

JOINED INTEGRATED STRATEGIES FOR ENHANCING THE RESILIENCE OF CNH SITES EXPOSED TO CLIMATE RISKS IN CE RIVER BASIN DISTRICTS

Summary report prepared within the INACO project, presenting discussions with public authorities on the implementation of the EU Directive, and outlining strategies and risk management plans to strengthen the resilience of cultural and natural heritage in Central European river basin districts.

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Contents

A. Introduction	3
Cultural and natural heritage sensitivity to extreme climate events	3
Gaps and challenges in current CE strategies.....	4
B. INACO-JIS (Joined Integrated Strategy)	7
Establish policy frameworks.....	7
Endorse the transfer of scientific knowledge to the policy and decision sectors...	8
Strengthen community involvement	10
Promote sustainable tourism and economic incentives	11
Enhance education and training	12
Foster international cooperation	12
Monitor, evaluate, and adapt strategies.....	14
C. General recommendations for cultural and natural heritage	16
Cultural Landscapes	16
Natural Reserves	16
Historic Buildings and Archaeological Sites	17
Historic Parks and Gardens	17
Historic hamlets.....	18

A. Introduction

INACO activity 1.3 aims to fine-tune a Central European common strategy for promoting the mainstreaming of cultural and natural heritage (CNH) sites as a priority sector to be protected in national plans of adaptation to climate change. In this framework, INACO takes advantage of good practice examples (e.g. Italy, Ireland, Cyprus, Slovenia, Greece, Finland and Sweden) as described in the recent report (2022) of the EU Open Method of Coordination (OMC) group of Member States' experts "Strengthening cultural heritage resilience for climate change". In addition, this activity also aims at fostering the adoption at local level of measures for strengthening the response capacities of CNH to climate disasters on the basis of the transnational cooperation among INACO partners.

This document reports the integrated strategy covering the regions of the INACO consortium for enhancing the resilience of CNH sites exposed to climate risks in CE river basin districts based on: i) tracking down still existing gaps of EU Water Directives and Strategies/Plans of Adaptation to Climate Change with regard to the protection of CNH sites at risk and ii) the tagged CNH sites most sensitive to the impact of climate extreme events in CE river basin districts

The deliverable is structured as follows: section A characterises the sensitivity of cultural and natural heritage to extreme climate events in central Europe, individuating gaps and challenges for the integration of heritage preservation into current management strategies; section B outlines the thematic areas and main actions addressed by the joined integrated strategy developed in collaboration with all PPs (INACO-JIS). Finally, part C summarises general recommendations for cultural and natural heritage protection, by asset typology; these would serve as the basis for the development of site-specific risk management plans foreseen in A3.3.

Cultural and natural heritage sensitivity to extreme climate events

Cultural and natural heritage in Central Europe is highly sensitive to extreme climate events, which pose significant threats to historical sites, landscapes, and ecosystems that have shaped the region's identity for centuries. The increasing frequency and intensity of extreme weather phenomena—such as heatwaves, heavy rainfall, floods, wildfires, and storms—are exacerbating existing vulnerabilities in both built heritage and natural landmarks. Many of Central Europe's historic cities, including Prague, Vienna, and Budapest, are located along major rivers like the Danube and the Vltava, making them particularly susceptible to flooding. Past events, such as the devastating 2002 and 2013 Central European floods, caused widespread damage to UNESCO-listed sites, museums, and architectural landmarks, leading to costly

restoration efforts. Meanwhile, prolonged droughts and heatwaves threaten the structural integrity of historical buildings by causing soil desiccation, which leads to subsidence and cracks in foundations, particularly affecting medieval castles, churches, and timber-framed structures. Additionally, rising temperatures accelerate biological degradation processes, such as the growth of mold and algae on stone facades, further eroding historical monuments. Forested landscapes and biosphere reserves, such as the Bohemian Forest and the Carpathians, face heightened wildfire risks, endangering both biodiversity and cultural sites embedded within these natural environments. Moreover, extreme windstorms have caused significant damage to historic parks, avenues of ancient trees, and cultural landscapes, such as the Lednice-Valtice Cultural Landscape in the Czech Republic. These climate-related challenges necessitate urgent adaptation strategies, including improved flood defenses, climate-sensitive restoration techniques, and the integration of risk assessment into heritage management plans. Without proactive measures, extreme climate events will continue to pose a severe threat to Central Europe's rich cultural and natural heritage, jeopardizing its historical legacy for future generations.

The INACO project concentrates on particular typologies of heritage exposed to the impact of climate change. Three main groups are considered, defined according to the environmental and hydrological context: 1) Group A- Sea/River shore, 2) Group B- Lake shore and 3) Group C- Inland. This research shows how climate change poses a significant risk to both cultural and natural heritage in Central Europe, where rising temperatures, more frequent extreme weather events, and shifting precipitation patterns threaten historic sites, monuments, and landscapes. Increased rainfall and flooding can damage delicate structures, artworks, and archaeological sites, while prolonged heatwaves and droughts accelerate the deterioration of building materials like stone, wood, and plaster. Natural heritage, including forests, wetlands, and ecosystems, is also at risk from changing climatic conditions that disrupt biodiversity and degrade habitats. Additionally, the combined effects of climate change—such as fluctuating humidity and temperature—can harm the preservation of archives, manuscripts, and other sensitive cultural objects. Addressing these threats is essential to protect both built and natural heritage for future generations.

Gaps and challenges in current CE strategies

In Central Europe, the integration of cultural heritage protection into climate change adaptation strategies has gained recognition, yet significant challenges persist. The European Union's Strategy on Adaptation to Climate Change acknowledges the necessity to safeguard cultural heritage from climate-induced impacts such as floods, storms, and sea-level rise. However, a comprehensive inclusion of cultural heritage considerations in national and regional adaptation plans remains limited (climate-adapt.eea.europa.eu). A report by the Open Method of Coordination (OMC) expert group highlights that cultural heritage is under unprecedented threat from climate change, and

current policies at both EU and Member State levels are inadequate in addressing these challenges. The report emphasizes the absence of proper policies and action plans to mitigate climate-related damages to cultural assets.

Similarly, the research conducted in INACO and outlined in D.1.1.2, shows significant challenges for a proper adaptation of strategies still need to be overcome. These include the absence of specific action plans, insufficient funding, and limited technical expertise at regional and local levels. To safeguard CNH from the increasing threats posed by climate change, targeted strategies, stronger coordination, and enhanced financial and technical support are needed. While adaptation strategies are broad, they often lack concrete guidelines and action plans tailored to CNH protection. Although the vulnerability of cultural heritage is acknowledged, practical implementation remains limited. There are no detailed action plans or dedicated funding allocations for directly safeguarding cultural sites, leading to CNH being deprioritized in climate adaptation initiatives, which tend to focus on infrastructure and environmental concerns. Despite the availability of EU funding opportunities, there is no dedicated financial stream for CNH protection. This restricts national and regional governments from prioritizing heritage preservation amid other pressing climate-related challenges. Weak coordination between climate adaptation efforts and CNH preservation is a key issue at the regional level. Heritage assets are often considered in isolation rather than through integrated approaches aligned with urban development, tourism, and other regional strategies. Regional authorities frequently lack the necessary technical expertise to implement climate adaptation measures specifically for CNH. Capacity-building programs are needed to equip local and regional governments with the skills required for effective heritage protection in a changing climate. CNH protection is often treated as a secondary concern compared to immediate environmental threats like flooding or soil erosion. As a result, heritage safeguarding efforts tend to be ad hoc rather than part of a structured, well-coordinated strategy. For instance, while drainage improvements near the Jasov Monastery and wetland restoration around the Bodva river in Slovakia are positive steps, they remain isolated actions rather than components of a broader, strategic heritage protection plan.

In broader terms, it can be highlighted that the aspects that should be directly addressed are:

Institutional & Governance Barriers

- Fragmented responsibilities: climate change adaptation involves various ministries and levels of authorities, limiting coordinated protection efforts.
- Lack of political prioritization: heritage is often overshadowed in climate adaptation plans by mitigation strategies or short-term political goals

Financial Constraints

- Heritage protection often competes with more politically urgent infrastructure or economic recovery projects.
- A significant disparity exists between the financial resources required for effective adaptation and the funds currently allocated. This shortfall impedes the implementation of necessary measures to mitigate climate impacts.

Knowledge and Data Gaps

- Lack of data in vulnerability assessments: planning needs fine-scale, region-specific data for heritage sites that is often unavailable or not updated, especially in smaller towns or rural areas.
- Low awareness and expertise: many decision-makers and stakeholders lack understanding of adaptation options or climate risks.

Public Engagement and Perception

- Low risk perception: climate change is still seen as a distant or abstract issue by parts of the public and some local authorities.
- Resistance to change: especially in rural or conservative regions, there's often reluctance to adopt innovative resilience-building measures.

Insufficient Cross-Border Cooperation

Many cultural landscapes and natural heritage sites span borders (e.g., the Carpathians, Danube Basin), but joint strategies are rare.

- Limited regional cooperation: despite shared climate risks, cross-border collaboration is often weak or inconsistent due to, among others, language barriers, system(s) incompatibility etc..
- Lack of shared databases or early warning systems complicates regional coordination.

Addressing these gaps requires a concerted effort to enhance funding mechanisms, improve local-level engagement and awareness, establish robust monitoring and evaluation frameworks, and develop targeted strategies that consider regional vulnerabilities and sector-specific challenges.

B. INACO-JIS (Joined Integrated Strategy)

Enhancing the resilience of cultural and natural heritage sites in central European river basin districts to climate risks requires a multifaceted approach integrating environmental, technological, and community-based actions. These aim at integrating cultural and natural heritage in climate change adaptation plans while contributing to broader climate resilience goals, ensuring that adaptation efforts are sustainable, inclusive, and effective. The main thematic areas addressed in the INACO-JIS are the following:

- A. Policy framework
- B. Knowledge transfer (informed decision-making)
- C. Community involvement
- D. Sustainable tourism and economic incentives
- E. Education and training
- F. International cooperation
- G. Monitor, evaluate, and adapt

Establish policy frameworks

To effectively address the challenges posed by climate change while preserving cultural and natural heritage, it is crucial to establish comprehensive policy frameworks that integrate heritage considerations into climate adaptation strategies.

- *Support the integration of cultural and natural heritage in climate adaptation policies*

Policymakers at the local, national, and international levels must recognize the vital role that cultural and natural heritage plays in community resilience. Advocacy efforts should emphasize the need to incorporate heritage conservation into climate adaptation policies, ensuring that historic sites, landscapes, and cultural traditions are safeguarded against climate-related risks. This includes engaging with governmental agencies, international organizations, and stakeholders in heritage and environmental sectors to promote holistic, heritage-inclusive adaptation planning.

- *Develop regulatory frameworks for heritage protection in adaptation strategies*

Governments and regulatory bodies should establish legal and institutional mechanisms that require the integration of cultural and natural heritage protection within climate adaptation measures. This involves embedding heritage considerations into water and land-use planning, ensuring that historic sites and landscapes are factored into risk assessments and mitigation efforts.

For example, regulatory frameworks can align with the EU Water Framework Directive, which promotes sustainable water management, to incorporate cultural heritage sites vulnerable to flooding, drought, or sea-level rise into national water governance strategies. Additionally, land-use policies should integrate climate-resilient infrastructure planning while protecting historical landscapes and cultural assets from adverse environmental impacts.

- *Establish clear responsibility and duty framework for all stakeholders involved*

A coherent and transparent framework defining the responsibilities and duties of all stakeholders is essential for effective risk management of cultural and natural heritage in the face of climate change. This framework should clearly delineate the roles of government agencies, heritage authorities, local communities, private sector partners, and civil society organizations, ensuring accountability and coordination across all levels. Responsibilities must cover planning, implementation, monitoring, and emergency response, with special provisions for integrating heritage considerations into broader climate adaptation and disaster risk reduction strategies. Legal mandates and institutional arrangements should be formalized to avoid overlaps, gaps, and conflicts in action.

- *Align adaptation policies with international conventions and agreements*

A robust policy framework should be in alignment with key international agreements that emphasize disaster risk reduction and heritage conservation. This includes:

- The UNESCO World Heritage Convention, which underscores the obligation of signatory nations to protect and preserve cultural and natural heritage sites at risk from climate change.
- The Sendai Framework for Disaster Risk Reduction, which advocates for reducing vulnerabilities and enhancing resilience, particularly by integrating cultural heritage into disaster risk management and climate adaptation strategies.

By ensuring coherence with these global frameworks, adaptation policies can benefit from established best practices, international cooperation, and funding opportunities for protecting heritage assets from climate-induced threats.

Endorse the transfer of scientific knowledge to the policy and decision sectors

As climate change increasingly threatens cultural and natural heritage, it is essential to invest in research initiatives and innovative monitoring systems that enhance resilience and safeguard valuable sites and traditions.

- *Support research initiatives on the intersection of cultural heritage, traditional knowledge, and climate resilience*

Supporting interdisciplinary research initiatives is key to understanding how cultural heritage and traditional knowledge contribute to climate adaptation. Studies should focus on how historic building techniques, indigenous resource management practices, and local ecological knowledge can inform contemporary climate resilience strategies. Collaborative research between archaeologists, conservationists, climate scientists, and local communities can provide valuable insights into sustainable heritage management in the face of changing environmental conditions.

- *Engagement of experts*

A comprehensive risk assessment requires the collaboration of conservation specialists, climate scientists, engineers, and local communities who hold invaluable knowledge about traditional resilience practices. Public participation ensures that adaptation strategies are both scientifically robust and culturally appropriate.

- *Identify cultural and natural heritage assets vulnerable to climate change*

Systematic identification and assessment of heritage sites at risk are critical steps in adaptation planning. Vulnerable assets may include:

- Coastal heritage sites threatened by rising sea levels and coastal erosion.
- Archaeological and architectural landmarks exposed to extreme weather events such as hurricanes, typhoons, and wildfires.
- Landscapes, agricultural terraces, and sacred sites affected by desertification, drought, and biodiversity loss.

Conducting vulnerability assessments helps prioritize conservation efforts and develop targeted protection strategies.

- *Utilize advanced technologies for site mapping and monitoring*
 - Geographic Information Systems (GIS) and remote sensing: these technologies can be used to map, document, and analyze heritage sites at risk. GIS mapping allows for spatial analysis of climate threats, while remote sensing through satellite imagery and drones provides real-time data on environmental changes affecting heritage assets.
 - Sensor-based and AI-driven early warning systems: implementing sensor networks to monitor river levels, humidity, temperature fluctuations, and the structural integrity of heritage buildings can provide real-time alerts for potential risks such as flooding, erosion, or material degradation. AI-powered predictive models can enhance

forecasting capabilities and enable proactive conservation measures.

- *Regular inspections and condition assessments*

Conducting frequent on-site evaluations helps detect early signs of deterioration due to climate impacts. Conservation teams should monitor cracks in historic structures, biological growth due to increased humidity, or shifts in foundational stability. Periodic assessments ensure that maintenance interventions can be undertaken promptly to prevent irreversible damage.

By integrating scientific research, technological innovation, and traditional knowledge, it is possible to develop more effective climate adaptation strategies that protect cultural and natural heritage for future generations.

Strengthen community involvement

Engaging local communities and indigenous groups in climate adaptation efforts is essential for creating sustainable and culturally appropriate solutions. These groups possess invaluable knowledge, passed down through generations, that can enhance resilience to climate change.

- *Involve local communities and integrating their knowledge*

Local communities have long relied on traditional ecological knowledge and cultural practices to adapt to environmental changes. By integrating these insights into adaptation planning, it is possible to develop more effective and context-specific solutions. Governments, researchers, and policymakers should actively consult and collaborate with these groups to ensure their voices are heard and their expertise is valued.

- *Promoting traditional and sustainable practices*

Many traditional building techniques, land-use strategies, and conservation methods have historically contributed to climate resilience. For example, indigenous agroforestry practices, water management systems, and locally adapted architecture can help mitigate the effects of extreme weather and environmental degradation. Encouraging the use of these techniques alongside modern innovations can create sustainable solutions that align with local environmental and cultural contexts.

- *Establishing participatory decision-making platforms*

To ensure continuous and meaningful engagement, it is essential to create inclusive platforms where community members can actively participate in adaptation planning. These platforms can take the form of advisory councils, public forums, or collaborative working groups that bring together stakeholders from diverse backgrounds. Transparent communication, capacity-building initiatives, and equitable decision-making processes will help build trust and encourage long-term community involvement.

By strengthening community involvement, it can harness local knowledge, empower stakeholders, and create adaptive strategies that are both effective and socially inclusive.

Promote sustainable tourism and economic incentives

- *Promote eco-tourism initiatives*

Encouraging sustainable tourism is essential for balancing environmental conservation with economic growth. By promoting eco-tourism initiatives, communities can benefit from economic opportunities while actively participating in heritage conservation efforts. These initiatives should focus on minimizing environmental impact, enhancing cultural appreciation, and ensuring long-term sustainability for local populations.

- *Develop funding mechanisms*

To support these goals, the development of funding mechanisms is crucial. Establishing financial instruments such as heritage conservation grants, carbon offset programs, and sustainable tourism funds can provide necessary resources for adapting and maintaining heritage sites. These mechanisms will enable governments, organizations, and communities to implement protective measures that ensure the preservation of cultural and historical landmarks against climate change and other environmental threats.

- *Foster public-private partnership*

Additionally, fostering strong public-private partnerships is key to driving sustainable adaptation projects. Collaboration between governmental bodies, private enterprises, non-governmental organizations (NGOs), and local communities can lead to innovative solutions that integrate heritage conservation with sustainable development. These partnerships can facilitate investment in infrastructure improvements, eco-friendly tourism facilities, and educational programs that raise awareness about the importance of heritage preservation.

By implementing these strategies, sustainable tourism can serve as a powerful tool for both conservation and economic resilience, ensuring that cultural heritage sites are protected while simultaneously benefiting local economies.

Enhance education and training

By strengthening education and training, it is possible to build a knowledgeable and skilled workforce that is well-prepared to integrate climate adaptation into heritage conservation, ultimately ensuring the sustainability of our shared cultural heritage for future generations.

- *Develop educational programs and campaigns*

Education and training play a vital role in building awareness and capacity for the intersection of heritage conservation and climate adaptation. By developing targeted educational programs and public awareness campaigns, it is possible to highlight the significance of preserving cultural heritage while addressing climate-related risks. These initiatives should leverage diverse mediums—such as storytelling, digital platforms, interactive museum exhibits, and virtual reality experiences—to engage communities, tourists, and policymakers. By presenting real-world examples of climate resilience strategies, these efforts can inspire action and foster a deeper understanding of the threats posed by climate change to historical and cultural sites.

- *Integrate climate change adaptation into management curricula*

To ensure that conservation professionals are equipped with the necessary skills, climate change adaptation should be integrated into heritage management curricula at academic institutions and training centers. This includes updating coursework to cover sustainable conservation practices, risk assessment methodologies, and the latest technological innovations for monitoring and mitigating climate impacts on heritage sites. Universities, cultural organizations, and research institutions should collaborate to create interdisciplinary programs that bridge environmental science, architecture, and cultural heritage management.

- *Train stakeholders*

Furthermore, practical training programs must be developed to enhance the capacity of key stakeholders responsible for heritage site protection. Site managers, architects, engineers, rescue operators, and policymakers should receive specialized training in climate resilience, disaster preparedness, emergency response, and sustainable conservation techniques. Hands-on workshops, field training, and knowledge exchange programs can help professionals implement adaptive strategies tailored to specific heritage contexts, ensuring that cultural sites remain safeguarded against natural disasters, extreme weather events, and long-term climate shifts.

Foster international cooperation

By fostering international cooperation, countries can leverage collective expertise, resources, and strategies to ensure that cultural and natural heritage remains protected against the growing threats posed by climate change. A

united global approach will not only strengthen heritage conservation efforts but also reinforce cultural connections and mutual understanding across nations.

- *Establish partnerships between governments, NGOs, academia, and international organizations to share best practices and technical expertise*

International collaboration is essential for effectively addressing the complex challenges that climate change poses to cultural and natural heritage. By establishing strong partnerships between governments, non-governmental organizations (NGOs), academic institutions, and international organizations, stakeholders can share best practices, technical expertise, and innovative solutions for heritage conservation in the face of climate threats. These partnerships should focus on developing joint research initiatives, policy recommendations, and capacity-building programs that enhance resilience and adaptive management strategies across different regions. Organizations such as UNESCO, ICOMOS, and the World Heritage Centre play a crucial role in fostering these collaborations, ensuring that countries have access to the latest scientific knowledge and conservation methodologies.

- *Facilitate exchange programs and workshops*

To strengthen professional networks and knowledge exchange, it is important to facilitate international exchange programs, workshops, and training initiatives for experts working at the intersection of climate adaptation and heritage conservation. These programs can provide hands-on experience in implementing climate resilience strategies, disaster risk management, and sustainable preservation techniques. By enabling professionals—including conservationists, architects, urban planners, and policymakers—to learn from real-world case studies and successful adaptation projects, these initiatives contribute to a more coordinated and informed global response to climate-related challenges.

- *Encourage cross-border cooperation in protecting transnational cultural and natural heritage*

Additionally, cross-border cooperation is vital for protecting transnational cultural and natural heritage sites that span multiple countries. Shared heritage landscapes, such as the Danube Delta, the Carpathian Mountains, and historic trade routes like the Silk Road, require coordinated efforts to address climate risks, including deforestation, rising temperatures, and extreme weather events. Joint conservation projects, harmonized policies, and regional monitoring frameworks can help safeguard these sites while promoting sustainable tourism and economic resilience for local communities. Establishing multinational agreements and frameworks, such as regional climate action

plans for heritage sites, will further enhance the long-term protection of these invaluable cultural and environmental assets.

Monitor, evaluate, and adapt strategies

By implementing a strong system of monitoring, evaluation, and adaptation, heritage conservation efforts can remain resilient and effective in the face of climate change. Ensuring that strategies are evidence-based, responsive to scientific advancements, and adaptable to new challenges will enhance the long-term sustainability of heritage protection, allowing future generations to continue experiencing and learning from these invaluable cultural and natural assets.

- *Develop indicators to assess the effectiveness of integrating heritage into climate adaptation plans*

Continuous monitoring, evaluation, and adaptation of strategies are essential to ensuring that heritage conservation remains effective in the face of evolving climate challenges. Developing robust indicators to assess the effectiveness of integrating cultural and natural heritage into climate adaptation plans is a crucial step in this process. These indicators should measure various factors, including the resilience of heritage sites to climate-related stressors, the success of implemented adaptation measures, the level of stakeholder engagement, and the socio-economic benefits of conservation efforts. By collecting data on these aspects, policymakers, conservationists, and researchers can identify strengths and areas for improvement in adaptation initiatives.

- *Conduct regular evaluations and update strategies*

Regular evaluations are necessary to track progress and refine strategies over time. Climate change is a dynamic and complex phenomenon, with risks that continue to evolve based on new scientific discoveries and shifting environmental conditions. Therefore, heritage adaptation strategies must be continuously reviewed and updated to reflect the latest climate projections, technological advancements, and conservation best practices. This process requires collaboration among climate scientists, heritage professionals, urban planners, and local communities to ensure that adaptation plans remain relevant and effective. Periodic risk assessments should be conducted to identify new threats to heritage sites, such as increased flooding, prolonged droughts, or rising sea levels, and to implement timely mitigation measures.

- *Ensure flexibility in policies to allow for the evolution of adaptation measures in response to emerging challenges*

Moreover, policies governing heritage conservation and climate adaptation must be designed with flexibility to accommodate emerging challenges and unforeseen climate-related events. Rigid frameworks can become obsolete as climate risks intensify, making it essential to incorporate adaptive governance

structures that allow for policy adjustments based on real-time data and expert recommendations. Developing dynamic adaptation roadmaps, investing in scenario planning, and fostering interdisciplinary collaboration will enable decision-makers to respond proactively to new threats while maintaining the integrity and significance of cultural and natural heritage sites.

C. General recommendations for cultural and natural heritage

The following includes general recommendations for protecting different types of cultural and natural heritage assets from climate change-induced disasters in central Europe.

Cultural Landscapes

Cultural landscapes, such as traditional farmlands, vineyards, and rural settlements, are highly vulnerable to climate change impacts like droughts, extreme weather, and biodiversity loss.

Recommendations:

- Sustainable land management: implement agroecological practices to maintain soil health, reduce erosion, and enhance water retention.
- Water conservation measures: introduce rainwater harvesting and irrigation systems to protect agricultural heritage from droughts.
- Traditional knowledge integration: preserve and promote traditional farming and land-use practices that have historically adapted to local climate conditions.
- Eco-tourism and sustainable use: promote responsible tourism that supports conservation efforts while minimizing environmental impact.
- Climate-resilient crop varieties: encourage the use of native, climate-adapted plant species to sustain cultural landscapes.

Natural Reserves

Protected areas, including national parks and biosphere reserves, face threats from rising temperatures, shifting ecosystems, and extreme weather events.

Recommendations:

- Ecosystem-based adaptation (EbA): restore degraded ecosystems (forests, wetlands, rivers) to enhance resilience against climate stressors.
- Biodiversity monitoring: establish early warning systems to track species migration, habitat loss, and invasive species proliferation.
- Fire prevention strategies: implement controlled burns and firebreaks in vulnerable areas to reduce wildfire risks; also raise awareness and enforce regulations against arson.

- Floodplain restoration: reconnect rivers with floodplains to improve natural flood management.
- Sustainable visitor management: limit tourist access in sensitive areas and promote low-impact tourism activities.

Historic Buildings and Archaeological Sites

Historic buildings and archaeological sites are susceptible to flooding, humidity, storms, and temperature fluctuations, leading to material degradation.

Recommendations:

- Climate-resilient materials and conservation techniques: use breathable, moisture-resistant, and historically appropriate materials in restoration efforts.
- Structural reinforcements: strengthen buildings against extreme weather by reinforcing foundations and installing wind-resistant features.
- Drainage & moisture control: improve drainage systems to prevent water infiltration and damage.
- Protective barriers: use flood defenses and landscape engineering to reduce erosion and water damage.
- Digital documentation & 3D mapping: digitally archive endangered sites for future restoration and research in case of irreversible damage.

Historic Parks and Gardens

Climate change affects the biodiversity, soil stability, and aesthetic value of historic gardens and parks through prolonged droughts, storms, and new pests.

Recommendations:

- Drought-resistant planting: use native and drought-tolerant plant species to maintain greenery with minimal water use.
- Smart irrigation systems: install rainwater harvesting and efficient irrigation methods to ensure sustainable water use.
- Pest & disease management: implement biological pest control strategies to protect heritage plants from climate-induced infestations.
- Storm-resilient landscape design: plant windbreaks and reinforce tree root systems to minimize storm damage.
- Soil conservation: use organic mulching and sustainable fertilizers to maintain soil health and prevent erosion.

Historic hamlets

Rural heritage settlements are at risk from depopulation, extreme weather, and shifting land use patterns that threaten their cultural identity.

Recommendations:

- Climate-adaptive architecture: retrofit traditional homes with sustainable insulation, energy-efficient heating, and rainproofing without altering their historical character.
- Sustainable infrastructure development: upgrade roads, drainage systems, and utilities to enhance climate resilience while preserving village aesthetics.
- Community-based adaptation plans: engage local residents in disaster preparedness and heritage conservation efforts.
- Green energy solutions: promote renewable energy sources (solar panels, biomass heating) to sustain traditional settlements with minimal environmental impact.
- Tourism & economic incentives: support eco-tourism and heritage-based economic activities to maintain village viability while funding conservation efforts.