CLIMAAX
climate ready regions

Deliverable Phase 3 – Climate risk management

Comunidade Intermunicipal da Beira Baixa (CIM-BB)

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Abbreviations and acronyms

Abbreviation / acronym	Description
AGIF	Agência para a Gestão Integrada de Fogos Rurais (Agency for Integrated Rural Fire Management)
ANEPC	Autoridade Nacional de Emergência e Proteção Civil (National Authority for Emergency and Civil Protection)
CCDR	Comissão de Coordenação e Desenvolvimento Regional (Regional Coordination and Development Commission)
CIM-BB	Comunidade Intermunicipal da Beira Baixa (Intermunicipal Community of Beira Baixa)
CRA	Climate Risk Assessment
CRM	Climate Risk Management
ICNF	Instituto da Conservação da Natureza e das Florestas (Institute for Nature Conservation and Forests)
KPI	Key Performance Indicator
LST	Land Surface Temperature
NDVI	Normalized Difference Vegetation Index
PDM	Plano Diretor Municipal (Municipal Master Plan)
PIAAC-BB	Plano Intermunicipal de Adaptação às Alterações Climáticas da Beira Baixa (Intermunicipal Climate Change Adaptation Plan of Beira Baixa)
RCP	Representative Concentration Pathway
SMPC	Serviço Municipal de Proteção Civil (Municipal Civil Protection Service)

Executive summary

This deliverable presents the outcomes of Phase 3 – Climate Risk Management (CRM) of the CLIMAAX project for the Comunidade Intermunicipal da Beira Baixa (CIM-BB). Building upon the Climate Risk Assessment (CRA) developed during Phases 1 and 2, this phase translated the identified priority climate risks into a practical and coordinated Climate Risk Management strategy aimed at strengthening the region's resilience to climate change.

The work addresses the need to move from climate risk assessment to implementation-oriented adaptation planning. While the previous phases established the regional climate risk baseline and identified rural wildfires and heatwaves as the priority climate risks affecting the territory, Phase 3 focused on defining how these risks can be managed through integrated governance, adaptation planning, stakeholder collaboration and implementation mechanisms. This deliverable therefore provides a comprehensive framework that supports municipalities and regional organisations in incorporating climate adaptation into planning processes, policy development and future investment decisions.

The main activities undertaken during this phase included the development of a Climate Risk Management framework tailored to the Beira Baixa region; the preparation of a portfolio of adaptation measures addressing the two priority climate risks; the definition of governance arrangements, implementation roadmaps and monitoring mechanisms; the assessment of enabling conditions for effective Climate Risk Management; and the continued engagement of municipalities, civil protection authorities, health organisations, environmental agencies and other regional stakeholders throughout the co-development and validation process.

The results demonstrate that effective Climate Risk Management requires a coordinated, multi-level and cross-sectoral approach combining structural and non-structural measures, nature-based solutions, public health interventions, spatial planning, institutional cooperation and stakeholder participation. The proposed strategy establishes clear Climate Risk Management objectives, identifies the policy instruments that can support implementation, defines monitoring indicators and provides guidance for integrating climate adaptation into regional and municipal planning frameworks. The project also highlights the importance of continuously updating climate information, strengthening institutional capacities and maintaining collaborative governance arrangements to ensure long-term adaptation to evolving climate conditions.

By connecting the findings of the Climate Risk Assessment with practical adaptation measures, Phase 3 completes the CLIMAAX methodological process for the Beira Baixa region. The proposed Climate Risk Management strategy provides an evidence-based framework that supports informed decision-making, strengthens institutional capacity and contributes to the long-term resilience of communities, ecosystems, critical infrastructure and economic activities.

In conclusion, the deliverable demonstrates that the transition from Climate Risk Assessment to Climate Risk Management is both feasible and operationally relevant when supported by robust scientific evidence, stakeholder engagement and effective governance. The outcomes achieved during Phase 3 establish a solid foundation for the future implementation, monitoring and continuous improvement of climate adaptation measures, ensuring that the knowledge generated throughout the CLIMAAX project can continue to support resilient territorial development well beyond the project's lifetime.

1 Introduction

The CLIMAAX project supports European regions and communities in strengthening their resilience to climate change by applying a transparent, harmonised and evidence-based Climate Risk Assessment (CRA) and Climate Risk Management (CRM) framework. For the Comunidade Intermunicipal da Beira Baixa (CIM-BB), the project has been implemented through a progressive three-phase approach, enabling the transition from climate risk identification to the definition of practical adaptation and risk management measures.

Phase 1 established the regional climate risk assessment baseline by defining the territorial context, engaging relevant stakeholders and identifying the climate hazards with the greatest relevance for the region. Phase 2 expanded this work through a detailed assessment of priority risks, refining the analysis of hazard, exposure, vulnerability and resilience capacity using regional datasets and stakeholder contributions. The results confirmed rural wildfires and heatwaves as the two priority climate risks requiring coordinated adaptation efforts across the territory.

Building upon these findings, Phase 3 focuses on Climate Risk Management (CRM), translating the knowledge generated during the previous phases into a structured portfolio of adaptation measures and implementation mechanisms. Rather than reassessing climate risks, this phase concentrates on identifying feasible responses, strengthening governance arrangements, supporting integration into existing planning instruments and promoting coordinated action among the institutions responsible for climate adaptation and civil protection within the Beira Baixa region.

This deliverable presents the activities undertaken during Phase 3 and documents how the results of the Climate Risk Assessment have been transformed into practical climate risk management actions tailored to the regional context. It also demonstrates how stakeholder engagement, policy integration and implementation planning contribute to strengthening the long-term resilience of the Beira Baixa territory to the impacts of climate change.

1.1 Main objectives of the project

The overall objective of Phase 3 was to support the transition from climate risk assessment to climate risk management within the Beira Baixa region by developing a coherent set of adaptation measures capable of addressing the priority climate risks identified during the previous phases of the CLIMAAX project.

Based on the results of the regional Climate Risk Assessment, Phase 3 sought to strengthen the capacity of the Comunidade Intermunicipal da Beira Baixa (CIM-BB) and its municipalities to implement practical and coordinated adaptation actions that enhance territorial resilience while supporting informed decision-making at both municipal and intermunicipal levels.

More specifically, the objectives of this phase were to:

- translate the results of the Climate Risk Assessment into operational Climate Risk Management measures;
- co-develop adaptation actions addressing the two priority climate risks identified for the region, namely rural wildfires and heatwaves;
- define implementation roadmaps, governance arrangements, monitoring indicators and institutional responsibilities for each proposed action;
- promote the integration of climate adaptation measures into regional and municipal planning and decision-making processes;

- strengthen coordination among municipalities, civil protection authorities, sectoral organisations and other relevant stakeholders;
- support the long-term implementation of adaptation measures through practical recommendations, monitoring mechanisms and implementation guidance;
- contribute to increasing the resilience of communities, ecosystems, critical infrastructure and public services to future climate change impacts.

Through these objectives, Phase 3 represents the operational component of the CLIMAAX methodology, transforming scientific evidence and stakeholder knowledge into a practical framework for climate risk management that can support future adaptation investments and policy implementation across the Beira Baixa region.

1.2 Project team

The implementation of Phase 3 was carried out through a collaborative partnership involving CIM-BB, INOVA+ and Greenmetrics.ai, combining institutional coordination, project management, scientific expertise and stakeholder engagement.

CIM-BB ensured the overall regional coordination of the project, facilitating the interaction with the member municipalities and regional stakeholders while validating the strategic orientation of the proposed Climate Risk Management measures. INOVA+ was responsible for the overall project management and coordination of activities, including the organisation of stakeholder engagement processes, the development of the regional Climate Risk Management strategy and the preparation of the project deliverables. Greenmetrics.ai provided specialised technical support, contributing scientific expertise, geospatial analysis and technical validation to ensure that the proposed management measures remained fully aligned with the results of the Climate Risk Assessment developed during the previous project phases.

1.3 Outline of the document's structure

This deliverable is organised into eight chapters. Following this introduction, Chapter 2 presents the regional profile, summarising the main findings of the Climate Risk Assessment developed during the previous phases, the existing climate risk management context, the principal governance and policy mechanisms, and the lessons learned from past climate-related events.

Chapter 3 constitutes the core of the deliverable and describes the Climate Risk Management framework developed during Phase 3. It presents the objectives of the climate risk management process, the enabling conditions for successful implementation, the portfolio of proposed adaptation measures and their integration into regional planning and decision-making processes.

Chapter 4 evaluates the outcomes of the project, including the usability of the developed results and the main lessons learned throughout the implementation process.

Chapter 5 summarises the principal conclusions of Phase 3, while Chapter 6 presents the overall progress evaluation, including the main outputs produced during the project.

Finally, Chapters 7 and 8 provide the supporting documentation and references that underpin the analyses and recommendations presented throughout this deliverable.

2 Local profile

2.1 Summary of Key Risk Assessment results

The Climate Risk Assessment (CRA) conducted during Phases 1 and 2 of the CLIMAAX project established the evidence base for Climate Risk Management (CRM) in the Beira Baixa region. Following the CLIMAAX methodological framework, the assessment combined climate projections, territorial characteristics, exposure, vulnerability and resilience analyses with an extensive stakeholder engagement process to identify the climate risks requiring priority intervention.

Phase 1 identified the principal climate hazards affecting the region and established an initial prioritisation of risks. Phase 2 subsequently refined this assessment through the integration of higher-resolution regional datasets, improved hazard modelling and a more detailed evaluation of exposure, vulnerability and resilience capacity. The resulting Key Risk Assessment Evaluation Dashboard provided the basis for prioritising climate risks and defining strategic focus of Phase 3.

The assessment consistently identified rural wildfires and heatwaves as the priority climate risks for the Comunidade Intermunicipal da Beira Baixa (CIM-BB). Both hazards are projected to intensify under future climate scenarios and are expected to generate increasing impacts on communities, ecosystems, critical infrastructure and economic activities. Beyond hazard intensity, the assessment highlighted the influence of demographic ageing, dispersed settlements, extensive forest landscapes, urban heat islands and critical infrastructure exposure on the overall climate risk profile of the region.

These findings established the foundation for the Climate Risk Management strategy developed during Phase 3, which translates the identified risks into a coordinated portfolio of adaptation measures integrating prevention, preparedness, governance, spatial planning and institutional cooperation.

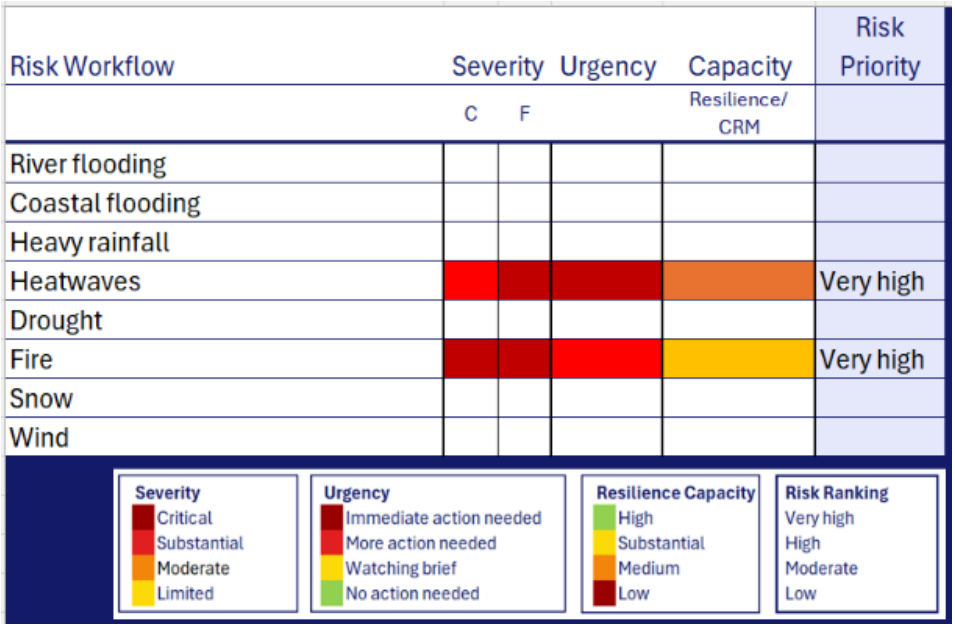


Figure 1 - Key Risk Assessment Evaluation Dashboard (Phase 2 Deliverable – Figure 2-24).

Table 1 – Summary of Priority Climate Risks and Resilience Capacity

Priority climate risk	*Resilience capacity*	*Description of the resilience capacity (such as existing knowledge, planned measures, gaps)*	*Stakeholders, experts and priority groups involved in the key risk assessment & modality of engagement*
Rural Wildfires	*Substantial*	*The region benefits from well-established civil protection structures, specialised firefighting organisations, existing forest management instruments and significant institutional experience in wildfire response. However, projected climate change, ageing population, fragmented land ownership and fuel accumulation continue to create important challenges requiring additional preventive and adaptation measures.*	*CIM-BB, municipalities, ANEPC, ICNF, AGIF, GNR, Fire Brigades, Forest Owners Associations, Civil Protection Services, regional technical experts, local stakeholders.*
Heatwaves	*Medium*	*Although national warning systems and public health contingency plans are in place, the region presents important vulnerabilities associated with an ageing population, dispersed settlements, urban heat islands and limited territorial monitoring of health impacts. Institutional coordination exists but requires further strengthening through integrated adaptation measures and improved local monitoring systems.*	*CIM-BB, municipalities, Local Health Units, Public Health Authorities, Social Services, Civil Protection, ADENE, regional experts, vulnerable population representatives and other local stakeholders.*

For rural wildfires, the region benefits from well-established emergency response structures, specialised operational organisations and extensive institutional experience. However, projected increases in wildfire intensity, combined with fragmented land ownership, fuel accumulation and demographic change, reinforce the need to strengthen prevention, landscape management and intermunicipal coordination.

For heatwaves, resilience capacity remains comparatively lower despite the existence of national warning systems and public health contingency mechanisms. The assessment identified important gaps related to local monitoring of heat-related impacts, protection of vulnerable populations and the integration of climate adaptation into urban planning and public health policies.

Stakeholder engagement was fundamental throughout the assessment process. Representatives from municipalities, civil protection authorities, environmental agencies, health services, academia and other regional organisations contributed to risk identification, validation of results and prioritisation of adaptation needs. This collaborative process ensured that the Climate Risk Management measures presented in Phase 3 respond to regional priorities and implementation needs.

2.2 Key implementation mechanisms and policy context for CRM

The implementation of Climate Risk Management (CRM) in the Beira Baixa region builds upon existing policy instruments, governance mechanisms and institutional responsibilities operating

across local, regional, national and European levels. Rather than creating new governance structures, the CRM strategy developed during Phase 3 seeks to strengthen and complement existing planning instruments, ensuring that climate adaptation becomes an integral component of territorial development and decision-making.

Spatial planning and territorial governance

Spatial planning provides one of the principal mechanisms for integrating climate adaptation into long-term territorial development. Municipal and intermunicipal planning instruments regulate land use, urban development, landscape management and infrastructure planning, creating opportunities to systematically incorporate climate risk considerations into future planning decisions.

The proposed CRM measures are aligned with the ongoing implementation and future revision of the Intermunicipal Climate Change Adaptation Plan (PIAAC-BB), Municipal Master Plans (PDM), Municipal Emergency Plans, Municipal Civil Protection Plans and other territorial management instruments. Their integration into these frameworks supports more resilient urban development, improved wildfire prevention and enhanced protection of vulnerable communities.

Sectoral policy integration

Climate Risk Management requires coordinated action across multiple policy sectors.

Within the forestry sector, adaptation is supported through existing forest management policies, fuel management programmes and civil protection responsibilities, providing the institutional basis for wildfire prevention, protection of critical infrastructure and landscape management.

Urban planning contributes through sustainable development policies promoting green infrastructure, nature-based solutions and climate-resilient public spaces, supporting measures to mitigate urban heat islands and improve thermal comfort.

The public health sector plays a central role in heatwave adaptation through contingency planning, health surveillance and protection of vulnerable populations. The proposed CRM measures reinforce these mechanisms by improving territorial monitoring, communication and coordination between municipalities, health authorities and civil protection services.

Climate adaptation is also closely linked to water management, biodiversity conservation and agriculture, recognising that healthy ecosystems and sustainable natural resource management contribute directly to reducing climate vulnerability while generating environmental, social and economic co-benefits.

Multi-level governance

Effective implementation requires coordinated action across different governance levels.

Municipalities are responsible for integrating adaptation measures into local planning instruments and investment programmes. At the intermunicipal level, CIM-BB provides strategic coordination, facilitating cooperation between municipalities and promoting knowledge sharing. National authorities contribute regulatory guidance, technical expertise and funding opportunities, while European policies—including the European Green Deal, the EU Strategy on Adaptation to Climate Change and the EU Civil Protection Mechanism—provide the overarching policy framework supporting long-term climate resilience.

Private stakeholders, including infrastructure operators, forest owners, agricultural organisations, businesses and civil society, also play a key role in implementing many of the proposed adaptation measures.

Policy objectives supporting Climate Risk Management

The proposed CRM strategy contributes to multiple policy objectives across governance levels, including:

- strengthening territorial resilience to climate change;
- reducing wildfire and heatwave risk;
- protecting vulnerable populations and critical infrastructure;
- promoting sustainable land use and integrated landscape management;
- supporting biodiversity conservation and ecosystem resilience;
- fostering climate-resilient urban development through nature-based solutions;
- strengthening institutional coordination and evidence-based decision-making;
- integrating climate adaptation into territorial planning and sectoral policies.

By aligning the proposed measures with existing governance and policy frameworks, the CRM strategy facilitates institutional ownership, supports access to future funding opportunities and establishes favourable conditions for the long-term implementation of climate adaptation beyond the lifetime of the CLIMAAX project.

2.3 Key actors and systems for CRM

Effective Climate Risk Management (CRM) in the Beira Baixa region depends on coordinated action involving public authorities, emergency services, environmental organisations, health institutions, infrastructure managers, research organisations, private stakeholders and local communities. As climate risks affect multiple sectors simultaneously, successful adaptation requires cooperation across institutional mandates and governance levels.

Throughout the CLIMAAX project, stakeholder engagement evolved progressively from risk identification during Phase 1, to validation of the Climate Risk Assessment during Phase 2, and finally to the co-development and prioritisation of Climate Risk Management measures during Phase 3. This participatory process ensured that the proposed measures reflect regional priorities, operational experience and institutional capacities while promoting long-term ownership of the adaptation strategy.

Table 2 summarises the principal organisations involved in Climate Risk Management, their respective roles and responsibilities, implementation needs, opportunities and barriers, together with their participation throughout the project.

The stakeholder mapping confirms that the Beira Baixa region benefits from a broad institutional network with complementary responsibilities across climate adaptation, civil protection, territorial planning, environmental management and public health. The main challenge identified is therefore not the absence of competent organisations, but the need to strengthen coordination mechanisms, information sharing and the systematic integration of climate adaptation into sectoral planning and investment decisions. These findings directly informed the governance measures proposed in Chapter 3.

Table 2 – Key actors involved in Climate Risk Management

Key actors	*Role and responsibility*	*Motivation and needs*	*Opportunities related to their active involvement in CRM*	*Barriers related to their active involvement in CRM*	*Type of engagement*
CIM-BB	*Overall coordination of the CLIMAAX project at regional level; coordination of municipalities; promotion of Climate Risk Management (CRM); integration of adaptation measures into intermunicipal strategies and planning instruments.*	*Strengthen regional resilience, improve intermunicipal coordination, support evidence-based decision-making and facilitate implementation of adaptation measures.*	*Strong institutional leadership, capacity to coordinate multiple municipalities and facilitate knowledge transfer across the region.*	*Dependence on external funding and the need to align priorities among municipalities.*	*Scoping: project coordination and stakeholder identification. Risk Exploration & Risk Analysis: validation of priorities and territorial needs. Key Risk Assessment: participation in risk validation workshop. Phase 3: co-development of adaptation measures and implementation roadmap.*
Municipalities of Beira Baixa	*Local implementation of adaptation measures; integration into municipal planning, emergency management and spatial planning; support to local stakeholder engagement.*	*Protect local communities, reduce climate vulnerability and improve municipal preparedness.*	*Direct implementation capacity, detailed local knowledge and proximity to citizens.*	*Limited financial and technical resources; different implementation capacities between municipalities.*	*Participated throughout all project phases, including surveys, workshops, technical validation sessions and co-development of CRM measures.*
Civil Protection Authorities (ANEPC, Municipal Civil	*Emergency preparedness and response; operational planning; wildfire prevention and*	*Improve operational preparedness, reduce disaster impacts and*	*Extensive operational experience and direct knowledge of territorial risks.*	*Increasing operational pressure due to more frequent extreme events and resource limitations.*	*Engaged during Scoping, Risk Exploration, validation of wildfire analyses, prioritisation of*

Protection Services and Fire Brigades)	*suppression; support to heatwave emergency planning.*	*strengthen emergency response capacity.*			*adaptation measures and review of implementation actions.*
National and Regional Authorities (ICNF, AGIF, CCDR, APA, Health Authorities)	*Regulatory oversight, technical guidance, sectoral policy implementation and support to climate adaptation, forestry management, biodiversity conservation, public health and environmental protection.*	*Ensure implementation of national climate adaptation policies and strengthen regional resilience.*	*Availability of technical expertise, regulatory instruments and funding mechanisms.*	*Coordination across multiple institutions and sectoral priorities may delay implementation.*	*Participated through technical consultation, provision of datasets, validation of analytical outputs and discussion of policy integration opportunities.*
Research Institutions and Technical Partners (INOVA+, Greenmetrics.ai, Universities)	*Climate modelling, spatial analysis, risk assessment, development of adaptation measures, stakeholder facilitation and technical support.*	*Produce robust scientific evidence supporting regional decision-making and adaptation planning.*	*Scientific expertise, innovation capacity and interdisciplinary knowledge.*	*Availability of long-term funding for continued technical support beyond the project duration.*	*Responsible for developing the CRA methodology, supporting stakeholder engagement, producing technical analyses and facilitating Phase 3 adaptation planning.*
Infrastructure Operators, Forest Owners Associations, Agricultural Organisation's, NGOs and Local Communities	*Management of critical infrastructure, landscape management, implementation of local adaptation actions, awareness raising and community participation.*	*Reduce operational risks, protect assets and livelihoods, improve local resilience and increase awareness of climate risks.*	*Local knowledge, direct implementation potential and contribution to long-term territorial resilience.*	*Fragmented landownership, different Organisation al capacities, limited financial resources and varying levels of awareness and engagement.*	*Engaged through stakeholder surveys, regional workshops, technical meetings and consultation during the definition and validation of Climate Risk Management measures.*

2.4 Lessons learned from past events

The Past climate-related events in the Beira Baixa region have provided valuable experience for strengthening Climate Risk Management (CRM). The Climate Risk Assessment undertaken during Phases 1 and 2 confirmed that both rural wildfires and heatwaves are becoming increasingly influenced by climate change, reinforcing the need to complement emergency response with long-term prevention, preparedness and adaptation measures.

Lessons from rural wildfires

Historical wildfire events have demonstrated that effective risk reduction depends not only on suppression capacity but also on prevention, landscape management and institutional coordination. Increasing fire intensity under future climate conditions may exceed operational response capacities during extreme events, highlighting the importance of fuel management, protection of critical infrastructure, operational accessibility and the integration of wildfire risk into spatial planning.

The Climate Risk Assessment further demonstrated the value of combining hazard projections with information on territorial vulnerability, infrastructure exposure and operational constraints. This integrated approach provides a stronger evidence base for prioritising adaptation investments and improving preparedness.

Lessons from heatwaves

Recent heatwave events have highlighted the growing vulnerability of older adults, socially isolated populations and other at-risk groups, while increasing pressure on health and social care systems. The assessment also identified important gaps in the local monitoring of heat-related impacts, limiting the ability to evaluate long-term trends and adaptation effectiveness.

High-resolution Land Surface Temperature (LST) analyses confirmed that thermal exposure varies significantly within urban areas, supporting the prioritisation of green infrastructure, urban cooling measures and targeted protection of vulnerable populations.

Cross-cutting lessons for Climate Risk Management

Experience from both hazards demonstrates that effective Climate Risk Management requires coordinated action across civil protection, public health, spatial planning, forestry, infrastructure management and environmental governance. While the region benefits from experienced institutions and established emergency management systems, future climate scenarios require a progressive shift from reactive emergency response towards proactive risk reduction and long-term resilience building.

The assessment also highlighted the importance of clearly defined institutional responsibilities, continuous stakeholder cooperation and the integration of climate projections with demographic, environmental and socio-economic information. These lessons directly informed the Climate Risk Management strategy and the portfolio of adaptation measures presented in Chapter 3.

3 Climate risk management – phase 3

3.1 CRM objectives

The Climate Risk Management (CRM) objectives for the Beira Baixa region were developed as the operational response to the Climate Risk Assessment (CRA) undertaken during Phases 1 and 2 of the CLIMAAX project. While the previous phases focused on identifying, analysing and prioritising the region's climate risks, Phase 3 translates this evidence into a coherent and implementation-oriented framework that supports decision-making, investment planning and long-term climate adaptation.

The definition of the CRM objectives follows the principles established by the CLIMAAX Framework, which promotes evidence-based decision-making, stakeholder participation and the integration of climate adaptation into existing governance structures and territorial planning processes. Accordingly, the proposed objectives are designed not only to reduce the impacts of the priority climate risks identified for the Beira Baixa region—rural wildfires and heatwaves—but also to strengthen the institutional, environmental and social conditions required to sustain climate resilience over time.

The objectives were defined through the combination of three complementary sources of evidence. Firstly, the Climate Risk Assessment provided a detailed understanding of the hazards, exposure, vulnerabilities and resilience capacities affecting the region under both current and future climate scenarios. Secondly, the stakeholder engagement process carried out throughout the three phases of the project enabled the validation of priorities and ensured that the proposed objectives reflected local operational needs and implementation capacities. Finally, the review of existing regional and national policy instruments ensured that the Climate Risk Management strategy remains fully aligned with the institutional framework already guiding territorial planning, civil protection, environmental management and climate adaptation.

Rather than proposing isolated actions, the CRM objectives establish a strategic framework capable of guiding future implementation, monitoring and continuous improvement. They define the expected outcomes of the Climate Risk Management process and provide the basis for selecting adaptation measures, identifying implementation priorities and evaluating progress over time. The inclusion of measurable indicators further supports adaptive management by enabling municipalities and regional organisations to periodically assess implementation progress, identify emerging challenges and update priorities as climate conditions and territorial needs evolve.

The proposed objectives are organised into two complementary groups. Primary objectives directly address the two priority climate risks identified through the Climate Risk Assessment and establish the principal outcomes expected from the implementation of the Climate Risk Management strategy. Additional objectives reinforce broader dimensions of resilience, recognising that effective climate adaptation also depends on environmental quality, social cohesion, institutional cooperation and equitable access to adaptation benefits. Together, these objectives provide a comprehensive framework capable of supporting both immediate risk reduction and long-term regional resilience.

Table 3 - Primary objectives

Primary objectives	*Examples of assessment indicators*
Reduce the impacts of rural wildfires on communities, ecosystems and critical infrastructure	*Area covered by fuel management interventions (ha); Number of municipalities implementing wildfire adaptation measures; Reduction of critical infrastructure exposed to high wildfire risk; Length of strategic fuel management corridors implemented (km).*
Strengthen preparedness and operational capacity for wildfire response	*Percentage of high-risk areas with improved operational accessibility; Coverage of strategic water supply points; Response time to high-risk areas; Number of updated Municipal Emergency Plans incorporating future climate risk.*
Reduce heatwave impacts on vulnerable populations	*Number of municipalities implementing Heatwave Action Plans; Population covered by early warning and communication systems; Reduction in the number of vulnerable people exposed to urban heat hotspots; Number of public facilities equipped with heat adaptation measures.*
Increase urban resilience to extreme heat through climate-adapted planning	*Area of new or improved green infrastructure (ha); Number of municipalities integrating thermal comfort criteria into planning instruments; Surface area benefiting from urban cooling interventions; Number of climate adaptation measures implemented in public spaces.*
Strengthen institutional capacity for Climate Risk Management	*Number of intermunicipal coordination initiatives implemented; Number of stakeholders involved in CRM implementation; Periodic monitoring reports produced; Percentage of CRM actions under implementation.*

The primary objectives focus on reducing the direct impacts of rural wildfires and heatwaves while simultaneously strengthening preparedness, institutional capacity and territorial resilience. Their associated indicators were selected to reflect measurable implementation outcomes that can be progressively monitored using existing municipal, intermunicipal and national information systems. Whenever possible, the indicators are linked to existing planning instruments and operational responsibilities, facilitating future integration into monitoring and reporting activities without creating additional administrative burdens.

The selected indicators also recognise that adaptation is a progressive process. While some indicators measure tangible physical interventions—such as the implementation of fuel management areas or green infrastructure—others capture improvements in governance, institutional coordination and planning capacity. This combination provides a more comprehensive understanding of implementation progress, recognising that successful Climate Risk Management depends equally on structural interventions and on strengthening the institutional capacities required to sustain them over time.

However, reducing climate risk requires more than hazard-specific interventions. The Climate Risk Assessment demonstrated that demographic trends, ecosystem conditions, governance arrangements and institutional cooperation significantly influence the overall resilience of the Beira Baixa region. Consequently, a second group of complementary objectives was defined to address these broader dimensions of Climate Risk Management.

Table 4 - Additional objectives

Additional objectives	*Examples of assessment indicators*
Public health	*Reduction in heat-related hospital admissions; Number of vulnerable people covered by prevention programs; Number of awareness campaigns implemented.*
Environmental quality	*Area of restored ecosystems; Increase in landscape connectivity; Area benefiting from nature-based solutions.*
Biodiversity conservation	*Protected habitats benefiting from wildfire prevention measures; Number of ecosystem restoration actions implemented.*
Social resilience	*Number of citizens participating in awareness and preparedness activities; Level of stakeholder engagement in CRM implementation.*
Governance and institutional cooperation	*Number of joint initiatives between municipalities and regional Organisation's; Frequency of coordination meetings; Level of integration of CRM into planning instruments.*
Justice and equity	*Number of adaptation measures specifically targeting vulnerable population groups; Number of municipalities incorporating social vulnerability criteria into adaptation planning.*

The additional objectives extend the Climate Risk Management strategy beyond the direct management of wildfire and heatwave risks by promoting conditions that increase the long-term adaptive capacity of the territory. Public health, ecosystem resilience, biodiversity conservation, social cohesion, governance and equity are recognised as essential components of a comprehensive adaptation strategy, contributing to the reduction of systemic vulnerabilities and enhancing the effectiveness of the proposed adaptation measures.

Particular attention has been given to the principles of justice and equity promoted by the CLIMAAX Framework. Climate change does not affect all communities equally, and certain population groups—including older adults, children, socially isolated individuals and communities located in areas of higher wildfire exposure or greater urban heat stress—face disproportionately higher levels of vulnerability. The proposed objectives therefore seek to ensure that adaptation measures prioritise those populations with the greatest needs while promoting equitable access to the benefits generated by climate adaptation investments.

Similarly, the proposed governance approach recognises that effective Climate Risk Management requires continuous collaboration between municipalities, civil protection authorities, public health organisations, environmental agencies, infrastructure managers, research institutions and local communities. Maintaining this collaborative governance model beyond the duration of the CLIMAAX project will be fundamental to ensuring the successful implementation, monitoring and continuous improvement of the proposed adaptation measures.

Taken together, the primary and additional objectives establish a balanced Climate Risk Management framework that combines immediate risk reduction with long-term resilience building. While the primary objectives focus on reducing the impacts of the priority climate risks, the complementary objectives strengthen the institutional, environmental and social conditions required to sustain adaptation over time. This integrated approach ensures that Climate Risk Management becomes an ongoing governance process rather than a one-off planning exercise, allowing municipalities and regional stakeholders to progressively refine adaptation priorities as new climate information, monitoring results and implementation experience become available.

The definition of measurable objectives and associated indicators also provides the foundation for adaptive management. By enabling periodic monitoring, evaluation and revision of implemented measures, the proposed framework supports evidence-based decision-making and facilitates the continuous improvement of regional climate governance. In this way, the Climate Risk Management strategy developed during Phase 3 not only addresses the current climate challenges identified through the Climate Risk Assessment but also establishes a flexible and robust framework capable of supporting the Beira Baixa region in responding to future climate uncertainties and evolving territorial needs.

3.2 Supportive elements for effective CRM

The successful implementation of the Climate Risk Management (CRM) strategy in the Beira Baixa region depends not only on the quality of the proposed adaptation measures but also on the existence of enabling conditions that ensure their long-term implementation, coordination and continuous improvement. Climate adaptation is an iterative process requiring appropriate governance arrangements, institutional capacity, technical knowledge, financial resources and stakeholder commitment. Consequently, the effectiveness of the proposed Climate Risk Management strategy should be understood not only through the measures themselves, but also through the institutional environment that supports their implementation.

The Climate Risk Assessment undertaken during Phases 1 and 2, together with the stakeholder engagement process conducted throughout Phase 3, enabled the identification of both the principal strengths already existing within the region and the remaining barriers that may limit the implementation of adaptation measures. These findings demonstrate that the Beira Baixa region already possesses an important institutional basis for Climate Risk Management, although further coordination, capacity building and integration between organisations will be necessary to maximise implementation effectiveness.

The supportive elements presented in this section therefore represent the enabling framework upon which the proposed Climate Risk Management strategy is built. Rather than constituting individual adaptation measures, they describe the institutional, organisational and technical conditions required to ensure that the proposed actions can be implemented efficiently, monitored consistently and progressively improved over time.

Table 5 - Supportive elements for effective CRM

Supportive elements for effective CRM	*Description*
Knowledge and data (e.g., institutional capacity, risk understanding)	*The Climate Risk Assessment developed during Phases 1 and 2 provides a robust evidence base for decision-making, combining regional climate projections, exposure and vulnerability assessments, stakeholder knowledge and locally refined datasets. Continued monitoring, periodic updates of climate information and integration of new datasets will further strengthen evidence-based Climate Risk Management.*
Tech and infrastructure (e.g., early warning systems, monitoring platforms, irrigation systems, green/grey	*The region benefits from existing civil protection systems, wildfire monitoring capabilities, emergency response infrastructure and meteorological warning systems. Future implementation should reinforce monitoring platforms, critical infrastructure resilience, urban green infrastructure, operational accessibility and digital tools supporting climate adaptation and emergency management.*

infrastructure to upgrade)	
Social-behavioral aspects (e.g., behavioral change, risk awareness, social capital/networks, trust, social norms)	*Effective adaptation requires increasing public awareness of climate risks, promoting behavioral change, strengthening community preparedness and encouraging collaboration between public authorities, local communities and private stakeholders. Building trust and improving climate risk communication are fundamental for successful implementation.*
Citizen engagement	*Stakeholder participation throughout the CLIMAAX project demonstrated the importance of involving municipalities, civil protection Organisations, health authorities, environmental agencies, infrastructure managers, landowners, businesses and local communities in the development of adaptation measures. Continued participatory processes will facilitate implementation, increase local ownership and improve the long-term sustainability of Climate Risk Management actions.*
Finances & resources	*Successful implementation will require mobilization of financial resources from municipal, national and European funding programs, together with adequate technical and human resources. The proposed implementation roadmap supports the prioritization of investments and facilitates the alignment of future funding opportunities with regional adaptation priorities.*
Governance arrangements & political leadership (e.g., coordination mechanisms, mandate clarity)	*The CIM-BB provides the institutional framework necessary to coordinate Climate Risk Management across municipalities and sectors. Continued political commitment, clearly defined institutional responsibilities and effective coordination mechanisms between regional, national and local Organisations will be essential to ensure coherent implementation, monitoring and continuous improvement of the proposed adaptation measures.*

Taken together, these supportive elements establish the institutional environment necessary for implementing the Climate Risk Management strategy proposed for the Beira Baixa region. They demonstrate that successful climate adaptation depends not only on the definition of appropriate adaptation measures but also on the capacity of institutions to cooperate, mobilise resources, generate knowledge and continuously improve implementation practices.

The combination of robust scientific evidence, collaborative governance, adequate institutional capacity, sustainable financing and adaptive monitoring provides a solid foundation for translating the Climate Risk Assessment into effective and lasting Climate Risk Management. These enabling conditions also strengthen the resilience of regional institutions themselves, ensuring that climate adaptation remains embedded within territorial governance long after the completion of the CLIMAAX project.

3.3 Potential CRM measures

Building upon the Climate Risk Assessment developed during Phases 1 and 2, Phase 3 translated the identified priority climate risks into a coherent portfolio of Climate Risk Management (CRM) measures addressing both current and projected future impacts. The proposed measures combine structural interventions, governance improvements, ecosystem-based approaches, spatial planning, public health actions and capacity-building initiatives.

The portfolio has been designed to reduce the impacts of rural wildfires and heatwaves while strengthening the long-term adaptive capacity of municipalities, institutions and local communities. Rather than considering adaptation as a standalone investment, the proposed measures promote the systematic integration of climate resilience into territorial planning, infrastructure management, public services and future investment decisions.

The measures were developed through a participatory process involving municipalities, civil protection organisations, environmental authorities, health institutions and other regional stakeholders, ensuring that they are technically feasible, institutionally supported and aligned with existing planning instruments.

Table 6 - Potential Climate Risk Management Measures

Key climate risk	*CRM measure*	*Effectiveness / Risk reduction*	*Contribution to CRM objectives*	*Possible co-benefits*	*Time line*	*Responsible Organisation*	*Possible adaptation limits*
Rural Wildfires	*Integrated Wildland–Urban Interface Management, including fuel management, protection of settlements and strategic landscape interventions.*	*High*	*Reduces wildfire exposure of communities and critical assets while increasing landscape resilience.*	*Biodiversity conservation, landscape restoration, reduced economic losses and improved public safety.*	*Medium term*	*CIM-BB, Municipalities, ICNF, AGIF*	*Fragmented land ownership, maintenance requirements and financial constraints.*
Rural Wildfires	*Improvement of operational preparedness through enhanced accessibility, protection of critical infrastructure and integration into emergency planning.*	*High*	*Improves emergency response capacity and reduces disruption of essential services.*	*Increased operational efficiency and protection of strategic infrastructure.*	*Short term*	*Municipalities, Civil Protection Authorities, Infrastructure Operators*	*Increasing wildfire intensity under future climate scenarios may exceed operational capacity.*

Rural Wildfires	*Strengthening intermunicipal governance and integrated wildfire risk management.*	*Medium*	*Improves coordination, planning consistency and long-term implementation of adaptation measures.*	*Institutional capacity building, improved decision-making and more efficient resource allocation.*	*Long term*	*CIM-BB, Municipalities*	*Long-term political commitment and institutional coordination required.*
Heatwaves	*Climate-resilient urban planning through urban greening, thermal comfort measures and nature-based solutions.*	*High*	*Reduces urban heat exposure and improves resilience of public spaces.*	*Improved environmental quality, biodiversity, air quality and citizens' well-being.*	*Medium term*	*Municipalities, CIM-BB*	*Limited urban space availability and investment capacity.*
Heatwaves	*Protection of vulnerable populations through health monitoring, early warning systems and targeted communication strategies.*	*High*	*Reduces health impacts associated with extreme heat, particularly for vulnerable groups.*	*Improved public health, social inclusion and emergency preparedness.*	*Medium term*	*Municipalities, Health Authorities, Civil Protection*	*Limited availability of local health data and demographic changes.*
Heatwaves	*Integration of climate adaptation into public buildings and municipal infrastructure investments.*	*Medium*	*Improves resilience of essential public services and infrastructure.*	*Lower energy consumption, improved comfort and reduced operational costs.*	*Long term*	*Municipalities, Infrastructure Managers*	*Financial resources and building renovation constraints.*
Heatwaves	*Capacity building, stakeholder engagement and continuous monitoring of Climate Risk Management implementation.*	*Medium*	*Supports adaptive management, continuous improvement and evidence-based decision-making.*	*Increased institutional cooperation, public awareness and long-term governance capacity.*	*Medium term*	*CIM-BB, Municipalities and Regional Stakeholders*	*Long-term availability of financial and human resources.*

The development of the proposed measures followed a structured and participatory process combining scientific evidence, technical analysis and stakeholder knowledge.
This approach ensured that the selected measures respond not only to the most significant climate risks affecting the region but also to the institutional capacities and governance structures available for their future implementation.
Another guiding principle was the promotion of intermunicipal cooperation. Many climate risks extend beyond municipal administrative boundaries, particularly rural wildfires, ecosystem degradation and the management of critical infrastructure. The proposed measures therefore seek to strengthen cooperation between municipalities while maintaining sufficient flexibility to accommodate local priorities and implementation capacities.
Although each measure addresses a specific aspect of Climate Risk Management, the portfolio was designed as an integrated system of complementary interventions. Structural measures are combined with governance improvements, monitoring systems, planning instruments, awareness activities and institutional capacity-building actions, recognising that effective adaptation requires simultaneous action across multiple policy domains.
The resulting portfolio consists of ten priority Action Plans organised around the two climate risks identified as priorities for the Beira Baixa region.
The first group of measures addresses the increasing wildfire risk projected under future climate scenarios. Rather than concentrating exclusively on emergency response, the proposed actions seek to reduce underlying vulnerability by improving landscape management, operational preparedness, spatial planning and institutional coordination.
Several measures promote preventive interventions, including the management of the wildland–urban interface, strategic fuel management and the protection of critical infrastructure. Others strengthen emergency preparedness through improved operational accessibility, integration of climate projections into emergency planning and enhanced coordination between municipalities and civil protection authorities.
Together, these measures contribute to reducing wildfire exposure while simultaneously increasing the capacity of institutions and communities to prepare for, respond to and recover from future wildfire events.
The second group of measures focuses on reducing the impacts of increasingly frequent and intense heatwaves, particularly within urban environments and among vulnerable population groups. The proposed actions combine physical adaptation measures—including urban cooling interventions, improved thermal comfort and climate-sensitive urban planning—with public health initiatives, monitoring systems and awareness campaigns designed to strengthen preparedness before and during extreme heat events.
Particular attention has been given to protecting vulnerable population groups, improving coordination between health and civil protection authorities and strengthening municipalities' capacity to monitor and respond to heat-related impacts.
Taken together, these measures contribute to reducing thermal exposure while promoting healthier, more resilient and climate-adapted urban environments.
Although each Action Plan has been developed independently, the proposed measures should not be interpreted as isolated interventions. Their effectiveness depends largely on their combined implementation and on the synergies established between different sectors of territorial governance.

For example, improvements in fuel management increase the effectiveness of emergency response measures, while the integration of future climate information into municipal planning strengthens the long-term sustainability of investments in critical infrastructure and urban development. Similarly, urban cooling interventions become more effective when accompanied by monitoring systems, public awareness campaigns and targeted protection of vulnerable populations.

This integrated approach reflects the systemic nature of climate risk and recognises that successful adaptation requires coordinated interventions addressing hazards, exposure, vulnerability and institutional capacity simultaneously.

The proposed portfolio intentionally combines structural and non-structural interventions.

Structural measures include physical investments such as green infrastructure, fuel management, accessibility improvements and protection of critical assets. These interventions directly reduce climate exposure and increase the physical resilience of the territory.

Non-structural measures focus on strengthening governance arrangements, institutional coordination, planning instruments, communication systems, monitoring frameworks and stakeholder engagement. Although they may involve fewer physical investments, these actions create the organisational conditions necessary for ensuring that structural interventions remain effective over time.

This balanced portfolio increases the flexibility of the Climate Risk Management strategy and facilitates implementation under different financial and institutional scenarios.

The implementation of the proposed Action Plans should be understood as a progressive process rather than a single programme of interventions. Different municipalities will inevitably advance at different speeds according to available resources, local priorities and institutional capacities.

Several measures can be initiated in the short term through updates to existing planning instruments and coordination mechanisms, while others require medium- and long-term investment programmes, external funding or broader institutional cooperation.

The proposed Climate Risk Management strategy therefore provides a flexible implementation framework capable of supporting incremental progress while maintaining a coherent long-term strategic vision for regional climate adaptation.

Collectively, the ten Action Plans establish a comprehensive Climate Risk Management portfolio capable of addressing both the immediate and long-term challenges posed by climate change in the Beira Baixa region. Beyond reducing the impacts of rural wildfires and heatwaves, the proposed measures strengthen governance, improve institutional cooperation, support evidence-based planning and promote the integration of climate adaptation into everyday territorial management.

By combining scientific evidence, stakeholder knowledge and implementation-oriented planning, the proposed measures represent the practical translation of the Climate Risk Assessment into operational Climate Risk Management. Their successful implementation will depend on continued institutional collaboration, sustained political commitment and periodic review through the monitoring framework proposed in this deliverable.

3.4 Integration into planning and decision making

The long-term effectiveness of the Climate Risk Management (CRM) strategy depends on its ability to become fully embedded within existing planning, governance and decision-making processes rather than remaining as a standalone project output. For this reason, the measures developed during Phase 3 have been designed to complement and strengthen the planning instruments already used by municipalities and regional authorities, ensuring that climate adaptation progressively

becomes an integral component of territorial governance across the Beira Baixa region. This approach reflects one of the core principles of the CLIMAAX methodology, namely that Climate Risk Management should not be regarded as a separate planning exercise but as a continuous process that informs policy development, public investment and operational decision-making across multiple sectors.

The Climate Risk Assessment carried out during Phases 1 and 2 generated the scientific evidence required to understand the region's current and future climate risks, identifying the principal hazards, vulnerabilities, exposure patterns and resilience capacities. Phase 3 builds upon this evidence by translating it into a practical framework capable of supporting decision-makers in selecting, prioritising and implementing adaptation actions. Consequently, the Climate Risk Management strategy should be understood as an operational instrument that enables climate information to inform territorial planning, infrastructure development, emergency management, environmental protection and public health policies in a coordinated and coherent manner.

One of the principal mechanisms for achieving this objective is the integration of climate risk considerations into existing territorial planning instruments. Decisions regarding land use, urban expansion, infrastructure location and landscape management strongly influence the future exposure of communities and assets to climate-related hazards. By incorporating the findings of the Climate Risk Assessment into strategic planning processes, municipalities can progressively reduce future vulnerability while avoiding the creation of new climate risks through inappropriate development decisions. In this context, the proposed Action Plans are intended to support the implementation and future revision of existing planning instruments, including the Intermunicipal Climate Change Adaptation Plan (PIAAC-BB), Municipal Master Plans (PDM), Municipal Civil Protection Plans, Municipal Emergency Plans and other strategic documents that guide territorial development and public investment throughout the region.

Integrating climate information into these planning instruments allows adaptation to be considered proactively rather than reactively. Instead of responding to the consequences of extreme events after they occur, municipalities are provided with the opportunity to anticipate future climate conditions during the planning stage, reducing long-term exposure and strengthening territorial resilience. This preventive perspective is particularly relevant in a region such as Beira Baixa, where projected increases in wildfire hazard and heatwave intensity require planning decisions capable of responding not only to current conditions but also to future climate scenarios.

The proposed Climate Risk Management strategy has also been designed to reinforce existing sectoral policies by incorporating climate adaptation into the routine activities of different public administrations. Climate risks affect a wide range of sectors simultaneously, including civil protection, forestry, environmental management, urban planning, public health, water management and critical infrastructure. As a result, successful adaptation depends upon coordinated action across these policy domains rather than the implementation of isolated initiatives. The Action Plans therefore seek to strengthen existing institutional responsibilities by providing a common evidence base and a shared strategic direction that can be integrated into sector-specific programmes and operational procedures.

Within the forestry and landscape management sectors, the proposed measures contribute to ongoing wildfire prevention efforts through improved fuel management, enhanced protection of the wildland–urban interface and the incorporation of climate projections into landscape planning. In the field of civil protection, the integration of future climate information into emergency planning supports more effective preparedness, operational coordination and emergency response. Urban planning policies benefit from the introduction of thermal comfort criteria, green infrastructure and nature-based solutions capable of reducing urban heat exposure, while public health strategies are

reinforced through improved monitoring systems, communication mechanisms and targeted measures aimed at protecting the most vulnerable population groups during extreme heat events. Rather than replacing existing sectoral policies, the Climate Risk Management strategy enhances their capacity to respond to evolving climate risks by introducing a long-term adaptation perspective into established governance frameworks.

Beyond supporting planning and policy development, the proposed strategy also provides an important basis for evidence-based investment decisions. Public authorities are increasingly required to allocate limited financial resources in ways that maximise long-term public value while reducing future climate risks. The Climate Risk Assessment identifies where climate risks are most significant, while the Action Plans developed during Phase 3 indicate how these risks can be addressed through practical adaptation interventions. Together, these components establish a transparent decision-support framework capable of guiding investment priorities according to risk severity, expected benefits, implementation feasibility and potential co-benefits. This approach contributes to improving the efficiency of public expenditure by directing resources towards interventions that simultaneously reduce climate risk, strengthen resilience and support broader environmental, economic and social objectives.

The existence of a structured Climate Risk Management framework may also facilitate access to future national and European funding opportunities. Many climate adaptation funding programmes require applicants to demonstrate that proposed investments are supported by robust evidence, integrated planning and clearly defined implementation priorities. By combining detailed climate risk information with a coherent portfolio of adaptation measures and measurable implementation objectives, the strategy developed through CLIMAAX provides municipalities and regional organisations with a solid strategic basis for preparing future funding applications and supporting long-term investment planning.

The integration of Climate Risk Management extends beyond planning documents and financial investment. It also requires climate considerations to become progressively incorporated into routine institutional decision-making processes. Municipal administrations, intermunicipal organisations, civil protection authorities, environmental agencies, public health institutions and infrastructure managers regularly make decisions regarding infrastructure maintenance, procurement, land management, service delivery and emergency preparedness. Embedding climate risk information within these everyday decisions represents one of the most effective mechanisms for mainstreaming adaptation throughout public administration. In this respect, the governance arrangements established during Phase 3 encourage continued cooperation between institutions, regular exchange of information and coordinated implementation of adaptation priorities across administrative boundaries, while preserving sufficient flexibility for municipalities to respond to their own local circumstances and operational needs.

An equally important component of this process is the establishment of an effective monitoring system capable of supporting continuous learning and adaptive management. Monitoring should not be regarded solely as a reporting obligation but as a practical management tool that enables institutions to evaluate implementation progress, assess the effectiveness of adaptation measures and identify emerging challenges requiring further intervention. The indicators proposed throughout this deliverable provide an initial framework for monitoring progress against the objectives established in Section 3.1, allowing municipalities and regional organisations to measure implementation, compare achieved results with expected outcomes and identify areas where additional effort or revised approaches may be necessary.

This adaptive management approach recognises that climate adaptation is an ongoing process rather than a fixed programme of actions. Climate conditions, socio-economic circumstances,

institutional capacities and scientific knowledge will continue to evolve over time, requiring periodic review of priorities and implementation strategies. By combining systematic monitoring with continued stakeholder engagement and institutional cooperation, the proposed framework enables Climate Risk Management to remain responsive to new evidence, updated climate projections and practical implementation experience. Rather than producing a static adaptation strategy, the work developed during Phase 3 establishes a dynamic management framework capable of supporting successive planning cycles and continuous improvement.

Although the CLIMAAX project concludes with the completion of Phase 3, the implementation of Climate Risk Management necessarily extends beyond the project's duration. Many of the proposed measures involve long-term planning processes, progressive institutional change and sustained investment programmes that will continue to evolve over the coming years. The principal legacy of the project therefore lies not only in the individual Action Plans but also in the establishment of a governance framework that enables municipalities and regional organisations to integrate climate risk considerations into future planning, decision-making and investment processes. In this way, the knowledge generated throughout the three phases of CLIMAAX becomes embedded within regional governance structures, providing a lasting foundation for future adaptation initiatives.

Ultimately, the integration of Climate Risk Management into planning and decision-making represents the principal mechanism through which the results of the CLIMAAX project can generate enduring value for the Beira Baixa region. By embedding climate considerations within territorial planning, sectoral policies, public investment and institutional governance, the proposed strategy transforms the Climate Risk Assessment from a technical assessment into a practical decision-support framework capable of guiding adaptation over the coming decades. Combined with the governance arrangements, monitoring system and implementation framework developed throughout Phase 3, this integrated approach provides the institutional conditions necessary for maintaining an adaptive, evidence-based and continuously evolving Climate Risk Management process, strengthening the resilience of the Beira Baixa region in the face of future climate challenges.

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4 Project Evaluation

4.1 Usability of the results

The CLIMAAX project has significantly strengthened the capacity of the Beira Baixa region to understand, assess and manage climate risks through the development of a comprehensive and evidence-based Climate Risk Management framework. By progressively advancing from climate risk identification in Phase 1, to detailed Climate Risk Assessment in Phase 2, and finally to the development of practical Climate Risk Management measures in Phase 3, the project has established a robust foundation for long-term climate adaptation across the region.

One of the principal benefits of the project has been the generation of new knowledge specifically tailored to the territorial characteristics of the Comunidade Intermunicipal da Beira Baixa (CIM-BB). The integration of regional climate projections, locally refined datasets, stakeholder knowledge and spatial analyses has considerably improved the understanding of wildfire and heatwave risks, moving beyond generic national assessments towards decision-support information adapted to local conditions.

The project has also strengthened institutional capacity by promoting collaboration between municipalities, civil protection authorities, environmental organisations, health institutions, infrastructure managers and other regional stakeholders. This collaborative process has contributed not only to the development of technically robust adaptation measures but also to increased institutional ownership and shared understanding of climate risks and adaptation priorities.

From a policy perspective, the project provides an important evidence base that can support future revisions of intermunicipal and municipal planning instruments, including climate adaptation strategies, spatial planning documents, emergency management plans and sectoral policies. The proposed Climate Risk Management measures have been specifically designed to facilitate their integration into existing governance and planning processes, allowing climate adaptation to become an integral component of future territorial development and public investment decisions.

The project has further demonstrated the value of integrating scientific evidence with stakeholder participation throughout the entire decision-making process. The active involvement of regional actors ensured that the proposed measures respond to operational needs, institutional capacities and local priorities, thereby increasing the likelihood of successful implementation beyond the duration of the CLIMAAX project.

The usability of the project extends beyond the immediate implementation of the proposed adaptation measures. The Climate Risk Assessment methodologies, governance arrangements, monitoring framework and implementation roadmaps developed during the project provide a transferable foundation that can support future updates of climate risk assessments, continuous monitoring of climate impacts and the progressive refinement of adaptation policies as new information becomes available.

Overall, CLIMAAX has enabled the Beira Baixa region to move from understanding climate risks towards establishing a practical and coordinated framework for Climate Risk Management. The project therefore represents an important step in strengthening regional resilience, improving evidence-based policymaking and supporting the long-term integration of climate adaptation into territorial planning, public administration and future investment strategies.

4.2 Lessons learned

Phase 3 represented the transition from Climate Risk Assessment to Climate Risk Management, demonstrating the importance of translating scientific evidence into practical and implementable adaptation measures. One of the main lessons learned throughout this phase was that the development of effective Climate Risk Management strategies requires a balanced combination of technical knowledge, institutional coordination and stakeholder participation. While robust climate analyses provide the foundation for decision-making, the successful definition of adaptation measures depends equally on the operational experience and local knowledge of the organisations responsible for their future implementation.

The project also confirmed that climate adaptation should be approached as a continuous governance process rather than as a standalone planning exercise. The collaborative development of the Climate Risk Management measures highlighted the importance of integrating climate considerations into existing planning instruments, investment decisions and institutional responsibilities, instead of creating separate adaptation mechanisms. This approach increases the feasibility of implementation and strengthens long-term institutional ownership of the proposed actions.

One of the principal challenges encountered during Phase 3 was the translation of complex technical information into practical adaptation measures that could be realistically implemented by municipalities and regional organisations. Achieving an appropriate balance between scientific robustness and operational applicability required continuous dialogue between technical experts and stakeholders. Additional challenges included the different institutional capacities across municipalities, the need to coordinate organisations operating under different sectoral mandates and the uncertainty associated with long-term climate projections and future socio-economic developments.

Stakeholders played a fundamental role throughout the development of the Climate Risk Management strategy. Municipalities, civil protection authorities, environmental organisations, health institutions and other regional stakeholders actively contributed to validating priorities, discussing implementation options and refining the proposed adaptation measures. Their feedback consistently emphasised the need for practical, implementable actions that complement existing planning instruments, improve institutional coordination and provide sufficient flexibility to respond to evolving climate conditions. This participatory process significantly increased the relevance, feasibility and potential acceptance of the proposed Climate Risk Management measures.

The project also demonstrated that learning is most effective when it is embedded within institutional processes rather than limited to individual project activities. Knowledge generated during the three phases of CLIMAAX has been consolidated through technical reports, stakeholder workshops, adaptation plans, implementation roadmaps and monitoring indicators, creating a knowledge base that can continue to support future planning, policy development and climate adaptation initiatives. The proposed monitoring framework further contributes to institutional learning by allowing adaptation measures to be periodically reviewed and updated as new information becomes available.

The results of Phase 3 were communicated through a combination of technical deliverables, stakeholder workshops, coordination meetings and dissemination activities involving regional institutions and local authorities. This communication strategy promoted transparency, facilitated stakeholder engagement and encouraged the integration of Climate Risk Management principles into future planning and decision-making processes.

Several aspects of the project proved particularly successful. The phased implementation methodology adopted by CLIMAAX provided a logical progression from risk identification to risk management, while the continuous involvement of stakeholders ensured that the proposed measures remained closely aligned with regional needs and implementation capacities. The use of locally refined datasets and region-specific analyses significantly improved the practical relevance of the Climate Risk Assessment compared with broader-scale assessments.

At the same time, the project highlighted several aspects that could be further strengthened in future initiatives. Greater availability of local health data, more detailed socio-economic information and continuous monitoring of climate impacts would improve future assessments and support more dynamic Climate Risk Management. Long-term implementation will also depend on maintaining institutional cooperation, securing adequate financial resources and periodically updating climate information and adaptation priorities.

From an implementation perspective, available resources were used efficiently by building upon the results of the previous project phases, avoiding duplication of work and ensuring that stakeholder engagement activities directly supported the development of the Climate Risk Management strategy. The phased structure of the CLIMAAX methodology enabled the progressive refinement of analyses and adaptation measures while making effective use of available technical expertise, financial resources and institutional capacities.

Overall, the Climate Risk Management process has substantially improved the regional understanding of climate risks and strengthened the institutional capacity of the Beira Baixa region to respond to future climate challenges. Beyond the specific adaptation measures proposed, the project has contributed to increasing awareness of climate risks, reinforcing cooperation between institutions, supporting evidence-based decision-making and establishing a solid foundation for future investment and policy development. These outcomes represent an important legacy of the CLIMAAX project and provide the basis for the continued development of climate resilience across the region.

5 Conclusions Phase 3

Phase 3 of the CLIMAAX project successfully completed the transition from Climate Risk Assessment (CRA) to Climate Risk Management (CRM) for the Beira Baixa region. Building upon the knowledge generated during Phases 1 and 2, this final phase transformed climate risk evidence into a structured portfolio of adaptation measures, implementation mechanisms and governance arrangements capable of supporting long-term regional resilience to climate change.

The Climate Risk Assessment developed during the previous phases confirmed rural wildfires and heatwaves as the two priority climate risks affecting the region. Phase 3 demonstrated how these analytical results can be translated into practical Climate Risk Management actions through an integrated approach combining prevention, preparedness, spatial planning, ecosystem management, public health, institutional coordination and stakeholder participation. This progression illustrates the value of the CLIMAAX methodology in connecting scientific risk assessment with evidence-based decision-making and practical implementation.

One of the principal outcomes of this phase has been the development of a coherent Climate Risk Management strategy specifically tailored to the territorial characteristics of the Comunidade Intermunicipal da Beira Baixa (CIM-BB). The proposed adaptation measures address not only current climate risks but also projected future impacts, while promoting the integration of climate adaptation into municipal planning, intermunicipal cooperation, public investment and sectoral policies. The implementation roadmaps, governance arrangements and monitoring indicators developed throughout Phase 3 provide practical guidance for the progressive implementation and evaluation of these measures.

The project also reinforced the importance of collaborative governance for successful climate adaptation. Continuous stakeholder engagement throughout the three phases ensured that scientific analyses were complemented by operational knowledge and local experience, resulting in adaptation measures that are technically robust, operationally feasible and aligned with regional priorities. This collaborative approach strengthened institutional ownership of the proposed Climate Risk Management strategy and established a solid foundation for its future implementation.

Despite these achievements, several challenges remain. Climate change will continue to intensify the frequency and severity of rural wildfires and heatwaves, requiring continuous adaptation and periodic revision of planning priorities. Furthermore, the effectiveness of the proposed measures will depend upon sustained political commitment, long-term financial resources, institutional coordination and continued stakeholder engagement. The project also identified opportunities to further strengthen future Climate Risk Management through improved local monitoring of heat-related health impacts, periodic updates of climate and socio-economic datasets, enhanced monitoring of adaptation outcomes and the continued development of technical and institutional capacities.

The scope of the present work was intentionally focused on the two priority climate risks identified during the Climate Risk Assessment—rural wildfires and heatwaves—and on the development of strategic measures to manage these risks within the Beira Baixa region. Other climate hazards and broader socio-economic scenarios were not addressed in detail and may be considered in future updates of the regional Climate Risk Assessment and Climate Risk Management framework as additional evidence becomes available.

Overall, the CLIMAAX project has significantly strengthened the capacity of the Beira Baixa region to understand, assess and manage climate risks. Beyond the technical outputs produced, the project

established an integrated framework for evidence-based Climate Risk Management that can support future policy development, territorial planning and climate adaptation investments. The results achieved during Phase 3 therefore represent not only the conclusion of the CLIMAAX project, but also the starting point for a continuous process of adaptive climate governance aimed at increasing the long-term resilience of the Beira Baixa region.

6 Progress evaluation

6.1 Project outputs

Phase 3 focused on transforming the results of the Climate Risk Assessment developed during the previous phases into an operational Climate Risk Management framework for the Beira Baixa region. The activities implemented during this phase were fully aligned with the Individual Follow-up Plan and resulted in the delivery of the planned technical outputs, stakeholder engagement activities and implementation guidance required by the CLIMAAX methodology.
The outputs produced during this phase build directly upon the work completed in Phases 1 and 2. While the previous phases established the regional climate risk baseline and refined the Climate Risk Assessment, Phase 3 translated this knowledge into practical adaptation measures, implementation roadmaps, governance arrangements and monitoring mechanisms. Consequently, this deliverable represents the culmination of the CLIMAAX methodological cycle, connecting scientific evidence with operational Climate Risk Management.
The results produced during Phase 3 also establish the basis for future implementation beyond the duration of the project. The Climate Risk Management measures, implementation guidance and monitoring framework developed through this work are intended to support future updates of regional and municipal planning instruments, facilitate access to future funding opportunities and enable the continuous monitoring of adaptation progress across the Beira Baixa region.

Table 7 - Overview key performance indicators

Key performance indicators	*Progress*
Delivery of Deliverable Phase 3 – Climate Risk Management	Completed
Development of Climate Risk Management strategy for the Beira Baixa region	Completed
Development of adaptation measures addressing the two priority climate risks	Completed
Stakeholder engagement activities supporting Climate Risk Management	Completed
Definition of implementation roadmaps, governance arrangements and monitoring indicators	Completed
Integration of Climate Risk Management recommendations into regional planning framework	Completed

Table 8 - Overview milestones

Milestones	*Progress*
Development and validation of the Climate Risk Management strategy	Completed
Preparation of the ten Climate Risk Management Action Plans	Completed
Stakeholder consultation and validation of proposed adaptation measures	Completed

Milestones	*Progress*
Definition of implementation and monitoring framework	Completed
Submission of Deliverable Phase 3	Completed

The successful completion of these activities demonstrates that the objectives established for Phase 3 have been achieved in accordance with the Individual Follow-up Plan. Beyond the production of technical deliverables, the project has strengthened institutional cooperation, consolidated stakeholder engagement and established an operational framework capable of supporting the long-term implementation of Climate Risk Management within the Beira Baixa region. The outputs generated during this phase provide a practical foundation for future adaptation initiatives, enabling municipalities and the CIM-BB to progressively implement, monitor and update the proposed Climate Risk Management measures as new climate information, socio-economic data and funding opportunities become available.

7 Supporting documentation

The outputs produced during Phase 3 of the CLIMAAX project document the transition from Climate Risk Assessment to Climate Risk Management for the Beira Baixa region. Together, these outputs provide the technical basis for the implementation of adaptation measures, support evidence-based decision-making and facilitate the dissemination and long-term use of the project results.
In accordance with the CLIMAAX guidelines, all outputs generated during this phase will be made available through the Zenodo repository, ensuring transparency, accessibility and long-term preservation of the project results. For consistency and traceability, the outputs listed below follow the same organisation and sequence adopted in the Zenodo repository.

Table 9 - Project Outputs

Output category	Output	Format	Description
Main Report	Deliverable Phase 3 – Climate Risk Management	PDF / Word	Final technical report documenting the Climate Risk Management strategy for the Beira Baixa region, including governance arrangements, implementation mechanisms, monitoring framework and project evaluation.
Technical Reports	Climate Risk Management Action Plans (10)	PDF	Portfolio of ten Action Plans developed during Phase 3 addressing the two priority climate risks (Rural Wildfires and Heatwaves), including implementation roadmaps, governance models, monitoring indicators and implementation guidance.
Communication Outputs	Stakeholder Workshop Materials	PDF / PPTX	Presentations and supporting materials used during stakeholder engagement activities carried out throughout Phase 3.
Communication Outputs	Dissemination Materials	PDF / PNG	Communication materials prepared to disseminate the objectives, methodology and outcomes of the Climate Risk Management process.

The outputs produced during Phase 3 collectively establish a comprehensive Climate Risk Management knowledge base for the Beira Baixa region. Beyond fulfilling the objectives of the CLIMAAX project, these materials provide practical resources that can support municipalities, regional authorities and other stakeholders during the implementation, monitoring and future revision of climate adaptation measures. Their publication through the Zenodo repository further ensures that the knowledge generated remains openly accessible, reusable and available for future climate resilience initiatives.

8 References

This deliverable is primarily based on the outputs generated throughout the CLIMAAX project, particularly the Phase 1 and Phase 2 deliverables, the regional Climate Risk Assessment and the stakeholder co-creation process. Consequently, no additional external references have been included, as all relevant sources are either project outputs or policy instruments cited within the corresponding sections of the document.