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bePrepARed Cross Border Action Plans for general Strategy implementation

WP2, att. 2.3, D.2.3.2

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Index

General presentation: nature of the bePrepARed Action Plans

As foreseen in the bePrepARed AF, deliverable D.2.3.2 consists of the elaboration of two Action Plans addressing material and non-material NbS, developed within pilot actions and tailored to the needs of the target areas, the chosen priorities and the available resources. According to the AF, the two Action Plans refer in particular to the activities 3.1 (on "material" investments about NbS) and 3.2 (on "non-material" projects on NbS for improving site ecological management).

Nevertheless, the complexity of the issues tackled as well as the nature of the expected results, suggest that the Action Plans should be considered according to an integrated approach going beyond the same pilot action, addressing how partners intend to use the results produced both by the pilot actions and by the preliminary activities implemented both in WP and in WP2. The "place" in which to make best value of these results is represented by the act. 3.3 on capacity building and 3.4 on education and sensitization, i.e. the activities that more than others are aimed at targeting the wider public, in view to improve common awareness about solutions for adaptation to climate change effects. In our opinion, this is a condition for bePrepARed to provide a concrete contribution to the present debate on adaptation and on the opportunities for a more extensive use of NbS.

Moreover, while the work process carried out so far has mainly focused on common (cross-border) problems, the critical issues addressed by partners through the proposed pilot actions, whether material or non-material, are inherently place-based, given the strong local dimension of both the challenges addressed and the implementation of the related solutions. Therefore, the real effort requested about the results achieved with the pilot actions, is to get to their generalisation within the wider framework of the knowledge emerged from the previous activities. Thus, not only a mere technical solution – although NbS- for a specific problem, but also the motivation for that choice according to specific feasibility conditions, towards a result of "usability" for addressing properly both project stakeholders and the wider public, in view to avoid any genericity in capacity building, education and communication.

This approach is consistent with the one adopted by bePrepARed since the beginning, when the main aim of the project was defined as identifying how to select a 'solution' not merely through a technical or technocratic perspective, but by considering the "boundary conditions" in which solutions can be defined, thus including opportune policy framework, capacity on conflict management, the availability of technical and financial resources among the other factors. This consideration appears valid also within the project, in its internal relation network, and not only towards external stakeholders.

In other words, the "package" of activities implemented by each partner in its own context in view to contribute to the common expected results, through knowledge interchange has also to help the other partners in adopting the most effective decision-making process to tackle their specific problems, consistently with the cross-border approach of bePrepARed. The two action plans hereby presented thus intend to pave the way for further internal debate and external communications, education and capacity building activities, as foreseen by activities 3.3 and 3.4.

According to these considerations, the integrated document presented hereby includes two sections:

- a first common section, addressing the issues that have been indicated by the general CB Strategy:
    - technical – scientific summary about the problems addressed;
    - gaps identified at country level;
    - main bottlenecks identified for NbS adoption;
    - overview of the NbS planned to be tested by partners through their pilot actions;

  - the governance scheme for Action plans implementation (who does what among partners).
  - monitoring and evaluation of the pilot NbS, with a particular focus on the transferability of the practices;
  - tentative implementation timeframe for the activities transcending project closure.

- a second section divided into two parts, each one devoted to the two Action Plans foreseen by del. D.2.3.2, in which partners provide information about the nature and objectives of the pilot action proposed and about the "use" of the expected results, both in terms of improved conditions of site management and about the "use" they intend to make of the results for the "outward-looking" activities, addressing their stakeholders. Each of the two include:
  - a pilot action fiche, describing the nature of the pilot action and of the planned NbS "solutions" that will be made available by partners to their territories;
  - the conditions for result "usability" and transferability beyond bePrepARed, as a viable practice for a specific climate-related problem to be tackled;
  - the indications about the contents for the technical capacity building for project stakeholders (act. 3.3);
  - the elements supporting education and awareness raising activities towards stakeholders (act. 3.4);
  - the institutional "lobbying" for mainstreaming the NbS practices experimented into concrete climate adaptation policies (e.g. on the side of their national/regional/local governments);
  - further fundraising to foster the NbS developed as pilot action and further implement them.

bePrepARed Cross Border Action Plans for general Strategy implementation

WP2, att. 2.3, D.2.3.2

Section 1: General characteristics

1. Executive summary

This section of the report addresses the main topics that have been indicated by the bePrepARed general Cross-Border Strategy, providing general information about the technical – scientific knowledge about the climate change-related effects hitting the territory of the project partners as well the gaps and obstacles and bottlenecks identified at partner and country scale, that make difficult the adoption of NbS. A resume of the NbS planned by partners to be experimented with their pilot actions is also provided. Then, some considerations are expressed about the governance structure for the Action plans implementation (who does what among partners), including a note about monitoring and evaluation of the pilot NbS, with a particular focus on the transferability character of the practice. A tentative implementation timeframe is provided for the activities that transcend project deadline.

Overall, the study underscores that while Italian and Croatian regions have made important strides in developing climate adaptation strategies, substantial work remains to ensure that ecosystems, cultural heritage sites, and local communities are resilient to projected climate extremes. Future efforts must focus on spatially targeted, proactive adaptation that integrates climate projections, addresses compound hazards, and fosters cross-sectoral collaboration to safeguard both environmental and socio-economic systems in these sensitive regions.

2. Knowledge findings about the climate change-related problems tackled

Despite regional diversity in topography, land use and socio-economic context, a harmonized climate risk assessment methodology across all partner areas has revealed a consistent set of systemic challenges. These cross-cutting vulnerabilities reflect physical impacts of climate change and also institutional and infrastructural constraints that limit the adaptive capacity of both natural and human systems.

a. Increasing climate risks across all target areas: all regions show clear trends of rising temperatures, more frequent and intense heatwaves, shifts in precipitation patterns, and compounded risks from droughts and flooding. Mediterranean lowlands, deltas, and coastal zones — such as the Po Delta, Neretva River Delta, and the area of the Parco San Bartolo — are particularly exposed to extreme hydrological and thermal stresses, while upland and island areas, like Paklenica National Park and the Trogir archipelago, face growing wildfire, drought, and heat stress risks.
b. Challenges in water resource management: water scarcity, drought, and increasing precipitation intensity pose significant challenges for agriculture, ecosystem integrity, and cultural heritage protection. While some regions have implemented monitoring systems and integrated adaptation measures, coordination across governance levels and alignment with future climate scenarios remain critical for long-term resilience.
c. Ecosystem and cultural heritage vulnerabilities: this framework represents an urgent threat for water ecosystems and landscapes within and outside protected areas, where natural systems, particularly those within protected and transitional landscapes, are exhibiting signs of ecological destabilization. At the same time, archaeological sites and UNESCO heritage zones are proving highly sensitive to climate stressors, as most territories in large parts are artificial and man-managed (including relevant protected areas like the Po and the Neretva river deltas), their vulnerability to heatwaves, droughts, coastal erosion is growing, threatening both biodiversity and cultural landscapes. This is particularly evident in karst ecosystems (like Apulia's and Paklenica park), where the absence of water surface runoff makes these landscapes inherently vulnerable to both drought and flash flooding. Biodiversity loss is a growing concern, particularly for endemic and less climate-resilient species. Adaptation strategies often lack detailed, ecosystem- and site-specific measures,

highlighting the need for tailored interventions that address local environmental, social, and economic conditions.

d. **Agricultural pressures:** regions with intensive agricultural production—especially Emilia-Romagna and the Neretva Delta — are experiencing reduced water availability during critical growing periods as well as a significant intrusion of the so-called "salt wedge". The mismatch between precipitation timing and crop water needs highlights the growing importance of efficient irrigation and crop selection[1]. In particular lowlands are highly dependent on engineered irrigation and drainage systems that have been conceived decades ago, under different climate conditions and that may no longer meet the present water management. Soil degradation, salinization, and erosion—driven by both climatic and land use pressures—further threaten long-term agricultural viability.

e. **Urban vulnerability and infrastructure strain**: both sides of the Adriatic sea are densely urbanized, hosting some of world's most fast growing tourism sectors. The interplay between urban morphology, demographic trends and climate extremes is evident in these continuously urbanizing and tourist-driven sectors, where the compounded effects of dense built environments, limited green cover and high impermeable surface ratios intensify the risks linked with sea storm surge, and urban heat islands while, concurrently, high-intensity rainfall events frequently exceed the capacity of existing drainage infrastructure, causing flash floods, property damage and transport disruption. This occurs while the structural limitation of climate-adaptive infrastructure to manage evolving hydroclimatic pressures, proves territories frequently overwhelmed by high-intensity precipitation events. On the other hand, cooling infrastructure and energy grids are increasingly stressed by extended heatwaves and tropical nights, particularly in urban areas with poor thermal performance. Water supply systems often lack redundancy and are vulnerable to drought-induced shortages. These infrastructure gaps, if unaddressed, will significantly constrain future adaptation capacity.

3. Policy gaps and main bottlenecks identified for NbS adoption

In general terms, the analysis of Italian and Croatian policies on Nature-based Solutions (NbS) in water management highlights a growing interest in sustainable approaches. Both countries, in line with European directives, are promoting the integration of NbS into water management plans, favouring ecological interventions for flood control, natural purification, and the protection of aquatic ecosystems. Special emphasis is placed on cross-border projects, such as those co-financed by the Interreg Italy-Croatia program, which encourage technical and scientific cooperation in integrated basin management, contributing to more resilient and shared water governance[2].

The key findings evidenced emerging from the cross-cutting analysis of policy frameworks across the Italian and Croatian target areas, can be resumed as follows:

a. **Policy frameworks are comprehensive but unevenly implemented:** European, national, and regional policies provide a solid foundation for climate adaptation through strategies such as the EU Adaptation Strategy, National Adaptation Plan for Italy (PNACC), Croatian Climate Change Adaptation Strategy, and regional/local plans (e.g., PAESC, SECAP). Measures include sustainable water management, indications for the adoption of nature-based solutions (including guidelines for water streams management), flood prevention measures, ecosystem restoration, and urban resilience. However, several gaps persist, including limited integration of site-specific climate projections, insufficient attention to compound hazards, and a

[1] For example, in Emilia-Romagna, just before 2023-2024 floods, a Delegate Commissioner was appointed to tackle the crisis of the agricultural sector, due to a two-years long drought.

[2] See bePrepARed deliverable D.2.1.1 "Guidelines report on ecosystem-based solutions for regeneration of cultural – natural landscapes"

reactive rather than proactive approach in implementing responses to extreme events and the development of adaptation measures.

b. **Persistence of policy gaps** suggest a reactive rather than proactive approach and several critical issues about adaptation persist. Drought and water scarcity are tackled through water reuse, improved drainage and reduced losses, but rising agricultural and tourism demands require more integrated, forward-looking solutions. Coastal risks—erosion and sea level rise—are considered within integrated coastal strategies but the level of coordination of policies addressing different territorial spaces (e.g. the coast vs. inland) remains weak, also due to the mostly sectoral and "vertical" structure of public policies, that difficult problem integrated governance; this often affects also coordination between policies for protection of the ecosystem and policies for the cultural heritage towards different type of risks (e.g floods and heatwaves, droughts and wildfires) and, overall, between territorial development and the policies aimed at protection of natural and cultural assets. Although updates based on recent climate data are available, a broader adoption of nature-based solutions remains necessary in most bePrepARed partner regions.

c. **Opportunities for proactive and integrated adaptation:** effective climate resilience requires forward-looking strategies that combine "soft" measures (tailored governance schemes, innovation and updating of territorial planning tools), "green" measures (ecosystem-based solutions) and "grey" measures (infrastructure and technological interventions). Cross-border coordination, particularly in transboundary hydrological systems like the Neretva Delta, and strengthened alignment between climate projections and policy implementation, is essential, calling for strong "lobbying-for-climate-adaptation" at the relevant institutional level, both at country and trans-boundary scale. Enhanced monitoring and evaluation of the ongoing NbS-based practices appears as core for transferability while the "use" of the technical-scientific results emerging from project activities appears of strategic relevance for concrete stakeholder engagement by proper capacity building, education and sensitization activities.

d. **About obstacles and bottlenecks:** several elements have been identified by partners and their stakeholders as factors that difficult NbS adoption and implementation as strategic for prevention and Disaster Risk Reduction (DRR). Apart of the very common structural lack of funding, one very critical aspect deals with the conflicts between policies, in particular aiming on one hand at territorial development and on the other to ecosystem protection. Social and cultural resistance to new, more ecosystem-sound solutions is also a very critical aspect, often underlying the NIMBY (Not-In-My-BackYard) syndrome with the related social conflicts. Insufficient knowledge and technical support and "vertical" governance settings that difficult policy integration, complete the picture.

4. Resume of the NbS planned by partners with the pilot actions

This section intends to summarize the content of the pilot actions planned by partners, with a view to emphasize the core aspects that characterize any action, including the climate change-related problems tackled and the NbS proposed as possible solutions.

According to the Application Form, the pilot actions proposed are subdivided in two categories:

a. *NbS for targeted man-made ecosystems and communities*: linked to act. 3.1[3], they address not only the problem analysis and the design of the Nature-based Solution(s) adopted but afford also a material investments on-field;

b. *Non-material NbS aimed at improving site ecological management*: linked to act. 3.2[4], they encompass improved site-tailored and new management solutions but not proceeding to material investments on-site.

[3] So called "material NbS"

[4] So called "non-material NbS"

It is worth stressing that, notwithstanding the relatively rigid partition of the categories, both need an in-depth site assessment and project design desk activities of various types. The real difference lies in the fact that the first type of Pilot Actions (according to act. 3.1) proceed to material investments, functional to realise on-field the proposed NbS. Conversely, in the second case partners do not proceed on-field material investments, because of budget forecast that are out of the reach of the project and/or an implementation timing that is not compatible with the project duration.

Table 1 proposed in the following pages, provides a synthesis overview of the type of pilot actions proposed by partners, outlining the problems tackled, the preliminary design activities, the NbS proposed and – if it is the case – the on-field investments to be realised. Instead, details of each pilot action are provided in the two dedicated reports, in section 2 of this document.

Tab. 1

Partner and Pilot action location	Climate-related problem tackled	Pilot Actions: NbS design phase (common to act. 3.1 + 3.2)		Pilot Actions: investments (only act. 3.2)	Pilot closure timing
		Studies & analyses; spatial planning integration; governance; etc.	NbS feasibility / physical design	On-field NbS implementation	
LP - Emilia-Romagna Reconstructions Agency *Po delta Park water landscapes (UNESCO heritage site; MAB reserve)* *- Cervia Saltworks*	Floods + subsidence	• Integrated knowledge framework / Savio river hydrology • Hydrological adaptive models • Multilevel governance w. regional/local adm. / reclamation consortia etc. (esp. about authorizations)	• Re-modeling of the saltwork perimetral margins (aprx. 8 km), for water lamination and retention • Ecological re-configuration of agrarian land • Adaptive earthworks to support hydraulic resilience	n.a.	September 2026
	Impacts on biodiversity (wetlands)	• Guidelines for habitat adaptive management and conservation	• Wetlands extension and habitat connection • Phyto-purification		
	Drought	• Integration of the topic in models/scenarios and planning tools	• Improvement of soil retention capacity by wetlands extension		
P3 ASSET – Apulia Region *Egnazia archaeological site*	Floods	• Feasibility study (geomorphological / hydrological analyses and modelling) • Predictive climate modeling update according to new knowledge • Integrated planning with Civil Protection / other relevant institutions / stakeholders	• Uphill hydrological management to regulate runoff and flow concentration to site • Water bypass around the site, draining to sea • Lamination tanks for flood management	n.a.	July 2026
	Drought	• Integration of the topic in models/scenarios and planning tools	• Lamination tanks for water storage (irrigation)		
P4 San Bartolo Regional Park *Monte San Bartolo*	Floods / surface erosion / landslides	• Integration of the topic in models/scenarios and planning tools • Multilevel governance (stakeholders coord., esp. with private land holders – 90% of the territory) • Staff capacity building on NbS and land maintenance	• Hydro-geomorphologic monitoring and adaptive management	• Soil modelling and vegetation bio-engineering • Slope reinforcement and stabilization • Re-establishment of native vegetation	September 2026
	Drought			• Selective replantation for water retention / infiltration	
	Heatwaves	• Signing and park users sensitization	n.a.	• Vegetation cover / micro-climatic shadowing	
	Wildfires	• Planning for continuous adaptation		• Fire prevention measures	
	Impacts on biodiversity (esp. vegetation)				

Partner and Pilot action location	Climate-related problem tackled	Pilot Actions: NbS design phase (common to act. 3.1 + 3.2)		Pilot Actions: investments (only act. 3.2)	Pilot closure timing
		Studies & analyses; spatial planning integration; governance; etc.	NbS feasibility / physical design	On-field NbS implementation	
P5 Zadra Nova – Zadar County dev. agency *Paklenica National Park (UNESCO heritage site; MAB reserve)*	Floods / surface erosion	• Data monitoring; GIS-based modeling • Est. of early warning systems • Multi-level governance with Park auth. and relevant institutions • Park staff capacity building	• Sediment traps / slope stabilization • Channel cleaning and maintenance • Re-establishment of native vegetation	n.a.	July 2026
	Droughts	• Integration of the topic in models/scenarios and planning tools • Multi-level governance with Park auth. and relevant institutions	• Improvement of soil retention capacity		
	Wildfires		• Prevention measures and fire emergency patrols		
	Impact on biodiversity		• All the previous intervention specified		
P6 PI RERA SD (Split-Dalmatia dev. Agency) *Trogir city urban center (UNESCO heritage site)*	Heatwaves	• Public spaces climatic design for urban management • Multi-level governance with and relevant institutions • Awareness raising and sensitization for water responsible use	• Design of urban green space for climate extreme mitigation	• Realization of urban green spaces (Mediterranean species)	September 2026)
	Floods (urban flooding)		• Upgraded drainage systems • Permeable surfaces to increase infiltration	• Installation of public fountains and heat mitigation rest spots	
	Drought (in relation to tourism pressure		• Public fountains to mitigate water-related public stress		
P7 PI DNC (Public Institution for the Management of Protected Natural Areas of Dubrovnik-Neretva county) *Neretva river delta Reserve*	Drought / salinization / salt wedge intrusion	• Research and monitoring of water quality parameters • Research to improve knowledge on local flora and fauna • Multi-level technical governance with and relevant institutions	n.a.	• Site cleaning from waste • Control fishing of invasive species	August 2026
	Waste in karstic sites				
	Impact on biodiversity (invasive species)				

5. Governance scheme for the implementation of the Action plans

According to the bePrepARed general Cross-Border Strategy, the establishment of an effective governance scheme must rely upon the partners' profile, according to their different functions, organization and operational capacities. In this respect, notwithstanding the gaps and bottlenecks evidenced by the analysis, all partners accumulated experiences in tackling climate change-related issues, that have to be pooled in view to ensure an effective governance during bePrepARed lifetime and beyond.

As a general criterion, the implementation of the Strategy and of the Action Plans in their different components - from problem identification, knowledge sharing till monitoring and evaluation – remains under the responsibility of the Steering Committee, as the most relevant decision-making level, supported by the Quality Management Board (QMB). This is somehow natural, as the partnership has been conceived as a structural relationship among partners who, to a large extent, have already been cooperating since previous ETC programming period and who intend to further consolidate this cooperation within the wider Adriatic cooperation space and in the framework of the pillar 3 of the EUSAIR strategy[5].

Within the project management bodies, the bePrepARed QMB among its tasks, is responsible for monitoring the project performance, assessing activities and deliverables effectiveness and supporting partners during implementation[6]. In this regard, monitoring and evaluation[7] will have to provide "evidences from the field", being a strategic tool for managing Strategy and Action plans effectively. These pieces of evidence include the point of view of stakeholders, who are, on one hand, natural targets for communication about the Strategy and Action Plan implementation, and on the other hand, key providers of information about the expected effectiveness of the actions carried out towards the problems tackled.

As already stressed yet by the CB Strategy, stakeholders are key for disseminating the new knowledge produced about climate patterns and potential NbS-based solutions, and for supporting policy improvement, fostering updated technical knowledge through capacity building for local governments in charge of land planning, and raising awareness and sensitizing the different actors of the civil society.

The following figure intends to illustrate the proposed governance scheme for both the CB Strategy and the Action Plans, also establishing the conceptual framework for the implementation of the Pilot Actions with a view to maximizing the value of the results expected from their implementation. The Steering Committee is identified as the body in charge of the function, operating with the direct support of the QMB.

[5] See: www.adriatic-ionian.eu/pillar/3-environmental-quality
[6] According to the Internal Quality Management Plan, the bePrepARed QMB is a "*scientific board composed by partners' experts, in charge to check the quality, correspondence and scientific and technical accuracy of strategies, action plans, pilot actions, as well as solution under WP3, as part of the implementation of the bePrepARed project*"
[7] See chapter 5.

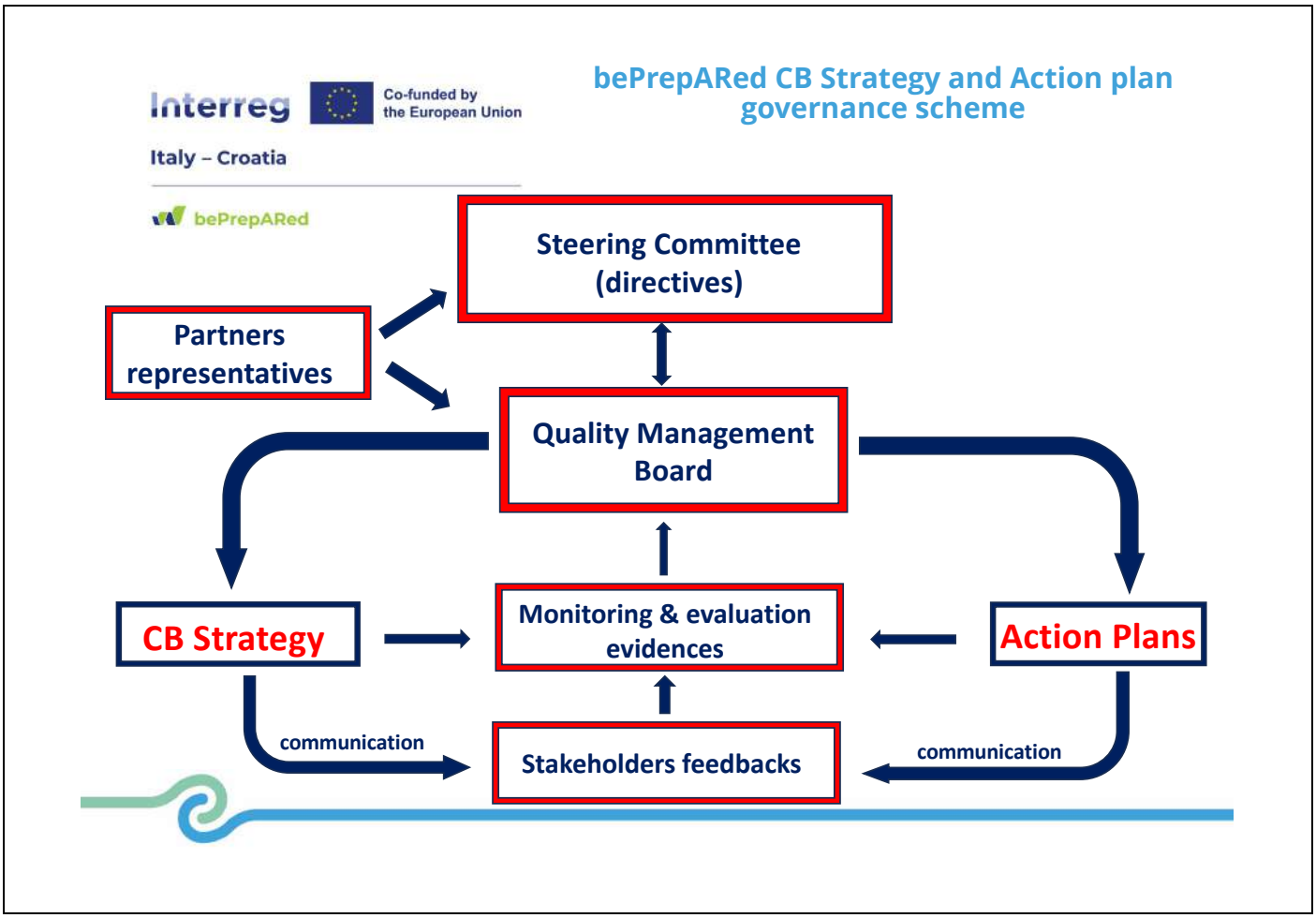


Fig. 1: outline of the CB Strategy and Action plan governance scheme

6. Pilot NbS monitoring and evaluation for practice transferability

Monitoring and evaluation (M&E) are key to assess project effectiveness i.e. the consideration of the real "use" of the project outputs by the stakeholders addressed. The best and most updated study, the most advanced guidelines for managing a specific issue, the most articulated and participated governance scheme, remain irrelevant if nobody actually utilizes the "new information" made available. From this perspective , M&E represents the main tool for a sound project management by the so-called "project owners" (i.e. the bePrepARed partners).

Nevertheless, project effectiveness – in particular post-closure - is a matter that remains largely beyond the control of the "project owners": the further away from inputs and activities, the higher the role played by context external factors, like the stakeholders intentions to actually appropriate the outputs produced by the project, transforming it into practices able to transform the reality, in this case improving territorial resilience by increasing adaptation capacity to climate change-related effects. Fig. 2 clearly represents this aspect.

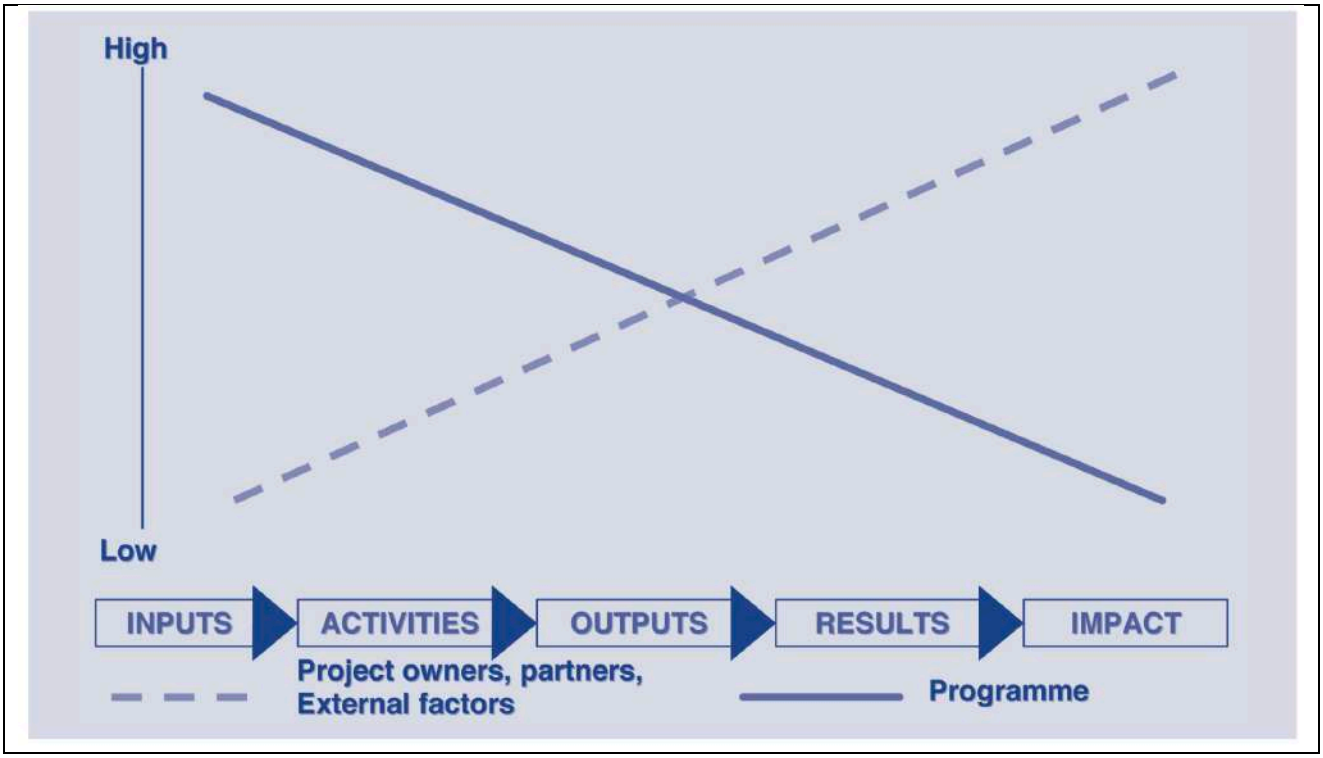


Fig. 2: Decreasing level of control by "project owners" and increasing role of the external factors, from inputs to impacts

This is the reason why capacity building, awareness raising and sensitization in general are key for achieving positive results. And, also, for keeping structural the relationship among partners.

Referring to the CB Strategy for an in-depth examination of the topic, we recall hereby the basic elements supporting the so-called "*Process Monitoring of Impacts*"[8], the method that appears more fit to the purposes of assessing the effectiveness of the project outputs. The method – we remember – has been choose because the short-term focus on activities and deliverables of such approach, with few quantified indicators, makes difficult to assess the medium and long-term processes needed to actually achieve the objectives, so that the impacts tend to be largely neglected. The approach assumes that "projects / programmes are open, complex processes, with effects that cannot be strictly determined in advance, being shaped by the actors involved, their responsibilities, resources and power to influence others.

The underlying concept is to steer the implementation of the projects by observing whether they are likely to achieve the expected results, maintaining a clear distinction between those components for which a project is directly responsible (= activities, outputs) and the expected results (or impacts), which take place because use is made of these outputs by some of the addressed stakeholders, considering that[9] effects are strongly influenced by external factors, whose importance tend to increase over time and functional distance to project activities and outputs.

Recalling the CB Strategy, the capacity building foreseen by act. 3.3 "*are to be designed to address in particular the needs for updating and upgrading the knowledge about climate change trends and the viable adaptation options linked with the use of NbS. At this regard, it has to be noted that, as those (online) capacity building events will have been completed, the related output 3.3 indicator will be more or less satisfied. But this does not imply by itself any real "impact": this will be achieved only if and when the targets of those capacity building will concretely use the "new information" from bePrepARed, mainstreaming it in the territorial management plans they are*

[8] Source: Interact (2006), cit.
[9] Source: Interact (2006), cit.

managing according to their own institutional function. And it has clearly to be stressed that this last factor is largely out of the control of any of the bePrepARed partners".

The scheme in fig. 4[10] synthesize the conceptual approach of the method, that is proposed to support the development of the Internal Quality Evaluation Reports.

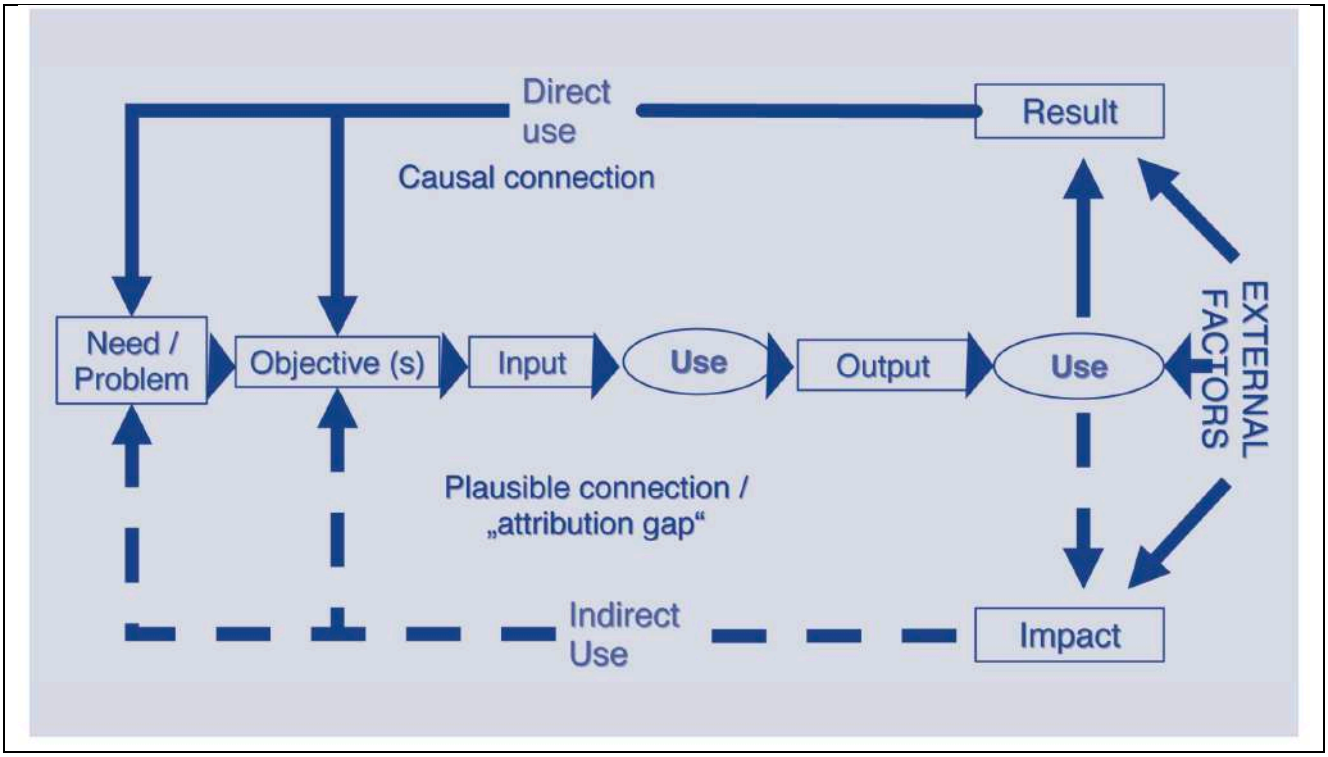


Fig. 4: Conceptual scheme of the "Process Monitoring of Impacts"

[10] Source: Interact (2006), cit.

bePrepARed Cross Border Action Plans for general Strategy implementation

Section 2 – Reports about pilot actions design and planning

WP2, att. 2.3, D.2.3.2

Introduction to the D.2.3.2 reports

The two reports that we introduce hereby, address "material" and "non-material" NbS respectively, i.e. the two types of Pilot Actions foreseen by the AF, according to activities 3.1[11] and 3.2[12]. At this regard, upon the basis of a dedicated template provided by the LP, each partner elaborated his work proposal, attributable to one activity or to the other, consistently with the scheme defined since the AF.

The proposed Pilot Actions have been prepared relying on the data and information analyses produced by the project within act. 1.2 on climate change scenarios and on the feedbacks and indications provided by the partners stakeholders, both with the survey questionnaire of act. 1.4 as well as on the working groups held with act. 2.2. With these proposals of Pilot Actions, partners intend to tackle different types of climate change-related effects that have been agreed as strategic, including among the others flood and drought risks, heatwaves and urban heat islands, wildfires, risks for biodiversity.

The differentiation of the proposals between "material" and "non-material" NbS relies essentially upon the fact that, while in both cases is foreseen a phase of analyses and studies functional to the specific NbS project design, in the first one partners will proceed also with on-field activities with concrete investments, while in the second case they do not. This is because of several different reasons, that mostly consist of the spatial scale of the requested intervention and the related dimension of the financial investment, out of the reach of a simple ETC project. It is for example the cases of the eastern Emilia-Romagna landscape re-design according to the new climate parameters, proposed by the LP, or of the relevant flood protection project for the Apulian archaeological site of Egnazia, held by P3.

The elaboration phase of the Pilot Actions accompanied the drafting of the Action Plans, as beyond serving as the 'planning tools' that give a concrete dimension to the CB Strategy, they also provided an opportunity for joint reflection on the concrete use of the results emerging from the implementation of the Pilot Actions, regardless of whether they are 'material' or 'non-material'. In other word, a reflection dealing with the "sustainability" of the results achieved.

From this point of view, the "pilot" character of the results expected, beyond being demonstrative, implies the need of their "use" – by any of the stakeholders of the partner territories or beyond – in view to "transfer" the practice, mainstreaming it into ordinary policies and planning tools at the relevant administrative levels. Otherwise, they would remain only a list of good intentions.

Therefore, having well clear that the control' exercised by each partner (as "project owner") tends to weaken over time, especially after project closure, partners have been invited to reflect carefully about the direct use of the project results they can do by themselves, within bePrepARed timeframe, in particular about:

- from a short-term perspective, which types of content produced by the project can be conveyed to relevant stakeholders, within act. 3.3 about capacity building of technical staff;
- from a medium-long term perspective, how the knowledge elements raising from the different project activities can be used for school students' education and citizens sensitization, as foreseen by act. 3.4.

[11] NbS for targeted man-made ecosystems and communities
[12] "Non-material" NbS aimed at improving site ecological management

I.e. the two project activities that have been conceived to give the highest possible resonance to the results achieved with bePrepARed, directly making best value of them since the project is still ongoing, by addressing as much stakeholders as possible.

All these aspects and considerations stand at the base of the structure of the Pilot Action fiches, that are included in the two reports, where each fiche address the following aspects:

- Title and subject of the pilot action;
- Site identified for pilot action implementation;
- Type of climate change-related effects tackled;
- Contribution of the pilot action to the Disaster Risk Reduction framework;
- Specific technical support required for pilot action design and implementation;
- Potential use and transferability of the expected results;
- External institutional support needed for result dissemination;
- Fundraising for fostering the results achieved;
- Risk analysis and contingency plan;
- Timeframe for pilot action implementation.

WP2, att. 2.3, D.2.3.2

Report #1, about “material” NbS for targeted man-made ecosystems and communities (act. 3.1)

Presentation of report #1, about “material” NbS for targeted man-made ecosystems and communities”

This report includes the pilot actions proposed by partners that, beyond the phase of identification and intervention design, includes also some concrete material implementation investments. We provide hereby a brief summary of the proposed initiatives.

- The pilot action envisaged by PP4 – Parco San Bartolo addresses areas subject to geomorphological instability, characterized by critical sections adjacent to the cliff, which is undergoing an intense erosive process. Combined with steep slopes, these conditions increase the level of hazard in the area. The proposed intervention involves a a walking trail in view to enable safe access to one of the most distinctive and scenic locations within the Park.

- The pilot action proposed by PP6 RERA SD, together with its AO – the Municipality of Trogir - addresses to issue of mitigation of the urban heat islands within the municipal territory. The planned intervention introduces a nature-based solution aimed at improving microclimatic conditions, user comfort, and the overall quality of the public space. The design integrates new greenery made of Mediterranean species, a public drinking fountain and other elements to create a welcoming and functional outdoor area that supports short stays and accessible and inclusive use, promoting hydration, public health and thermal comfort.

- The pilot action proposed by PP7 PI DNC addresses two main topics of high relevance for the ecological quality of the Neretva River Delta reserve, i.e.:
the impact of alien invasive species on biodiversity, with research actions and fishing activities tackling alien invasive shellfish species – zebra mussel (*Dreissena polymorpha*);
the impact of flooded waste on biodiversity in speleological objects, in particular by waste removal service from speleological objects in the Delta area.

P4 - San Bartolo Regional Park: NbS and stabilization works for a cliff section, including safety measures for Trail no. 151

a. Site identified for the development of the pilot action

The pilot action will be developed within the Regional Natural Park of Monte San Bartolo, located along the Adriatic coast near Pesaro. The park features a mosaic of coastal cliffs, Mediterranean scrub, cultivated fields, meadows, and wooded areas, with significant landscape and ecological value. The area can be explored through various hiking trails, in particular the well-known trail no. 151 (Pesaro–Gabicce Mare – see Figure 1), which is currently affected by significant erosion and instability. These phenomena are largely attributable to intense climatic events linked to climate change, including a constant increase in temperatures, prolonged periods of drought, and episodes of extremely intense rainfall.

Figure 1. Map of trail no. 151 – Monte San Bartolo Park. *Source: Pesaro Trekking*

The trails for the Park Authority are not only the access route to the most evocative and biodiverse places, but are also a calling card from a tourist point of view, as well as an access route in case of emergency, rescue and surveillance. The geotechnical survey carried out by the Park through a specialized company revealed the presence of localized landslide risks and surface weakening along the trails in several sections, especially where vegetation cover has been lost or is insufficient to contain erosion. These conditions make some parts of the trail network unsafe, compromising both the conservation and the image of the Park.

This pilot project focuses on critical sections of trails identified in the geological survey, with the aim of maintaining their functionality. These include erosion control measures such as soil modelling, vegetative bioengineering and targeted reinforcements to stabilize slopes and reduce runoff velocity, while preserving the natural aesthetics. Monitoring and restoration efforts also aim to revitalize native vegetation that protects against soil loss.

Monte San Bartolo is a fragile coastal landscape increasingly exposed to climate change impacts such as rising temperatures, drought, wildfires, erosion and sea-level rise, which threaten its ecosystems and cultural heritage. Ensuring the usability of these trails will contribute significantly to the preservation of natural and cultural values, while also guaranteeing safe public access. *(2.212 characters)*

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

The Parco San Bartolo area is subject to a range of climate change-related impacts that significantly affect its landscapes and infrastructures, particularly the trail network. The prevailing Mediterranean climate is characterized by hot, dry summers and mild, wet winters. However, recent climate trends reveal increasing frequency and severity of extreme weather events, including:

- prolonged drought periods causing soil desiccation, increased vulnerability to erosion and vegetation stress;
- more intense and irregular rainfall events with high peak intensities, resulting in surface runoff, washouts and slope instability along trails;
- rising average temperatures and heatwaves that exacerbate evapotranspiration and reduce soil moisture retention, further weakening soil structure along paths;
- higher risk of wildfires in the dry season, which can severely degrade vegetation cover that stabilizes soil and regulates water infiltration;
- sea-level rise and coastal erosion processes threaten low-lying park zones, indirectly affecting water flow and sediment transport within the catchment area.

This pilot action on Monte San Bartolo aims to mitigate these interconnected climatic and geomorphological vulnerabilities by increasing soil and slope stability, improving vegetation cover and managing water runoff.

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

The pilot action in Parco San Bartolo actively contributes to the Disaster Risk Reduction (DRR) governance framework by promoting an integrated, multi-level governance approach that aligns with regional, national and EU climate adaptation policies. It advances the use of ecosystem-based and Nature-based Solutions (NBS) to mitigate environmental hazards such as landslides, erosion, drought and wildfire risks that threaten the park's natural and cultural heritage.

The pilot project also aims to raise awareness of climate change and the need to adapt by installing special signage along the trails.

d. Organization and technical resources available for the Pilot action

The technical resources available include a team of geologists, supported by park staff with expertise in nature-based solutions (NbS). Tools are available for detailed mapping, hydrological modelling and on-site geomorphological assessments. Previous studies and ongoing monitoring programs form the basis for adaptive management of interventions. Naturalistic engineering and trail stabilization will be entrusted to specialized consultants selected through competitive bidding procedures.

e. Specific support required for the design and implementation of your Pilot action

The support required includes specialist advice on the design of advanced erosion control techniques, the procurement of bioengineering materials and specific training for park staff on the maintenance of NBS. Support is also needed to manage permits and facilitate coordination between the various stakeholders, including issues relating to private property. For hydrological monitoring and technical data analysis, it will be necessary to rely on external suppliers for equipment and expertise that are not fully available internally.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

The expected results will be used to support the technical capacity building of project stakeholders (act. 3.3) through their dissemination via the institutional website, highlighting the final project phases and the implementation of the pilot action, with the aim of transferring operational knowledge and good practices.
In parallel, social media channels will be used to increase the visibility of the Programme and to support education and awareness-raising activities towards stakeholders (act. 3.4).
Students will be actively involved in the dissemination process through educational field activities, fostering experiential learning and strengthening awareness of environmental protection.
Furthermore, the involvement of local mountain bike associations will contribute to more effective sensitization on the protection and sustainable use of park trails, ensuring the transferability of knowledge and practices beyond the bePrepARed project.

g. External support needed for result dissemination

For the post-project dissemination of the results achieved through the pilot actions in Parco San Bartolo, dedicated local communication and educational support will be needed. In particular, the involvement of a local social media manager would help ensure continuous visibility of the results at territorial level and support dialogue and advocacy with municipal authorities and regional institutions.
The support of a local graphic designer and videomaker will be essential to produce clear and accessible visual and audiovisual materials, capable of effectively communicating the value of the Pilot Action to residents, visitors and decision-makers.
In addition, the engagement of environmental guides and educators operating within Parco San Bartolo will be crucial to support field-based dissemination activities, guided visits and awareness-raising initiatives, strengthening local ownership of the results and fostering their long-term integration into Park management and protection practices.

h. Fundraising for fostering of the results achieved (NbS further promotion)

The further promotion of the NbS adopted through the Pilot Action within the Parco San Bartolo area can be financially supported through targeted sponsorship initiatives and voluntary donations from private entities. In particular, partnerships with local businesses, foundations and environmentally responsible enterprises operating in or connected to the Park area could be activated to support communication, awareness-raising activities and small-scale replication actions.
Additional financial support could be mobilised through donations linked to educational initiatives, guided activities or events promoted within the Park, ensuring that private contributions are transparently reinvested in the promotion, maintenance and visibility of the NbS implemented.

i. Risk analysis and contingency plan

The main risks identified are:
• weather variability, which could slow down construction and intervention work;
• possible budget overruns caused by the complexity of the site and the need for specialized interventions;
• difficulties in coordinating local structures, externalised services providers and private owners, who cover more than 90% of the area, with potential delays in authorizations and operational obstacles.
To mitigate these risks, a flexible management plan will be adopted with contingency timeframes, frequent meetings with stakeholders for effective and coordinated communication and an adaptive management approach based on continuous monitoring and environmental feedback. Collaboration and ongoing stakeholder engagement will promote shared responsibility and timely resolution of critical issues.

j. Timeframe for pilot action implementation

Please provide information about the real time needed for Pilot action implementation.
(synthetic Gantt diagram, by macro-activities)

ACTIVITY	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26
Preliminary analysis (geological report)													
Approval of the technical-economic feasibility project													
Executive design													
Works assignment (e-procurement platform)													
Suspension of activities (bird breeding period)													
Partial or complete execution of works and final delivery													

P6 RERA SD - Trogir Municipality: NbS for urban heat mitigation and climate-resilient public space in a healthcare area

a. Site identified for the development of the pilot action

The pilot action will be developed at Trg bl. Augustina Kažotića, located in front of the Church and Monastery of St. Dominic in Trogir, Croatia. The site is part of the UNESCO-protected historic core of Trogir and is listed as a cultural asset in the Register of Cultural Goods of the Republic of Croatia (No. Z-3491). The intervention area covers approximately 911 m² and is bordered by the monastery garden wall to the north, the southern façade of the church to the south, the green area with palm trees to the east, and the façade of the Port Authority to the west. This square is designed as an intimate public space that enhances the historical and cultural significance of the church while providing a multifunctional urban environment for both residents and visitors.

The northern boundary is defined by the stone wall of the monastery garden, serving as a compositional backdrop for the sculpture of Blessed Bishop Augustin Kažotić, which will be slightly relocated eastward to align with the central axis of the square. Along the western and southern edges, concrete benches separated by stone borders are installed, creating shaded seating areas under the trees while emphasizing the square's spatial structure. The paving consists of white stone laid with a gentle slope towards a central drain, reflecting the traditional Trogir style, and subtle linear lighting is embedded in key areas to enhance safety and highlight architectural features.

Additional urban elements include a bronze model of the city of Trogir, a drinking water feature for public use, and movable infrastructure for occasional cultural or religious events, such as a fire bowl for ceremonial purposes. Low Mediterranean vegetation, shrubs, and a marked line of the medieval fortification wall provide visual and ecological diversity.

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

Please provide information about the impacts you are planning to address with your pilot action (flood/drought, hydrogeological/landslide risks, heat islands, fire, biodiversity loss/perturbation, etc.
(Max 3000 characters incl. spaces)

The pilot action at Trg bl. Augustina Kažotića in Trogir is designed to address multiple climate change-related impacts that are increasingly affecting urban areas in the City of Trogir, particularly within the UNESCO-protected historic core. Observed and projected climate trends indicate that the region is experiencing a combination of extreme weather events, including higher frequency of short-duration, high-intensity rainfall, prolonged dry periods, and increasingly warm nights—also referred to as tropical nights. These phenomena are exacerbated by the urban heat island (UHI) effect, where densely built-up areas absorb and retain heat during the day, releasing it at night, leading to elevated minimum temperatures in the city center. The combination of extreme precipitation and urban heat presents both immediate and cumulative challenges for public spaces, water infrastructure, and vulnerable populations.

The first climate-related impact targeted by this intervention is **urban heat stress**, particularly in high-density, paved areas with minimal green coverage. Summer temperatures in Trogir regularly exceed the thermoneutral zone for human comfort, and tropical nights prevent effective nighttime cooling. This creates cumulative heat exposure for residents, tourists, and service personnel, increasing the risk of heat-related illnesses, particularly among the elderly. By introducing shaded seating, strategically planted Mediterranean greenery, and an open spatial layout that encourages airflow, the pilot action aims to reduce local heat stress and provide microclimatic relief in the historic center.

A second critical impact is **stormwater and surface water management under extreme rainfall events**. The historic square, being primarily paved, is prone to rapid runoff during high-intensity precipitation, which can overwhelm existing drainage infrastructure. The pilot action addresses this by integrating a central drain system connected to the municipal stormwater network, while also allowing for controlled infiltration in vegetated areas. This intervention not

only prevents localized flooding but also mitigates the urban contribution to runoff that can lead to erosion and water quality deterioration in the nearby Kaštela Bay.

Water scarcity and demand management represent a third category of climate-sensitive challenges. Trogir's water supply is limited by both seasonal peaks in tourism and long-term variability in river discharge, which is projected to decrease due to climate change-driven reductions in precipitation. The installation of publicly accessible drinking water fountains within the square directly addresses the rising need for potable water for residents, tourists, and workers, reducing pressure on household and commercial water consumption during summer peaks. This measure also encourages the use of reusable containers, contributing to sustainable water management and urban resilience. Finally, the pilot action indirectly addresses **health and social vulnerability related to climate change**. By creating a multifunctional, comfortable, and shaded public space, the intervention provides safe outdoor areas where residents and tourists can gather, reducing exposure to heat, promoting social interaction, and enhancing mental well-being. The design of the square also anticipates occasional ceremonial events and gatherings, ensuring that climate stressors, such as high temperatures and limited water availability, do not compromise community functions or cultural activities.

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

If relevant, please provide information about the way how your proposed pilot action on NBS may contribute to risk reduction within the wider framework of the disaster risk reduction policies adopted in your region/county (if any) (Max 2000 characters, incl. spaces)

The proposed pilot action on nature-based solutions in Trogir directly contributes to the implementation of Croatia's **Disaster Risk Management Strategy until 2030**, specifically addressing **Strategic Goal 1 – Disaster Risk Reduction** and **Strategic Goal 2 – Increasing Preparedness for Disaster Management**. By intervening in the urban core of Trogir, the pilot action aims to reduce the impacts of climate change-related hazards, such as flooding, drought, and extreme heat, in line with measures outlined in the Strategy.

In terms of Strategic Goal 1 – Disaster Risk Reduction, the pilot action aligns with several key objectives. Firstly, the integration of **green and blue infrastructure**, including permeable surfaces, shaded areas, and vegetation, supports flood mitigation by improving water retention and reducing surface runoff. This approach mirrors the Strategy's recommendations on **restoration and revitalization of natural floodplains** and minimizing human interventions in watercourses to enhance ecosystem resilience. By maintaining and increasing natural retention capacities in the urban environment, the NBS reduces vulnerability to intense rainfall and coastal surge events, contributing to measures under the Strategy that promote **flood risk management and prevention**. Furthermore, by enhancing shading, evapotranspiration, and cooling effects, the intervention addresses the Strategy's focus on reducing the urban heat island effect and mitigating **risks from extreme temperatures**, supporting public health and lowering heat-related hazards.

Regarding Strategic Goal 2 – Increasing Preparedness for Disaster Management, the pilot action fosters enhanced community resilience and awareness. The creation of publicly accessible shaded and green spaces improves social preparedness for heatwaves and droughts, providing both immediate protection and long-term adaptive capacity. The intervention also strengthens the capacity of local authorities to respond to climate-related events by demonstrating practical, nature-based techniques for urban climate adaptation. These efforts support measures identified in the Strategy, including **strengthening operational capacity of civil protection forces**, **community education**, and **raising awareness of disaster risk reduction**.

Moreover, the pilot action contributes to Croatia's broader objectives of integrating disaster risk reduction into urban planning and environmental management. By implementing NBS in a UNESCO-protected historic area, the project demonstrates how **sustainable and nature-based solutions** can simultaneously protect cultural heritage, enhance urban resilience, and contribute to the **strategic reduction of economic losses and human vulnerability** from disasters, consistent with the Strategy's performance indicators.

d. Organization and technical resources available for the Pilot action

The pilot action will be implemented in collaboration with the **City of Trogir** and **RERA S.D.** (Public Institution for Coordination and Development of Split-Dalmatia County).
The City of Trogir provides local knowledge, administrative support and direct access to the intervention site, ensuring alignment with urban planning, heritage protection and local disaster risk reduction strategies.
RERA S.D., as the accredited regional coordinator, offers expertise in regional development, strategic planning, and EU-funded project implementation. Their support includes technical assistance, compliance with strategic and environmental frameworks and integration of best practices in nature-based solutions. RERA S.D., part of the BEPREPARED project, contributed to the climate risk analysis in Trogir and now provides technical expertise and support in developing the green spot to address these risks.
External technical assistance will support specialized tasks such as landscape architecture, urban ecology, hydraulic engineering, heritage conservation and GIS analysis. Resources will include construction equipment, materials for hardscape and softscape elements, water management infrastructure and monitoring tools to evaluate the effectiveness of the green spot interventions.

e. Specific support required for the design and implementation of your Pilot action

City of Trogir and **RERA SD** provide local coordination, planning support and regional development expertise. Specialized skills not available internally will need to be procured through public procurement to ensure high-quality execution. These include:
Architectural and urban design expertise is needed for the detailed shaping of the square, paving, placement of urban equipment, and alignment with the historical context.
Heritage conservation and cultural-historical expertise is required for the protection and proper handling of cultural assets.
Construction and technical execution expertise is necessary for site preparation, installation of stone paving, water and lighting systems, and horticultural works, with skilled contractors and supervising engineers ensuring quality and compliance with standards.
Horticultural and landscape expertise is required for designing and planting Mediterranean vegetation, tree rows, and maintenance of green areas.
Electrical and lighting specialists are needed for the installation of linear lighting, urban equipment illumination, and drinking water systems in accordance with safety and aesthetic standards.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

The expected results will be used to support the technical capacity building of project stakeholders (act. 3.3) through their dissemination via the institutional websites of the City of Trogir and RERA S.D., highlighting the design, implementation and operation of the pilot action, with the aim of transferring operational knowledge and good practices in nature-based solutions for healthcare-adjacent public spaces.
Social media channels will be used to increase the visibility of the project and to support education and awareness-raising activities towards stakeholders (act. 3.4), focusing on climate adaptation, urban greenery and public health benefits.
Healthcare staff, trainees, and local community members will be engaged through guided site visits, demonstrations, and small-scale participatory activities, fostering experiential learning, raising awareness of environmental protection, and highlighting the role of green infrastructure in improving comfort, shading, and well-being for patients and visitors.
Furthermore, the lessons learned from the pilot action—including design guidelines, plant selection, microclimate improvements and accessibility solutions- contribute to the transferability of knowledge and practices beyond the bePrepARed project, allowing replication in other healthcare facilities, public institutions and urban contexts.

g. External support needed for result dissemination

The pilot action results will be used to support awareness-raising activities by translating monitoring data and field experience into clear and accessible messages on the benefits of nature-based solutions for patient comfort, staff well-being, and urban microclimate improvement.
These outputs will be used in communication, education, and outreach aimed at increasing public understanding of the role of green infrastructure in mitigating heat stress, improving hydration access, and enhancing the overall quality of healthcare-adjacent public spaces.
Evidence generated by the pilot action will support institutional dialogue and advocacy towards competent authorities by demonstrating the effectiveness of NbS-based interventions in climate-vulnerable urban areas, including the reduction of heat stress and improved water management in outdoor healthcare spaces.
The results can contribute to the integration of nature-based solutions into local development plans, public health facility management, and urban climate adaptation policies.

h. Fundraising for fostering of the results achieved (NbS further promotion)

The results of the pilot action at the Trogir Health Centre can serve as a basis for future funding applications to expand and replicate nature-based solutions in other healthcare facilities, urban public spaces, and community areas across Split-Dalmatia County and beyond. Potential funding sources include EU programmes (e.g., LIFE, Horizon Europe, Interreg), national health and climate adaptation funds and local or regional budgets for urban resilience, public health and green infrastructure.
The pilot action offers practical implementation experience and evidence that can support further investments in urban NbS, particularly those that improve microclimate, comfort for patients and visitors and overall public health. This experience also strengthens the ability of the City of Trogir and RERA S.D. to develop well-prepared project proposals and ensure that NbS measures continue to be implemented and maintained beyond the bePrepARed project.

i. Risk analysis and contingency plan

The implementation of the Pilot action may face several risks, particularly those independent of the partners' will or operational capacities. External regulatory or administrative delays may occur, such as prolonged approvals from heritage conservation authorities or local government permits. Weather and environmental conditions could affect construction and landscaping works, especially for stone paving and planting of Mediterranean vegetation. Supply chain disruptions may delay the procurement of specialized materials such as stone, bronze, or electrical components. Unforeseen structural findings during site preparation could require additional work or modifications. Public safety and logistical risks may arise during construction due to the site's location in a busy historical urban area. Finally, financial or funding uncertainties may impact the timely acquisition of services or materials through public procurement.

To mitigate these risks, the project will adopt a multi-layered approach: close coordination with heritage and municipal authorities will be maintained to ensure timely approvals and compliance. Work schedules will include seasonal and weather contingencies to avoid delays. Procurement planning will consider alternative suppliers and early orders to minimize supply chain risks. Site preparation will include preliminary archaeological and structural surveys to anticipate unexpected findings. Safety measures and clear traffic management plans will be implemented to protect workers and the public during construction. Finally, financial planning and phased procurement will ensure that essential activities are funded and executed on schedule, maintaining the overall timeline of the Pilot action.

j. Timeframe for Pilot action implementation

	Months										
Macro-Activity	*Nov 2025*	*Dec 2025*	*Jan 2026*	*Feb 2026*	*Mar 2026*	*Apr 2026*	*May 2026*	*Jun 2026*	*Jul 2026*	*Aug 2026*	*Sep 2026*
1. Preparation, planning and monitoring											
2. Earthworks, paving and infrastructure installation											
3. NBS Implementation and Landscaping											
4. Monitoring, Evaluation, Handover, and Dissemination											

P7 PI DNC - Neretva Delta Reserve: actions to reduce harmful invasive species by selective fishing and riverbed cleaning from flood-transported waste

a. Site identified for the development of the pilot action

The area most exposed to extreme floods and droughts in the Dubrovnik-Neretva County is the Neretva River delta. It is the largest river estuary in the Republic of Croatia and the only true delta. It is one of the few remaining wetlands in Europe, and it consists of remnants of Mediterranean wetlands with preserved coastal lagoons and large areas of wetland habitats important for biodiversity. The Neretva Delta is one of the five areas of the Republic of Croatia included in the Ramsar list and represents an international wetland area. The delta area has also been a part of the Natura 2000 ecological network (HR5000031). In the area of the Neretva delta, there are seven protected areas and one protected mineral, in accordance with the Nature Protection Act. These are Special ornithological reserves (Modro oko i jezero Desne, Pod Gredom, Prud, Orepak, Kuti), a Special ornithological and ichthyological reserve (Mouth of Neretva River), Protected landscape (Predolac- Šibenica) and a Protected mineral- stone spheres (in the Municipality of Pojezerje). In the dry period, due to the reduced inflow of fresh water from the basin, there is an increased penetration of the sea into the interior of the basin, through the beds of surface streams, and underground through the karst fissure system and through the alluvium of the Neretva River valley. In this way, the water in the surface watercourses, especially in the Neretva bed, as well as the underground water, becomes very salty. In the summer months, a wedge of sea water penetrates through the mouth of the Neretva upstream all the way to Bosnia and Hercegovina. Consequently, the influence of drought and seawater salinization negatively affect all freshwater fauna of Neretva River Delta (such as Freshwater fish, Reptiles and Amphibians), while reduced water inflow has a negative effect on fauna whose life cycle depends on water or wetlands (some Insects). It is necessary to research the impact of drought on the fauna of the Neretva delta and their development forms in order to obtain a basis for more efficient management of the area.

Due to the impact of climate change, species and habitats are disappearing, species are migrating to other areas, and invasive alien species are settling. Regarding the impact of salinization by seawater intrusion, which is most significant in Lake Desne (in the status of special ornithological reserve) in which salinity of up to 25 PSU was recorded in the summer, which negatively affects all freshwater flora and fauna. Invasive freshwater plants e.g. Egeria densa and Myriophyllum heterophyllum and blue crab (Callinectes sapidus) inhabit the aquatic habitats of the delta Neretva. In laguna Parila (the part of Neretva River Delta) there is complete disappearance of benthic shellfish such as striped venus clam, lagoon cockle, and Mediterranean mussel, declining native green crab, and some fish species that were previously numerous such as leaping grey mullet.

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

Impact of alien invasive species on biodiversity:

- Research and fishing of an alien invasive shellfish species – zebra mussel (*Dreissena polymorpha*).

Impact of flooded waste on biodiversity in speleological objects:

- Waste removal service from speleological objects in the Neretva River Delta.

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

1. The invasive species population control service in the Neretva Delta is necessary, as the species *D. polymorpha* can cause a number of undesirable economic and ecological effects, such as the accumulation of individuals in water pipes, cooling ponds of power plants, concrete reservoir banks, pipelines and pumps. Large biofouling accumulations also interfere with fisheries because they settle on fishing nets, engines and ship hulls. Within this project, the proposed population control measure is implemented as an experimental fishing practice, in line with the definition provided in the AF. Its pilot character lies in testing an innovative, NBS approach to managing the species: instead of relying on mechanical or chemical removal methods, the action explores whether targeted, specially adapted fishing techniques can effectively reduce local populations while minimizing disturbance to native habitats and non-target species. The pilot will therefore serve to generate evidence on feasibility, efficiency and ecological safety of this NBS-oriented method, providing data for future upscaling and integration into long-term management strategies.
2. Flood-transported waste in speleological objects in the Neretva River Delta needs to be removed. This waste results from changing rainfall patterns. Increasingly intense rain events wash greater amounts of waste from inland areas toward the delta, causing a decline in ecological conditions. This means that, in some cases, NBS for climate adaptation simply involve restoring basic ecological quality by removing this accumulated waste

d. Organization and technical resources available for the Pilot action

1. Research and control of the alien invasive shellfish species – the zebra mussel:
- four research experts (including divers);
- benthic sampling net ('scraper', 25 × 25 cm);
- 80% ethanol;
- digital caliper with 0.01 mm accuracy;
- car;
- boat;
- equipment for measuring physical and chemical water parameters.

2. Waste removal from speleological objects in the Neretva River Delta:
- six speleologists;
- static ropes, pulleys, descenders, ascenders (crolls, rope clamps), and other speleological equipment;
- scale;
- waste container;
- truck.

e. Specific support required for the design and implementation of your Pilot action

1. Research and control of the alien invasive shellfish species – the zebra mussel:
When selecting the key expert, the criterion was the number of previous zebra mussel research projects completed. This service provider has already been selected through public procurement.
2. Waste removal from speleological objects in the Neretva River Delta:
When selecting the key expert, the criterion was the number of previous cleaning services performed in speleological sites. This service provider has already been selected through public procurement.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

These results will be used as input for capacity building activities addressed to protected area managers, public authorities and technical staff. They will be transformed into case studies, training materials and practical examples supporting skills development in planning and implementing Nature-Based Solutions in climate-vulnerable ecosystems.
Selected results and evidence from the pilot action will be used for sensitization and education initiatives targeting local communities, resource users and the general public. They will support communication activities aimed at increasing awareness on climate change impacts on delta ecosystems and on the role of NbS in enhancing ecosystem resilience.
The pilot action results are transferable to other Mediterranean river deltas, wetlands and transitional water bodies experiencing similar environmental and climate pressures. The applied NbS-based approach can be adapted to different territorial and governance contexts and replicated by institutions responsible for nature protection, water management and climate adaptation within and beyond the Italy–Croatia Programme area

g. External support needed for result dissemination

The results of the pilot action will address local communities, resource users (e.g. fishermen, farmers), visitors of the protected area, as well as local, regional and national institutions involved in nature protection, water management and climate adaptation.
The pilot action results will be used to support awareness-raising activities by translating monitoring data and field experience into clear and accessible messages on climate change impacts on delta ecosystems and on the vulnerability of associated subterranean habitats.
These outputs will be used in communication, education and outreach initiatives aimed at increasing public understanding of the benefits of Nature-Based Solutions.
Evidence generated by the pilot action will support institutional dialogue and lobbying towards competent authorities by demonstrating the effectiveness of NbS-based management measures in a climate-vulnerable delta environment including surface and subterranean ecosystems.
The results can contribute to the integration of ecosystem-based adaptation measures into local development plans, protected area management plans and climate adaptation policies

h. Fundraising for fostering of the results achieved (NbS further promotion)

After project closure, the results of the pilot action can be used as a basis for further funding applications aimed at scaling up and replicating NbS measures in the Neretva River Delta and in other connected surface and subterranean ecosystems. Potential funding sources include EU programmes (e.g. LIFE, Horizon Europe, future Interreg calls), national environmental and climate funds, and regional or local public budgets dedicated to nature protection and climate adaptation.
The pilot action provides tested practices, monitoring evidence and implementation experience that can be used to justify future NbS investments. This strengthens the institutional capacity of P7 PI DNC to design mature project proposals and to ensure continuity and long-term sustainability of NbS measures beyond the bePrepARed project.
By embedding the pilot action results into regular management practices and strategic planning documents, P7 PI DNC can ensure that NbS implementation in the Neretva River Delta continues and evolves after project closure, avoiding discontinuity and loss of achieved results.

i. Risk analysis and contingency plan

The main potential risk concerns the limited time available for finalization of all technical outputs and reporting activities, in particular the timely delivery of external expert reports.

While field activities related to the cleaning of speleological objects have already been completed and the relevant report has been submitted, the report related to invasive shellfish research is expected by end of June 2026, with the official project deadline for both reports set for 20th of August 2026. Although this timeframe is considered adequate, delays in report finalization could reduce the time available for internal validation and integration of results into project deliverables.

The risk is mitigated by the advanced implementation stage of the pilot action, continuous communication with external contractors and the availability of a buffer period between the expected delivery of reports and the official project deadline. In case of minor delays, preliminary findings can already be used for internal validation and integration.

j. Timeframe for Pilot action implementation

Activity	Mar-2025	Apr-2025	May-2025	Jun-2025	Jul-2025	Aug-2025	Sep-2025	Oct-2025	Nov-2025	Dec-2025	Jan-2026	Feb-2026	Mar-2026	Apr-2026	May-2026	Jun-2026	Jul-2026	Aug-2026	Sep-2026
Planning and preparation of Public Tender Procedure																			
Public Tender procedure																			
Preparation of a field waste removal plan and implementation of waste removal activities in speleological objects																			
Analysis of waste removal results and preparation of the report on speleological objects																			
Preparation of a research and fishing plan of invasive shellfish and implementation of field research and fishing activities																			
Analysis of the results of invasive shellfish research and fishing activities and preparation of the related report																			
Public presentation of the results																			

bePrepARed Cross Border Action Plans for general Strategy implementation

WP2, att. 2.3, D.2.3.2

Report #2, about “non-material” NbS aimed at improving site ecological management

Presentation of report #1, about “non-material” NbS aimed at improving site ecological management

This report includes the pilot actions proposed by partners that, beyond the phase of identification and intervention design, includes also some concrete material implementation investments. We provide hereby a brief summary of the proposed initiatives.

- The pilot action proposed by the LP – Emilia-Romagna Reconstruction Agency – together with its AO Po River Delta Regional Park - addresses the flood vulnerability assessment of the area of the Cervia Saltworks, in the south-eastern part of the Region, in view to improve hydraulic performance and protect the extent from freshwater intrusion. In this framework, the implementation of Nature-Based Solutions (NBS) will lead to a reconsideration of the area’s overall spatial configuration, aligning climatic projections with the geomorphological features, to enhance hydraulic resilience and foster positive effects on biodiversity. The impacts addressed by the project particularly concern the context of the saltpans, including the loss of high-quality salt production and damage to productive infrastructures. These are associated with degradation of significant environmental and cultural heritage, resulting in a decline of the overall landscape quality.

PP2 ASSET is coordinating a pilot project at the site of Egnazia, the most significant example of a Roman and Late Antiquity city in Puglia, located among farmhouses and centuries-old olive trees overlooking the Adriatic Sea and representing one of the most significant archaeological sites in the region. Characterized by extreme precipitation events above all ccurring during summer, the period of mayor visits to the area, by heath waves and the increase in droughts frequency, the site will be object of the design of NbS-sound mitigation measures, in view in particular to mitigate the effects of the extreme precipitation events.

- PP5 ZADRA NOVA, together with its AO, the National Park Paklenica, located on the southern slopes of the Velebit Mountain in Zadar County, will implement a pilot action addressing climate-related critical issues, in particular within the protected area the Velika Paklenica stream, subject to flash-flood behaviour and sediment transport. This location provides suitable conditions for enhancing existing monitoring practices and supporting the further development of Nature-Based Solutions (NBS) as well as Early Warning System, by collecting data aimed at understanding rainfall–runoff dynamics, in view to support le elaboration of low-impact, non-material strategies designed to enhance the scientific, planning, and monitoring frameworks for climate adaptation through Nature-Based Solutions (NBS).

LP Emilia-Romagna AfR- Design of Nature-based Solutions for flood risk reduction in the area of the Cervia Saltworks - Po river Delta Regional Park

a. Site identified for the development of the pilot action

Thanks to its favorable climate, characterized by long, warm, and dry summers combined with steady winds, the Mediterranean basin has historically been a key region for salt production through solar evaporation. In Italy, about twenty saltworks are included in the Natura 2000 network, but only six remain active today, among which the Cervia saltworks represents one of the most important examples for both cultural and environmental value.

Located in the southernmost area of the Po Delta Regional Park (Emilia-Romagna; Fig. 1), the Cervia saltworks covers 827 hectares and has been recognized as a wetland of international importance under the Ramsar Convention since 1979. The area, rich in biodiversity, hosts numerous protected bird species such as flamingos, black-winged stilts, and avocets, making it a crucial site for conservation and ecotourism.

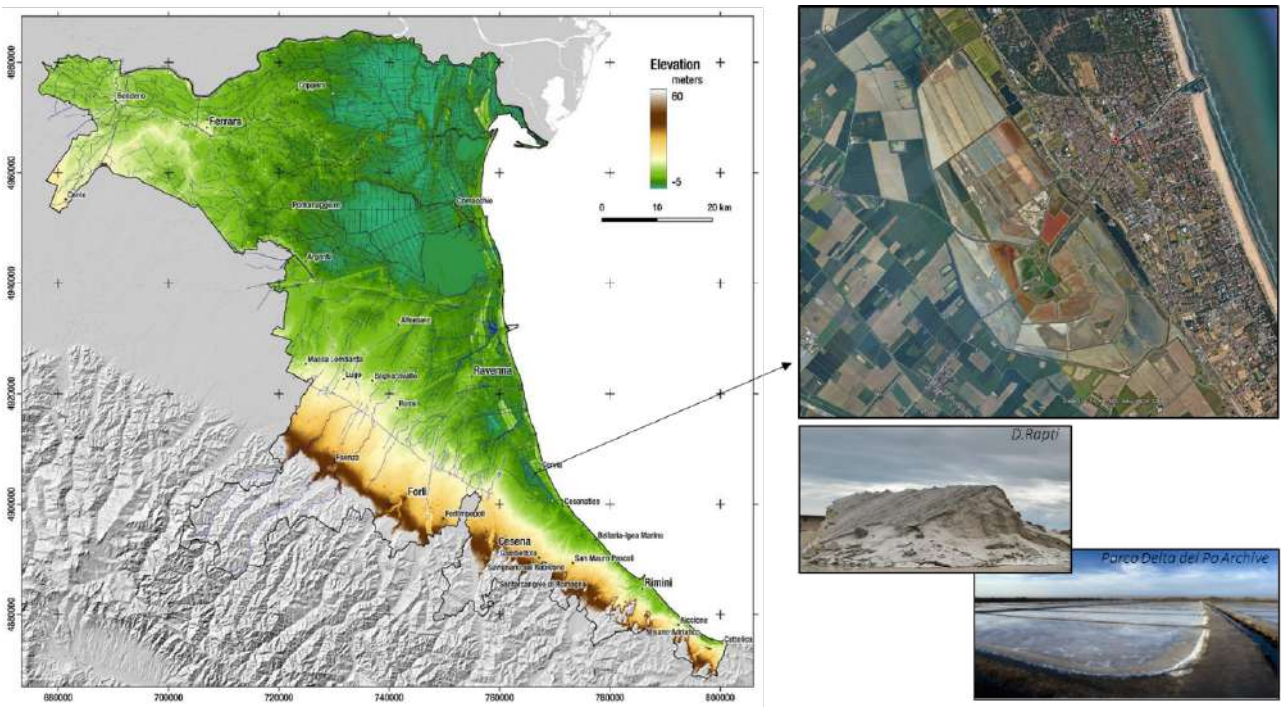


Figure 1: Elevation model of the Delta Po area, Cervia Saltworks salt accumulation and evaporation ponds.

From a geological perspective, the territory evolved through major environmental transformations. During the last glacial period, the area was a wide alluvial plain, later submerged by the Flandrian marine transgression about 15,000 years ago. Over the last two millennia, fluctuating sea levels, subsidence, and tectonic activity shaped the coastal landscape, alternating phases of dune formation and lagoonal environments (Fig. 2). Between 1950 and 2004, the area experienced a subsidence of 0.42 m, mainly due to intensive gas and groundwater extraction.

Archaeological excavations conducted in 2014–2015 revealed the remains of Roman saltworks, with wooden sluices, canals, and evaporation basins, proving that salt extraction in Cervia dates back to at least the 4th–3rd centuries BC. Historical documents from 965 AD further confirm the strong link between the city and its salt, which became a defining element of Cervia's identity.

Currently, the saltworks' structure includes over 50 evaporation basins surrounded by a 14 km canal system. Its spiral-shaped layout allows seawater from the Adriatic Sea to circulate through the system of gates and channels, gradually concentrating until salt crystallizes (Fig. 3). Harvesting occurs manually in the central "rango" basins during the traditional event known as the cavadura, held annually from August for about forty days.

The salt's distinctive pink hue derives from the microalga Dunaliella salina, rich in beta-carotene and glycerol, which protects against high salinity and light exposure. Beyond its ecological role, this alga holds promising applications in biotechnology, including vaccine and therapeutic protein production.

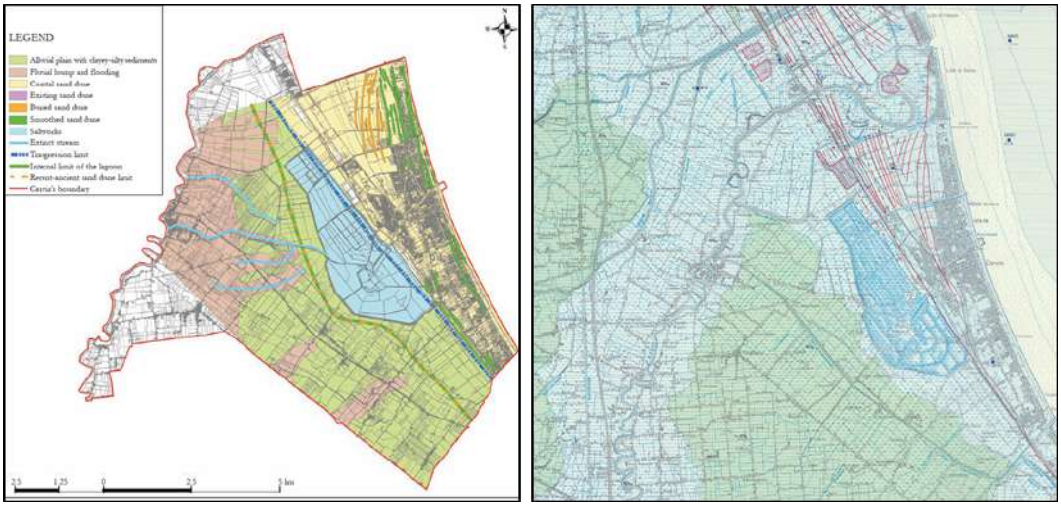


Figure 2: On the left, geomorphologic map and on the right geological map; the red lines represent dune ridges.

Cervia's salt is unrefined, washed only with saturated brine, and naturally dried in open-air piles. Known as "sweet salt," it contains a very pure form of sodium chloride with minimal bitter chlorides, maintaining essential trace elements such as iodine, zinc, copper, manganese, iron, calcium, and magnesium. The average composition per 100 g includes 95 g of NaCl, 0.659 g of sulfates, 0.193 g of calcium, and 0.292 g of magnesium.

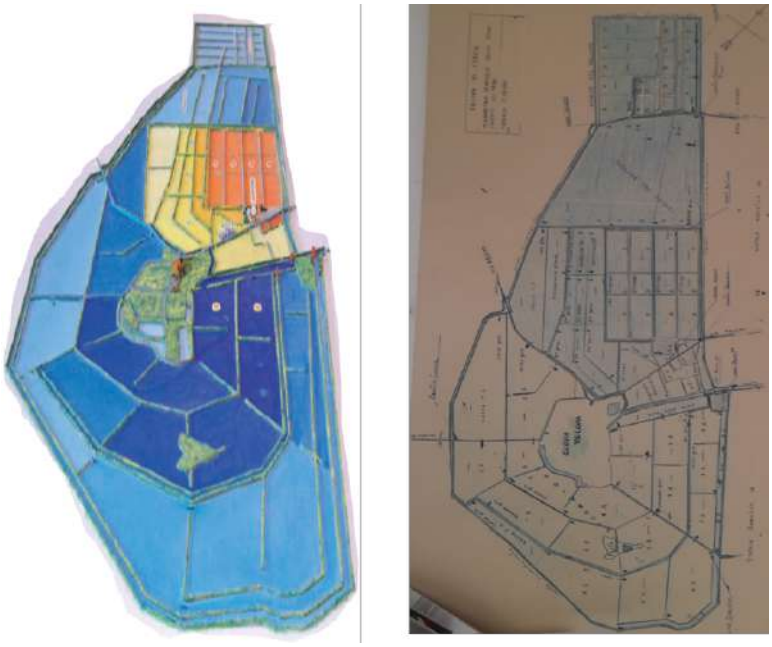


Figure 3: The sequence of evaporation basins at the Cervia saltworks is illustrated in a model displayed at the visitor center. The progression—from light blue to purple to yellow—represents the different stages of seawater evaporation and salt concentration, leading to the orange-colored salting basins where the actual salt harvesting occurs.

Since 2002, the saltworks has been managed by the ***Parco della Salina di Cervia*** company, mostly publicly owned by local institutions. Annual production averages 7,000–8,000 tons, and in 2025, Cervia salt became the first in Italy to achieve both **marine bio** and **vegan** certifications, underscoring its environmental and ethical value. However, recent extreme weather events have challenged the site's resilience. In May 2023, flooding from the Savio River caused complete production loss and major structural damage, while heavy rainfall in July 2025 diluted the hypersaline brines, reducing salt yield (Fig. 4).

The Cervia saltworks thus represents a unique model where **heritage, ecology, and traditional production coexist,** symbolizing the enduring interaction between human ingenuity and natural forces that has characterized Mediterranean salt making for millennia.

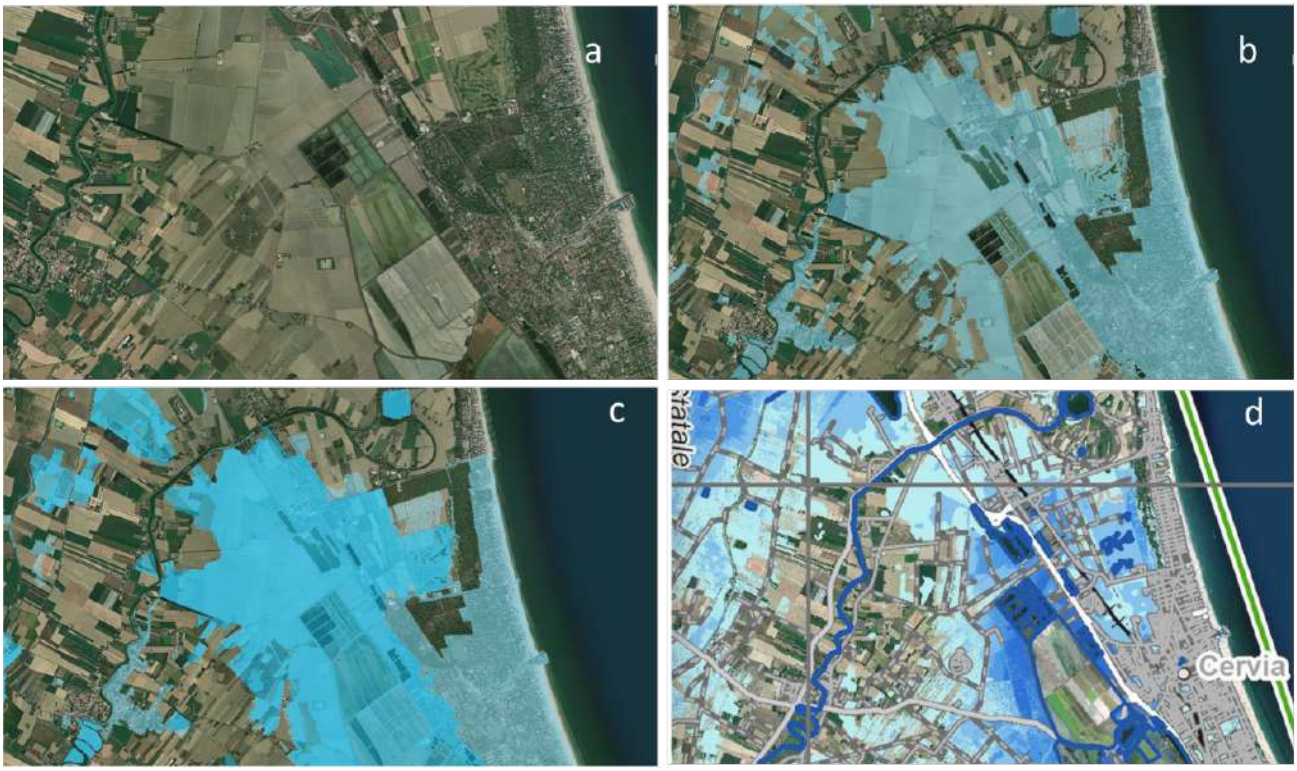


Figure 4: The 2023 flood in the Cervia saltworks a) the saltworks before May 16; b and c) flood propagation dynamics May 16 and 17; d) maximum flood depth between May 16 and 23: water depth (m) ranges from light blue (0–0.5) to dark blue (3.5–5.5).

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

Project Description

The project is part of a broader strategic framework aimed at improving the hydraulic performance of the Saline di Cervia area by reducing floods and protecting the extent from freshwater intrusion. In this framework, the implementation of Nature-Based Solutions (NBS) leads to a reconsideration of the area's overall spatial configuration, aligning climatic projections with the geomorphological features of the territory to enhance hydraulic resilience and foster positive effects on biodiversity. The impacts addressed by the project particularly concern the context of the saltpans, including the loss of high-quality salt production and damage to productive infrastructures. These are associated with degradation of significant environmental and cultural heritage, resulting in a decline of the overall landscape quality.

The assessment of vulnerability scenarios and risk levels underpins an incremental approach to intervention planning, reflecting the central importance of saltpan protection within the pilot action. Accordingly, the decision-making process must prioritize interventions through cost–benefit evaluations. Special attention should be given to earthworks, which must be supported by pedological and agronomic analyses to prevent the degradation of fertile soils.

Three main macro-actions are envisaged:

Action 1 – Building a Knowledge Framework

The first action concerns the development of an integrated knowledge framework based on a comprehensive hydraulic study of the existing and planned infrastructures along the entire course of the Savio River.

The analysis aims to reconstruct the hydrological behavior of the river basin and the lowland areas, also taking into account climate change scenarios. The objective is to strengthen understanding and awareness of hydraulic management challenges, in order to design appropriately scaled interventions in the Cervia area.

Expected impact: Improved territorial knowledge, increased awareness of hydraulic risks, and enhanced support for integrated land management aimed at developing a replicable land-use model for the entire river basin.

Action 2 – Physical Protection of the Saltpan Perimeter

The second action foresees targeted interventions along the margins of the saltpans bordering the morphologically lower areas, covering a total length of approximately 8 km. These works are not conceived as simple embankments, but rather as soil remodeling interventions designed for multifunctional purposes (agriculture, tourism, leisure, etc.). The boundaries toward the town of Cervia are already protected by the railway embankments, the State Road Romea, and the coastal dune system. Analyses of past flooding events and simulations of the area's behavior after the implementation of the planned adaptation measures along the Savio River will help identify the stretches most vulnerable to freshwater intrusion, thus defining a new protection perimeter based on vulnerability and focusing interventions where they are actually needed.

Expected impact: Strengthening the physical margins contributes to environmental protection and the safeguarding of the saltpan's productive system, while preserving the environmental and cultural heritage associated with this unique landscape.

Action 3 – Ecological and Functional Reconfiguration of Agricultural Areas for Hydraulic Risk Management

The third action focuses on the functional reconfiguration of agricultural areas, through an adaptive strategy that can be transferred to broader contexts. It envisages the redesign of the agricultural landscape surrounding the saltpans, promoting productive systems capable of tolerating periodic inundation or waterlogging, and integrating with flood retention functions.

The intervention also aims to increase biodiversity through the creation of complex and interconnected habitats and by expanding wetlands in support of threatened ecosystems. Moreover, it seeks to improve water inflow and circulation within the high-biodiversity wetland system, enhancing natural purification processes through Phyto depuration.

This action includes both physical interventions (mainly earthworks to adapt areas to wetland conditions) and the establishment of agreements with private stakeholders and public bodies involved in the area.

Expected impact: Enhanced hydraulic resilience, increased biodiversity, improved ecological and functional quality of the wetland system, and broader benefits in terms of regulating ecosystem services.

The map shows the hypothetical areas affected by action 2 (red line) and action 3 (dashed areas).

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

The actions may serve as an operational reference for the integrated management of hydraulic and environmental systems at the regional scale, interacting with the outcomes of other recent or ongoing studies in the Emilia-Romagna region and in comparable contexts. Many of these are connected to European project frameworks and rely on multidisciplinary expertise in the field of territorial and urban resilience.
The proposed approach is grounded in Nature-Based Solutions (NBS), promoting a realignment between hydrological dynamics, geomorphology, and the ecological structure of the territory. The actions are consistent with the strategic orientations of the PTR (Piano Territoriale Regionale) and with the climate change adaptation policies promoted by the Emilia-Romagna Region.
The definition of an integrated knowledge framework and adaptive hydrological models provide a methodological template that can be replicated in other catchments, supporting hydraulic risk planning and management at a supra-municipal scale. Physical protection and ecological reconfiguration interventions further promote the enhancement of wetland areas and the conservation of biodiversity, strengthening territorial resilience and the ecosystem regulation capacity of regional coastal and lowland areas.
By engaging with territorial and landscape planning instruments, the pilot action is expected to contribute positively to their evolution and to the related policy frameworks, both at local and regional scales.

d. Organization and technical resources available for the Pilot action

The document outlines the range of expertise required for the development of the project phase, which is conceived as a strategic guidance tool, aimed at defining reference scenarios, principles, and operational guidelines developed through Nature-Based Solutions (NBS) approaches. The study is grounded in the analysis of territorial criticalities, providing support for sustainable future decisions and interventions. Its goal is to produce an informative and propositional framework that identifies objectives, strategies, and guiding principles for territorial transformation, serving as a reference basis for subsequent executive design phases and relevant administrative procedures.

Required Expertise:

Hydrological and geomorphological analysis:

Expertise in the interpretation of hydrological and geomorphological processes through modelling and GIS-based spatial analysis, integrating ecological and engineering knowledge to design resilient and adaptive interventions.

Strategic assessment and evaluation methodologies:

Competence in the application of Cost–Benefit Analysis (CBA) and Multi-Criteria Analysis (MCA) methodologies. This activity plays a crucial role in highlighting the economic rationale of preventive actions, demonstrating that investments in mitigation and adaptation are more sustainable than the restoration and compensation costs resulting from potential environmental and infrastructural damages.

Institutional and participatory governance:

Skills in managing institutional dialogue among the various stakeholders through the design of a participatory and bilateral engagement process. In practice, this involves coordinating relationships among the involved municipalities, the Saltpan management authority, the Reclamation Consortium, the Emilia-Romagna Region, agricultural associations, and other private or third-sector actors.

Interdisciplinary coordination and project management:

Capacity for interdisciplinary coordination of research groups, time and resource management, and the monitoring and evaluation of interventions. This also includes the ability to maintain effective communication with stakeholders and institutions, ensuring coherence, efficiency, and long-term sustainability of results.

e. Specific support required for the design and implementation of your Pilot action

The activities included in this document will be supported by consultancy services integrated into the Interreg project structure, making use of existing internal expertise for the strategic assessment of processes, methodological implementation, and knowledge framework development. This internal technical support will guarantee the proper interpretation of data and an in-depth analysis of environmental, social, and economic impacts. It will also ensure that the assessment of the economic feasibility of preventive actions is comprehensive, accurate, and consistent with best practices in mitigation and adaptation, thereby avoiding the need for external contracting.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

The pilot action delivers integrated tools that can be effectively transferred both within and beyond the bePrepARed framework. The combined use of hydraulic modelling, climate-based risk assessment and Nature-Based Solutions provides a replicable decision-support model for flood risk management in vulnerable coastal and lowland areas, which can be replicated in other areas of the Emilia-Romagna region.
Within bePrepARed, the experience gained can guide other pilot sites in aligning spatial planning, ecosystem restoration and productive landscapes to enhance resilience. Although the project may not generate immediate or concrete spatial impacts, it produces a significant awareness-raising effect within public administrations and, in particular, among private actors.
This process is crucial in fostering future collaborations for the implementation of new Nature-Based Solutions (NBS). The outcomes will also be part of publications, contributing to knowledge dissemination on adaptive landscape strategies.
In addition, the results offer clear indications for technical capacity building among project stakeholders and provide key elements for education and sensitization activities, strengthening awareness of hydraulic risk, ecosystem services and climate adaptation. Beyond the project, the approach is highly transferable to other river basins and transitional environments, promoting long-term sustainability and biodiversity enhancement

g. External support needed for result dissemination

Effective dissemination of the pilot action results will require targeted external support to ensure that knowledge, tools and experiences reach a wide and diverse audience. Specialized communication expertise is needed to translate technical outcomes into accessible materials for policymakers, practitioners and local communities. Support from external communication agencies, scientific publishers and professional networks would strengthen the visibility of the project at regional, national and European levels.
In addition, collaboration with universities, research institutes and training providers can facilitate the organization of workshops, webinars and capacity-building activities, enhancing the uptake of results among public authorities and stakeholders.
External support is also essential for developing digital platforms, visual tools and policy briefs that can effectively convey the benefits of Nature-Based Solutions and adaptive landscape strategies. By combining technical dissemination with strategic communication, the project can maximize the impact of its results and foster long-term replication across different territorial contexts.

h. Fundraising for fostering of the results achieved (NbS further promotion)

The project opens significant opportunities for future fundraising aimed at scaling up and consolidating the proposed interventions. In particular, the project aims to demonstrate the cost-effectiveness of Nature-Based Solutions (NBS) within cost–benefit analysis frameworks, thereby enhancing stakeholders' awareness of the economic costs associated with climate change.
The integrated approach combining hydraulic risk management, Nature-Based Solutions and adaptive agricultural systems provides a strong foundation for attracting funding focused on climate adaptation, biodiversity restoration and sustainable territorial development.
Future funding could support the extension of the protection measures in the surrounding areas, the enlargement of wetland systems and the implementation of transferable models in other river basins. Additional resources may also be mobilized to strengthen monitoring activities, applied research and capacity-building programs for public authorities and local stakeholders.
By demonstrating tangible environmental, social and economic benefits, the project positions itself as a strategic platform for long-term investment in resilient landscapes, fostering partnerships between public institutions, research bodies and private actors committed to climate-resilient development.

i. Risk analysis and contingency plan

1. Risks related to the timing of interactions with public bodies

The project involves collaboration among several authorities and agencies responsible for hydraulic and environmental management. Potential delays in data transmission, technical validation, or authorization procedures could lead to shifts in the project schedule.

Mitigation measures:

Establishment of a permanent technical working group.
Periodic updates among project representatives.
Definition of a shared calendar.
Possibility of overlapping compatible activities to ensure operational continuity.

2. Risks arising from technical or environmental incompatibility

The proposed solutions — particularly Nature-Based Solutions (NBS) and adaptation interventions — may prove partially ineffective or inconsistent with local hydraulic and geomorphological conditions. Furthermore, the timelines required for authorization processes may not fully align with those for the operational implementation phases (e.g., earthworks, planting, etc.).

Mitigation measures:

Periodic verification of the results of hydraulic and environmental analyses. Revision of design solutions based on simulated scenarios. Continuous involvement of multidisciplinary experts and managing authorities in technical validation processes.

3. Risks related to overall project coordination

The complexity of parallel activities may lead to overlaps or organizational slowdowns.

Mitigation measures:

Continuous monitoring of project progress. Use of shared project management tools. Regular coordination meetings with all partners to verify progress and adjust activities as needed.

The application of the mitigation measures described above will ensure effective control over project objectives and maintain the overall efficiency and effectiveness of the planned actions, even in the presence of external or operational variables.

j. Timeframe for Pilot action implementation

ID	Activities	Task	Description	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26
1	Analysis, Framework, and Knowledge Base													
1.1		*Initiation and technical-design coordination*	*Establishment of the working group, definition of the operational plan, and collection of documentation; meetings with managing authorities (Municipality, Park Authority, ARPAE, and Reclamation Consortium).*											
1.2		*Data collection, surveys, and development of an integrated knowledge framework*	*Development of the knowledge framework through the collection of ongoing projects, acquisition of existing cartographic data, field surveys, and technical interviews.*											
1.3		*Cost–benefit analysis*	*Strategic assessment of processes to evaluate environmental, social, and economic impacts, aimed at defining the scale and scope of potential interventions.*											
2	Interaction with Institutions to Define Intervention Areas													
2.1		*Vulnerability assessment and prioritization of interventions along the salt pan boundaries*	*Mapping of areas vulnerable to water intrusion during flood events, assessment of existing barriers, and preparation of intervention data sheets.*											
2.2		*Co-design and consultation with institutions and stakeholders*	*Technical working groups with public administrations, management bodies, and local communities; assessment of synergies between Actions 2 and 3; review of the hydraulic management model.*											
2.3		*Preliminary design of physical and environmental interventions*	*Drafting of preliminary project designs: embankment reinforcement, improvement of water circulation, expansion of wetland habitats, with verification of environmental and landscape compatibility.*											
3	Definition of Final Deliverables and Potential Activation of Agreements with Institutions and Associations													
3.1		*Technical validation and optimization of the overall pla*	*Technical validation and optimization of the overall plan; assessment of effectiveness with involved stakeholders and validation by competent authorities.*											
3.2		*Synthesis, dissemination of results, and project closure*	*Preparation of the final report, including both technical-scientific and outreach summaries; public presentation of results and drafting of guidelines for model replicability.*											
3.3		*Final processing*	*Final documentation and project deliverables preparation*											

P3 ASSET – Apulia Region- NBS suggestions to reduce flood risk and to improve fruition of the area of Egnazia

a. Site identified for the development of the pilot action

ASSET will coordinate a pilot project at the site of Egnazia, the most significant example of a Roman and Late Antiquity city in Puglia.
The archaeological site is located among farmhouses and centuries-old olive trees overlooking the Adriatic Sea.
The Archaeological Park of Egnazia, located in Puglia, near Fasano (Brindisi), is one of the most significant archaeological sites in the region. It bears witness to a multi-century occupation, spanning from the Bronze Age to the Middle Ages, with a complex history that developed due to its strategic position along the Adriatic coast.
The first settlement dates back to the 15th century BC, after which it became a Messapian center. In the 3rd century BC, it was conquered by the Romans and gained great importance thanks to its port and the passage of the Via Traiana, which connected Brindisi to Rome. The city experienced a decline with the fall of the Roman Empire and was abandoned around the 13th century.

Figure 1-2: Map of the area and view of the archaeological site.

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

Regarding climate aspects the pilot area is characterized by:
* Extreme precipitation events above all that occur during summer, the period of mayor visits to the area
* Heath waves
* Increasing droughts
The coast is made by rocks, subjected to coastal erosion and the archaeological site stands on the rocks, divided in two parts by the road.
We are planning to address the pilot actions to the extreme precipitation events.

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

We will contract a hydraulic engineer for a feasibility study.
Probably the study will suggest a different way for water going to the sea, preserving the archaeological site.
The study must be based on preliminary geomorphological analysis, hydrological analysis, and hydraulic modelling in order to achieve the optimal solution for extreme precipitation events.
We suggest to include also integrated planning and governance, including civil protection.
Some NBS interventions to be taken into consideration include:
- the hydrogeological arrangement of the area starting from the hill (in Fasano, there are four major hydrogeological arrangement projects in the territory);
- the hydrogeological layout upstream of the site, given that there are catchment basins that meet/close basins on Egnazia, creating a depression;
- water collection upstream of the inhabited centers (which has not been done in Fasano), or collecting the water and diverting it around the site.

d. Organization and technical resources available for the Pilot action

- hydraulic engineers within the ASSET team with experience in the construction of hydrogeological mitigation works aimed at reducing flood risk;
-other INTERREG projects on the same topic and different pilot areas.

e. Specific support required for the design and implementation of your Pilot action

We are contracting a hydraulic engineer for a feasibility study in the pilot area.
Probably the study will suggest a different way for water going to the sea, preserving the archaeological site and also a lamination tank that, on one side, contains the arrival of large quantities of water in the pilot area during extreme precipitation events and, on the other, conserves water for drought periods.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

The expected results such as the feasibility study will be shared with the institutional stakeholders in order to collect suggestions. The facilitation skills for multi-stakeholder workshops will be useful for capacity building.
The technical expertise in ecological engineering, proposing NBS performance and quantifying their co-benefits (e.g., biodiversity, social benefits) will be useful for future strategies.
Education and sensitization activities will be targeted to local communities, citizens, students. The scenarios studied for the Egnazia pilot area will be shared in a simplified version for non-technical people and students.
The results on NBS solutions could be used also to create recreational areas or boosts local tourism addressed to local business stakeholders.
Beyond bePrepARed proyect, the developed materials could be used to create certified, professional short courses or public seminars in the critical field of climate resilience.
Moreover the capitalization of projects is really useful to reinforce the obtained results so we plan to write new projects on this topic.

g. External support needed for result dissemination

The external support may consist in drafting policy briefs that directly link the pilot action results to current policy priorities and for this reason we need the cooperation of other regional and local authorities.
We also need lobbying activities with local government.
It could be important to generate texts for compelling infographics and social media content that visually translate complex technical results but we need to define target audiences and local supporter to spread the knowledge.
One more aspect is structuring and optimizing content for long-term accessibility (e.g., ensuring all final deliverables uploaded to an open-access repository or local government data portals) and for that we need the cooperation of other public bodies.

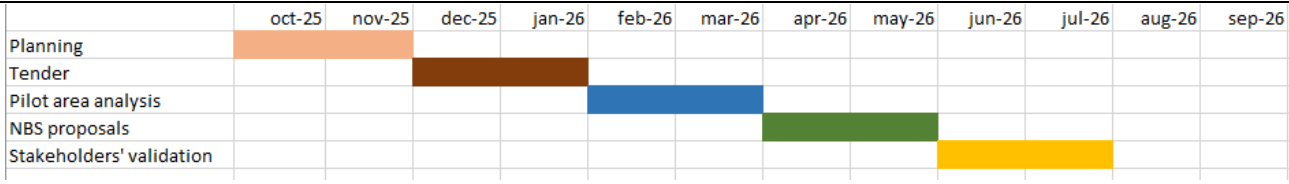
h. Fundraising for fostering of the results achieved (NbS further promotion)

The support could focus on leveraging the public sector to pursue these objectives to find funds.
We can also work on new proposal for project funding capitalizing the project's results.

i. Risk analysis and contingency plan

i. low institutional cooperation (while we have strong participation from water management structures, tgehre is less involvement from the archaeological park, the basin authority and the municipality) – in order to mitigate this risk, we can promote more meetings, including on-site visits.
ii. timing (seasonality of events) – in order to mitigate this risk, we can provide updated predictive models based on the new climatic conditions currently underway.

j. Timeframe for Pilot action implementation



P5 Zadra Nova – Paklenica National Park: Eco-hydrological monitoring and nature-based management for flash-flood and erosion risk reduction)

a. Site identified for the development of the pilot action

The pilot action will be implemented within Paklenica National Park, located on the southern slopes of the Velebit Mountain in Zadar County, Croatia. The Park covers 9,507 hectares and represents a typical Dinaric karst landscape characterised by steep limestone slopes, narrow canyons and highly permeable terrain with limited surface water retention. It is part of the Natura 2000 ecological network and the UNESCO Velebit Biosphere Reserve.

Within this protected area the Velika Paklenica stream near the Lugarnica station, in the central part of the canyon is selected for pilot site for improving the understanding of flash-flood behaviour and sediment transport. This location provides suitable conditions for enhancing existing monitoring practices and supporting the further development of Nature-Based Solutions (NBS) as well as Early Warning System.

The Lugarnica site is hydrologically active and safely accessible for installation of a low-cost monitoring station. It reflects the characteristic response of karst streams to short, intense rainfalls — sudden rise of water levels followed by rapid infiltration and drying. Data collected here will help understand rainfall–runoff dynamics and support the design of adaptive Nature-Based Solutions (NBS).

In parallel, the Park Authority will continue implementing and upgrading a range of routine management activities that already contribute to ecosystem stability and risk reduction. These include **vegetation clearing**, **maintenance and cleaning of drainage channels**, **regular upkeep of existing trails**, and **fire-prevention measures**. Although operational in nature, these measures provide clear NBS-related functions by reducing surface runoff, improving soil stability, and increasing the resilience of habitats to extreme hydro-climatic events.

Together, improved hydrological observations at Lugarnica and the continued application of these routine NBS-supporting measures throughout the Park create a coherent framework that strengthens adaptive management and enhances resilience to climate-driven hydrological extremes. All activities remain fully aligned with the Park's long-term conservation priorities and its legally defined maintenance and protection obligations. Both locations are within zones managed directly by the Park Authority, ensuring access, safety and long-term maintenance of installed equipment and pilot measures.

The pilot action will be executed in collaboration with ZADRA NOVA and the Public Institution Paklenica National Park, concentrating on low-impact, non-material strategies designed to enhance the scientific, planning, and monitoring frameworks for climate adaptation through Nature-Based Solutions (NBS). Furthermore, the park is integrated within Zadar County, where strategies for climate adaptation are incorporated into regional planning frameworks.

b. Type of climate change-related impacts you are planning to tackle by implementing your pilot action

The pilot area within Paklenica National Park is increasingly exposed to hydroclimatic extremes typical of Mediterranean karst environments. The most relevant climate-related risks are flash floods, slope erosion, prolonged droughts and secondary wildfire exposure, all of which directly affect ecosystem stability and visitor safety. To address these, the pilot focuses on establishing a hydrological monitoring station to collect real-time data on rainfall, water level and sediment movement, and on applying small-scale Nature-Based Solutions (NBS) to stabilise slopes and reduce runoff.

At the Lugarnica Pilot site, in the central part of the Velika Paklenica canyon, short and intense rainfall events generate rapid surface runoff, causing sudden increases in discharge and stream power. These flash floods erode the streambed, displace sediment and occasionally damage sections of the trail and small bridges. During dry months, infiltration dominates and the streambed becomes completely dry. This shows the dual nature of the Park's hydrology

alternating between extreme wet and dry phases. Such unstable regime is projected to intensify with future increases in temperature and shifts in rainfall patterns.
In other areas, the main impacts are surface erosion and sediment transport. The area contains fine-grained, sand-rich layers interbedded with carbonates, where heavy rainfall triggers rill and gully erosion. Droughts and high summer temperatures further weaken soil cohesion by reducing vegetation cover and root binding, leading to topsoil loss during the first autumn storms. These processes accelerate land degradation, sediment yield and local habitat disturbance.
Beyond physical impacts, both sites are affected by indirect climate pressures such as growing visitor activity in warmer months, limited water availability for firefighting, and higher maintenance needs for trails and drainage.
Stakeholder consultations under WP2 confirmed that flash-flood risk and erosion management are top priorities. Park managers also highlighted the lack of quantitative data to support decisions during extreme weather events. The pilot therefore integrates continuous monitoring at Lugarnica to improve understanding of rainfall–runoff dynamics, and low-impact NBS in other areas to enhance infiltration, stabilise soil and restore vegetation. Together, these actions address the Park's dual exposure to flash floods and erosion, strengthen ecological resilience and provide a model for adaptive management in karst protected areas.

c. Contribution of the Pilot action to the Disaster Risk Reduction governance framework

The Paklenica pilot contributes directly to disaster risk reduction (DRR) by integrating ecosystem-based and nature-based approaches into Park management. It operationalises the concept of eco-DRR, using natural processes to mitigate hydro-meteorological hazards through practical, small-scale actions adapted to karst landscapes.
At the Lugarnica Pilot site, a hydrological monitoring station will collect continuous data on rainfall, water level and sediment transport to improve understanding of flash-flood dynamics. This supports the Park Authority in defining early-warning thresholds and adaptive visitor management measures. The monitoring framework will be transferable to other karst rivers in Zadar County and the Adriatic region.
The pilot supports national and EU frameworks: the Croatian Climate Change Adaptation Strategy (2040/2070), National Disaster Risk Management Strategy (2022–2030), EU Biodiversity Strategy 2030 and EU Soil Strategy, by promoting local adaptive capacity and ecosystem-based risk mitigation. It also aligns with the Zadar County Climate Programme (2022) and the Paklenica NP Management Plan (2023–2032). Overall, the pilot illustrates the Sendai Framework principle that healthy ecosystems form the foundation of effective and sustainable DRR.

d. Organization and technical resources available for the Pilot action

Paklenica National Park will lead the implementation of the pilot at site level, ensuring access, supervision and basic data collection. The Park provides qualified ranger teams, existing environmental monitoring structures, fire-prevention patrols and local logistical support for equipment installation and maintenance. ZADRA NOVA acts as the coordinating partner, responsible for overall pilot management, stakeholder engagement, communication with the Lead Partner and procurement of technical services when needed.
Scientific and technical support will be provided by the CMCC which contributes with climate data, GIS analysis and expertise in hydrological modelling. Additional inputs will be sought from Croatian Mountain Rescue Service (HGSS) and external experts. Available resources include GIS datasets, meteorological and hydrological records, and the infrastructure necessary for setting up a low-cost hydrological monitoring station at Lugarnica. The Park's staff will also assist in maintaining photo-monitoring points and sediment traps in the Suva Draga area to evaluate NBS performance.

e. Specific support required for the design and implementation of your Pilot action

The implementation of the pilot will require targeted technical and scientific support in several fields.
Expertise in eco-hydrology and NBS engineering is needed to design, install and calibrate the hydrological monitoring system at the Lugarnica site and to interpret collected data.
Specialised support in soil conservation and slope stabilisation will guide the design of small-scale NBS interventions in the Suva Draga area, including the choice of suitable local materials and vegetation.
Further assistance in GIS and remote sensing will help integrate spatial data and visualise changes in surface stability.
ZADRA NOVA will coordinate procurement of external experts through simplified public procedures, while CMCC will provide scientific supervision and data analysis. Training sessions for Park staff and rangers will ensure continuity of monitoring and long-term use of acquired knowledge.

f. Potential use and transferability of the expected results from the pilot action, within and beyond bePrepARed

The pilot will produce the first continuous dataset on water-level dynamics and rainfall–runoff behaviour in Paklenica. These data will strengthen technical skills under activity 3.3. Park staff and county institutions will better understand threshold values, response times after rainfall and seasonal patterns. This knowledge supports early-warning interpretation and operational decisions during extreme events.
The results also support activity 3.4. Visualisations of rising and falling water levels and simple illustrations of rainfall–runoff links can be used in education for visitors, schools and local communities. These materials can raise awareness of climate risks in karst environments.
The approach is fully transferable. The monitoring design and interpretation methods can be applied in other karst protected areas in Croatia and Italy. This includes sites that experience sudden hydrological responses and lack continuous surface-water data.

g. External support needed for result dissemination

Post-project dissemination will rely on coordinated support from relevant national ministries and agencies, together with Zadar County, to facilitate alignment with existing plans and procedures. Engagement with protected-area managers, civil protection and HGSS will help translate the results into routine operations where appropriate. Scientific partners will underpin methodological credibility. Cross-border cooperation frameworks will provide a neutral avenue for awareness and uptake.

h. Fundraising for fostering of the results achieved (NbS further promotion)

ZADRA NOVA, together with the associated partner Paklenica National Park and relevant stakeholders, will continue participating in NbS implementation and sustain core activities. Operational resources will cover essential monitoring and maintenance, while ZADRA NOVA prepares and submits follow-on proposals to EU and national programmes that build on the results and enable gradual expansion. Co-financing from county and sectoral institutions, and selective private/CSR support, will be pursued as appropriate under a light joint arrangement for priorities, budgeting and timing.

i. Risk analysis and contingency plan

Climatic and environmental risks – Extreme rainfall may damage the monitoring equipment. Conversely, prolonged dry periods could reduce the number of measurable flood events. Mitigation: installation of robust, low-cost sensors in protected locations, scheduling fieldwork outside the peak rainfall season, and ensuring backup data storage.
Technical and financial risks – Limited availability of local contractors, procurement delays or fluctuations in equipment prices could affect implementation timing and budget flexibility. Mitigation: early procurement, use of standard low-cost components, simplified contracting procedures and continuous financial monitoring by ZADRA NOVA.
Institutional and administrative risks – Possible delays in coordination, internal approvals or reporting. Mitigation: clear division of responsibilities between ZADRA NOVA, NP Paklenica and CMCC, with regular communication and documentation sharing.
Social risks – Unintentional disturbance by visitors or limited awareness of the pilot activities. Mitigation: discrete signage at the sites, short interpretative material and awareness briefings for Park rangers.
Overall, the pilot is designed for adaptive management, allowing results from each phase to guide subsequent actions and reduce uncertainty. Its small scale, non-invasive nature and strong institutional coordination make the overall risk low and manageable.

j. Timeframe for Pilot action implementation

Please provide information about the real time needed for Pilot action implementation.
(synthetic Gantt diagram, by macro-activities)