complex climate resilience initiatives. With climate risks escalating faster than funding and planning can adapt, Nicosia struggles to balance urgent mitigation needs with equitable resilience-building for vulnerable groups. Socio-economic disparities exacerbate vulnerabilities as marginalized groups such as low-income households, migrants, and the elderly lack access to resources for adaptation (e.g., home energy needs). Institutional barriers, including fragmented governance and bureaucratic delays, slow the implementation of adaptation strategies. Without significant increases in funding, technical capacity, and integrated policymaking, Nicosia's adaptive capacity will remain insufficient to address climate threats.

Risk ownership is a key and tricky component in any city's plans towards sustainability and climate resilience. By tricky, we mean that it is very difficult to embed general risk ownership into Nicosia's regulatory framework, for purposes of fairness, legal implications, enforcement, etc. Risk ownership is distributed across the municipality, private sector, and citizens, with the municipality of Nicosia playing a central regulatory role. The exact mechanisms depend on specific policies, but the approach emphasizes shared responsibility and adaptive governance. While each sector (e.g., health, energy, transportation, waste) entails different municipal policies, the following general principles apply regarding risk ownership for Nicosia:

a) Municipal responsibility: The Municipality of Limassol acts as the primary regulator and coordinator of climate-related risks, ensuring:

- Policy Implementation: The municipality enforces climate adaptation and mitigation measures, assigning responsibilities to relevant departments.
- Stakeholder engagement: Collaboration with businesses, NGOs, and citizens to share risk ownership (e.g., through public-private partnerships).
- Compliance monitoring: Ensuring that municipal projects and private sector initiatives align with climate resilience goals.

b) Risk allocation in key sectors:

- Infrastructure and urban development: The municipality retains ownership of risks related to public infrastructure (e.g., flood defenses, green spaces) but may require private developers to integrate climate-resilient designs.
- Energy and transport: Risks associated with transitioning to renewable energy and sustainable transport are shared between the municipality, private sector, and national agencies. In Cyprus, it is national agencies (i.e., Department of Environment, Department of Transport) that define general policies which then the municipalities need to adhere to.

c) Public-Private Partnerships (PPPs):

- The municipality may enter agreements where private companies work on the mitigation of certain climate risks (e.g., renewable energy projects, green building standards). Insurance mechanisms and incentives could be used to distribute financial risks.

d) Citizen and community Involvement:

- Residents and community groups are encouraged to participate in local climate initiatives (e.g., urban greening, waste reduction), sharing responsibility for resilience. Awareness campaigns promote individual and collective risk mitigation.

e) Legal and regulatory framework:

- The municipality may introduce local ordinances mandating climate adaptation measures (e.g., water management, energy efficiency in buildings). Enforcement mechanisms (inspections, fines, or incentives) ensure compliance.

Nicosia does not explicitly define a quantified "**acceptable level of risk**" in terms of thresholds (e.g., specific flood probabilities or emission limits). Unacceptable risks are those that threaten life, critical infrastructure, or legal obligations. The municipality approaches “acceptable risk” based on its alignment with EU and Cypriot climate adaptation standards, emphasizing:

- Avoidance of high-probability, high-impact risks (e.g., urban flooding, heatwaves) through infrastructure upgrades (drainage systems, green roofs).
- Tolerance of residual risks where mitigation is impractical (e.g., extreme weather events), managed via emergency response plans and insurance mechanisms.
- Progressive reduction targets (e.g., CO_2 emissions cuts by 40% by 2030), implying risks beyond these thresholds are unacceptable.

The municipality’s risk tolerance is shaped by the precautionary principle, i.e., prioritizing proactive measures over reactive fixes (e.g., flooding protection measures in flood-prone areas). Risks may be acceptable only if mitigation costs exceed projected damage (e.g., minor flooding may not justify expensive upgrades to riverbanks). Public consultations are a common practice of the municipality to ensure that risks align with community priorities (e.g., protecting cultural heritage sites from climate impacts).

We will communicate the project’s results by leveraging various channels of communication so that each message category finds the most appropriate recipients. Both partners will apply the most effective strategy to deliver the messages by drawing from their dissemination capacity. Channels include emails and newsletters to local and European stakeholders, leaflets and posters in relevant local and European events and networking initiatives, newspaper articles, online news and stories at the main social media of Cyprus, press releases at different intervals of the project’s lifetime, as well as exploiting the monthly meetings of the Union of Cyprus Municipalities, the scientific information days organized by Research and Innovation Foundation (RIF Cyprus) (*The Research and Innovation Foundation*, 2025) and by the Deputy Ministry of Research, Innovation and Digital Policy of the Republic of Cyprus (*Deputy Ministry of Research, Innovation and Digital Policy*, 2025). Our strategy is to use a variety of media (emails, leaflets, online and printed publications, webinars, workshops, science cafes and info days) to address the target groups of the project. An on-site conference will be organized near the end of the project, inviting all stakeholders to attend, expecting at least 100

participants. Our website and online social media pages, visited by tens of thousands of users per month, will help promote the project and build a community of stakeholders. Enticing narratives and successful stories will be produced, supported by data, to showcase how various risks affect different parts of the city based on different climatic projections, while various possible actions will be illustrated via narratives to inspire citizens and investors. In addition, web interfaces showing how various risks change in the city through space and time, visualized by means of geo-visualizations, will be produced, shared and communicated to the public under a common online web portal.

The scientific partner of the project (CYENS) is committed to preparing and submitting at least two high-impact scientific publications at top-class journals, such as Nature Climate Change, Elsevier Global Environmental Change and Springer Mitigation and Adaptation Strategies for Global Change.

Our **structured engagement approach to foster awareness**, cooperation, and action also includes the following:

- Awareness and education: We intend to organize public workshops in the form of town halls, climate adaptation seminars, and expert panels. Further, we will perform various media campaigns, using local media to disseminate climate risks and adaptation strategies, plus any updates about the project and its progress. Finally, specific workshops will be organized for municipal employees to educate them on climate risks, climate action plans and systemic roadmaps towards resilience.
- Collaborative governance: We will harness our strong position at the Union of Cyprus Municipalities to bring all municipalities together to join forces, exchange best practices and lessons learned, to improve our climate action plans, learning from and supporting each other in this effort. At the same time, we will invest effort in various PPPs, working with local businesses on green infrastructure possibilities (e.g., flood barriers, urban green to mitigate the UHIE). We will organize more systematic meetings with existing contacts, plus reach out to new ones.
- Participatory planning: We will reach out to existing citizen science initiatives, involving local citizens in monitoring flooding and drought risks, and training them on emergency response scenarios. We will consider co-design workshops, engaging residents and businesses in urban adaptation projects.

Summing up, by systematically engaging these stakeholders through awareness, collaboration, and empowerment, Nicosia can build a resilient coastal city prepared for climate change impacts. A mix of participatory and regulatory approaches contributes to inclusive and effective adaptation.

2.2 Risk Exploration

2.2.1 Screen risks (selection of main hazards)

There are three areas concerning climate-related hazards and potential risks in the municipality of Nicosia. Initially, flooding is a typically low-risk phenomenon that climate change is increasingly amplifying through intense rainfall events. Urbanization has reduced the amount of green infrastructure and outdated city designs, especially its drainage systems. Among the many hazards, flooding can cause damage to roads, bridges, buildings and disrupt traffic. The cost of repairing damage caused by flooding could be very high. The risk of contamination of water sources and

disease is also significant. The second area of concern regards the Urban Heat Island (UHI) effect. The phenomenon of urban areas being much warmer than their rural peripheries is exacerbated by climate change and the rising rates and intensities of heatwaves. Materials such as concrete and asphalt have been extensively used, which increases the problem by holding the heat. The dangers of the UHI effect are related to an increase in energy use as a result of expanded air conditioning use, resulting in higher GHG emissions, and serious public health hazards, especially among at-risk groups such as the elderly. Finally, losses to vegetation are a risk as heat waves and droughts become more frequent and severe. This puts local ecosystems and food production at risk. Crops like wheat, olives, citrus and vegetables, which comprise Cyprus' native crops, are particularly vulnerable to prolonged heat. This can cause heat stress, lower yields, premature ripening and poor-quality produce, and can establish favorable conditions for pests too.

Most urgent climate-related hazards in Nicosia Municipality are floods, heatwaves and UHIE, and a very persistent drought. The situation also includes systemic, long-term risks and immediate and continuing weather conditions. The most prevailing dangers existing today are extreme heatwaves and drought. However, the Municipality of Nicosia is also regarded as at risk for river floods, with such hot spots as the Pediaios, Klimou, and Kalogiros riverbeds due to their low elevation. The Nicosian Mayor is calling for immediate action on flood protection infrastructure after a recent heavy rain turned some parts of Engomi into a "fast-moving river". Other areas of vulnerability are Agios Pavlos, Pallouriotissa, and Aglantzia districts, which have experienced flooding events on several occasions during the last decade. There have been recurring incidents of flooding in other city districts as well, like Strovolos, Dasoupolis and Lakatamia, mainly because of substandard materials usage and improper drainage design and build. Immediate implications for the population of Nicosia include property damage, inundation of homes and businesses, and destruction of belongings, resulting in a situation of displacement and hardship. The incessant floods also impede day-to-day life, resulting in traffic chaos, school closures, and the temporary shutdown of critical services. Economically, the damage is severe because the cost of damages to public infrastructure and private property is substantial, and the problem weighs on a municipalities and citizens' finances.

Nicosia is also struggling with extreme heat and a punishing drought, as well as flooding. According to the latest weather forecasts, daily temperatures could be as high as 41-43°C, with a "feels like" temperature of 45°C (Knews Staff Reporter, 2025). Climate risk reports for Nicosia point out the "historic walled city areas" and the "dense urban fabric" as the most impacted by heatwaves and the UHIE. At the same time, the capital area is in its most critical water crisis. According to the national statistics, there is an estimated 7.5% reservoir capacity in the Nicosia region, which is far below last year's value, which fell to 23.3% (Cyprus-FAQ.com, 2025). The Cyprus Water Department is directing citizens to conserve water and fines citizens for water waste to avoid water cuts, but officials have warned that "more difficult years lie ahead". Dangers impact all kinds of stakeholders throughout the city. Older individuals and individuals with chronic illnesses are also at a more serious risk based on the risks of heatwaves and the urban heat island effect. The prevailing drought and water scarcity are affecting the general population and are also affecting water use. Drought and high temperatures adversely affect the agricultural sector as well, affecting peri-urban agriculture in particular. The persistent threat of heatwaves and drought strains public resources and can negatively affect key economic sectors such as tourism and agriculture, which are crucial for the local economy.

Exploring the Copernicus Interactive Climate Atlas (Copernicus Climate Change Service-C3S, 2025) for the island of Cyprus, our project scoping aligns with the hazards identified by the tool. While we experimented with various climate projection schemes, we eventually focused on the Coupled Model Intercomparison Project Phase 6 (CMIP6) because it introduces fundamental improvements in the analysis models it implements and in the applied framework compared to older models such as CMIP5. We also focused on the SSP2-4.5 climate change scenario because it strikes a balance between extreme outcomes and offers a plausible, "middle-of-the-road" future that is highly relevant for planning and risk assessment. SSP2-4.5 reflects current policies and pledges by representing a world where countries continue to make some progress on climate policy, but not at the pace or scale needed to meet more ambitious targets like the 1.5°C goal. This scenario also offers a balance between mitigation and impact, supporting the development of a better understanding of future hazards and the prompt implementation of mitigation measures. Since our ultimate aim is to validate our scope with the results from a reliable analysis engine, we noted how much the climate indicators change instead of noting their absolute values. We also chose to produce comparative results between two reference periods (1981-2010 and 1991-2020) and two target periods (2041-2060, 2081-2100). Observing the long-term climate impact accounts for the accelerated climate change during the most recent decades. The most important findings are shown in the table below:

Table 2-1. Comparative Change of Climate Indicators for Cyprus according to the Copernicus Interactive Climate Atlas.

	Climate Indicator Change per period			
Indicator	**2041-2060 vs 1981-2010**	**2041-2060 vs 1991-2020**	**2081-2100 vs 1981-2010**	**2081-2100 vs 1991-2020**
Max Temp. Summertime (Change in degrees Celsius)	2°C	1°C	3°C	2,5°C
Soil moisture (Change in kg/m2)	-0.75 kg/m2	-0.5 kg/m2	-1.5 kg/m2	-1 kg/m2
Extremely hot days with max temperature above 40 °C (change in days)	13	10	18	15
Minimum of minimum annual temperature (change in degrees Celsius)	1 °C	1 °C	2.3 °C	1.5 °C
Tropical nights (minimum temperature above 20 °C) (change in days)	20	15	30	25
Mean of daily accumulated precipitation (relative change %)	-12 %	-10 %	-20 %	-15 %

	Climate Indicator Change per period			
Indicator	**2041-2060 vs 1981-2010**	**2041-2060 vs 1991-2020**	**2081-2100 vs 1981-2010**	**2081-2100 vs 1991-2020**
Mean near surface specific humidity (relative change in %)	15 %	10 %	25%	22 %
Mean sea surface temperature (change in degrees Celsius)	2 °C	1.5 °C	3 °C	2.5 °C

The values in the table may not be accurate because they are inferred from color interpretations from the Copernicus Atlas tool, but they clearly demonstrate a tendency: all indicators are affected by climate change, and the phenomenon seems to be accelerating through the years. The indicators contained in the table are considered of high importance for the Cyprus case. For example, given the high temperatures and heatwaves experienced on the island, the increase in humidity plays a significant role in how citizens perceive the adjusted temperature, i.e., the discomfort level. On the other hand, the mean sea surface temperature is also an important climate change indicator for Cyprus since the island's economy depends on tourism and the preservation of marine ecosystems, which are endangered by the disruption of the water temperature. However, the mean sea temperature is easily measured with submersible devices and we will not be included in our study. The remaining climate change indicators described in the above table are directly linked to the risks we will study in this project, i.e., heatwaves and drought.

Considering the climate conditions, the economy, the particularities of the Nicosia Municipality and the climate change effect on Cyprus as communicated by several authorities and prediction tools (like Copernicus Climate Atlas), we decided to focus on the hazards of flooding, heatwaves and the UHIE and drought. We provide our reasoning in the following paragraphs.

Historically, Nicosia has faced a low risk of flooding. Yet climate change has greatly heightened this hazard for several reasons: increased and more intense rainfall, urban extension, which has reduced the amount of natural green space in cities that absorbs water, and the city's aging and under-prepared drainage systems. Infrastructure in Nicosia, particularly roads, transit links and housing, may all be massively damaged by flooding. Heavy rains occasionally flood old roads, bridges and underpasses, resulting in communication interruption. This is especially the case in lower-lying portions of town or within proximity to older drainage systems. These factors increase the risk of rain and river waters flooding homes, business complexes, and social buildings, causing structural damage that may be compensated with additional expenses by tenants and even the relocation of residents. Floodwater itself is a severe public health problem. Sewage and other pollutants can contaminate floodwaters, bringing people waterborne illnesses like dysentery and other gastrointestinal infections. This is particularly concerning when the city's sewage systems overflow. The expanded flood hazard due to climate change has serious economic and social fallout. Some businesses in the affected locations would be likely to incur large financial losses due to property damage, loss of inventory and extended closures. Daily operations and supply chains would also be cut off, leading to an economic impact on the bigger picture. From a personal perspective too,

residents could be burdened with emotional and financial strain, rebuilding or fixing their homes, as well as their long-term displacement. That makes the most vulnerable groups, with people in a vulnerable position, the elderly (such as older people), low-income families, and people with disabilities, disproportionately affected because they don't have the resources to recover quickly enough from such events. In the context of educating the general public, raising awareness among the authorities and reinforcing public awareness on the consequences of such a disaster and helping the authorities in taking proactive measures against flooding, we decided to analyze the hazards and risks of flooding in the city of Nicosia.

The problem of **heatwaves** in Nicosia and the island of Cyprus is particularly serious. The potential impact on human health from these heatwaves is an increasingly urgent issue. Extreme temperatures can have severe effects on the human body, compromising physiological functions and worsening pre-existing health conditions. This can result in all kinds of problems, from pain to an extreme disease, hospitalization, or even death. For example, prolonged extremes of high temperatures have been described by the WHO as one of the most hazardous natural hazards. Studies show that high temperatures are positively associated with hospital admissions and mortality in Cyprus. For example, for heatwave days, the rates of attributable deaths increase five times higher than on regular warm days. These health risks hit the older and more vulnerable group particularly hard. Heatwaves don't just create a public health crisis but also have a significant effect on the economy and daily life. Booming temperatures also pose a danger to sectors at the heart of the economy, like agriculture, the water-energy nexus and tourism. Worker productivity declines for every degree the temperature rises above 20°C and manual laborers in agriculture, construction and fishing are at extreme risk of heat-related illnesses. The hot conditions are also changing the social face of the capital. But in peak summer heat, especially August, many of Nicosia's residents leave for cooler coastal regions, causing the capital to "empty." The temperature phenomenon shows unbearable conditions and a need for relief from the sweltering urban environment. The environmental effects are no less devastating. Also put under pressure by heatwaves are the country's natural resources, already overstretched in semi-arid conditions. Agriculture is especially, prone to severe heat and drought. Water scarcities - the number of rainy days per year on average is predicted to reduce, with water availability decreasing 20-30% on a 2°C change in global average warming. This depletion of water resources directly threatens food production, industry, and the residential sector. The increased frequency and intensity of heatwaves present significant and multidimensional challenges for Cyprus and its capital, Nicosia. The effects are already being felt in a variety of sectors, from an increase in heat-related illnesses and deaths to economic losses and an increased risk of water shortages. This growing issue represents a serious stress point to the resilience of and the capacity of a nation to preserve its public health, economy, and environment in a warm climate. The tourism industry, which is crucial to the economy of the Cypriot Republic, is being severely and rapidly transformed by the effects of heatwaves. With the exacerbation and increased frequency and intensity of heatwaves, the summer season in July and August is increasingly unpopular with tourists, especially from Northern Europe. This is already resulting in a dramatic forecast of tourism growth in the 'shoulder seasons': spring and autumn – it is said by some to be only a matter of time before July and August are no longer the top tourist months for Cyprus. A study among tourists found that the vast majority would change destinations if they were exposed to severe heat, water scarcity, or regular forest fires. A 4°C temperature rise would severely impact tourism prospects for Cyprus, which in turn would incur a loss of significant revenue (CBN Staff, 2024). The more direct impact of heat on tourists: discomfort, health risks and interruptions

to outdoor activities are reinforced by indirect effects, like an increased risk of wildfires, or the loss of beaches because of rising sea levels. Moreover, the higher demand for air conditioning from warmer temperatures leads to an increase in hotel operational costs.

The **UHIE** is a pressing concern for cities worldwide, especially those located in already warm climatic regions. This phenomenon refers to the large temperature difference found in urban regions as opposed to rural conditions, generally exacerbated by human activities, thick infrastructure and a variety of heat-absorbing materials. While global temperatures remain on the rise, as is increasingly the case with climate change, the UHIE raises the heat in the air, causing cities to become warmer. This study examines the specific manifestation of this phenomenon in the capital of Cyprus, Nicosia, where the IPCC refers to it as one of the main climate change hot spots. Nicosia is uniquely geographical, as it experiences extreme heat stress when the mercury reaches over 43°C. In this regard, the UHIE is an important intensifier, generating localized hot spots that are layered threats to the city's populace and infrastructure. The overwhelming density of buildings, vast asphalt surfaces and various urban features absorb and hold solar radiation during the day and then re-emit it deep into the night. Such widespread thermal stress has serious human-health implications – particularly to vulnerable groups like the elderly, young children and people who already have certain health conditions and is associated with an increased risk for heat-related illness and mortality.

In addition to the immediate public health risks, the warming urban temperatures drive large surges in electricity use. Both residents and enterprises resort to huge air conditioning and other cooling measures, placing a massive strain on the power grids during the high summer months. This surge in energy demand is not just a burden for our local energy infrastructure but also represents increased operational costs and hence, higher carbon dioxide emissions. What is more, the continual heat can also accelerate the deterioration of city infrastructure materials from roadways to building facades and require more frequent servicing times. Conditions that reduce the overall quality of life limit the extent to which people move outdoors, reduce the quantity of outdoor activities due to temperature-related discomfort, thus diminishing public spaces and community living. Answering this immediate call for concerted action between these interconnected challenges, this study is evidence-based research into the urban heat processes of Nicosia.

The island of Cyprus features a hot, dry climate, and the capital, Nicosia, is not exempt from environmental stressors. This study tackles one of the city’s central, urgent issues: the increasing threat of **drought** as it affects urban life, economic growth, and public health. This vulnerability has not been new; historical and current data indicate that Cyprus experiences the worst water stress levels in Europe, and this will continue to aggravate with climate change, resulting in a reduction in precipitation. The problem is magnified by a number of factors, including the city's thick urban fabric, the demands of an expanding population and a vibrant tourism sector. Water scarcity is a widespread problem in Nicosia city. While heatwaves and urban heat island effects impose an immediate burden on energy and human health, drought steadily undermines the base structures of a city. The country's reliance on high-energy production from desalination plants to supply potable water is itself a feedback loop. The solution for water shortage adds fuel to the fire of a growing greenhouse gas problem. The pressure on water supplies is so great that it has already caused intermittent discontinuity of water supplies, which has led to major frustration for the citizens and financial loss for the local businesses reliant on a reliable water supply. In addition, the city's archaic water distribution network is particularly prone to breaks and contamination, an issue compounded by the pressure fluctuations from those irregular cutoffs. Tourism contributes a vast amount to the

economy of the country, but also creates a massive strain on the island's limited availability of water.

Tackling these problems necessitates an attitude transformation from a reactive to a proactive one. Like in other settings, the local government tends to take action only after serious incidents occur. This study aims to break the cycle, thus serving up a strong, data-driven framework of understanding, assessing and ultimately managing the implications of drought. The main goal of this research is to develop a substantiated evidence base which would empower the Municipality of Nicosia to take sound decisions and bring in climate resilience in its policy and planning. Through a convergent climate risk assessment process, it is targeted to estimate the risk and vulnerability of the sector of the city in the spatiotemporal scope. This will support the formulation of concrete, impactful approaches for risk reduction and adaptation. Consequently, the findings of this report will not only inform the Nicosia Municipality's Sustainable Energy and Climate Action Plan (SECAP) but also set a benchmark for other national strategic plans that do not have much or up-to-date information on their climate risk assessment. The collaboration of the CYENS Center of Excellence with the Municipality of Nicosia within the scope of this project aims at the integration of scientific expertise with local governance in combination with contextual insight. We have established that synergy among these two areas of research aims to ensure scientific rigor as well as the practical relevance of the research, which will empower policymakers and city planners toward the development of a more sustainable and resilient Nicosia. By bringing together a wide range of stakeholders like local citizens, research institutes, and commercial entities, the project promotes collective accountability in resilience and establishes a pathway for a more effective approach to address the existential threat posed by climate change.

In all risks, we need info about citizens' population dynamics, ideally where vulnerable populations live (e.g. low-income people, migrants, elderly, people with health issues). To properly assess the heatwaves and UHIE, the flooding and drought hazards, we need a **great amount of data and analytics** that we describe in the following paragraphs in more detail. We plan to make the assessment for climate risk stronger by incorporating region-specific analytics and involving partners in the process so that they have an active role throughout the project.

UHIE: Currently, several resources exist to understand and quantify the phenomenon. We have extensive spatial information about the cover and distribution of trees using tree mapping (from the PERIOPSIS company), which is necessary for examining the cooling performance of green infrastructure. Moreover, for building footprints, elevation and materials details are collected from building landscapes (via the iNicosia project carried by CYENS), giving information on heat absorption and release in urban environments. Specialized geoanalytics are readily available by the GAEA geospatial application (*GAEA: A Country-Scale Geospatial Environmental Modelling Tool*, 2025; Jamil et al., 2023). GAEA is a comprehensive and versatile platform developed by CYENS that offers a range of essential tools for analyzing and understanding geographic data. With its three main services - Proximity General Service, Land Cover Service, and Geohazard Service - users can gain valuable insights into spatial relationships, land composition, and potential hazards within specified areas on the Cyprus Map. GAEA land use and land cover high-resolution maps also offer invaluable information about surface characteristics throughout the area, which is critical for detecting hard or soft surfaces and vegetated areas. Lastly, temperature and meteorological data at the ground level, from the weather stations of the Department of Meteorology, provide ground-truthing and calibration data to remote sensing observations and climate models. To improve the evaluation of the UHIE

and ensure closer visibility into its space use, it is clear that more specific thermal sensors and other environmental monitoring devices (ideally deployed in municipal vehicles) must be installed for high-resolution street-level scans of the city's thermal landscape to be carried out. It would deliver rich, dynamic on-target data from the ground, providing more granularity than fixed weather stations or satellite imagery would. The temperature differences computed from the measures taken with the devices mounted on the Municipality cars travelling around the city will act as the basis of the UHIE study. We also plan to utilize Digital Elevation Models (DEMs), landcover data from the CORINE Land Cover dataset (*CORINE Land Cover*, 2025), Normalized Difference Vegetation Index (NDVI) (Frazier & Hemingway, 2021; *Sentinel-2*, 2025) and building shadow data. We will also consider using an accurate Digital Surface Model (DSM) of the buildings in Nicosia, developed by the iNicosia project by CYENS.

Flooding: To date, capabilities to assess flood risk are underpinned by existing Geographic Information Systems (GIS) of rivers, which create spatial datasets to characterize river networks, including their courses, widths, and possibly hydrological characteristics. Moreover, DEMs provide crucial topographic data essential for modeling water movement and for mapping flood-risk zones. If we are going to progress towards predictive modeling and a finer mapping in flood dynamics, we urgently need detailed historical and projected precipitation regimes, including intensity, duration, and frequency as key inputs for hydrological modeling. Furthermore, there is a need to ensure accurately documented historical incidents of flooding by tracking their area of spread, depth, duration and repercussions to validate the model and establish pinpoint vulnerable sites.

Drought: In estimating the drought, initial data have been obtained using heat and precipitation regimes collected from the weather stations of the Department of Meteorology; the first step is to establish a basis for the climatic status and factors that cause drought, through long-term recorded temperature and rainfall. To develop a better understanding of drought effects in general, and on natural and agricultural landscapes in particular, it is necessary to obtain water stress data on plants directly from multispectral satellite imagery. This would entail applying satellite-derived indices e.g., NDVI, EVI, SAVI, NDWI, from Planetscope (Frazier & Hemingway, 2021), and thermal infrared measurements to monitor vegetation health and water-stress indicators that are important for building a wide temporal perspective of the ecological effects of drought. Critical climate and climatic water balance information, like actual monthly evapotranspiration, climate water deficit, potential evapotranspiration and Palmer Drought Severity Index (PDSI) is available by TerraClimate (Abatzoglou et al., 2018). Across all identified climate risks—UHI, flooding, and drought—a key global gap is the paucity of information about population dynamics. More precisely, there is a pressing need for disaggregated data on the spatial distribution of vulnerable populations, such as those who live in poverty and migrants, the elderly, or the ill, as well as among individuals with pre-existing health issues. Knowing exactly where these are and how they relate to climate risks is crucial to designing equitable and effective adaptation measures, such that interventions are directed towards populations at greatest risk in the Nicosia Municipality.

Heatwaves: For the heatwaves hazard and risk computation, things are much simpler because they can directly use the provided workflows, which contain all the necessary data to produce the expected results. The methodologies applied in the workflows are reliable and scientifically solid. We will exploit the results of the workflow (analytics, projections, visualizations) in a way that they become insightful and impactful tools for forming suitable policies and actionable plans. We plan to study and consider population dynamics and vulnerable communities for all risks. We have

identified a pressing gap in the study of all climate risks: the dynamics and spatial distribution of vulnerable populations. But, to design effective and equitable approaches to climate adaptation, that data needs to be disaggregated and broken down where at-risk groups are living. This will include individuals who are low-income, migrants, the elderly, or those with pre-existing health conditions. The exact location of these communities and how they relate to climate risk needs to be understood. We can utilize this information to inform targeted interventions and to guarantee that identified hazards countermeasures affect those citizens within the Nicosia Municipality most in dire need, rather than taking a one-size-fits-all approach.

Summarizing, for the hazards under study, we **have and/or need information or knowledge** as follows:

UHI:

- We have: Trees' mapping (PERIOPSIS), building landscapes (iNicosia), LULC of GAEA, weather stations of the Department of Meteorology for ground-truthing and calibration purposes
- We need: Our own devices placed on municipal vehicles to scan the city, tree mapping of the city of Nicosia

Flooding:

- We have: GIS of rivers, elevation maps
- We need: precipitation patterns, historic incidents of flooding

Drought:

- We have: Heat and precipitation patterns from weather stations of the Department of Meteorology
- We need: Water stress on plants from multispectral satellite imagery

2.2.2 Workflow selection

Considering Nicosia's geographical position, climate characteristics, history of extreme natural phenomena, and the local economy's features, we consider heatwaves and UHIE, flooding, and drought to be the most relevant risks for our study. We analyze the rationale for this decision and the extent of exposure in the following subsections.

2.2.2.1 Heatwaves risk - UHIE

Heatwaves in Nicosia pose significant public health problems for at-risk groups and vulnerable populations, particularly the elderly. In extreme scenarios, a very high level of utilization of air conditioning and other cooling systems is required to preserve human health and comfort. These extreme conditions directly and severely endanger public health. UHIE is a significant issue for areas exposed to heatwaves, particularly those with extensive use of concrete and asphalt. The urban fabric—including residential buildings, commercial centers, and critical infrastructures—is especially vulnerable to the effects of heatwaves. Peri-urban agriculture and essential urban greenery are also exposed, as they respond to heat and drought stress. In concrete terms, the entire Nicosia Municipality district is vulnerable to heatwaves and the UHIE, and population groups such as the elderly and those with chronic illnesses are especially at risk. Additionally, other communities with limited rights to movement, like undocumented immigrants or prisoners, are generally more vulnerable to extreme heat. Finally, individuals working outside are also exposed to extreme heat

and often face the dilemma between stopping work and losing income. The exposure of workers conducting work outside is a particularly serious problem in Cyprus because the construction industry, after the tourism industry, is the second most flourishing economic sector in the island employing a massive number of people.

2.2.2.2 Flooding

Vulnerable segments and areas exposed in Nicosia are mostly within low-lying regions and near rivers. The city's aging infrastructure, which suffers from crumbling drainage and sewage systems, and insufficient green space because of rapid urbanization, renders the whole city more exposed to flooding events. This happens particularly in regions where flash floods often damage roads, transit links, and buildings. As many reports and studies suggest, Nicosia's neighborhoods are especially vulnerable to flooding. Examples: Engomi, Agios Pavlos, Pallouriotissa, Aglantzia, and Agios Dometios. Areas at high risk include those along the Pedieos, Klimou, and Kalogiros rivers. Flooding in these areas can cause devastating damage to houses, businesses, public utilities, and the way of daily living and economies as well. Because flooding can result in the displacement of residents and the health risks linked to contaminated water supply, the elderly and the poorest segments of society are especially vulnerable to the effects of floods in Nicosia. A combination of a missing early warning system and an uncoordinated response among various government agencies compounds the risks to all residents.

2.2.2.3 Drought

Several vulnerable groups and exposed areas for drought have been identified in the Municipality of Nicosia. A key vulnerable group is at-risk populations, particularly the elderly, for whom extreme heat and drought pose significant public health risks. Exposed areas and sectors include both peri-urban agriculture and vegetation, both of which face challenges such as heat stress and reduced crop yields resulting from prolonged heat and drought. Essential economic sectors, such as tourism and agriculture, are vulnerable to the continuing threat of drought. Drought is a continuing, widespread, yet perennial problem of the entire population in the study area, the Municipality of Nicosia, and affects virtually everyone on the island of Cyprus. The prevailing drought and water scarcity are affecting the general population. This effect has a more general cause since the issue is not just a particular group but affects public health and the environment as well. The dependence on an outdated water supply system with breaks that can be contaminated places the entire population at risk when water flow is decreased. To conserve water because of reduced reserves, the authorities run water supply cutoffs to ensure demand for these resources is only used based on essential daily needs. This measures a great deal of strain on the people and is the source of big frustration. The cutoffs also cause revenue losses for businesses that depend on a constant water supply. Car washes, water parks and hotel owners are affected by this. To make things worse, sudden pressure deviations that follow these cutoffs compound the stress on the water supply system. This unfortunate convergence of heat, drought, and water scarcity means that integrated, forward-looking strategies are required to protect the city's future habitability and economic sustainability.

2.2.3 Choose Scenario

We acknowledge the importance of choosing a scenario timescale that is most suitable and appropriate for the pressing needs of our study and also contains the highest potential impacts. For Cyprus, the focus on the medium term, a period of 20-30 years, is not some choice but a necessity. This period is the moment when the compounding forces of climate change, demographic changes

and economic trends will finally rise from manageable issues to elemental stress on the island's infrastructure, society and economy. The immediate and narrow short-term scenarios may not account for full-scale change while long-term projections may be too remote to guide implementation. On the contrary, the next two to three decades demand immediate and focused attention to ensure the island's sustainable development and resilience. Cyprus is identified as a climate hotspot, which is why, the medium-term scenario is particularly relevant. The island is already warming faster than the average global warming. During the previous century, Cyprus experienced temperature increases between 1 and 1.5°C. We have been predicted to witness an acceleration in this trend, with mean temperatures likely to increase another 1 to 3°C by mid-century. This escalating reality will manifest as more frequent and severe heatwaves, extended droughts, and deteriorating UHIE, particularly in the densely populated regions. The ramifications are many: higher demand for energy for cooling, more scarcity of water, and increased public health dangers. Several climatic pressures will have an impact on the population's living conditions and productivity in economic sectors in the next 20-30 years. Cyprus' demographics underscore the case for a medium-term perspective. While Cyprus has experienced moderate growth in population, this is not attributed to local births but to the arrival of political and economic migrants seeking better working and living conditions (Statistical Service of the Republic of Cyprus-CYSTAT, 2024). This trend probably would continue, and possibly even grow, as climatic instability and conflict in the larger Eastern Mediterranean and Middle East worsen. The population growth from migration will put significant pressure on finite resources, especially water and electricity. For over 20-30 years, the challenge will be both the integration of these new populations and the creation of the required infrastructure to sustain them even in harsh weather regimes. It is also in this timeline that the island will experience a key economic juncture. While tourism still comprises the backbone of the nation's economy, the economy's survival isn't guaranteed from the extreme heat and water shortage. At the same time, the construction industry is growing strongly (Cyprus Mail, 2025a) with a rapidly increasing foreign demand. Its growth is being driven by foreign capital and demand for properties, especially from non-EU citizens and businesses relocating to the island (Cyprus Mail, 2025b). The rising interest from foreign buyers, who are seeking both residential and commercial properties, is a key factor in the current construction boom. However, this growth is especially vulnerable to climate-related disruptions such as extreme heat cancelling outdoor work and flash floods causing infrastructural damage. As a dominant EU trade and business hub, Cyprus's strategic location represents an enormous asset, but its sustained viability relies on the stability of its port and transportation infrastructure, which will come under increasing threat from extreme weather in the medium term. Last, the twin crises of food and energy security will be defining features of the medium-term future. With drought and summer temperatures damaging local farming, food self-sufficiency is already in decline for Cyprus, with a significant reliance on expensive imports. The situation may get much worse: prices will go up and this will put an enormous burden both on households and on the tourism sector itself. At the same time, energy consumption is soaring thanks to technology that has advanced and with the use of energy-hungry products, such as electric vehicles and air conditioning systems. An inevitable rise in the price of energy and less investment in renewable energy may eventually destabilize the economy, while high living costs become a matter of fundamental concern for the population and are also one of the driving forces behind social and economic unrest. The next 20-30 years are thus important for taking the strategically targeted investments in renewable power and water management infrastructure to counterbalance these upcoming threats. We expect huge changes in the economic life and trade of Cyprus in the

next 20-30 years, and climate change risks could derail any attempt to manage the constantly shifting landscape of the Eastern Mediterranean. The global political landscape is currently dominated by concerns over energy. As an island nation, Cyprus must address its energy issues and climate-change risks in a holistic and self-contained manner. This is because it has no land borders with other countries, and integrated solutions, such as international electrical interconnections, are, at least for now, very unlikely. Any solutions to such critical matters must be in accordance with the evolving climate-change landscape; otherwise, they will fail catastrophically.

Our analysis of the Nicosia Municipality's region socio-economic facts and the consideration of the characteristics of the Cyprus island, reveal that the **most appropriate scenarios from the ones available in the workflows** are the following:

Heatwaves – assess how heatwaves' frequency and risk evolve through 2041–2070, mainly under the RCP 4.5 scenario.

Relative Drought – explore drought hazard relative to 2031–2060.

Extreme Precipitation – forecast changes in magnitude and frequency (e.g., return periods) from 2041 to 2070.

Estimates of future emissions under current policies tend to most closely match or fall slightly below those of the middle-of-the-road SSP2–4.5 scenario. Consequently, we mainly focus on the RCP 4.5 scenario rather than the extreme RCP8.5 scenario.

2.3 Risk Analysis

In this section, we describe how the selected risk workflows from the CLIMAAX handbook are applied in our region, based on the selected risks for the city of Nicosia, Cyprus.

2.3.1 Heatwaves

Table 2.2 lists the data used for the heatwaves' workflow.

Table 2-2. Data overview for the heatwaves' workflow.

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
EuroHEAT project approach Copernicus Climate Data Store (CDS) – Heat and Cold Spells Data Derived NetCDF datasets (processed from the CDS data) **EURO-CORDEX data analysis**	Population distribution data, Age and sex structures, 2024, 1Km spatial resolution from WorldPop Hub	Landsat8 land surface temperature (LST) from RSLab portal, spatial resolution of 30x30m	Overheated areas (heat map) Density of vulnerable population Heat Risk Level (heat map) Interactive map (Heat Risk Level + Nicosia Municipality map)

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
EURO-CORDEX Regional climate projections EuroHEAT dataset			

2.3.1.1 Hazard assessment

Running the EuroHEAT approach gives the number of heatwave days throughout the years 1980-2100 (historical data and projections in the future) for both the RCP4.5 and RCP8.5 scenarios. The results are shown in Figure 2-1 below.

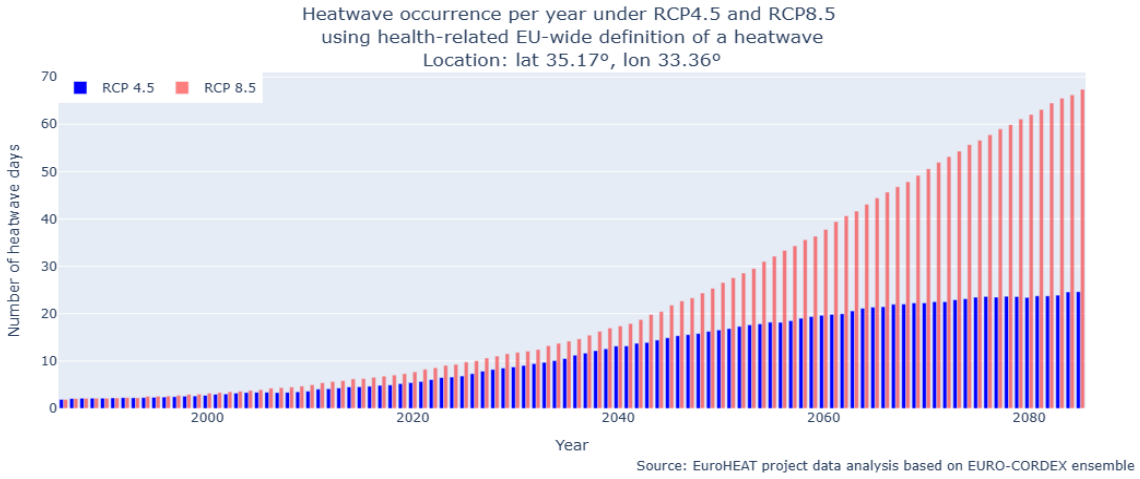

Figure 2-2. Number of subsequent heatwave days per year under the RCP4.5 and RCP8.5 scenarios in Nicosia.

Heatwave hazard assessment based on EURO-CORDEX data analysis (Xclim package) allows us to identify hot and cold spells in the data, calculate heatwave frequency (per year) and total length of heatwaves. By following this methodology, we analyzed the data for a central location in the Municipality of Nicosia, shown on the map below.

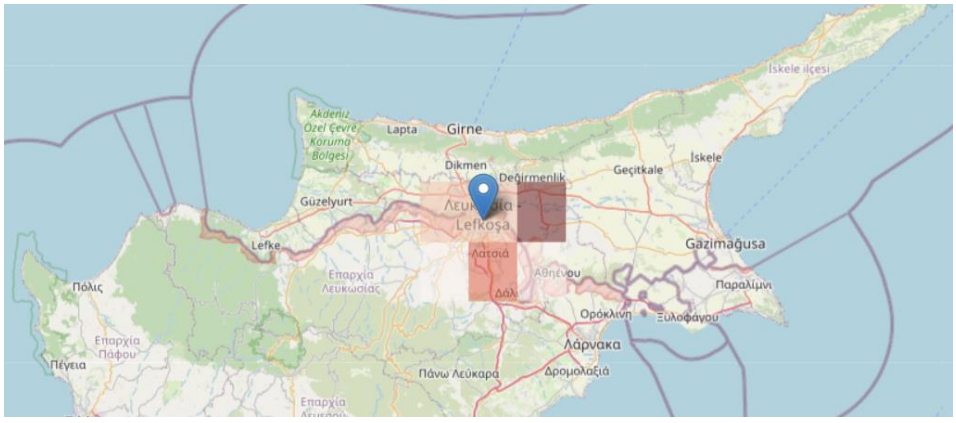

Figure 2-3. Area of Nicosia Municipality considered for the heatwave hazard assessment under EURO-CORDEX methodology.

The following three figures show the heatwave frequency (number of heatwaves per year), heatwave index (number of days part of a heatwave) and total number of heatwaves per year respectively.

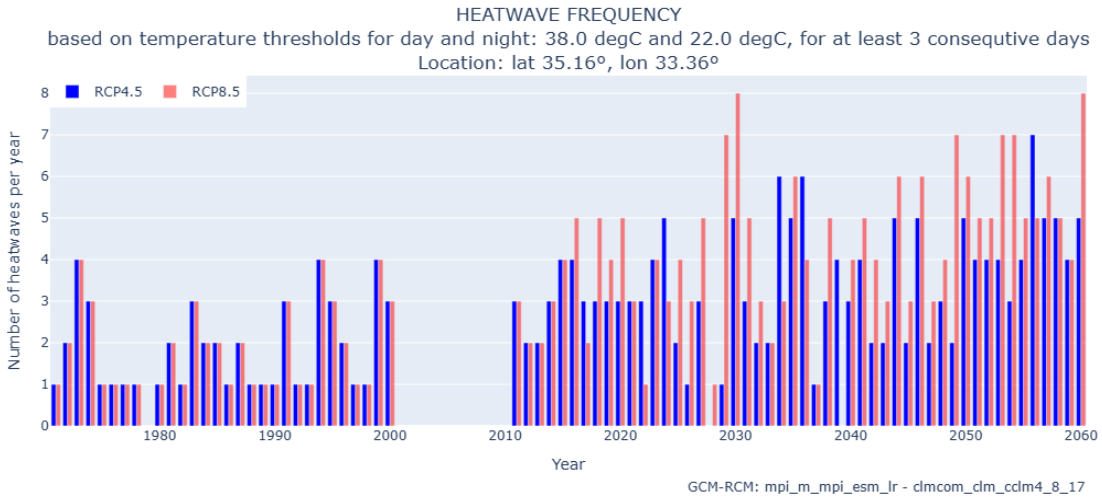

Figure 2-4. Predicted heatwave frequency per year. A heatwave is identified as at least 3 consecutive days of minimum day and night temperatures of 38°C and 22°C, respectively

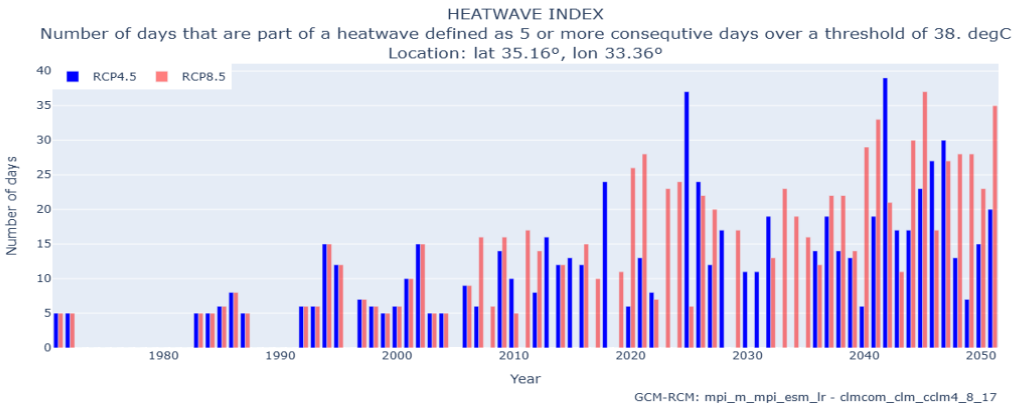

Figure 2-5. Heatwave duration per year. A heatwave identified as at least 5 consecutive days of minimum day temperature of 38°C.

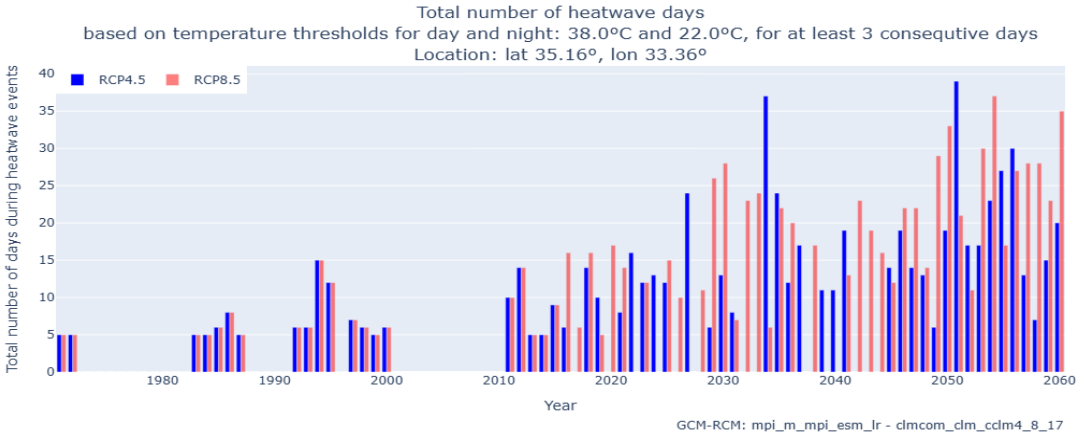

Figure 2-6. Heatwave duration per year. A heatwave is identified as at least 3 consecutive days of minimum day and night temperatures of 38°C and 22°C, respectively.

2.3.1.2 Risk assessment

For the heatwave risk assessment, we used the suggested satellite-derived data (Landsat Land Surface Temperature data from the RSLab portal). The selected region (urban area of the Nicosia Municipality) is shown below. The analysis period was set to 1/6/2024 - 1/9/2024, which was a

very hot period in Cyprus with prolonged heatwaves. The selected source was Landsat8 and the MODIS-based emissivity was preferred because the area of interest is urban and MODIS is more appropriate for such landscapes. The dataset can be found at the Zenodo repository under the name LSTdatasetNicosia.zip.

Figure 2-7. The selected region corresponding to the Municipality of Nicosia used for data collection from the Landsat Land Surface Temperature data from the RSLab portal.

The overheated areas in the area of interest, according to the analysis conducted by the workflow, are shown below in Figure 2-7.

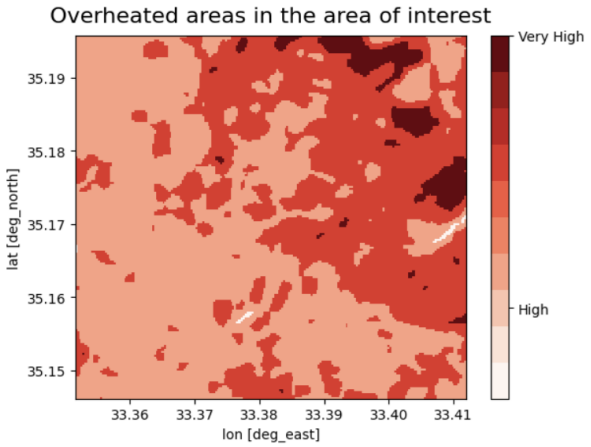

Figure 2-8. The land surface temperature map of the Municipality of Nicosia according to the RSLab portal data.

Exploiting the data available from WorldPop Hub regarding age and sex structures in Cyprus, we obtained the following density of the vulnerable population in the Nicosia Municipality. The dataset can be found at the Zenodo repository under the name *cyp_agesex_structures_2025_CN_1km.zip.*

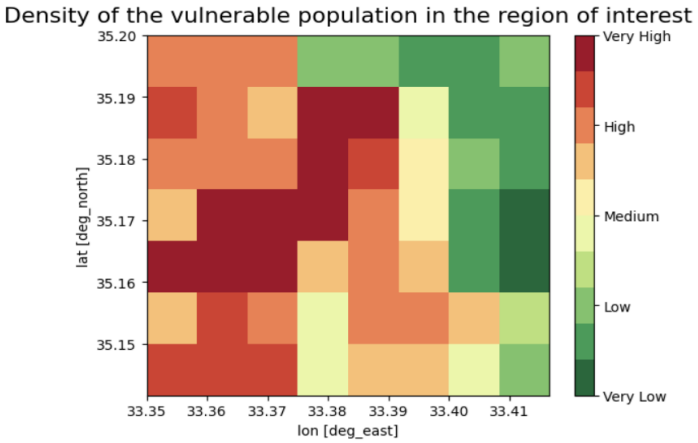

Figure 2-9. Vulnerable population density map in Nicosia Municipality region according to data from World Population Hub.

The final risk heat map for the Nicosia Municipality is estimated based on the exposure and vulnerability of the population extracted from the datasets used.

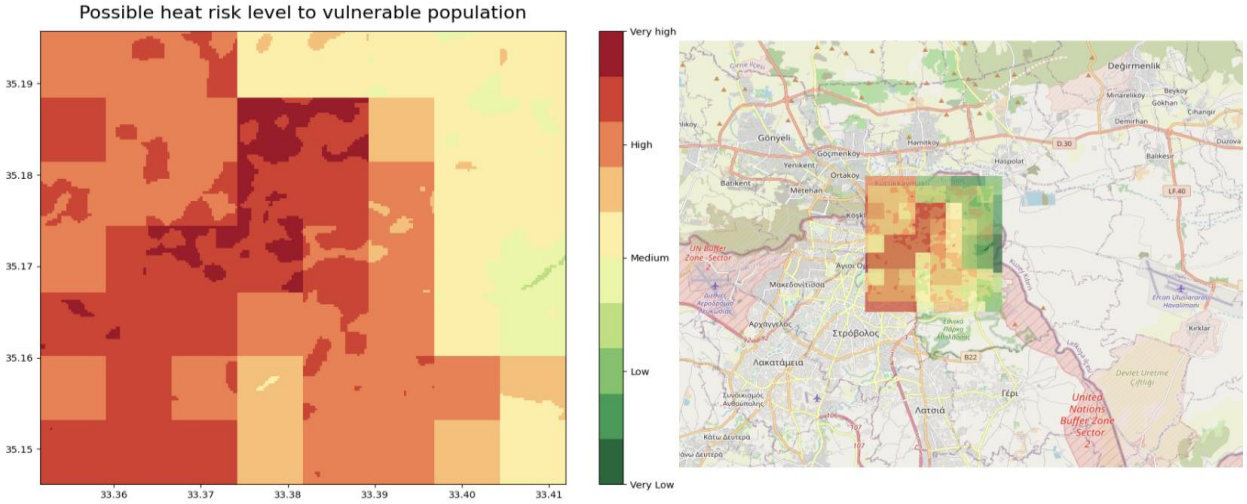

Figure 2-10. Left: The heat risk density map in Nicosia Municipality regarding the vulnerable population. Right: The heat risk density map overlaid on the city map.

2.3.1.3 UHI Effect

The UHI Effect is a pressing concern for cities around the world, especially those located in already warm climatic regions. This phenomenon refers to the large temperature difference found in urban regions as opposed to rural conditions, generally exacerbated by human activities, thick infrastructure and heat-absorbing materials. While global temperatures remain on the rise, as is increasingly the case with climate change, the UHIE raises the heat in the air, causing cities to become warmer. This study examines the specific manifestation of this phenomenon in the capital of Cyprus, Nicosia, where the IPCC refers to it as one of the main climate change hot spots. Nicosia is uniquely geographical, as it experiences longer warm spells when the mercury reaches over 42°C. In this regard, the UHIE is an important intensifier, generating localized hot spots that are layered threats to the city's populace and infrastructure. The overwhelming density of buildings, vast asphalt surfaces and various urban features absorb and hold solar radiation during the day and then re-emit it deep into the night. Such widespread thermal stress has serious human-health implications – particularly to vulnerable groups like the elderly and young children and people who already have certain health conditions and is associated with an increased risk for heat-related illness and

mortality. In addition to the immediate public health risks, the warming urban temperatures drive large surges in electricity use. Both residents and enterprises resort to huge air conditioning and other cooling measures, placing a massive strain on the power grids during the high summer months. This surge in energy demand is not just a burden for our local energy infrastructure but also represents increased operational costs and, hence, higher carbon dioxide emissions. What is more, the continual heat can also accelerate the deterioration of city infrastructure materials from roadways to building facades and need more frequent servicing times. Conditions that reduce the overall quality of life limit the extent to which people move outdoors, reduce the quantity of outdoor activities due to temperature-related discomfort, thus diminishing public spaces and community living. Answering this immediate call for concerted action between these interconnected challenges, this study is evidence-based research into the urban heat processes of Nicosia.

The focus of this study, that will be mainly conducted in Phase 2 of the project, is to address the broad recognition of heat-related risks, from this perspective, through a more specific characterization of UHIE's spatial and temporal attributes in the municipal area beyond the acknowledgment itself. Using strong methods including detailed environmental monitoring and spatial analyses, we endeavor to quantify the exposure of different urban areas to extreme heat and their vulnerability to it. We're hoping to produce high-resolution reports on how all this UHIE damage has affected the city most sharply on its vital hot spots and the social groups that are most affected. Findings from this work will allow municipal authorities to access a well-rounded analysis, allowing them to develop evidence-based policies and adaptation tactics based on data. These are informing actions framed into the Nicosia Municipality's Sustainable Energy and Climate Action Plan (SECAP), encouraging investments that can respond to climate change in urbanization, and embedding smart governance best practices. Since this project is both a partnership with the national-level institutions and research bodies, the scientific assessment is not only demanding but rather embedded in this particular local context, ensuring the relevancy, practicality, and actionability of the scientific findings to urban planners and the wider community. The present research aims to lay the solid groundwork for the transformation of Nicosia into a more climate-resilient and sustainably built environment that will not only buffer against the adverse effects of urban heat but also positively impact the quality of life in the city. We consider the study of UHIE in the Municipality of Nicosia as a critical aspect of the heatwaves study and an integral and intrinsic part that should be carefully studied and analyzed if we want to mitigate the effects of the seemingly unavoidable prolonged and intense heatwaves in the future. To this direction, we are designing and developing two UHIE devices that can be mounted on a car to measure the temperature and wind speed at the locations travelled by car. Prototypical equipment has been developed during the first phase of the project and is currently mounted on Nicosia Municipality cars and is used for recording data during their everyday travel around the city, conducting their daily operations. Our purpose is to collect thousands of measurements from diverse locations in the city at different times of the day and night (when the UHIE is more intense) and process them. The reason we spent effort on building the equipment during the first phase of the project and did not solely focus on it during the second phase relates to the Summertime we are currently in. The UHIE is better studied during extreme temperatures and we decided to take advantage of the hottest months in Cyprus, July and August. We plan to further improve and expand the capabilities of the equipment during the second phase of the project and acquire more measurements during the following months and most probably during the next Summer of 2026 so that we have enough data to conduct the study. Thus, further data acquisition

and analysis and UHIE modeling will be carried out during the second phase of the project. Figure 2-10 below shows the device built and how we plan to mount it on the municipality's cars.

Figure 2-11. The equipment developed for studying the UHIE in Nicosia (right) and a demonstration of its mounting on a car for mobile use (left).

In the context of studying the UHIE in the Municipality of Nicosia, we collaborated with the METACITIES Horizon Europe project (*MetaCities Excellence Hub in South-Eastern Europe*, 2025) to organize a workshop. The workshop aimed to shape the requirements and build a better understanding of the risks posed by the UHIE. Experts, including architects from local municipalities, shared their ideas, experiences, and potential mitigation measures. This contributed to raising awareness and facilitating knowledge transfer among all participants. Photos from the workshop can be found at the Zenodo repository.

2.3.2 Drought

To run this workflow, we need monthly total precipitation for each NUTS3 region during the historical reference period or future projection period in a selected country. This data for Cyprus and Nicosia is not available in the workflow datasets. The figure below demonstrates the lack of data from the available workflow.

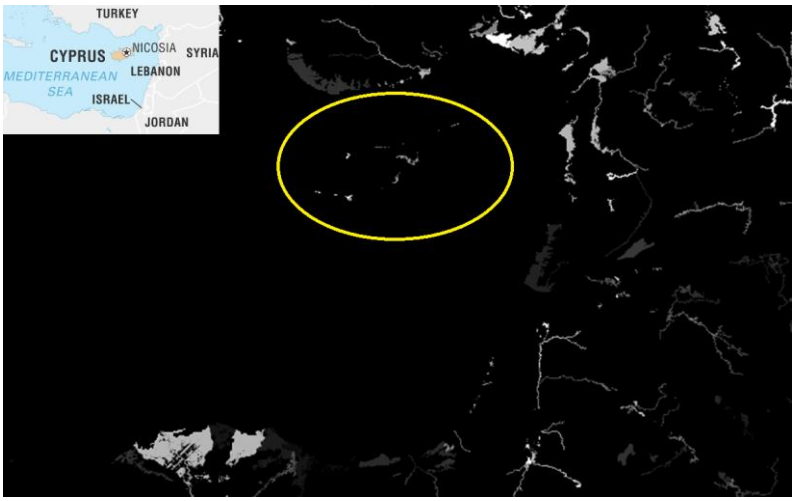

Figure 2-12. Illustration of the precipitation data related to Cyprus as provided by the drought workflow. There is data only for a few regions (mainly coastal) of the island.

To overcome this obstacle, we created our own precipitation dataset using measurements provided by the Climate Hazards Center from the University of California, Santa Barbara (CHIRPS v3). We

specifically downloaded the monthly precipitation data for 7 geographical areas carefully selected to overlap with the Nicosia Municipality. The measurements span a period from January 1981 to December 2024. CHIRPS v3 combines satellite-based thermal infrared rainfall estimates with in-situ station observations to produce a 0.05° gridded rainfall time series over land. For the coordinates of Cyprus, this roughly translates to grids of size 4×4 Km. The 7 geographical areas of the measurements located in the Municipality of Nicosia are shown below. To maintain code compatibility, we kept the NUTS id column name, but we replaced the data point IDs with our custom IDs (CY001-CY003, CY005-CY008). The dataset is shared in the Zenodo repository (NicosiaMonthlyPrecipitationDataset.csv).

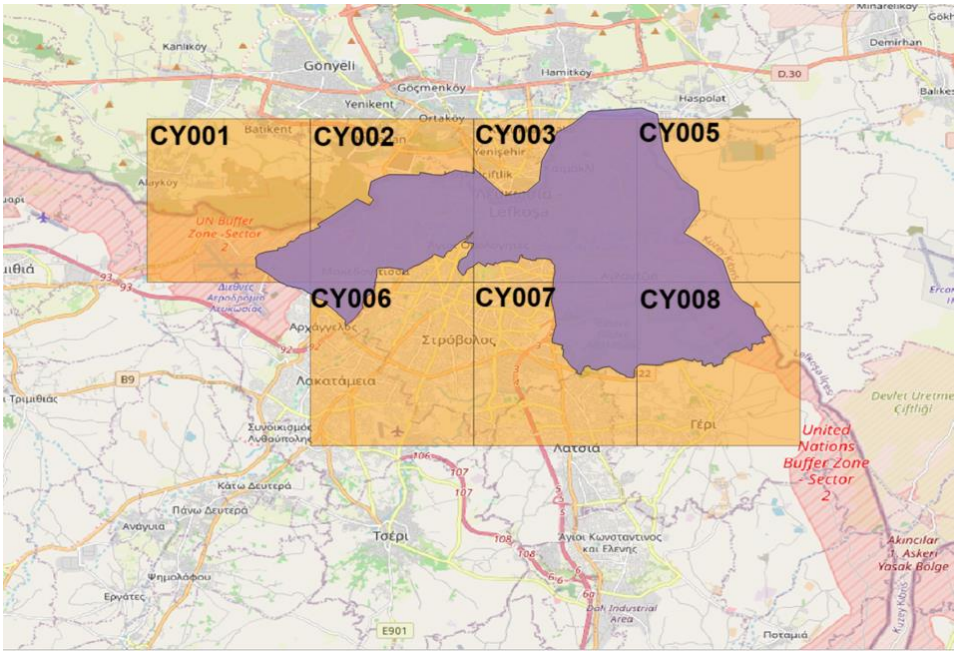

Figure 2-13. The seven geographical areas overlapping with the Nicosia Municipality selected for collecting custom precipitation data.

2.3.2.1 Hazard assessment

Equipped with the monthly precipitation data for 7 regions in the Nicosia Municipality, we were able to run the hazard assessment of the relative drought workflow and compute the Weighted Anomaly of Standardized Precipitation (WASP) indices. The table below shows the WASP indices computed with the hazard assessment of the relative drought workflow based on our collected data.

Table 2-3. The computed values for the WASP indices for the relative drought workflow.

Region ID	*Mean*	*Q25*	*Median*	*Q75*	*Count*	*Hazard*
CY001	-0.1292	-0.2080	-0.0691	-0.0454	75	0.8400
CY002	-0.1319	-0.2206	-0.0652	-0.0391	74	0.7840
CY003	-0.1237	-0.1827	-0.0837	-0.0519	78	0.8850
CY005	-0.1207	-0.2232	-0.0530	-0.0213	83	0.6270

Region ID	Mean	Q25	Median	Q75	Count	Hazard
CY006	-0.1194	-0.1907	-0.0684	-0.0400	77	0.8310
CY007	-0.1271	-0.1983	-0.0772	-0.0515	76	0.8950
CY008	-0.1372	-0.2034	-0.0805	-0.0535	74	0.9190

2.3.2.2 Risk assessment

To calculate the exposure for each of the 7 regions we identified we need, according to the methodology, the region's cropland fraction, the livestock number, the population density and the water stress. Nicosia Municipality is solely an urban area and thus, there is no cropland inside it. Furthermore, no agricultural areas exist in the city, and thus there is no livestock. The water stress in the city of Nicosia is considered uniform in all areas because of its small size and the similarity between the regions under consideration (same landscape, access to fresh water, uniform demand, etc.). For water stress, we use the data provided by the World Data Bank for the level of freshwater withdrawal as a proportion of available freshwater resources. The last available data is from 2020 (0.32), but since the drought problem became bigger during the last years, we will consider a water stress level of 0.35, which is the maximum value observed in the data and was recorded in 2012. The population density is computed by first obtaining the population for each region and then dividing by the area of each region. To extract the regions' population, we overlay the Nicosia population GIS layer with the GIS layer of the 7 regions of interest. An overview of the exposure data is shown in the following table.

Table 2-4. The exposure data used for drought risk assessment.

Region ID	Cropland fraction	Livestock	Population Density	Water stress
CY001	0	0	1296.12	0.35
CY002	0	0	232.25	0.35
CY003	0	0	1724.55	0.35
CY005	0	0	129.09	0.35
CY006	0	0	158.53	0.35
CY007	0	0	1655.05	0.35
CY008	0	0	1122.44	0.35

The vulnerability data, based on the workflow, contains the portion of the rural population over the total population and the GDP of the region. Since Nicosia does not contain rural areas and is solely an urban environment, the rural proportion is zero. The GDP of the regions is considered to be the same as the country GDP (30K euros) because Cyprus is a very small country with no great

differences in the characteristics of the population, especially in the urban area of its capital, Nicosia, the focus of this project. An overview of the vulnerability data is shown in the table below.

Table 2-5. The vulnerability data used for drought risk assessment.

Region ID	Rural pop./Total pop.	GDP
CY001	0	30000
CY002	0	30000
CY003	0	30000
CY005	0	30000
CY006	0	30000
CY007	0	30000
CY008	0	30000

Unfortunately, we could not run the workflow code for computing the drought risk as provided because data for Cyprus (especially data required for visualization purposes) was not available for the country. However, after a lot of code modifications, we were able to use the underlying methodology and compute the drought risk for the 7 regions in the study. The most important code modifications are the following:

- Consistent geometry/versioning, robust filtering, indicator screening, and multiple clean fallbacks (population-based exposure, neutral vulnerability, non-spatial visualizations, safe map center) added so the risk workflow still runs and produces interpretable outputs when data are missing, sparse, or mismatched.
- Regions are filtered based on the area of interest and then based on whether they are present in the hazard table. If no regions match (e.g., different vintages), it falls back to using NUTS_ID codes from the hazard CSV instead of the shapefile.
- Code execution proceeds even with truncated data; made modifications to keep the flow working with partial inputs.
- Truncated normalized values to the lowest value of 0.01 to avoid zeros that cause computation failures.
- If a factor group has no valid indicators, the execution falls back to a neutral vulnerability score (0.5) rather than failing.
- Set USE_PYGEOS=0 to avoid geometry backend issues.

The modified code can be found in the Zenodo repository under the name 'ModifiedDroughtCodeRiskAssesmentVisualization.py'

The results obtained after the modifications are shown in the following table.

Table 2-6. The results of drought risk assessment.

Region ID	Hazard raw	Exposure raw	Vulnerability raw	Risk raw	Risk category
CY001	0.84	0.731	0.5	0.307	2
CY002	0.784	0.065	0.5	0.025	1
CY003	0.885	1.0	0.5	0.442	3
CY005	0.627	0.01	0.5	0.003	1
CY006	0.831	0.018	0.5	0.007	1
CY007	0.895	0.956	0.5	0.428	3
CY008	0.919	0.623	0.5	0.286	2

Based on the above results, we plot the drought risk per region of interest.

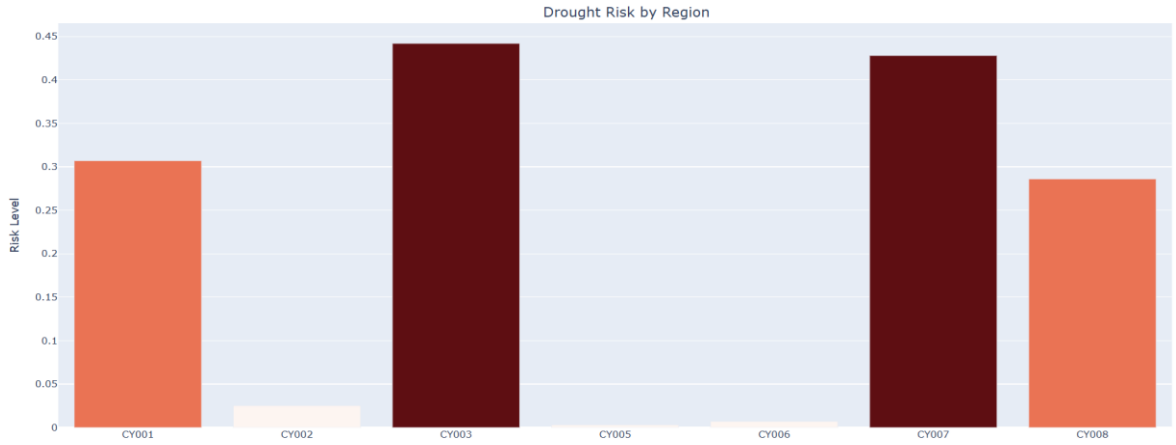

Figure 2-14. The drought risk for each of the seven regions considered in the execution of the drought workflow.

We also found it very useful to create an interactive 3D scatter plot of the drought risk components (hazard, exposure, vulnerability) for each of the 7 studied regions because it joins all data analysis into a single plot, making it easier to understand the dynamics of the risk calculation.

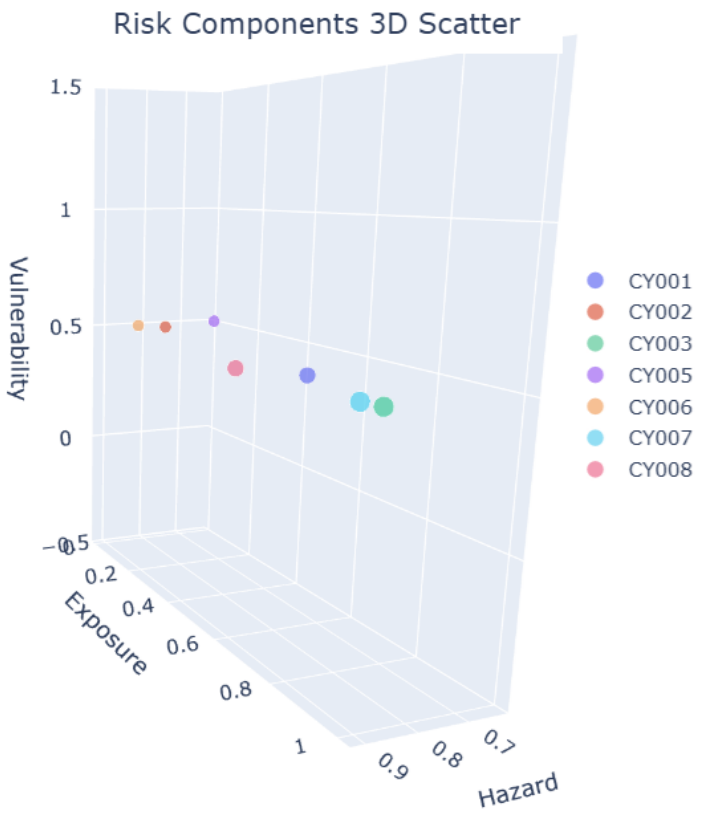

Figure 2-15. A snapshot from the interactive 3D scatter plot of all drought components (hazard, exposure, vulnerability) corresponding to the seven studied regions.

Concretely, the data used for estimating the drought risk in the Municipality of Nicosia is shown below in Table 2-7.

Table 2-7. Data overview for the drought workflow.

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
Custom precipitation dataset CHIRPS v3 - 7 geographical regions in the Municipality of Nicosia	**Custom data** Rural Population portion Regional GDP	**Custom data** Cropland portion Livestock Population Density Water stress	Metrics for hazard, exposure and vulnerability Metric for risk Categorization of risk Risk visualizations

2.3.3 Flooding

The specific workflow does not contain data for Cyprus regarding rivers and their banks, making its execution impossible. After multiple discussions, including a face-to-face online meeting with Christopher Polster, the facilitator for the CLIMAAX project's workflows, we were informed that the unfortunate lack of data primarily stems from the fact that Nicosia is a very small city compared to other European cities involved in the project, and that other participating cities of comparatively small to moderate size face similar issues. Furthermore, the rivers in Nicosia are very small in size

(in terms of both bank width and length), which makes data collection impractical and prone to severe inaccuracy. During our discussions, it became evident that collecting the necessary data to run the workflow promptly within Phase 1 of the project was infeasible.

Given the lack of data for properly executing the provided flooding workflow, we decided to explore alternative ways to assess the flooding hazards/risks for the Municipality of Nicosia during the second phase of the project. This will allow us time to collect the required data and design and execute a feasible plan for studying the specific climate change threat.

2.4 Preliminary Key Risk Assessment Findings

2.4.1 Severity

The Nicosia Municipality in Cyprus faces a significant and escalating risk from climate change, particularly from the synergistic effects of heatwaves and droughts. The severity of this risk is evident when examining historical trends, current impacts, and future projections. This suggests that our choice of studying the specific risks is sensible. Below we focus on the risk assessment of heat and drought, while risk assessment of flooding will occur in Phase II, due to lack of data in Phase I.

Heat and drought: In the Eastern Mediterranean and Middle East region, which includes Cyprus, the temperatures are rising at twice the global average. This trend is not a matter of a few hot days but a systemic shift toward more intense, frequent, and prolonged periods of extreme heat and reduced precipitation, directly increasing the vulnerability of Nicosia's urban environment and population. Historic and recent trends show a clear and alarming pattern. Since the 1960s, the intensity, duration, and number of heatwave events in the Eastern Mediterranean have been steadily increasing. For example, the annual mean temperature in Nicosia has already risen, and future projections indicate a warming of up to 4°C by the end of the century. The number of hot days with temperatures exceeding 38°C is expected to increase by an additional two weeks per year, while "tropical" nights with minimum temperatures above 25°C will be a month more frequent (The Cyprus Institute, 2025). This extreme heat is compounded by a multi-year drought, with dam reserves being at critically low levels, a stark contrast to historic averages. The results of the workflows show that even with the more streamlined scenario (RCP4.5), the heatwaves' frequency and duration are expected to increase dramatically in the following decades. The impact of this climate risk is high in both frequency and magnitude within the Nicosia Municipality. From a human perspective, heatwaves pose a direct and severe threat to public health. Studies have shown a strong correlation between rising temperatures and increased hospital admissions and mortality. For instance, even an increase of just 1°C above the baseline temperature has been linked to a 24% rise in heat-related mortality in the city (Pyrgou & Santamouris, 2018). The urban heat island effect, amplified by the city's concrete infrastructure, makes Nicosia's urban and suburban areas particularly susceptible. The most vulnerable populations, including the elderly and those with pre-existing conditions, face a disproportionately high risk. Economically, the combined impact of heatwaves and drought is a significant burden. With dam levels in the district at a mere 5.3% of their capacity, the government has been forced to prioritize household and livestock water supply over irrigation. Heatwaves increase energy consumption for air conditioning, straining the power grid and raising costs for residents and businesses. Combined with the energy sufficiency problem that Cyprus is currently

facing, the increased electricity consumption caused by the intensified heatwaves is inevitably going to impact the local economy and the civilian living conditions.

The risks associated with these climate hazards are not limited to direct, immediate impacts, but also unleash cascading and potentially irreversible consequences. The destruction of agricultural land and the loss of crops threaten local food security and the livelihoods of the population. Economic strain can lead to social unrest and increased mental health issues within affected communities. The intensified heat and drought conditions also increase the risk of massive wildfires, which can lead to the destruction of ecosystems and human casualties, as tragically demonstrated in recent years with major fires across the country. Cyprus is still reeling from the recent and devastating fires in the Limassol district (Knews, 2025). This tragedy claimed lives and caused hundreds of millions of euros in damage to homes and infrastructure. The fires were so extensive that they burned through 1.3% of the island's entire land area.
The depletion of water resources is perhaps the most critical long-term and irreversible consequence. The results show that the drought risk is high for certain regions of Nicosia, even if the proposed methodology considers a vulnerability metric that is not representative of the city population: the absence of rural areas and the uniform GDP produce a uniform vulnerability metric. The drought problem will certainly worsen in the future. While desalination plants provide a buffer for drinking water, they do not address the fundamental issue of water scarcity for agriculture and ecosystems. The ongoing drought forces a reliance on a single, energy-intensive source, creating a fragile water-energy nexus. Should this system fail, the consequences could be catastrophic, leading to a breakdown of essential services and potentially forcing internal or external migration, as citizens seek more climate-resilient areas.
In conclusion, the risk of heatwaves and drought in the Nicosia Municipality is not a future possibility but a present reality with severe, high-impact, and frequent consequences. The combination of prolonged drought and intense heatwaves is creating a chain reaction of adverse effects, from human mortality and economic losses to the irreversible destruction of agricultural land and ecosystems. The trends in the results of the CLIMAAX workflows are clear, and the consequences are immediate. The municipality's capacity to adapt and mitigate these risks will be a critical factor in ensuring the long-term resilience and sustainability of the city and its population.

2.4.2 Urgency

Based on the CLIMAAX workflows' results for the Municipality of Nicosia, the climate risks are considered to be an immediate and growing threat, with significant impacts already being observed. The analysis reveals that the Municipality faces a high and escalating risk from heatwaves and droughts, which are classified as pervasive and long-standing climatic challenges for the entire island of Cyprus. The report underscores the need for proactive action, as these risks are not merely future projections but are already a reality affecting public health, the economy, and the environment. The urgency of these issues is highlighted by the fact that the Municipal Sustainable Energy and Climate Action Plan currently lacks information on climate risks, making it critical to take immediate action to assess these threats and develop mitigation strategies. The outcomes of the current project, including risk-estimation models and actionable recommendations, are intended to serve an immediate purpose by being integrated into upcoming local and regional development plans. This is a clear indicator that the time to act is now, rather than in the distant future. The results obtained

by running the workflows for Nicosia emphasize that the major impacts of climate change on the island are expected to rise from "manageable issues to elemental stress" within the medium-term, a period of 20-30 years. The focus on this timeframe is a necessity because it is when the compounded forces of climate change, economic trends, and demographic changes will become most severe. The immediate and short-term scenarios may not fully account for the full-scale changes that are predicted to occur, making the medium-term the most relevant period to guide focused attention and ensure sustainable development and resilience.

The climate hazards of heatwaves and drought are expected to worsen significantly in the near future. Projections indicate that the annual mean temperature in Nicosia could increase by up to 4°C by the end of the century. The number of hot days with temperatures exceeding 38°C is expected to increase by an additional two weeks per year, while the frequency of "tropical nights" will also rise. At the same time, heatwave frequency and duration are expected to increase dramatically in the following decades. The climate hazards affecting Nicosia are associated with both sudden events and slow-onset processes. Flooding, for instance, is a traditionally low-risk hazard that is being increasingly amplified by sudden and intense rainfall events. These events can cause significant and immediate damage to infrastructure, such as roads and buildings, and disrupt daily life. In contrast, heatwaves and droughts are characterized as slow-onset processes. The results highlight that they have been long-standing primary concerns for the general geographical region and are part of a systemic shift toward more frequent and prolonged periods of extreme heat and reduced precipitation.

This combination of slow and sudden events influences urgency scoring in different ways. While the gradual worsening of heat and drought requires long-term, proactive planning and adaptation measures, the potential for sudden, intense flooding events necessitates immediate preparedness and robust emergency response systems. While the city proactively monitors potential flooding threats and adapts its plans (especially against flash flood incidents), the slow onset risks of heatwaves and droughts are also identified as serious and growing threats. The respective climate hazards have the potential to persist and even become irreversible. The depletion of water resources is identified as the most critical long-term and irreversible consequence. This is because the region, including Nicosia, already faces inherent water scarcity, and decreased precipitation coupled with increased temperatures further strains water supplies. The risks are not limited to immediate impacts but can unleash cascading effects, such as the destruction of agricultural land and the loss of crops, which threaten food security and livelihoods.

The persistence of these climate risks is further demonstrated by the UHIE, which is magnified by the city's infrastructure and is a significant and growing concern as climate change increases the already hot conditions. The combination of an already hot climate and the intensifying effects of climate change means that these hazards are a continuous and lasting threat that will persist for the foreseeable future.

2.4.3 Capacity

The Municipality of Nicosia has already introduced a wide range of measures to address the main climate risks of flooding, the urban heat island effect, and prolonged drought. On the financial side, the city consistently secures EU and national co-funding (Structural Funds, LIFE, Horizon Europe,

EUCF, RRF), supplementing its limited municipal budget with large-scale investments. Physical measures include the rehabilitation and widening of the Pedieos River to increase flood protection, major anti-flood works in vulnerable districts, and the pilot use of permeable ("waterpass") materials to reduce surface runoff. Natural measures focus on expanding green areas through tree-planting, restoring degraded land, and introducing pollinator-friendly practices. On the social side, projects such as the Pedieos Linear Park, pollinator gardens, and shaded public spaces involve inclusive design and direct citizen benefits. The human dimension has been strengthened through participation in EU projects (CARDIMED, EUCF), which have equipped municipal staff with valuable applied knowledge. Finally, the municipality is laying the groundwork for more advanced monitoring and decision-making through its Smart City Action Plan, which includes the digitalization of parks, development of a GIS platform, and use of environmental metrics.

Capacity to address climate risks

Nicosia demonstrates growing and consolidating capacity to manage climate risks. Financial capacity is strengthening, as the municipality actively secures EU and national funding while building a robust pipeline of projects. The forthcoming Integrated Development Strategy for the next EU programming period will provide a structured framework to prioritize adaptation measures and access ERDF resources. The issues studied through the CLIMAAX project will feed directly into this strategy, ensuring that local climate risks such as flooding, heat stress, and drought are reflected in future investments.

Human capacity is expanding, with municipal staff gaining practical expertise through participation in European projects. To build on this progress, further systematic training and awareness-raising across departments will be pursued, enabling continuity, scaling-up, and institutional learning. Natural capacity is being steadily reinforced through tree planting, the development of biodiversity corridors, and restoration of riverbanks, laying a foundation for long-term ecological resilience, even if challenges remain due to urban density and water scarcity.

Physical capacity has advanced through €2M of anti-flood works, the piloting of permeable paving, the deployment of smart irrigation systems, renewable energy concepts, and national hazard monitoring. The next step will be to strengthen local integration with early-warning and forecast systems, ensuring timely response and preparedness at the city level. Social capacity is strong, with NGOs, citizens, and neighboring municipalities actively engaged. Flagship projects like the Pedieos River masterplan also demonstrate how climate adaptation can simultaneously support accessibility, inclusion, and cross-community collaboration.

Overall, Nicosia is well positioned to coordinate climate adaptation efforts together with its partners. The municipality's evolving capacities, combined with external partnerships and EU support, provide a solid basis for embedding climate resilience in its future development trajectory.

Interventions implemented / planned

Nicosia is combining large-scale infrastructure investments, nature-based solutions, clean energy transition projects, and cutting-edge research pilots. Importantly, these are underpinned by municipal and EU co-funding, reflecting a clear commitment to resilience. Key interventions include:

- **Flooding and Stormwater Management**
  - *Major Anti-Flood Infrastructure Projects* (€2M, 2026 – Structural Funds): Upgrading stormwater networks and safeguarding vulnerable districts.
  - *Pedieos River Rehabilitation* (€4.4M, completion 2025): Restoration of 18 km of riverbanks with native vegetation, erosion control, and sustainable pedestrian/cyclist infrastructure.
  - *Pedieos River Strategic Masterplan* (€27M, completion 2027): Joint project with five neighbouring municipalities to create Cyprus's longest sustainable linear park, linking communities and enhancing biodiversity.
  - *Piloting of Water-Pass Materials*: Testing permeable paving to reduce flash flooding and increase infiltration.

- **Urban Heat Island Mitigation and Green Infrastructure**
  - *Urban Tree Planting Initiative* (€120,000, 2026): Large-scale planting to expand canopy cover, mitigate UHI, improve air quality, and enhance biodiversity.
  - *Pollinator-Friendly Greening*: De-cementing areas, planting native species, and adopting pesticide-free practices (LIFE project).

- **Biodiversity and Ecosystem Services**
  - *LIFE BUZZ – Urban Nature and Pollinator Support* (€150,000 local actions, start Feb 2026):
    - Restoration of degraded spaces with native plants.
    - Creation of flowering "buzz lines."
    - Enhancement of greenery with rainwater harvesting and planting.
    - Installation of bee hotels in public parks.
  - *CARDIMED (Horizon Europe, €250,000 local actions, ongoing):* Rainwater harvesting for irrigation, improved water management, and vertical hydroponic walls to enhance cooling, biodiversity, and food security.
- **Smart City and Resource Efficiency**
  - *Integrated Automated Irrigation System* (€400,000, 2026): IoT-based system integrating soil sensors, weather data, and real-time monitoring to optimise irrigation and conserve water.
  - *Smart City Action Plan (2024–2027):* Digitalization of parks, GIS platform development, fiber optic expansion, real-time parking management, and e-government exploration.
  - *LIFE EUCF Investment Concept – Smart PV, Storage & EV Infrastructure* (€60,000, ongoing): Roadmap for installing 6.25 MW of PV, 5 MWh of storage, and 70 EV charging stations across the city.

- **Emergency Preparedness and Governance**
  - *Earthquake and Natural Disaster Response Plan (update 2026):* Defines municipal roles and coordination with national agencies. Budget allocated for training, staff capacity-building, and integration with new municipal boundaries.
  - *Integrated Development Strategy (upcoming):* Will guide investments for the next EU programming period, ensuring alignment with ERDF and other structural funds.

- Sustainable Energy and Climate Action Plan (SECAP): Already prepared and submitted, this plan provides the long-term framework for reducing emissions, improving energy efficiency, and adapting to climate impacts at the local level, in line with Covenant of Mayors commitments.
- *Proposal under the P2R Call (submitted):* Seeking further EU co-funding for resilience and sustainable development.

2.5 Preliminary Monitoring and Evaluation

The first phase of the CRA for Nicosia has provided a vital foundation for understanding the city's climate vulnerabilities and priorities. The findings confirmed that heatwaves, intensified by the UHIE and persistent drought remain the most urgent hazards, with flooding emerging as a growing threat due to the combination of intense rainfall events, rapid urbanization, and aging drainage systems. This phase also highlighted that extreme temperatures, regularly exceeding 43°C, are no longer a rare occurrence but an expected part of summer, posing serious risks to public health and placing sustained pressure on the energy grid. By applying the CLIMAAX workflows and carrying out preliminary spatial analysis, we were able to create a baseline understanding of exposure and vulnerability patterns, including mapping of hotspots where vulnerable populations are most affected.

Despite this progress, the first phase encountered several difficulties. A major challenge was the lack of high-resolution, locally relevant data for small municipalities like Nicosia. While pan-European datasets are useful for a continental perspective, they fail to capture the microclimatic and socio-economic variations that are critical for effective planning. This forced the project team to spend significant effort modifying the available workflows and supplementing them with custom data collection, including deploying mobile heat sensors and compiling localized exposure data. This experience underscored the need to invest in a permanent, open-access urban climate monitoring system that can support evidence-based decision-making in the long term.

Stakeholder engagement proved to be one of the most valuable components of Phase 1. Feedback from municipal officials, environmental NGOs, and citizen groups highlighted a strong demand for actionable recommendations that could be immediately incorporated into policy, particularly in the city's Sustainable Energy and Climate Action Plan (SECAP). Stakeholders also requested a deeper socio-economic analysis to better understand how climate impacts disproportionately affect vulnerable populations, including the elderly, low-income households, and migrant communities. To respond to these concerns, the next phase should broaden stakeholder involvement to include public health authorities, private developers, and representatives from critical infrastructure operators, ensuring that adaptation strategies are equitable and feasible to implement.

During Phase 2 of the project, new data sources will become available that can significantly enhance the analysis. These datasets will allow for a better assessment of the risks and provide the stepping stone for scenario-based modeling of different adaptation interventions, such as tree planting, cool roofs, and shading infrastructure, and their potential impact on urban temperature reduction. Additionally, collaboration with water authorities is expected to unlock more granular

data on consumption and leakage patterns, which will strengthen the drought and water scarcity analysis.

Looking ahead, further resources are needed not only to refine the data but also to expand local capacity for modeling, GIS analysis, and cost-benefit assessment of adaptation options. Building in-house expertise within the municipality will be crucial to ensure that the results of the CRA are continuously updated and integrated into planning cycles. A research partnership with local universities could provide a sustainable pipeline of knowledge and innovation, allowing the CRA process to evolve as climate risks change over time. The momentum from Phase 1 provides a unique opportunity for Nicosia to transition from risk assessment to implementation of concrete measures, positioning the city as a model for climate resilience in the Eastern Mediterranean.

2.6 Work plan

We intend to enrich the CLIMAAX toolbox datasets with our own local data to improve the multi-risk assessment performed in Phase 1. This data has higher resolution and detail. Guidance from the CLIMAAX partners would be very welcome during this process. Considering D2.2 (hazard data pre-selection table), we will enrich the existing climate variables and include new ones, taking advantage of the demographic information by the Ministry of Nicosia, as well as the country-scale GAEA tool (http://gaea.cyens.org.cy) and the iNicosia digital twin (https://inicosia.cyens.org.cy), both developed by CYENS (entity to be subcontracted for the technical work of the project):

- Flooding: Digital surface model of rivers, buildings and infrastructures; Distance to rivers; Historical flooding incidents; elevation data.
- UHI effect and damage to vegetation: 3D model of the city of Nicosia (buildings, plants), detailed temperature, humidity and precipitation patterns. For the UHI effects, drones equipped with thermal cameras will fly through Nicosia, to identify hotspots in the 3D spatiotemporal context, as well as to link heat islands with building materials and different vegetation types. For vegetation, multispectral satellite imagery data from Sentinel-2 will be harnessed to assess the stress on plants from climate change.

The enhanced data will allow better calculation of hazards considering the exposure and vulnerability of the Nicosia region/society to the respective hazards, identifying changing trends in climate hazards, exposure (due to evolving land use or infrastructure layout) and vulnerability patterns (due to dynamic population structures). Demographic info from the Ministry of Nicosia to be used. A comparison of Phase-1 and Phase-2 results will also take place.

Potential adaptation options and actions will be explored, improving current local Risk Management Plans (RMPs) and adaptation strategies, to cope with the increase of the frequency and intensity of climate risks selected. Some potential adaptation actions under discussion by policymakers now include:

- Cool urban environments, increase green spaces (tree planting, urban parks), improve energy efficiency of buildings, shading structures, solar panels for shading, cool materials, green roofs etc. (UHI effect)

- Widen banks of Pediaios river, upgrade drainage system capacity, green infrastructure to absorb rainwater, subsidence for flood-proof buildings, flood barriers etc. (flooding)
- Drought-tolerant plants/crops, water management, heat-resilient landscaping, urban planning prioritizing green infrastructure, etc. (vegetation damage)

The regional processes for monitoring and evaluation of the risks will be defined, based on the indicators defined in Phase 1, assigning the task to municipality operators. This will ensure the project's sustainability. Parallel and future steps include securing further funding and aligning the best adaptation responses with local development planning and regional policies.

3 Conclusions Phase 1- Climate risk assessment

The completion of Phase 1 of the CRA for the Municipality of Nicosia marks a critical first step in building a structured, evidence-based understanding of how climate change is shaping local risks. Applying the CLIMAAX Framework, this phase focused on scoping, preliminary risk exploration, and workflow selection, while also beginning the groundwork for full-scale risk analysis in the next project stage (Phase 2). This process confirmed the climate challenges that Nicosia faces today, identified the most pressing hazards, and outlined both the opportunities and limitations of the current assessment. The findings provide a practical starting point for integrating climate risks into municipal planning and decision-making. Overall, the results of running the workflows confirmed our initial intuition about what we perceived as the greatest climate change risks in Nicosia and Cyprus more generally.

We provide a list of the main key insights gained from completing Phase 1 of the project:

Heatwaves and Urban Heat Island Effect (UHIE): Heatwaves, intensified by the Urban Heat Island Effect, emerged as the most urgent risk for Nicosia. With summer temperatures already reaching and exceeding 43°C, the city's dense built environment exacerbates heat stress. This creates serious public health risks, particularly for vulnerable groups such as the elderly, children, and people with chronic illnesses. In addition, the surge in cooling demand during extreme heat places stress on the electricity grid and increases greenhouse gas emissions. The evidence highlights the importance of adaptation measures such as urban greening, reflective building materials, shading, and smart planning to reduce overheating in the city. During Phase 1, we set the ground for studying the UHIE in Nicosia by developing data acquisition equipment that will be mounted on municipality cars. We plan to use AI to correlate landscape characteristics with the intensity effect in the city of Nicosia. We have been using the equipment since mid-August for collecting valuable Summertime data. The AI development and data analysis will be conducted during Phase 2 of the project.

Drought and Water Scarcity: Drought is another dominant and worsening risk. Declining rainfall and higher evaporation rates are reducing natural water availability. Reservoir levels have already reached critically low levels in recent years, and water supply cuts are periodically enforced. Agriculture and peri-urban vegetation are highly exposed, with heat threatening local food production. Reliance on desalination plants helps meet demand but comes with high economic and environmental costs due to energy consumption. This points to the need for integrated water management, improved infrastructure, and drought-resilient urban and agricultural practices.

Flooding: Flooding has historically been at a lower risk but is becoming more relevant due to urbanization, outdated drainage systems, and the increased frequency of heavy rainfall events. Flash floods have already disrupted transport, damaged property, and contaminated water supplies. However, this risk could not be fully analyzed in Phase 1 due to the absence of localized hydrological and infrastructure data. Further work is needed to assess flood hazards with the same level of detail as heat and drought. We will address this risk during Phase 2 of the project.

Despite data limitations, mainly sourcing from the small size of Nicosia and Cyprus more generally, Phase 1 successfully tackled several key challenges:

- **Stakeholder Mapping:** Over 100 local stakeholders were identified across public institutions, academia, NGOs, the private sector, and citizen groups, creating a solid basis for participation in future phases.
- **Workflow Application:** CLIMAAX workflows for heatwaves and drought were applied and adapted, generating valuable first results despite gaps in local data. Despite the extensive code modifications and the collection of custom data required for overcoming the lack of data, we managed to run the workflows and exploit the offered methodologies and gain valuable insights into the climate change risks and the urgency to address them.
- **Policy Linkages:** Preliminary findings are already relevant to the Municipality's Sustainable Energy and Climate Action Plan (SECAP) and national adaptation strategies, ensuring that this work can inform ongoing planning.

Several issues remain unresolved and will require focused attention in Phase 2:

- **Data Gaps:** Reliance on pan-European datasets limited the accuracy of exposure and vulnerability assessments at the municipal level. Local, high-resolution datasets are needed to refine the analysis.
- **Incomplete Flood Analysis:** Flood risk workflows could not be fully implemented. Collecting and integrating hydrological and infrastructure data will be essential for a complete picture.
- **Socio-economic Impacts:** The costs and economic damage linked to climate risks have not yet been quantified. Estimating these impacts will be necessary to prioritize adaptation measures.
- **Adaptation Options:** While potential solutions have been identified, their feasibility, cost-effectiveness, and long-term impact still need evaluation.

Phase 1 confirms that climate change poses an immediate and escalating threat to Nicosia, with heatwaves and droughts standing out as the most severe and urgent risks, and flooding emerging as a secondary but increasingly relevant hazard. Despite data limitations, this phase has provided an evidence-based foundation for the city's adaptation planning and demonstrated how the CLIMAAX methodology can be applied in a small urban context. Looking forward, Phase 2 will address the current gaps by integrating detailed local data, expanding the analysis of flood risks, and quantifying the socio-economic impacts of climate hazards. This will allow for the development of tailored, practical adaptation measures that respond directly to Nicosia's needs. Overall, Phase 1 has succeeded in setting the direction for a more climate-resilient future. It has mobilized stakeholders, aligned local efforts with European and national strategies, and identified clear next steps for action. The outputs of this stage will directly support the municipality in designing targeted interventions, from green infrastructure and heat-mitigation strategies to improved water and flood management. By doing so, the project strengthens Nicosia's capacity to anticipate, adapt, and respond effectively to climate challenges, ensuring a safer, healthier, and more sustainable city for the years ahead.

4 Progress evaluation and contribution to future phases

The completion of Phase 1 has laid a strong foundation for the project's subsequent phases by delivering a structured scoping of Nicosia's climate risks and the identification of key hazards (heatwaves, floods, droughts). This deliverable has clarified the local context, mobilized key stakeholders, and aligned the project's objectives with municipal policy frameworks. It has also helped us build a better understanding of the risks addressed and obtain further technical knowledge of how to successfully analyze the hazards and risks. These outputs are essential as they provide the methodological direction for Phase 2, where the risk analysis will be deepened through the integration of localized datasets, more refined methodologies and the production of spatiotemporal risk maps. The findings and processes of Phase 1, therefore, directly enable a more targeted, data-driven approach to evaluating vulnerabilities and prioritizing adaptation strategies in the phases that follow. Looking forward, the outcomes of this deliverable contribute to shaping the design of the next phases by ensuring continuity between preliminary exploration and detailed risk analysis. These outcomes also set the stage for the formulation of concrete adaptation and mitigation measures. Phase 1 outputs harmonize the scoping and exploration work with the CLIMAAX Framework and thus will streamline stakeholder engagement, improve data integration, and facilitate cross-sectoral alignment in later stages. Furthermore, the insights on urgency, severity, and local adaptive capacity gathered during this phase will facilitate the prioritization of interventions into Nicosia's action plan.

An overview of the project's **key performance indicators** is shown below.

Table 4-1. Overview of key performance indicators.

Key performance indicators	*Progress*
At least 3 workflows successfully applied on Deliverable 1 (Phase 1)	All workflows were successfully developed and recorded on Deliverable 1
At least 100 local stakeholder entities identified by Deliverable 1 (Phase 1)	All local stakeholders identified. First 100 local specific stakeholder entities identified and recorded.
At least 3 refinements of the workflows applied to Deliverable 2 (Phase 2)	To be done
At least 200 local stakeholders are involved in the activities of the project (Phase 3)	To be done
At least 10 communication actions taken to share results with the stakeholders by the end of the project (Phase 3)	To be done (First communication action took place already: Invited by the METACITIES project to present our work and to discuss with experts from local municipalities about the impact of the UHIE on cities.
At least 2 scientific publications by the end of the project (Phase 3)	To be done

Key performance indicators	*Progress*
At least 10 notes for policy makers by the end of the project (Phase 3)	To be done
At least 10 specific risk adaptation and mitigation actions and solutions identified and assessed by the end of the project (Phase 3)	To be done (Five specific risk adaptation/mitigation actions have been identified and they are being assessed right now)
At least 5 articles in regional media mentioning the project (Phase 3)	To be done
At least 3 spatiotemporal maps of risks published by the end of the project (Phase 3)	To be done
At least 3 models of risk estimation will be published by the end of the project (Phase 3)	To be done

The **project milestones** are demonstrated below.

Table 4-2. Overview of project milestones.

Milestones	*Progress*
M1: Dissemination and Communication Plan developed (Month 3)	The plan has been developed and it is being followed.
M2: Subcontracting done (Month 3)	The subcontracting process has been set into motion. There are some delays, but everything is expected to run smoothly. The partner CYENS is already contributing significantly to the project.
M3: Attended the CLIMAAX workshop held in Barcelona (Months 3-4)	Representatives of both the Municipality of Nicosia and CYENS attended the CLIMAAX workshop and shared our vision and concepts for the project. It was an excellent networking opportunity.
M4: Identification of all relevant local stakeholders done (Month 6)	All relevant local stakeholders have been identified and a list of 100 specific stakeholders has been created.
M5: Multi-risk climate assessment performed for the three targeted risks based on the CLIMAAX common methodology, workflows successfully applied (Month 6)	Climate assessment based on the three targeted risks and based on the CLIMAAX methodology and workflows has been done. It is in low resolution and limited conclusions can be extracted; thus, we look forward to Phase II of the project, where higher granularity is expected.

Milestones	*Progress*
M6: Refined regional/local multi-risk assessment implemented for the three targeted risks (Month 14)	Regarding the UHI effect risk in particular, we have developed sensory devices that measure temperature with high accuracy, placing these sensor devices on municipal vehicles that move opportunistically within the city of Nicosia. This will allow us to understand heat conditions all around the city, creating spatial maps of the UHI effect risk eventually. We started this experiment, although part of Phase II, to exploit the intense heat of the summer period in Cyprus, i.e., August and September.
M7: Refined spatiotemporal maps of risk published (Month 16)	To be done
M8: Adaptation strategies studied and assessed (Month 20)	To be developed (we have already identified certain adaptation strategies being used around the city)
M9: Presentation of results to policy and decision makers in our region (Month 20)	To be done
M10: Improved risk management plans developed (Month 22)	To be done
M11: Attended the final CLIMAAX workshop held in Brussels (Month 22).	To be done

5 Supporting documentation

Besides the main report for the completion of Phase 1 (CLIMAAX_Report_Phase1.docx), we also attach various documents and products related to the work conducted. We summarize the outputs submitted to the Zenodo repository in the following table.

Table 5-1. List of documents and data submitted as products of this Phase.

Description	*Filename*
Main Report	CLIMAAX_Report_Phase1.docx
Dataset: Age and sex structures for Cyprus, 2025 from WorldPop Hub	cyp_agesex_structures_2025_CN_1km.zip
Dataset: Landsat8 land surface temperature (LST) from RSLab portal, spatial resolution of 30x30m	LSTdatasetNicosia.zip
Dataset: Nicosia Monthly Precipitation (7 regions)	NicosiaMonthlyPrecipitationDataset.csv
Photos from dissemination actions: METACITIES workshop on UHI effect	UHIE_Workshop.zip
Code for the modified drought risk assessment and visualization	ModifiedDroughtCodeRiskAssesmentVisualization.py
List of stakeholders	StakeholderList.xlxs

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