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Final report

CULTURAL HERITAGE IN CRISIS | CHRISIS

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ABSTRACT

The *Cultural Heritage in Crisis* (CHrisis) project was initiated after the July 2021 floods in Wallonia. Coordinated by the Royal Institute for Cultural Heritage (KIK-IRPA) and funded by BELSPO, the project aimed to turn this emergency into a learning opportunity by developing practical tools and strategies for resilience.

CHrisis adopted an interdisciplinary approach, combining scientific research with operational measures and governance improvements. It investigated how water and mud affect diverse heritage materials – as ceramics, archaeological metals, textiles, and historic masonry – and produced protocols for emergency treatment and recovery. Alongside technical solutions, the project analysed systemic gaps in crisis coordination and proposed measures to embed cultural heritage into national risk management frameworks. A post-crisis analysis (*Retour d'expérience*) informed recommendations for integrated emergency planning, rapid funding mechanisms, and structured collaboration between heritage actors and emergency services. Recognising that recovery is not only material, CHrisis also revitalised intangible heritage practices disrupted by the floods. The Bethléem de Verviers initiative illustrated how living traditions can foster social cohesion and psychosocial recovery. Dissemination was a core priority: outputs included open-access publications, emergency guidelines, training sessions, and public events such as the CHrisis Lunch Talks, which received highly positive feedback.

By linking research, practice, and policy, CHrisis demonstrates that cultural heritage can be a driver of resilience rather than a passive victim of disaster. Its tools and recommendations offer a replicable model for integrating heritage into preparedness strategies, ensuring that future crises do not result in irreversible cultural loss.

Keywords: cultural heritage, disaster preparedness, floods, conservation protocols, intangible heritage, resilience, Belgium.

1. INTRODUCTION

The July 2021 floods in Wallonia were a turning point for cultural heritage protection in Belgium. Beyond the immediate devastation of monuments, collections, and intangible practices, the disaster revealed systemic weaknesses: fragmented governance, lack of emergency protocols, and limited technical guidance for flood-specific damage. These gaps underscored the urgent need for coordinated strategies to safeguard heritage in the face of climate-related risks.

The *Cultural Heritage in Crisis (CHrisis)* project was conceived as a response to this challenge. Funded by the Belgian Science Policy Office (BELSPO) and led by the Royal Institute for Cultural Heritage (KIK-IRPA), CHrisis aimed to strengthen resilience by developing practical tools, scientific protocols, and governance models for crisis preparedness and recovery.

Rather than focusing solely on restoration, the project adopted a holistic approach. It combined research on material deterioration with operational measures and policy recommendations, addressing both tangible and intangible heritage. Activities ranged from testing emergency treatments for ceramics, metals, textiles, and masonry to revitalising disrupted traditions such as the Bethléem de Verviers puppet theatre.

This report consolidates the lessons learned from these actions. It presents the methodology, findings, and recommendations that emerged from CHrisis, offering guidance for integrating cultural heritage into disaster risk reduction frameworks and ensuring that future crises do not result in irreversible cultural loss.

2. MOTIVATION AND OBJECTIVES OF THE PROJECT

CONTEXT AND RATIONALE

The CHrisis project was launched in response to the devastating floods that hit Wallonia in July 2021 (fig. 1). This event revealed critical weaknesses in the cultural heritage sector and highlighted the urgent need for coordinated measures to protect cultural assets. Moreover, it demonstrated the lack of scientific knowledge on the behaviour of materials under flood conditions (water & mud), which therefore creates difficulties to develop suitable conservation treatments.

Internationally, disaster risk management for cultural heritage has been guided by the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015) and initiatives by UNESCO, ICCROM (ICCROM, 2018), and ICOMOS (UNESCO, 2010), among others. However, these frameworks remain largely generic and do not provide detailed, operational methodologies for flood-specific heritage protection. This gap is particularly critical because floods often involve context-dependent challenges (such as mud contamination) that require locally adapted approaches. CHrisis positioned itself within

this gap, combining conservation science, preventive and preparedness strategies, and governance models to strengthen resilience at both institutional and community levels.

Reaction of the Heritage Sector: Summary and Timeline

Immediate Actions (July 15–20, 2021)

- **July 15**: Initial emergency response by heritage site managers; Blue Shield Belgium (BSB) received calls for assistance from museums in Liège and Verviers. A call for professional help (e.g. conservators/restorers) was issued to its members.
- **From July 15**: Individual, uncoordinated assistance by heritage experts including staff from the Royal Institute for Cultural Heritage (KIK-IRPA), Flemish Institution for Cultural Heritage (FARO), State Archives, Royal Museums of Art and History, and private conservators, working voluntarily.
- **From July 16**: Coordinated response initiated by BSB, including the establishment of a central emergency number for requests and volunteer coordination.
- **Building Safety Assessments**: Municipal and city stability engineers began evaluating buildings early due to collapse concerns but often overlooked the heritage value of sites.
- **Emergency Interventions**: Heritage experts from BSB, KIK-IRPA, the *Centre Interdiocésain du Patrimoine et des Arts Religieux* (CIPAR), the *Agence wallonne du patrimoine* (AWaP), and private companies like the International Platform for Art Research and Conservation (IPARC) prioritized immediate interventions. Formal evaluations of affected sites were limited by the absence of a standardized methodology.
- **July 19**: KIK-IRPA issued invitations to establish a crisis committee, leveraging its network to bring together heritage organizations and experts.
- **July 20**: First meeting of the crisis committee took place.

First Months

- **Crisis Committee**: Coordinated actions included sharing information on affected sites, organizing volunteers, planning rescue missions, fundraising, and managing communication.
- **Access Challenges**: Obtaining critical information (e.g. site accessibility, needs, and contact points) was difficult, as was sourcing intervention materials like protective equipment and packaging supplies. Initial resources came from KIK-IRPA and the State Archives, later supplemented by BSB, Monumentenwacht, and other organizations.
- **Site Security**: Many sites lacked proper security, leading to risks of theft and unauthorized access. Collaboration with KIK-IRPA, CIPAR, and BSB ensured the safe relocation of movable heritage to secure depots.
- **Heritage Assessments**: Formal evaluations began, though systematic assessments were constrained by limited personnel. Remote evaluations (via phone and surveys) became the primary method.
- **Collaboration**: Organizations like CIPAR and AWaP shared assessment data with the crisis committee.

January–June 2022

- **Restoration Efforts**: Selected artworks were restored using funds from a dedicated fundraising campaign. Other heritage items were included in the CHrisis project for conservation studies and restoration protocols.
- **Funding Opportunities**: The *Fédération Wallonie-Bruxelles* (FWB) launched calls for projects to support conservation/restoration of artworks and community recovery initiatives.
- **Volunteer Support**: BSB continued deploying expert volunteers to aid site managers with rescue operations.
- **Field Schools**: BSB co-organized field schools for conservation-restoration students (University of Antwerp, *Ecole nationale supérieure des arts visuels de La Cambre*), continuing through 2023.

November 2022

- Launch of the CHrisis project and feedback report (*Rapport de Retour d'expérience* – RetEx) (2022-2024). Interventions focused on rescue missions and monitoring damage evolution.

FIG. 1. Timeline of the heritage sector's reaction during the July 2021 Floods, (Marique and Collange, 2025) (Beyl, De Bruyn and Boschloos 2025).

Although the July 2021 floods primarily affected Wallonia and cultural heritage competencies are largely regional and community, CHrisis required federal coordination under KIK-IRPA because the disaster revealed systemic gaps that transcended regional boundaries. The absence of a transversal vision and operational emergency plans demanded a national response to ensure coherence between regions and heritage actors. As Belgium's federal scientific institute for cultural heritage, KIK-IRPA uniquely combines multidisciplinary expertise (conservation science, analytical research,

and restoration protocols) necessary to address complex challenges such as mud contamination and material degradation. The project built on international frameworks and methodologies. mentioned above (Sendai, UNESCO, ICCROM), adapting them to Belgian contexts, while leveraging KIK-IRPA's long-standing knowledge in preventive conservation and heritage science. This federal approach ensured that lessons learned, and practical tools developed would benefit all regions and integrate into national crisis management strategies, strengthening preparedness for future disasters beyond floods.

MOTIVATION

The motivation behind CHrisis was rooted in several key considerations:

- The imperative to ensure recovery and long-term resilience of affected heritage.
- The necessity to address critical knowledge gaps regarding the impact of flooding on diverse materials and practices.
- The commitment to preserving cultural continuity within local communities.

Furthermore, the project aimed to foster collaboration among conservators, scientists, institutions, and stakeholders, while laying the groundwork for robust preparedness strategies to mitigate future crises. In addition, CHrisis sought to conduct a thorough post-crisis analysis of the 2021 flood response to evaluate what worked, what failed, and how disaster risk management mechanisms could be improved.

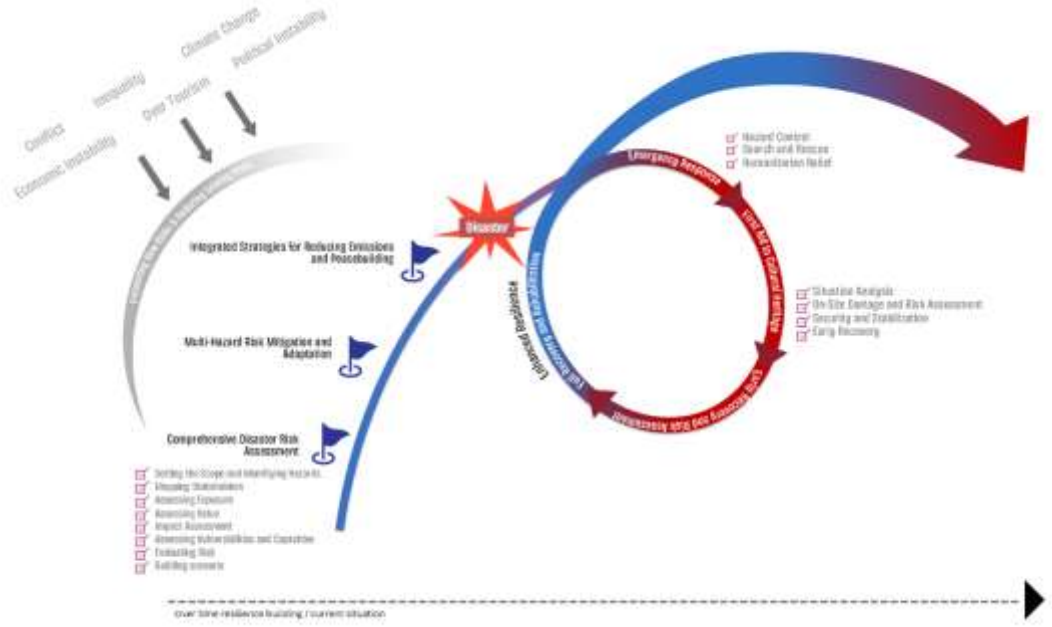

FIG. 2. Comprehensive Disaster Risk Management Process for Cultural Heritage © ICCROM - FAR Programme (2025).

This reflective process was aligned with ICCROM's Comprehensive Disaster Risk Management Process for Cultural Heritage (fig. 2), ensuring that lessons learned would inform future strategies. By combining scientific research, practical protocols, and governance models, the project aimed not only to repair damage but also to embed cultural heritage into national resilience planning.

OBJECTIVES

Overarching Objective

CHrisis aimed to coordinate and integrate scientific and societal efforts across disciplines to strengthen KIK-IRPA's and Belgium's capacity for disaster preparedness and cultural heritage resilience. This interdisciplinary approach ensured that lessons from the 2021 floods translated into actionable strategies, reinforcing KIK-IRPA's role as a national and international leader in heritage risk management.

Based on this overarching objective, CHrisis pursued two ambitions.

1. Scientific objectives

The scientific agenda was designed to develop evidence-based protocols and tools that reduce irreversible damage and improve resilience of cultural heritage to flooding. These objectives respond to a critical need: the lack of emergency plans and technical guidance exposed by the 2021 floods.

Specific objectives per material/workshop:

- Ceramics

  Why? To prevent permanent staining and loss of historic integrity in ceramic heritage. *How?* Analyse composition and damage mechanisms; develop stain-reduction and glaze reconstruction methods; create mock-ups for controlled testing; share findings through training and publications.
- Metals

  Why? To mitigate accelerated corrosion and ensure long-term preservation of archaeological metals.

  How? Study corrosion phenomena and chloride impact; design emergency stabilization and cleaning protocols; produce mock-ups for corrosion studies.
- Textiles

  Why? To safeguard liturgical textiles as carriers of identity and history. *How?* Test cleaning and stabilization methods; develop prioritization frameworks; compile inventories and dating tools; support cultural significance assessment.
- Monuments

  Why? To improve resilience of historic buildings and prevent structural collapse. *How?* Diagnose masonry conditions; identify moisture and salt sources; test biocide treatments; consolidate recommendations into a professional guide.

- Preventive Conservation
  Why? To enable institutions to act quickly and effectively during crises.
  How? Monitor climate and mould; reorganise storage; develop emergency protocols; publish disaster management guidelines.
- Intangible Practices
  Why? To maintain cultural continuity and community identity post-disaster.
  How? Revive traditions linked to the Bethléem de Verviers puppet theatre through participatory approaches.

2. Societal and Policy objectives

Floods disrupt communities and erode cultural identity. Safeguarding cultural heritage during disasters is not only a technical challenge but a societal imperative. CHrisis sought to embed cultural heritage in disaster risk reduction strategies and strengthen institutional and community resilience, ensuring that heritage remains a pillar of identity and recovery.

The societal and policy objectives were:

- Enhance institutional preparedness and resilience.
  Support museums, archives, and heritage sites in improving storage conditions and documenting collections.
- Establish integrated crisis coordination mechanisms.
  Create operational links between cultural heritage professionals and emergency services to enable rapid, coordinated response during disasters.
- Support psychosocial recovery and cultural revitalisation.
  Safeguard both tangible and intangible heritage to help communities maintain identity and continuity after crises.
- Build partnerships for long-term impact.
  Strengthen collaboration with cultural heritage actors (regional authorities, organisations, Blue Shield Belgium) to create a sustainable network for crisis management.

The post-crisis analysis (*Retour d'expérience - RetEx*) was central to these societal goals. By systematically gathering lessons learned from the 2021 floods, a RetEx transforms past challenges into actionable knowledge. Its recommendations inform policy development for disaster preparedness and cultural heritage protection. In essence, a RetEx ensures that the societal objectives are not abstract aspirations but grounded in real-world experience, fostering a culture of resilience and continuous improvement.

CHrisis was not just a technical project: it was a strategic investment in capacity-building, knowledge transfer, and societal resilience, ensuring that cultural heritage remains a pillar of identity and recovery in times of crisis.

POSITIONING

CHrisis is pioneering in Belgium as the first federally funded project to reconnect cultural heritage crisis management with its historical roots and future needs. In the aftermath of the Second World War and during the Cold War, KIK-IRPA played a strategic role in safeguarding heritage during emergencies – a mandate that gradually disappeared due to institutional reforms and the regionalisation of competencies. This fragmentation led to the loss of integrated knowledge and coordination mechanisms, leaving heritage highly vulnerable in times of crisis.

The 2021 floods exposed these gaps dramatically: more than 250 heritage sites were affected, and the absence of emergency plans and transversal governance hindered an effective response. While Flanders has advanced its own disaster strategies (as analysed in the *Rampenstrategie* report (Beyl, Boschloos and De Bruyn, 2025), Belgium lacked a federal framework to ensure coherence across regions and disciplines. CHrisis addresses this systemic weakness by rebuilding federal-level expertise and creating a sustainable structure for coordination, research, and policy integration.

Why now? Climate change is increasing the frequency and severity of disasters, making cultural heritage risk management an urgent priority. CHrisis responds to this urgency by producing transferable methodologies, fostering interdisciplinary collaboration, and embedding cultural heritage in national disaster risk reduction strategies. It aligns with KIK-IRPA's institutional priorities (risk preparedness, interdisciplinary research, and societal engagement) and positions the Institute as a facilitator between heritage professionals, emergency services, and international partners.

By bridging scientific research with crisis governance, CHrisis strengthens Belgium's role in global heritage resilience discourse and ensures that cultural heritage remains a cornerstone of identity and recovery. Its impact extends beyond technical protocols: it rebuilds a federal capacity that was lost, creates partnerships across governance levels, and delivers knowledge that benefits cultural institutions, emergency services actors, and policymakers alike.

3. METHODOLOGY AND SCIENTIFIC RESULTS

SUMMARY OF THE METHODOLOGY

The CHrisis project adopted an interdisciplinary and multi-scalar approach, combining conservation science, preventive strategies and socio-cultural analysis. The methodology demonstrated originality by linking empirical research on flood-induced deterioration with participatory models of heritage recovery and governance.

The project was structured around three main tasks (fig. 3):

- Task I: Coordination. Led by KIK-IRPA's Sustainability Unit, this task coordinated the overall project and ensured effective collaboration among all actors.

- Task II: Advice and Protocols. The project provided field interventions and specialised guidance from KIK-IRPA experts to support cultural institutions throughout their recovery process. As the organisation uniting all relevant conservation and restoration disciplines, KIK-IRPA led the research and development of protocols for treating heritage affected by flood-related sludge. Activities were organised into five workstreams, each addressing specific material or thematic challenges while contributing to an integrated resilience framework.

- Task III: Post-Crisis Analysis and Recommendations. The project also included a comprehensive post-crisis analysis in the form of a RetEx (feedback report/post-crisis analysis – *Rapport de retour d'expérience*). The analysis was conducted by KIK-IRPA and reviewed by the federated entities, field actors and members of the heritage crisis committee. This transversal and coordinated process resulted in a series of recommendations for future crises.

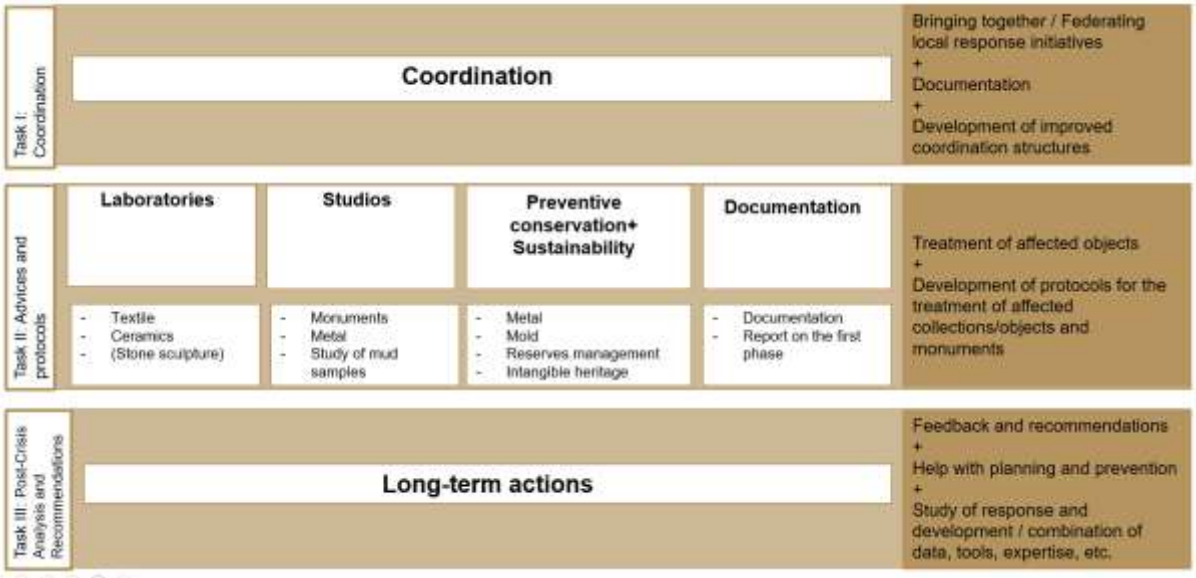

FIG. 3. CHrisis project's structure © KIK-IRPA.

TASK I: COORDINATION

Task I was led by KIK-IRPA's Sustainability Unit and provided the backbone for the CHrisis project. Its primary purpose was to ensure overall coordination and strategic direction, maintaining coherence across scientific, operational, and administrative components while fostering collaboration among

all actors involved. This task was essential for linking research activities with governance realities and for ensuring that lessons learned from the 2021 floods informed the project's outputs.

To achieve these objectives, the Sustainability Unit organised regular coordination meetings with colleagues, workstream leaders, and external stakeholders. These meetings served as a platform for monitoring progress, aligning methodologies, and addressing emerging challenges. Internal communication was supported by shared digital platforms (Microsoft Teams and KIK-IRPA's internal server), which facilitated information flow among participants. Outputs of Task I included coordinated work plans, meeting reports, and project management documents that tracked deliverables. This structured approach strengthened interdisciplinary collaboration and improved the execution of field interventions and research.

Beyond internal coordination, Task I played a crucial role in maintaining links with the Heritage Crisis Committee, which had been established during the emergency phase of the July 2021 floods. Although the committee's most intense activity occurred before CHrisis officially began, its experience and networks were instrumental for shaping the project's recommendations. The committee brought together a wide range of actors, including Blue Shield Belgium (BSB), *Centre Interdiocésain du Patrimoine et des Arts Religieux* (CIPAR), *Agence wallonne du patrimoine* (AWaP), *Fédération Wallonie-Bruxelles* (FWB), *Musées et Sociétés en Wallonie* (MSW), ICOM Belgique/Wallonie-Bruxelles and ICOM Belgium Flanders, ICOMOS Wallonie-Bruxelles, State Archives and Flemish actors (FARO - Vlaams steunpunt voor cultureel erfgoed, Monumentenwacht). Coordination with this platform allowed CHrisis to build on lessons learned during the crisis, particularly regarding collaboration and emergency materials. These exchanges informed the RetEx analysis and recommendations for future preparedness (Task III), such as the need for a permanent crisis unit and rapid funding mechanisms. Importantly, this collaboration also strengthened the partnership between KIK-IRPA and BSB, helping to better define their complementary roles in heritage crisis management.

Task I also ensured dialogue with emergency services and civil protection units, notably through contacts with the National Crisis Centre (NCCN) and provincial authorities. These interactions were essential for exploring how cultural heritage could be integrated into official emergency plans and for aligning heritage protection with broader disaster management frameworks. Since 2024, KIK-IRPA has been recognised by the NCCN as the entry point to the cultural heritage sector. As a result, KIK-IRPA was granted access to *Paragon*, Belgium's new emergency management portal (NCCN 2024). This platform enables all Belgian emergency authorities to share information rapidly and efficiently during crises. It features a map-based interface, a repository of approved emergency plans, and real-time feeds to record actions taken. With more than 10,000 registered users, *Paragon* now includes KIK-IRPA among its active participants.

Although KIK-IRPA did not hold an operational mandate during the 2021 floods, its coordination role helped consolidate relationships that will strengthen future preparedness efforts. One example is the

Athena working group, a knowledge exchange platform coordinated by KIK-IRPA in 2024–2025, bringing together representatives from competent cultural heritage authorities across Belgium. The project also raised awareness within emergency services networks, emphasising the importance of cultural heritage in resilience strategies. Outputs included targeted presentations to stakeholders, meeting minutes, and active participation in strategic discussions.

Beyond coordination and governance, Task I actively pursued external funding opportunities to ensure continuity and scalability of heritage crisis management initiatives. Several target groups were approached, including Belspo (P4S: SAVE CH), the European Union (calls such as FIRESAVE and EU Training on Sustainability and Crisis), and the FPS Interior in collaboration with the National Crisis Centre to explore a federal centre of excellence. Regional authorities (FWB, AWaP, Flemish Government, Brussels-Capital Region), provincial and local authorities, insurance institutions (Assuralia, Ageas, AG Insurance), and private sponsors were also engaged. This proactive approach reinforced KIK-IRPA's leadership role and laid the groundwork for long-term sustainability of crisis preparedness initiatives.

In summary, Task I was not limited to internal project management; it contributed to KIK-IRPA's strategy (2022–2024 and 2025–2029) and extended to high-level engagement with heritage and emergency networks. By combining structured planning with external collaboration, Task I ensured that CHrisis operated as an integrated initiative rather than a series of isolated research actions. This dual focus, scientific coherence and governance connectivity, was essential for achieving the project's objectives and for laying the foundations for more effective crisis management in the cultural heritage sector.

TASK II: ADVICE AND PROTOCOLS

Task II focused on providing field interventions and specialised guidance to support cultural institutions in recovering from flood damage. KIK-IRPA, uniting all relevant conservation and restoration disciplines, led the research and development of evidence-based protocols for treating heritage affected by flood-related sludge. Activities were organised into six thematic workstreams, each addressing specific challenges related to materials, conservation or practices. Task II combined scientific research, practical testing, and participatory approaches to provide comprehensive guidance for the recovery and preservation of flood-affected heritage. Here is the presentation of each project developed by KIK-IRPA's units.

CERAMICS

Ceramics focused on analysing mineralogical and chemical changes in tiles and ceramics using X-ray diffraction and SEM-EDS. Mock-ups replicating historic materials were used to test stain-reduction

treatments and glaze reconstruction under controlled conditions. Workshops and surveys validated these protocols with practitioners, ensuring their applicability beyond the laboratory.

Introduction & Context

The project aimed to understand and mitigate the impact of floods on ceramic collections in cultural heritage institutions. Flood events in Belgium (July 2021) and Italy (May 2023) severely affected museums and repositories, exposing thousands of ceramic objects to water and mud. While ceramics are generally chemically stable (Buys & Oakley, 2016), their susceptibility varies depending on type, porosity, glaze condition, and previous restorations. This report synthesizes observations from three case studies and outlines diagnostic findings, treatment development, and proposed solutions (Journée et al., 2023; Koks et al., 2021).

Diagnostic and Post-Flood Monitoring

The diagnostic phase revealed that mechanical damage posed the greatest risk to ceramic collections during floods. Objects were broken or cracked due to the movement of water and mud, collapsing shelves, and handling during recovery. Previous restorations deteriorated under prolonged exposure to water, with adhesives softening or failing completely, leading to misaligned fragments and structural instability. Consolidators such as Paraloid B-72 exhibited whitening, and fills swelled or cracked (Molina et al., 2023).

There was also a significant risk of dissociation, as inventory numbers and labels were washed away, making it difficult to keep fragments together. Biological contamination was another challenge. Mould developed on packaging materials and, in some cases, on ceramic surfaces, particularly where organic residues or adhesives were present. Staining and deposits were observed on porous ceramics, including iron oxide rings caused by prolonged contact with mud. In some cases, the mud exacerbated pre-existing stains rather than creating new ones. The composition of floodwaters, which included industrial pollutants, hydrocarbons, and sediments, influenced the type and extent of damage (Journée et al., 2023; Koks et al., 2021). Monitoring continued for months after the floods, with systematic documentation of condition changes and occasional analyses of deposits and soluble salts.

Development of Adapted Treatments and Project Activities

Emergency cleaning began as soon as safe access to the sites was possible. Initial treatments involved rinsing ceramics under running water to remove mud, followed by gentle cleaning with brushes and, in some cases, Marseille soap to address greasy residues (Buys & Oakley, 2016). Biocides such as benzalkonium chloride were applied where biological growth was suspected (Mazzotti, 2023). Drying was carried out using Tyvek sheets, dehumidifiers, and, in Italy, drying ovens at controlled temperatures.

Specialized treatments were developed for more complex cases. Poultices were used to extract efflorescence's and stubborn deposits, applied through a barrier layer of Japanese tissue to protect delicate surfaces. Final cleaning steps often involved solvent mixtures of water, ethanol, and acetone

applied with cotton swabs. Experimental research supported these interventions: reconstruction tiles were stained to test the effectiveness and safety of various cleaning methods, and comparisons were made between different brushes, sponges, and detergents. These experiments highlighted the importance of selecting accessible and economical materials for emergency situations.

Logistical organization was a critical component of the project. Treatment chains were established, including stations for rinsing, drying, re-inventorying, and repackaging. Volunteers were trained rapidly to assist with cleaning and documentation, and collaboration between museums, conservation institutes, and organizations such as Blue Shield ensured the success of these operations despite limited resources (Mazzotti, 2023).

Solutions

The solutions proposed by the project address preventive, curative, and organizational needs. Preventive measures include improving storage conditions by using water-resistant shelving and elevating objects above floor level, as well as implementing emergency protocols that prioritize fragile materials and systematic photographic documentation with colour charts. Packaging materials should be inert and resistant to water to reduce contamination and mould growth.

Curative solutions focus on developing practical guidelines for post-flood cleaning, including recommendations for safe and effective products and techniques. Further research into the effects of floods on ceramics and the long-term impact of cleaning methods is essential: some of the gaps are further examined through a research project at the Polychrome Artefacts Lab. Collaborative studies between universities and conservation laboratories will help refine these protocols.

Organizational solutions emphasize the importance of strong networks for emergency response. Partnerships with professional associations and volunteer groups should be reinforced, and funding mechanisms must be established to support rapid interventions and secure temporary storage facilities. These measures will ensure that cultural heritage institutions are better prepared to face future disasters.

Conclusion

The floods in Belgium and Italy highlighted the complex vulnerabilities of ceramic collections when exposed to water and mud. While ceramics are generally considered stable materials, the case studies demonstrated that mechanical damage, deterioration of previous restorations, and biological contamination can occur rapidly under such conditions. The diagnostic phase confirmed that the greatest risks were structural, followed by issues related to staining, efflorescence, and loss of documentation. These findings underscore the importance of systematic condition monitoring and rapid intervention.

The treatments developed during the project proved effective in mitigating damage, but they also revealed the need for further research into the long-term effects of cleaning methods and the behaviour of ceramics under flood conditions. Emergency response protocols must be refined to include clear prioritization strategies, accessible cleaning techniques, and robust documentation practices. Preventive measures such as improved storage infrastructure and water-resistant packaging are essential to reduce future risks.

Ultimately, the success of recovery efforts depended on collaboration between institutions, volunteers, and professional networks. Strengthening these partnerships and securing dedicated funding for emergency interventions will be critical for resilience in the face of climate-related disasters. This project demonstrates that preparedness, combined with adaptable and well-researched treatment strategies, can significantly reduce the impact of floods on cultural heritage collections.

METAL

Introduction

In July 2021, catastrophic flooding struck Western Europe, causing severe damage to cultural heritage collections. The archaeological storage facility of the Agence Wallonne du Patrimoine (AWaP) at the Centre de Conservation et d'Étude (CCE) in Saint-Servais, Namur, Belgium, was inundated (Barnich, 2022). This event exposed archaeological iron artefacts to contaminated floodwater, a condition known to trigger corrosion within minutes (Selwyn, 2021).

Iron artefacts are particularly vulnerable because chloride ions absorbed during burial remain active even after conservation treatments. These ions catalyse corrosion cycles when moisture and oxygen are present (Wang, 2007). Despite prior stabilization using consolidators such as epoxy resins, acrylic polymers (Paraloid®), and wax coatings, the flooded artefacts exhibited reactivated corrosion and new degradation patterns. Literature confirms that polymers degrade over time, wax layers admit water, and even Paraloid® does not guarantee resistance under high humidity (Scott & Eggert, 2009; Pingitore et al., 2015; Jaeger, 2008). This report documents the observed damage, analyses underlying mechanisms, and proposes preventive strategies for future disaster scenarios.

Methodology

Seventeen iron artefacts—including keys, marmite fragments, tripod cooking pots, a skimmer, a ladle, and various tools—along with thirty-five nails were selected from six archaeological sites (Juprelle, Wanze, Château Renaud, Château d'Herbeumont, Poilvache, Pommeroeul). Selection focused on items showing marked changes after flooding, such as reactivated corrosion or instability (Loeper-Attia, 2007).

Macroscopic examination identified pitting, cracking, flaking, blistering, and fragmentation. Optical microscopy (Leica S9i stereoscope) revealed hollow spherical shells of dried droplets, elongated particles, and white crystalline accretions. SEM–EDX analysis (ZEISS Evo 15LS with Oxford Instruments Aztec) mapped elemental distributions (Fe, O, Cl, S, Ca, Si) and assessed chloride-rich layers. Interactions with packing materials (polyethylene film, bubble wrap, zip-lock bags) were documented where imprints or adhesion occurred (Scott & Eggert, 2009).

Results

- Corrosion phenomena: Practically every artefact exhibited orange-red rust patina with pitting and exfoliation. Two flake morphologies were distinguished: inner corrosion-layer exfoliation (friable, red-orange oxides) and outer surface detachment (compact, darker

treated iron). Blistering and cracking were evident, such as on the horseshoe fragment (Loeper-Attia, 2007).

- Mud residues and white veils: Mud crusts were observed on Herbeumont Château artefacts; Poilvache objects displayed a white superficial veil, possibly linked to conservation material reactions or chloride corrosion (Scott & Eggert, 2009).
- Packing interactions: Bubble wrap imprints and polyethylene adhesion were documented, notably on a Juprelle key and Herbeumont Château fragments. These patterns indicate mechanical imprinting and possible additive transfer under wet conditions (Jaeger, 2008).
- Microscopic observations: Hollow spherical shells and dried droplets were widespread, consistent with chloride-induced weeping corrosion (Organ, 1977). Semi-transparent orange-brown deposits adopted packaging imprints, suggesting complex interactions between corrosion products and consolidators. Elongated particles resembling columnar iron oxide growth were noted (Scott & Eggert, 2009).
- White crystalline features: Calcium-rich crusts and white acicular crystals were found on Poilvache and Herbeumont artefacts. SEM–EDX confirmed chlorine-rich layers adjacent to metal and Ca-rich zones, reinforcing chloride's role in reactivation (Neff et al., 2004).

Discussion

The presence of dried droplets and hollow shells indicates chloride-driven weeping corrosion (Organ, 1977; Knight, 1982; Turgoose, 1982). Oxidation of Fe^{2+} ions precipitates iron oxyhydroxides—goethite, lepidocrocite, and akageneite—whose formation within corrosion layers causes volumetric expansion and cracking (Réguer et al., 2007). Hygroscopic $FeCl_2$ hydrates absorb moisture above critical RH, regenerating acidic solutions and perpetuating corrosion cycles. White acicular crystals and Ca-rich crusts likely reflect secondary products or altered consolidators under prolonged wetting (Neff et al., 2004).

Packing materials, while intended as barriers, contributed to imprinting and adhesion. This underscores the need for risk–benefit analysis of plastics in storage and adherence to guidelines such as orienting bubble wrap's smooth side toward artefacts (Jaeger, 2008).

Future Research

µRaman spectroscopy will be employed to confirm chloride-bearing corrosion products, notably akageneite, and correlate findings with SEM–EDX maps (Neff et al., 2004; Réguer et al., 2007). Further work from the KIK-IRPA metal laboratory will develop a risk framework for packing and consolidator materials under disaster conditions.

Conclusion

Flooding reactivated corrosion in previously treated iron artefacts. Chloride contamination drove weeping corrosion and akageneite formation, while conservation treatments and packaging failed to prevent water ingress. Preventive strategies should include disaster preparedness, informed material selection, and targeted microanalysis.

Preventive Conservation addressed environmental monitoring and risk mitigation. Sensors tracked temperature, humidity, and mould proliferation in affected storage spaces, while electrochemical analyses assessed post-flood corrosion in archaeological metals. Rapid stabilization techniques for mixed collections were designed and tested, and practical guidelines for emergency preparedness were developed.

PROJECT 1: PREVENTIVE CONVERSATION WORKS

This report outlines the strategies implemented to support heritage collections during and after the crisis, focusing on diagnostic and monitoring, tailored treatments, and preventive solutions.

Diagnostic and Post-Flood Monitoring

On-site visits revealed the complexity of the situation: buildings remained damp for months, mould proliferated, and collections were constantly shifted within unstable environments. The team recognized that technical evaluation alone was insufficient. They introduced psychosocial support elements, collaborating with the Belgian Red Cross to facilitate debrief sessions during workshops. These sessions helped caretakers cope with exhaustion and isolation, reinforcing the human dimension of recovery.

Development of Adapted Treatments

Instead of focusing on individual objects, the project guided institutions in prioritizing stabilization over full restoration, ensuring that limited resources had maximum impact.

A cornerstone of this phase was the adaptation of the RE-ORG method. Originally designed for storage optimization, RE-ORG tools were repurposed to reorganize collections displaced by floods. For example, the IKOB Museum transformed its in-house storage, previously deemed inadequate, into a functional space for 400 objects within one week. Similarly, Verviers Museum used RE-ORG worksheets to analyse its 50,000-item collection and plan redeployment. These interventions demonstrated that preventive conservation is not only about preserving objects but also about restoring institutional control and confidence.

Mentoring complemented technical tools. The team provided individualized guidance to site managers, helping them navigate complex administrative environments and shifting priorities. Simple project management techniques - such as retro-planning and tracking charts - enabled managers to regain a sense of direction amid uncertainty.

Preventive Solutions and Emergency Plans

Beyond immediate recovery, the preventive conservation unit worked to embed resilience into future practices. They reintroduced risk analysis into daily operations, encouraging institutions to balance short-term urgency with long-term conservation goals. Workshops fostered networks among impacted professionals, creating a culture of mutual support.

The unit also advocated for scenario planning, helping sites under reconstruction anticipate future challenges.

Conclusion

The work of KIK-IRPA's preventive conservation unit during and after the 2021 floods illustrates that recovery is as much about people as it is about objects. Their adaptive strategies - rooted in technical expertise, psychosocial awareness, and collaborative networks - transformed a devastating event into an opportunity for systemic improvement. By bridging emergency response and long-term planning, they have set a precedent for resilience in the face of climate-driven disasters.

PROJECT 2: RE-MOLD PROJECT

After the flood, high humidity persisted for months, creating conditions for mould growth on wooden furniture. Many churches remained closed for over a year, limiting ventilation and exacerbating the problem. The RE-MOLD project was launched to design eco-friendly, low-cost methods for managing recurring mould on non-polychrome wooden furniture, aimed at non-professional users such as parishioners. The goal was to shorten closure periods and support resilience while respecting health and environmental concerns.

Diagnostic and Post-Flood Monitoring

Initial investigations focused on understanding the timeline of events and factors influencing mould development. Seven churches in the Vesdre Valley were studied to map mould activity over time. Tools included ARA-Kit DG18 agar tests to confirm active mould presence and ATP monitoring to quantify contamination levels, using a ranking system adapted from the National Trust. Findings highlighted the strong correlation between ventilation and reduced mould activity. Structural changes in historic buildings, such as sealed windows and added modern materials, were found to trap moisture, worsening mould problems after flooding.

Development of Adapted Treatments

Given the impossibility of controlled drying or removal of large furniture, the project tested practical, eco-friendly antifungal solutions for in-situ application. Treatments were applied to oak and northern red fir samples prepared with typical church furniture finishes (stain, varnish, wax). Seven options were evaluated: essential oils (Origanum compactum alone and in combination with thyme and rose geranium), chitosan, garlic macerate, Syra-Oleovictis©, caffeine solution, and demineralized water (control). Results showed that wiping active mould with damp absorbent paper combined with antifungal agents reduced mycelial development, though effectiveness varied by surface type. Smooth surfaces responded better than rough ones. Garlic and oregano treatments appeared most promising visually, while chitosan showed preventive potential.

Preventive Solutions

Preventive measures include dust removal before and after flooding to limit spore presence and accelerate drying; avoiding wiping rough wood surfaces where mould tends to anchor and sporulate, using ethanol sprays instead; and considering preventive coatings such as chitosan for wood exposed to high humidity. The study emphasizes the need for simple, reversible methods suitable for non-specialists, supported by professional guidance. Training and awareness are critical to avoid damage from well-intentioned but uninformed interventions.

Conclusion

RE-MOLD addressed a neglected aspect of heritage conservation: recurring mould on unpainted wooden furniture in churches after floods. By combining diagnostic tools, eco-friendly treatments, and preventive strategies, the project offers practical recommendations for crisis contexts where resources and expertise are limited. Future research should explore synergies between treatments, long-term preventive solutions, and knowledge transfer to local communities to ensure sustainable conservation of both tangible and intangible heritage.

TEXTILES

This report compiles two major projects undertaken by the Textile Conservation Workshop. The direct cause for two subprojects submitted by the textile workshop was the flooding that affected several churches, endangering collections of religious textiles. The first project focuses on first aid, restoration, and conservation of water-damaged textiles, while the second project addresses the value and significance assessment of liturgical textiles.

PROJECT 1: FIRST AID, RESTORATION AND CONSERVATION OF WATER-DAMAGED TEXTILES

Introduction

The Textile Conservation Studio undertook this project following the catastrophic floods of 2021 in Belgium, which severely affected several churches and endangered collections of religious textiles. The flooding highlighted the urgent need for research into the effects of water damage on textile heritage and the consequences of first aid actions on long-term preservation. The project aimed to analyse these impacts, develop sustainable conservation treatments, and propose preventive strategies for future disasters. Two case studies provided the foundation for this research: a collection of liturgical textiles from the Saint-Lambert Chapel in Verviers and an 18th-century dress from the Royal Museum of Art and History, part of the Albert Glibert donation.

Diagnostic and Post-Flood Monitoring

Water damage on textiles triggers a complex interplay of degradation processes. Heritage textiles often combine fibres, metals, dyes, and other materials, each reacting differently when wet. The construction methods of these objects further influence their resistance or vulnerability. Once exposed to water, textiles become highly susceptible to mechanical stress, chemical reactions, and biological growth. Common phenomena include migration of starch, bleeding of dyes, movement of dirt through fibres, swelling and shrinking, mould development and corrosion of metallic elements. These processes often occur simultaneously and progress rapidly, making immediate intervention critical.

The diagnostic phase confirmed that wet or damp textiles deteriorate quickly and that a rapid response can determine whether damage remains minimal or becomes irreparable. Controlled drying or freezing within forty-eight hours of a water incident emerged as a decisive factor in reducing mechanical and biological damage.

The first case study involved liturgical textiles from the Saint-Lambert Chapel, which were severely affected during the 2021 floods. Volunteers evacuated the pieces, rinsed them with tap water, and laid them out to dry on church pews. While these actions prevented total loss, the rinsing, the absence of controlled drying led to deformation, dye migration, and starch movement creating long-term conservation challenges.

The second case study concerned an 18th-century silk dress, a Robe à la Française with a Watteau pleat, from the Royal Museum of Art and History. This garment, part of a significant donation by Albert Glibert in the 1920s, suffered localized water damage in the mid-20th century and remained untreated for decades. Prolonged neglect caused severe degradation, yet the storage method (free placement without contact with other objects) limited colour migration and allowed contamination to remain on the surface. Thanks to these measures and targeted research, a tailor-made conservation treatment plan could be drawn up, which led to successful conservation.

Development of Tailored Treatments

The project initiated preliminary research to establish a protocol for sustainable conservation treatment of water-damaged textiles. Objectives included restoring fabric flexibility, removing water rings, stains, and contaminants, analysing starch migration and dye bleeding, and assessing the re-treatability and long-term stability of materials.

Tailor-made treatments were developed and tested. For the 18th-century dress, a customized cleaning process based on soil and dye analysis achieved a sustainable result, restoring both mechanical integrity and visual appearance. This case demonstrated that even severely degraded textiles can be conserved effectively through targeted interventions.

The research also examined the influence of first aid actions on future treatment options. For example, rinsing textiles immediately after flooding, as seen in the Saint-Lambert case, can exacerbate dye bleeding and starch migration, complicating later restoration. These findings underscore the need for cautious decision-making during emergency response.

Preventive Solutions and Emergency Plans

Preventive strategies emerged as essential for reducing the impact of water-related disasters. Storage methods significantly affect damage patterns. Folding and stacking contributed to severe deformation and colour bleeding in the liturgical textiles, whereas free storage helped preserve the structural integrity of the 18th-century dress.

The report emphasizes the importance of preliminary valuation of collections to guide rescue priorities and storage strategies. Such assessments ensure that the most significant objects are both well protected and easily accessible during emergencies.

Although no universal first aid approach exists, limiting immediate intervention to evacuation and controlled drying or freezing often reduces long-term damage. Rinsing to remove soil should be approached with caution, as it carries a high risk of mechanical and chemical deterioration.

Future research scheduled for 2025–2026 will focus on refining sustainable treatment protocols, analysing the consequences of first aid actions, and developing measures to extend the lifespan of affected objects. Key areas include restoring flexibility, addressing contamination, studying dye bleeding and starch migration, and evaluating the influence of physical forces on treated textiles.

Conclusion

This project highlights the critical role of informed emergency response and tailored conservation strategies in safeguarding textile heritage after water-related disasters. The two case studies demonstrate that both immediate and delayed interventions present unique challenges and opportunities. The findings reveal that actions taken during the first hours after a disaster have lasting consequences for preservation and future treatment. Continued research will refine protocols, ensuring resilience and sustainability in textile conservation practices.

PROJECT 2: SUPPORTING THE PROCESS OF VALUE AND SIGNIFICANCE ASSESSMENT OF RELIGIOUS TEXTILES

The project on value and significance assessment of liturgical textiles aims to support heritage managers and professionals in the process of assessing the cultural heritage value and significance of liturgical textiles primarily preserved in Walloon churches. To achieve this goal, the Textiles Studio of KIK-IRPA also focused on expanding and deepening its own (art) historical knowledge in the field of this specific type of heritage.

The assessment project for liturgical textiles focused primarily on the Walloon region, as it originated from the needs that arose during and shortly after the floods in southern Belgium in 2021.

Step 1: Orientation in the Walloon Cultural Heritage Field

The first phase of the project involved an orientation in the cultural heritage field in Wallonia. The cultural policy domain, which includes movable religious heritage, is organized and subsidized differently in Flanders and Wallonia. With the aim of supporting heritage managers and professionals in assessing the value of liturgical textiles preserved in Walloon churches, it was necessary to gain a clear understanding of the relevant institutions, existing tools, and the current state of value assessment for religious heritage in Wallonia.

In Wallonia, the Centre Interdiocésain du Patrimoine et des Arts Religieux (CIPAR) serves as the expertise centre for the preservation, protection, and promotion of religious heritage. It is the Walloon counterpart to PARCUM, the expertise centre for religious art and culture in Flanders . Additionally, each of the four French-speaking dioceses (Namur, Liège, Tournai, and the Vicariate of Walloon Brabant) has a heritage service or department, with one or more staff members acting as points of contact for church councils regarding the management of their religious heritage. CIPAR supports both these diocesan heritage services as well as directly the church authorities and local governments in managing the heritage preserved in churches. The project on value assessment was hence concretized in collaboration with CIPAR and the diocesan heritage services.

Initially, essential knowledge was exchanged regarding the regional state of affairs in the management of religious heritage in general and regarding the evaluation of liturgical textiles in particular.

Collection Registration

The collection registration of religious heritage from parish churches in Wallonia is conducted in a closed database managed by CIPAR. Church councils have access to the database to enter the inventory of heritage preserved in their churches . This database links to the KIK-IRPA database, BALaT, for objects that have been catalogued.

Status of Registration Degree

CIPAR systematically tracks, by diocese, which parish churches have fully digitally inventoried their movable heritage. In a crisis situation, it is possible to quickly determine whether an inventory is available for an affected church. In recent decades, significant progress has been made in inventorying, and many inventories are still added each year. To provide the best possible support to church councils, CIPAR offers training, publications, and a validation procedure for inventories.

Practice in Value Assessment

CIPAR has prepared a step-by-step plan for assessing, selecting, and repurposing movable religious heritage in case of complete or partial repurposing of a church building . This is similar to the Stappenplan Religieus Erfgoed established in Flanders . The next paragraph will discuss the key steps of this evaluation methodology. However, in practice, there is still limited experience with significance assessment of religious heritage.

Step 2: Orientation in Methodologies for value and significance assessment

The first phase of the project also involved becoming further acquainted with evaluation methodologies for heritage collections. Several well-developed methods exist for assessing value and significance. Most of these methodologies are inspired by the Australian assessment methodology Significance 2.0 . A key reference work in the Dutch-speaking world is Op de museale weegschaal - collectiewaardering in zes stappen . FARO, the Flemish Institution for Cultural Heritage, gathers various evaluation manuals on their website, highlighting the differences between them . On one hand, there are general guidelines applicable to heritage collections of various kinds, and on the other hand, there are manuals for specific collections. For example, the Flemish *Stappenplan Religieus Erfgoed* and the similar step-by-step plan developed by CIPAR are a translation of the general evaluation methodology, tailored to the assessment, selection, and repurposing of religious heritage collections, respectively developed for the Flemish and Walloon contexts. As the Flemish step-by-step plan is accessible online, this article refers to this Dutch-language tool several times.
What makes both step-by-step plans for evaluating religious heritage particularly unique is that they are directly addressed to church boards. This is a different target group compared to collection managers in museums and other professional contexts, which is the focus of most evaluation methodologies. The management of religious heritage from parish churches is usually in the hands of volunteer and hence non-professional heritage managers. They play a crucial role in preserving and managing religious heritage. This is an important factor that should not be underestimated. Supporting this large group of volunteer heritage managers in their challenging management tasks is an enormous challenge.
The theoretical background regarding the evaluation of heritage collections can be found in the sources cited above.

Step 3: Building knowledge and experience in liturgical textiles assessment.

Specialized knowledge on the art-historical development of liturgical textiles was gathered through literature review . As a result, information was distilled on the formal, material, and stylistic evolution of liturgical vestments. This formed the basis for a working paper outlining key points of observation when examining liturgical textile collections, many of which are discussed in the Results section.
Additionally, a collection of visual material was compiled, featuring paraments with known dates based on the online KIK-IRPA database and illustrations from specialised literature.
Further enrichment of art-historical knowledge regarding liturgical textiles resulted from the symposium Fashion for God - Reuse in Religious and Secular Dress, organized by the Museum Catharijneconvent (Utrecht) in connection with the exhibition Fashion for God on religious vestments from Dutch hidden churches between 1580 and 1800 . This event also provided an excellent opportunity to expand the professional network with experts in the field.
The acquired knowledge was subsequently applied to gain hands-on experience with the evaluation of liturgical textiles. In collaboration with CIPAR and the diocesan heritage services, suitable case studies were identified. A list was compiled for each diocese of churches that preserve an extensive

collection of liturgical textiles, featuring a broad range of object types and dates. From this list, at least one church or museum per diocese was selected to review the textile collection and initiate an assessment.

Prior to each site visit, the corresponding inventory, including photos of all objects, was closely examined. The closed database managed by CIPAR proved to be a valuable resource, allowing an export to Excel, on which additional information could be noted on materials, techniques, and dating during the site visits.

To further enhance knowledge and experience, peer textile specialists were invited to collaborate on several case studies. Each collaboration resulted in a rich exchange of knowledge and expertise.

Value and significance assessment of liturgical textiles

The *Value and Significance Assessment* project for liturgical textiles produced a diverse range of outcomes, which are detailed below.

Outcome 1: Observation Points for Researching and Evaluating Liturgical Textiles

Based on specialized literature, a list of observation points was compiled for examining and subsequently assessing a collection of liturgical textiles. Various characteristics assist in dating and evaluating the heritage values of these textiles.

One important note is that attention should not only be given to the oldest vestments in a collection. It is a reality that a significant number of liturgical textiles from the 19th and 20th centuries has been preserved; however, this does not diminish their value. This is demonstrated by the publication *Kerkelijk textiel in Vlaanderen en Brussel in de 19de en 20ste eeuw*[1]. A similar study for liturgical textiles preserved in Walloon churches would be worthwhile to find out where, by whom and what textiles were produced in this region. Given the significant preservation of liturgical textiles from this period, there is a risk that these objects may be the most among the first to be rejected during repurposing efforts, which could result in the loss of valuable information in a relatively short time.

The following list of observation points is not exhaustive but serves as a guideline. This list was discussed during a consultation meeting with CIPAR and the diocesan heritage services. During site visits, it served as a framework for gaining relevant experience.

Assembling Related Pieces into a Liturgical Vestment

During the inventory process, it is essential to assemble the vestments as much as possible. This means bringing together the complete set of associated garments and accessories of a liturgical vestment, typically made from the same fabric and in the same liturgical colour. A complete vestment usually consists of a chasuble, a cope, two dalmatics, stoles, and possibly also maniples, a chalice veil, and a burse, and sometimes a shoulder veil[2]. Sometimes a vestment is complemented with an altar antependium in the same fabric.

1 Van Dyck 2009

2 The French and Dutch terminology for liturgical textiles can be found in the publications CIPAR 2017 (available online) and PARCUM 2020, respectively.

Often, the smaller liturgical items such as stoles, maniples, chalice veils, and bursae are stored in different cabinets or drawers and are not always inventoried together with the vestment they belong to. It is important to examine the fabrics, trimmings, and decorations in detail to assemble these sets. For evaluation and potential repurposing, it is crucial to consider the vestments as a whole. When reviewing and supplementing an inventory, it is important to make cross-references between objects that are part of a vestment set.

Typology of Liturgical Vestments

Each component of liturgical garments has undergone an evolution in terms of shape, usually as dictated by ecclesiastical regulations. For instance, the chasuble has evolved from a wide, circular or semicircular model to the Baroque Roman model, commonly known as the *violin case* model, and back again to a wide, bell-shaped model.

The most common model of old chasubles still preserved in parish churches is the violin case model. Very rarely, an older circular chasuble has been preserved[3]. Exceptionally, based on the nature of repairs, it can be inferred that the shape of an original wide chasuble was adapted to the violin case model due to new liturgical regulations[4].

Similarly, certain stylistic features of a cope provide clues about its dating, such as the shape and size of the cope's shield[5].

Type of Fabric and Traces of Reuse

Many fabrics are characteristic of specific periods, making it essential to examine both the stylistic features of the fabric and its technical characteristics. While this is specialists' work, there are several identifiers to note.

For instance, the so-called Renaissance silk velvets are recognizable by their large pomegranate motifs and pointed ovals[6,7].

The fabrics that give a distinctive appearance to many 18th-century garments are the silk figured textiles, typically with woven-in floral patterns, often enhanced with gold or silver threads[8] (fig. 1). These luxurious silk fabrics were also used for upholstery or as exquisite clothing for the upper bourgeoisie.

It is not uncommon for liturgical garments and altar frontals to be made from worn clothing that was donated to the church[9]. With careful observation of the liturgical attire, signs of usage can be recognized, such as needle holes, fabric creases, specific wear and tear, soiling, and discolouration.

3 For example, the so-called chasuble of Thomas Becket from the Cathedral of Notre-Dame de Tournai (KIK object 10061595) and the so-called Saint Bernard chasuble from the former Abbey of Cambron (KIK object 10076606).

4 For example, the chasuble of Nicolas de Romont (KIK object 10037009), which was studied as part of the Ornamenta Sacra project (https://ornasacra.kikirpa.be/index.php/Chasuble_de_Jean_de_Romont, accessed 14/10/2024).

5 Van Dyck 2009, p. 27; Van Roon 2010, p. 38-39.

6 Monnas 2012

7 For example, the garment from the church of Saint-Lambert in Dinant (KIK object 10090146).

8 Lugtigheid 2021, p. 106; Aribaud 1998

9 An extensive study on this subject was conducted by René Lugtigheid. Lugtigheid 2021.

These traces not only help to date the garments but also provide insight into their history and previous use, underscoring their cultural significance.

Woven Patterns in Fabrics: Typical Ecclesiastical or Not

In the early decades of the 19th century, the same fabrics were used for liturgical garments as for civilian clothing and interiors. Neither the pattern of the fabric nor the colour scheme was specifically ecclesiastical. It was only during the significant expansion of the French silk industry after 1820 that specialized companies emerged, focusing primarily on fabrics for ecclesiastical use[10]. When closely examining monochromatic damask silk weavings, it is essential to look for the presence or absence of typical ecclesiastical motifs. These may include eucharistic symbols such as ears of grain, grapes or grape leaves, as well as symbols of the Passion, like a crown of thorns, or distinct neo-Gothic motifs such as quatrefoils, pointed arches, and Gothic letters[11].

Shaped Woven Crosses and Ornamental Borders

Typical of the 19th century are the woven-into-shape crosses and bands for chasubles and the woven-into-shape shields for copes. If these elements are cut from another fabric or only marked with trimmings, it is an indication that the vestments are older, in many cases 18th-century. The method of weaving decorative elements specifically for liturgical vestments became possible due to technical improvements in looms and the industrialization of (silk) weaving. This replaced the time-consuming embroidery work[12].

Embroidery Techniques

Like many fabrics, certain types of embroidery which appear on aurifrices, chasubles, crosses, and decorative borders of vestments are characteristic of specific periods. Notable examples include the beautiful medieval embroideries executed in gold thread and multi-coloured silk, often referred to as *painting with the needle*[13] and *Opus Anglicanum*[14]. With the rise of the Neo-Gothic style, this type of embroidery was once again appreciated and applied in various degrees of complexity, often resulting in beautifully historicised vestments[15].

Gold and relief embroidery from the 16th and 17th centuries can also be relatively easily identified[16]. In the 17th century, relief embroidery could become so heavy and thick that it appeared sculptural. This type of embroidery, made with gold or silver thread, remained popular in the 18th and 19th centuries, although its technical characteristics did change. In the 19th and 20th centuries, many other, less labour-intensive embroidery techniques gained popularity, such as appliqué, cross-stitch, and (machine) chain stitch embroidery[17].

10 van Roon 2010
11 Van Dyck 2009, p. 31-32
12 Van Dyck 2009, p. 32
13 Leeflang and van Schooten 2015
14 Brown, Davies and Michael 2016
15 Van Dyck 2009, p. 30 en 47
16 van Roon in Arts and de Beer 2023, p. 41-43
17 Van Dyck 2009, p. 47-48

Labels, Signatures, Inscriptions, and Dates

An important aspect to investigate is whether there are indications of the manufacturer, embroiderer, workshop, or tailor who created the vestment. Especially when dating 19th and 20th-century vestments, a label bearing the company's name can be very useful for achieving a more precise dating. The publication *Kerkelijk textiel in Vlaanderen en Brussel in de 19de en 20ste eeuw*, includes lists of known workshops and manufacturers of liturgical vestments organized by region, compiled through archival research in address books, advertising sources, and catalogues. Where possible, a timeframe has been provided for the periods during which these producers were active in making vestments[18].

Other clues for the historical context of the piece may sometimes be well hidden, such as a date, a name or initials of the maker or donor, a coat of arms, etc.

Church Accounts, Exhibition Catalogues, and Archival Documents

If possible, (archival) research can provide additional information. An inventory campaign and/or evaluation process is a good opportunity to take action in this regard. It is worthwhile to ask the local historical circle or archivist to conduct archival work in search of extra information. Although church accounts often contain general descriptions, such as “red vestment,” it is sometimes possible to link a dated record to the corresponding vestment in the collection. When such information is found regarding an object or a set of vestments, it is essential to include this data in the digital inventory.

Iconography

It is important to investigate whether the vestment features images that reference the church for which it was made, such as the patron saint of the church or the parish coat of arms.

Less Common Object Categories

In addition to the more common textile items, such as liturgical vestments, antependia, banners, and clothing for statues, there are also less frequently encountered textile objects, such as a pall box, a reliquary cover, special upholstery in a tabernacle, floor carpets, cushions, and more. When compiling the textile inventory and during an assessment process, it is important to look at all objects in textiles to allow for the possibility of exceptional discoveries.

Linens

A challenging category to assess is linens, which can often be found in significant quantities within a church, including albs, surplices, and various liturgical linens such as altar cloths, corporals, chalice veils, and more. However, this object group should not be overlooked. Often, these linens are finished with decorative borders made using various textile techniques, such as lace, fine crochet, and embroidered netting. It is advisable to have these assessed by a textile specialist. Linen undergarments, such as albs and surplices, are frequently still pleated and tied up as they were

18 Van Dyck 2009.

originally stored. It is important to maintain this preservation technique, as it holds historical value; this practice represents a skill that has nearly been lost.

Outcome 2: Case Studies

As indicated in the Methodology section, the aim of this project was not to establish participatory assessment processes. The primary objective was to gain experience in assessing liturgical textiles, alongside the staff members of the heritage services and members of the church councils. The case studies served as a starting point for potential future assessments processes. Each case study had a separate approach and outcome.
The collections of liturgical textiles from the following parish churches and museums were investigated in whole or partially.

Verviers, Saint-Lambert chapel
This case involves the liturgical textile collection of the Saint-Lambert chapel in Verviers, which was severely impacted by floods. From the perspective of value and significance assessment, this case serves as an example of how such evaluations can be carried out during a crisis situation. Under the coordination of CIPAR, several independent restorers and textile experts voluntarily assisted in the aftermath of the floods. Their tasks included assessing the damage, compiling an emergency inventory of the textiles, and evaluating which garments held the most heritage value. In the subsequent phase, Thibaut Roblain of the heritage service of the Diocese of Liège thoroughly prepared the value assessment of the affected textile collection, drawing on the emergency inventory created during the initial phase. The evaluation process involved classifying the objects into three categories: (1) to be preserved and conserved, (2) to be retained, and (3) to be disposed of. This emergency categorization was reviewed with the textile workshop of KIK-IRPA, after which the objects were physically labelled with color-coded tags corresponding to their assigned category. On the day the items were packed, the categorization was reviewed again, with only minimal adjustments made. Through close observation of smaller objects, several accessories, such as stoles, chalice veils, and burses, were successfully reunited with their corresponding vestments.

Namur, Church of Saint-Loup
The management of the religious heritage in this church is in good hands. The non-profit association *Amis de Saint-Loup* is a highly committed group of volunteers dedicated to preserving this exceptional baroque art heritage site. In recent years, they have made significant improvements to the storage conditions of the liturgical textiles, starting with a detailed inventory of the extensive collection. The inventory is meticulously prepared, featuring high-quality, systematically numbered photographs. Furthermore, all objects have been labelled with their corresponding inventory numbers, a crucial step in ensuring a clear link between the physical objects and their descriptions in the inventory.
However, a complication in starting the assessment process was that the inventory had not yet been fully digitized.

As part of the CHrisis project, two site visits were conducted with several textile specialists to thoroughly examine the liturgical textiles and to exchange knowledge and experience. Some notable discoveries were made, including the attribution of a significant number of vestments to the 18th-century Namur tailoring family Lekeu. During that era, it was uncommon for creators to sign their work, making this identification particularly remarkable. The work of the Lekeu family is part of ongoing research at UCLouvain.
One concrete outcome of this case was the refinement of the inventory's entry into the digital database, a prerequisite for conducting a systematic valuation process.

Enghien, Church of Saint-Nicolas

The committed church council of Saint-Nicolas was actively working to improve the storage conditions of their extensive collection of liturgical textiles during the project period[19]. The inventory of their collection had been excellently digitized, which made it possible to carry out much of the evaluation remotely using the photographic documentation and the Excel-based inventory. During three site visits, together with textile experts and the heritage staff of the Diocese of Tournai, the vestments were visually studied, and most pieces were dated. Notably, a remarkable 17th-century vestment, dated to 1642, was thoroughly examined and deemed to be of significant historical value. Embroidered coats of arms on the garment clearly indicate that it was specially made for this church. The multi-coloured silk embroidery on the vestment showcases exceptional artistic craftsmanship, both in design and execution. The vestment will be further studied as part of ongoing research at UCLouvain. This case resulted in a comprehensive evaluation report, which is intended as the start of a participatory value assessment process to evaluate social and use values in addition to historical values.

Estinnes, Centre d'Histoire et d'Art Sacré en Hainaut (CHASHa) Namur, Diocesan Museum of Namur

In both the CHASHa in Estinnes and the Diocesan Museum of Namur, we conducted examinations of the liturgical textile collections alongside the responsible heritage staff from the diocesan heritage services. The aim and outcome of this work were to apply the acquired expertise in practice through hands-on collaboration. This knowledge transfer to professional heritage staff indirectly supports non-professional heritage managers, helping to build capacity in the broader heritage management community.

Liers, Saint-Rémy Church

This case was included in the project due to a specific concern raised by the church council regarding the preservation and management of their liturgical textiles. They had noticed mould on some of the older vestments, prompting questions about the value of the textiles and whether it was worth investing in improving the climate control in the sacristy.
Collaborating with them to examine the collection of liturgical textiles raised awareness about the heritage value of their textiles. It was confirmed that the collection indeed included significant pieces,

19 Guidelines for the proper preservation and management of liturgical textiles include CIPAR 2018 and Monumentenwacht Vlaanderen vzw 2010.

such as medieval embroidery. This case highlights the importance of supporting the efforts and investments of an average parish church in preserving its heritage.

Outcome 3: Framework and workflow for assessing a collection element by element.

Although this project did not aim to carry out complete evaluations, several essential tools were developed for such a process.

First and foremost, an assessment framework is necessary. This reference framework provides guidance during the value and significance assessment and consists of a combination of established evaluation criteria and accompanying guiding questions. By systematically reviewing these, an assessment team can work in a rational and structured manner. This framework can be used to assess either the entire (sub)collection or individual elements. Evaluating each value involves assigning a qualitative rating (ranging from high to low). For each criterion, it is essential to define what a specific object or (sub)collection must meet to be rated as high, moderately high, moderately low, or low. It is also possible to indicate the potential for future development of a value, as it may evolve over time. For example, an assigned value can be increased through provenance research, improving the condition through restoration, or making the object or collection more accessible to the public.

Since this project was conducted for the Walloon region, the evaluation framework was developed in French and made available to diocesan heritage services through CIPAR. It will also be downloadable via the *Online Resources* button on the main page of BALaT, the KIK-IRPA database.

The assessment framework was created based on various existing documents, including:

- The evaluation form from the publication *Op de museale weegschaal*[20]
- The Stappenplan Religieus Erfgoed at step 3[21]
- formulier waardering geheel
- bijlage waarderingscriteria
- The document Évaluation du patrimoine mobilier : feuille de route from CIPAR[22]

As a second tool for assessment, a form is useful for evaluating the different heritage values for each element. To work efficiently and obtain a clear result, a printout of the textile inventory to be evaluated in spreadsheet format can be used to which columns for the various heritage values are added (fig. 4). When filling out the form, the assigned score can be indicated using colour codes or symbols (see legend fig. 4).

20 Versloot 2013, p. 60-61.

21 https://www.stappenplanreligieuserfgoed.be/alle-downloads; accessed October 7, 2024.
These documents have been translated and slightly adapted with the permission of the Flemish working group *Waarderen en herbestemmen roerend religieus erfgoed*, which developed the Religious Heritage Step-by-Step plan.

22 Unpublished document, provided to the authors.

FIG. 4. Example of an inventory in spreadsheet format with added columns for the assessment of various values.

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Recommendations following from the subproject on value and significance assessment of liturgical textiles.

The assessment project for liturgical textiles represents an important impetus toward implementing the roadmap for the assessment, selection, and repurposing of movable religious heritage in Walloon parish churches.

Moreover, it is recommended to conduct systematic evaluation research on liturgical textiles preserved in churches and museums in Wallonia and Brussels. This would establish a robust foundation for listing liturgical textiles of remarkable significance to heritage in these regions. Throughout the project, it became evident that textile cultural heritage is currently underrepresented among classified artworks and objects of notable importance in Brussels and Wallonia[23], consequently including religious textile heritage. All stakeholders involved in this project agree on the necessity and urgency of this endeavour. Numerous liturgical textile objects hold substantial cultural-historical, socio-cultural, scientific, or artistic significance for the community and deserve protective measures as well as visibility. Listing and protecting these heritage objects acknowledges the centuries-long effort and care dedicated to their preservation.

Conclusion

Throughout the project, collaboration with CIPAR was established to achieve the objective related to the value and significance assessment of liturgical textiles. The primary target audience for the dissemination of the knowledge and information gathered within the project consisted of the working group of CIPAR and the diocesan heritage services. Specific dissemination activities focused on transferring knowledge and skills related to the valuation and significance assessment of liturgical textiles included:

23 In the Federation Wallonia-Brussels, a distinction is made by decree between the category *des trésors* (treasures), which means masterpieces, and the category *biens d'intérêt patrimonial* (BIP), meaning artworks and objects of exceptional heritage significance (https://patrimoineculturel.cfwb.be/patrimoine-culturel-mobilier, accessed on 14/10/2024).

- Consultation meetings with stakeholders from CIPAR and the diocesan heritage services
- Development of the working document *"Key Points for Observing Liturgical Textiles"*, presented and distributed during a CIPAR meeting (see annex)
- On-site advice provided during the case studies in Verviers, Namur (St-Loup), Enghien (St-Nicolas), Estinnes (Chasha), Namur (Diocesan Museum), and Liers (St-Rémy)
- In addition, the project was communicated to the committed heritage community through the CIPAR newsletter and the KIK website.
- CIPAR Newsletter, published on 31/05/2024: Les textiles religieux: ignorés et mal-aimés? (annex)
- KIK Website Post: Milestones of the Textile Subprojects within the CHrisis Project (yet to be published)

MONUMENTS

The main objective of the research project done by Monuments Laboratory in the CHrisis project was to develop a global approach for choosing the most appropriate conservation-restoration interventions and the means of prevention to develop in situ, taking into account the specific features of each building.
To reach this objective the project has been divided into 3 work packages.

- Drying and Degradation of 7 selected buildings impacted by 2021 floods in Wallonia
- Development of treatment adapted to buildings after floods.
- Concrete solution in preparedness and preventive phase

DRYING AND DEGRADATION OF 7 SELECTED BUILDINGS IMPACTED BY 2021 FLOODS IN WALLONIA

This work package focused on the recovery phase after flooding event to limit the development of secondary damages. The major cause of the secondary damages is the presence of moisture, in the building structures but also as water vapor fixing an indoor climate. The goal of this work package is to develop an efficient recovery process for floods impacted built heritage. To reach this objective the moisture and salt content and climatic conditions (indoor and outdoor relative humidity and temperature) were monitored, the salt weathering and mould growth issue were assessed.

Materials and Methodology

Seven heritage buildings affected by the 2021 floods in the province de Liège in the Wallonia have been studied. They are composed of five churches, one dwelling and one museum both in high heritage value buildings (Fig. 5).

These are:

- The *Saint-Nom-de-Jésus* Church in Chanxhe
- The *Saint-Laurent* Church in Prayon (Trooz)
- The Saints-Antoine-Ermite-et-Apolline Church in Pepinster
- The Notre-Dame des Récollets Church in Verviers
- The *Saint-Lambert* Chapel in Verviers
- The *Maison Lambrette* in Verviers
- The Musée d'Archéologie et de folklore in Verviers

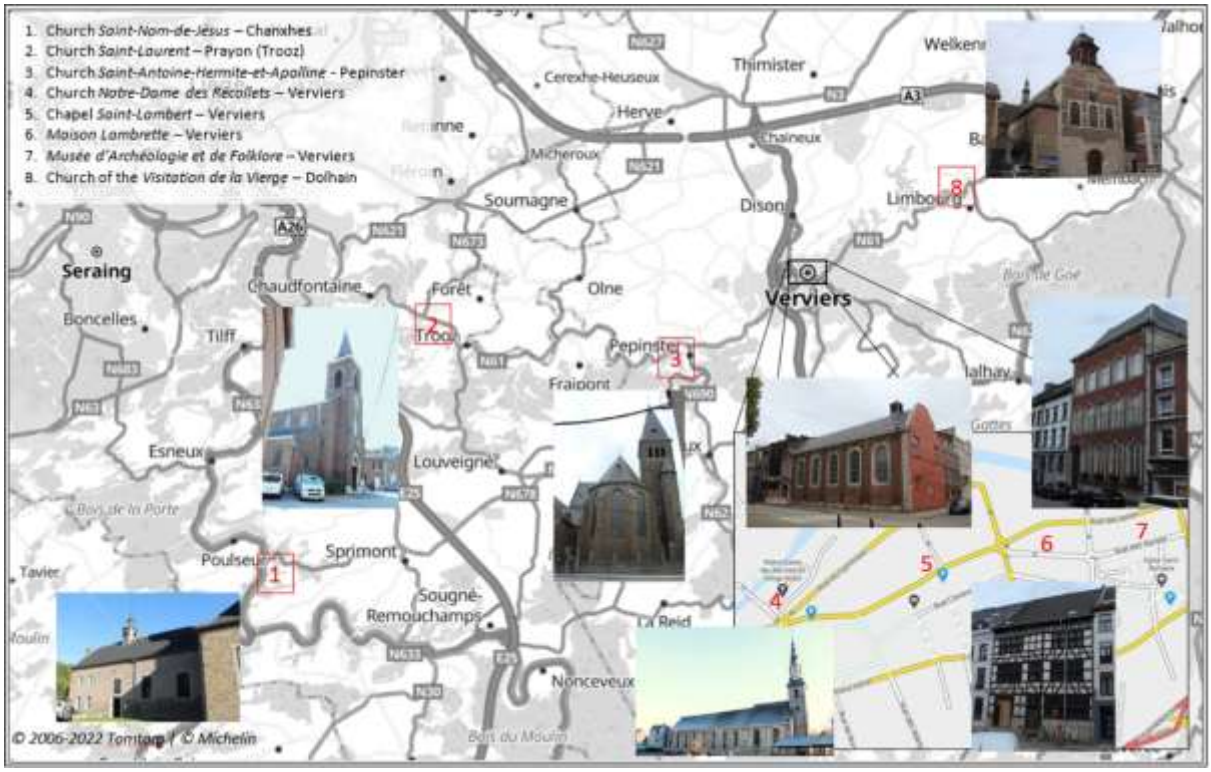


FIG. 5. Selected building used in this study © KIK-IRPA

Relative humidity and temperature monitoring

The relative humidity and the temperature in all buildings have been measured from April 2023 to October 2024. Relative humidity and temperature measurements are recorded continuously every hour and collected by RH- and T-sensors. Next, the data are transmitted to a local LoRaWAN gateway located in the church. The gateway then sends the data to a cloud, an IoT (internet of things) web platform. This platform provides live information on humidity and temperature in the building.

Moisture, Hygroscopic Moisture and ions contents

The moisture content profiles in the building structures have been measured to determine the spatial and temporal moisture and salt content. Depending on the buildings, 2 to 4 moisture profiles have been measured at 3 periods to study the impact of the season : one Winter period in January 2023, one summer period in July 2023 and a second winter period in January 2024.

Each moisture profile has been obtained with destructive method, gravimetry method. It consists in slowly drilled powder sample in building materials of the masonries (Bricks, natural stones, plasters and mortar) at four different heights (20, 50, 100 and 150 cm) on two depths (0-5 cm and 5-10 cm). The moisture content (MC) of these samples was determined gravimetrically after drying at 60 °C by the difference between the dry weight and the initial weight. Then sample are placed in a climatic chamber at 95%RH. The weights of the samples are measured again after two weeks, and the hygroscopic moisture content (HMC) is calculated as the difference between this new weight and the weight of the dried sample. In this context, the hygroscopic moisture is an indicator of the presence of hygroscopic salts.

Ions content and Salt crystallization behaviour

Ultrapure water was, then added to the dried samples to extract the salts. This extract was analysed by ion chromatography (Metrohm) to quantify the amount of Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, NO_3^- and SO_4^{2-}. The ion analysis and data treatment are extensive and described in [9]. The identification of salt mixtures, and behaviour under changing RH conditions is based on the ion dataset corrected to achieve an equilibrium charge balance within each individual sample. The balanced ion concentrations are presented as mole fraction and equimolar contents of calcium and sulphate, considered as the gypsum content, are removed. The data were used as direct input for the ECOS/RUNSALT model. The model has equivalent principles to the molality-based model, generally known as the Pitzer–Simonson–Clegg model, includes ion concentrations expressed as mole fractions. The outputs of the model are investigated to determine the crystallization behaviour of salt mixtures under changing RH between 15 and 95% with a 0.2% resolution at 15 °C.

Mould prediction modelling and mould activity

The assessment of mould growth risk has been determined by modelling. Since the relative humidity (or water activity), the temperature and the exposure time are the main mould inducing factors, the Sedlbauer isopleth model has been used to predict mould growth risk. He developed a lowest isopleth for mould (LIM), below which no mould will grow but also isopleths indicating the critical RH and temperature threshold to initiate mould spore germination for a specified time (e.g. 1, 2, 4, … days). Additionally, he developed Sedlbauers' LIM-curves for different substrate categories. This study assumes category II corresponding to porous building materials such as renderings, and mineral building materials.

The results of mould growth risk obtained by modelling has been compared to the mould activity measured by ATP monitoring devices; ATP (adenosine triphosphate) is ATP is found in all living cells. Once the cells are dead the ATP decays. The ATP test is based on the firefly luciferase reaction, which can produce light from luciferin and ATP. The amount of light produced is proportional to the amount of ATP in a sample and can be quantified rapidly (in seconds) by measuring the light with a luminometer that displays the results in relative light units (RLU). The presence of ATP is consequently a marker of organic contamination at the tested surface. The measurement consists of 3 steps : 1) collecting the sample over three wall surfaces of 100cm² with a disposal swab; 2) mixing

the swab with luciferase reactant; 3) putting the solution (by-product from the reaction) in a luminometer and measuring the number of photons (light). A consistent swab protocol adapted from manufacturers and has been developed to improve consistency of the measurements performed with an ATP SystemSure® device. The RLU values correspond to contamination can been categorized:

- From 0 RLU to 30 RLU: no living cells are present.
- From 30 RLU to 250 RLU: dormant spores
- From 250 RLU to 500 RLU : active sporulation and growth
- Beyond 500 RLU : high level of growth

In this study only the presence of active mould has been deduced from the ATP-test results.

The overall methodology of this work package can be defined by the figure 6 (fig. 6); The combination of the Relative Humidity (RH) and temperature (T) measurements, Moisture and salt content enables the assessment of drying and to find the main water sources. The combination of RH and T measurements, Salt identification, salt content measurements and Salt crystallization behaviour modelling allow us to predict the salt weathering. The combination of HR and T measurements, Sedlbauers isopleths modelling, ATP measurements and Visual observations allow us to calibrate the model and to predict the mould growth.

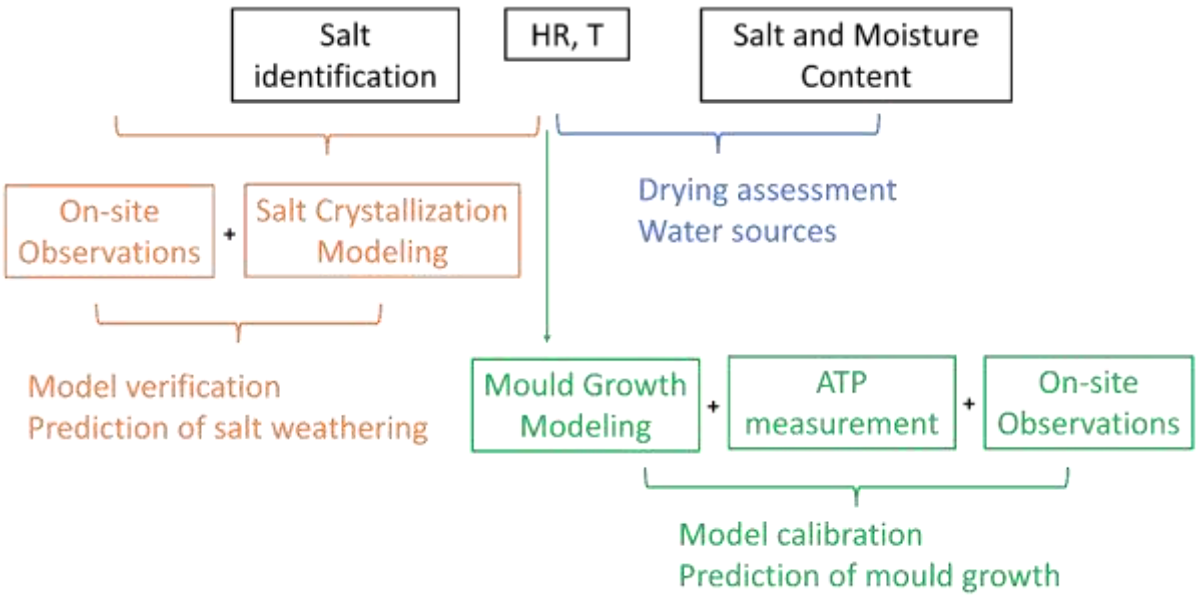


FIG. 6. Schema of the WP1 Methodology © KIK-IRPA

DEVELOPMENT OF TREATMENT ADAPTED TO BUILDINGS AFTER FLOODS

Based on the results obtained in the WP1 a series of potential treatments has been developed for each building. Moreover, In this WP2 a study on the efficiency of biocide treatment in the recovery phase have been carried out. The effectiveness of seven types of products was evaluated on moulds: ethanol diluted with demineralised water (50/50 and 30/70), two quaternary ammonium mixtures,

a product based on essential oils and a gel composed of peracetic acid generated in situ. The products were selected on the basis of their biocidal capabilities and are all of the 'broad spectrum' type.
The assessment has been done on the same wall of a church impacted by floods in the same climatic conditions.

Materials

Name	Active product
Fungibio	Ammonium quaternaires de benzyl-C12-18-alkyldiméthyl et de chlorides à 1-3%, du chlorure de didécyldiméthylammonium (<1%), du propan-2-ol (<0,5%) et du 2-octyl-2H-isothiazol-3-one (octylisothiazolinone 0,1%)
Syra-Mouss 3R	Quaternary ammonium + benzalkonium chloride
Gel Sets Grandes O-ND	Peracetic acid
Eau/éthanol 30/70	Absolute Ethyl alcohol + 3% iso-propylique alcohol (IPA)
Eau/éthanol 50/50	Absolute Ethyl alcohol + 3% iso-propylique alcohol (IPA)
deionized Water	water
Syra Oléovictis	Essentials oils mixture Citral, Geraniol and le (S)-P-Mentha-1,8-Diene

Methodology

The Relative humidity, temperature and mould activity has been measured the same way than describe for WP1 (cf. supra).

Colour measurement

The colorimetric study is a second method for determining the effectiveness of conservation treatments. A portable @BYK spectrophotometer was used to quantify the surface colour of the test areas. This device quantifies colour using the L*a*b* referential; this system is used to describe a colour in an orthonormal space. It has three axes:

- The x-axis describes the change in hue from green (-a*) to red (+a*).
- The ordinate axis describes the change in hue from blue (-b*) to yellow (+b*).
- The slope axis represents clarity.

The colour is therefore represented by a point in this frame of reference, which allows it to be defined very precisely (fig.7).

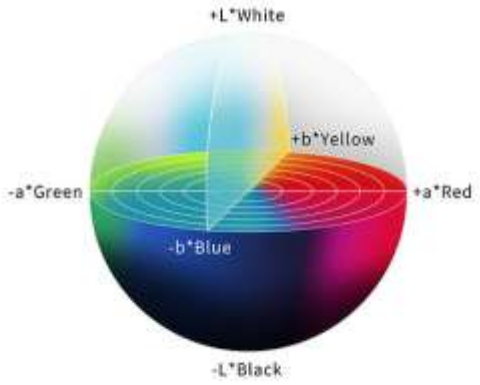


FIG. 7. Lab colour system © KIK-IRPA

The colorimetric difference between two samples is given by :

$DE^*=(\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})^{1/2}$

With : ΔL*: difference in lightness. Δa*: difference in red/green hues. Δb*: difference in yellow/blue hues.

Multicriteria assessment

The assessment has been done by multicriteria methodology using 7 criteria (fig. 8):

- Biocide efficiency
- Long term efficiency
- Impact on substrate
- Duration of the application
- Innocuity
- Cost
- Consumption

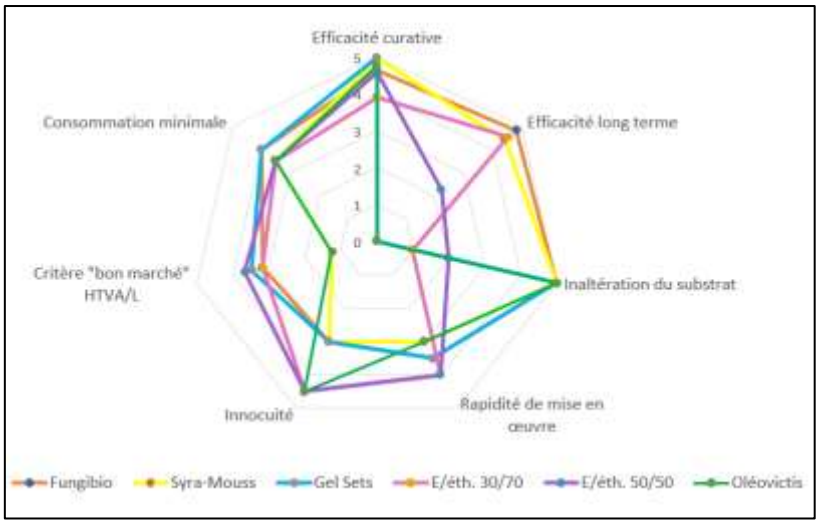


FIG. 8. Spider net to assess the biocide product in the church of Trooz after floods © KIK-IRPA

In this last WP a series of solutions to prevent damages caused by floods have been studied.
The main criteria in their application on a context of listed buildings, historic deterioration and environmental context.

The main objective of the research project done by Monuments Laboratory in the CHrisis project was to develop a global approach for choosing the most appropriate conservation-restoration interventions and the means of prevention to develop in situ, taking into account the specific features of each building.

As mentioned above, to reach this objective, the project has been divided into 3 work packages.

- Drying and Degradation of 7 selected buildings impacted by 2021 floods in Wallonia
- Development of treatment adapted to buildings after floods.
- Concrete solution in preparedness and preventive phase

Drying and Degradation of 7 selected buildings impacted by 2021 floods in Wallonia

The Moisture content (MC) and the Hygroscopic moisture content (HMC) have been monitored to assess the drying process in the 7 buildings for one year to define the temporal and spatial moisture content after floods.
The measurement of moisture and hygroscopic moisture content by gravimetry allows to determine the source of water in the wall. An example of the moisture content obtained during the figure 1, 2. The measurement started a year after the floods explaining than in most cases the water content was not the result of flooding. The water sources have been identified in the example given in the figures 9 and 10 (fig. 9-10), it is clear than the main source is the presence of salt in the nave's wall and the presence of rising damp.

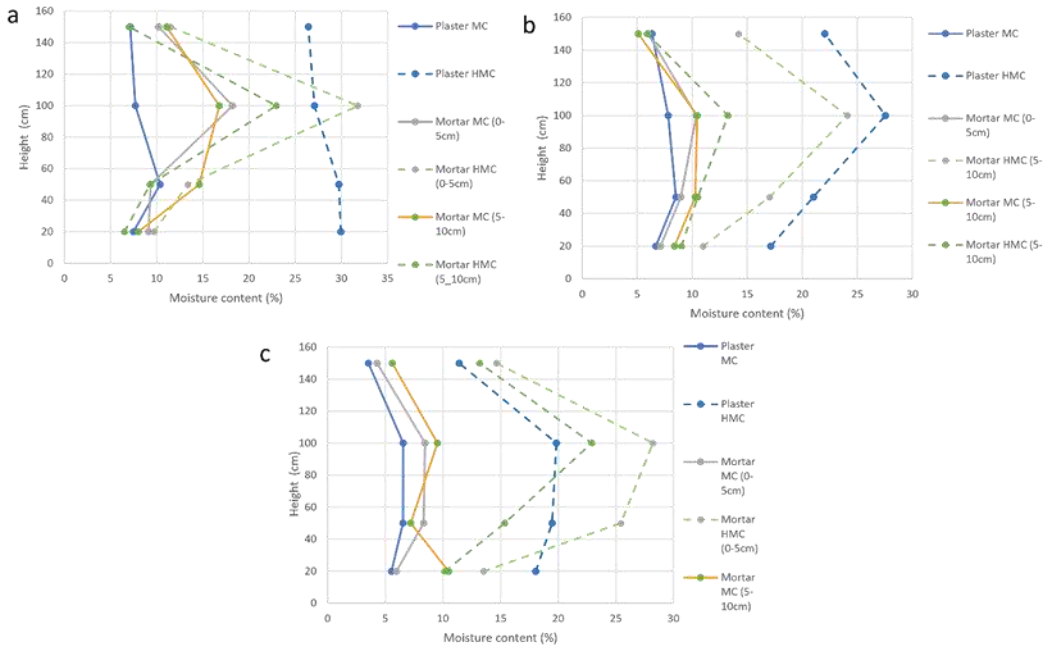


FIG. 9. Moisture content Hygroscopic moisture content profiles obtained in the wall of the nave of the Trooz Church during a) the 1st winter measurement in 2022, b) the second series of measurement in summer 2023 and c) The 3rd series of measurement in January 2024. © KIK-IRPA

The salt content and its identification by CI make it possible to model the crystallisation behaviour of salt in all the buildings studied. An example can be found in Figures 11 and 12 (fig. 11-12). The salt content measured by ion chromatography is used to identify water sources. The ion concentrations are then fed into thermodynamic modelling using Eco-RunSalt, which predicts when salt weathering will be most severe. An example of the results is shown in Figure 12. In the Trooz example, it has been shown that for the choir wall, there is no salt problem. For the Nave wall, the salts are mainly present at a height of 100 cm, which is very symptomatic of rising damp, but is no longer active.
Secondly, modelling of the crystallization behaviour of the salts showed that the riskiest period is when relative humidity fluctuates between 57% and 75%.
Taken together, the results enable site managers to prioritize their actions regarding secondary damage caused by salt crystallization.

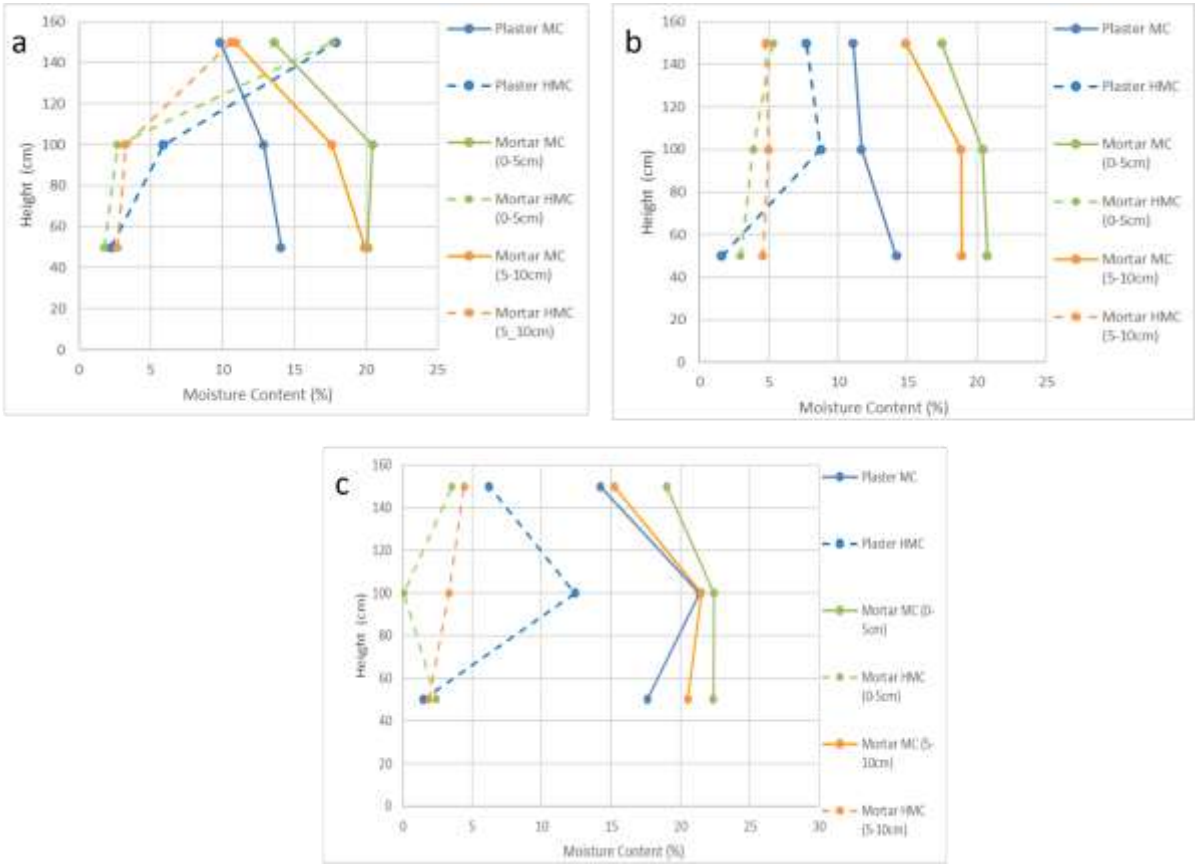


FIG. 10. Moisture content Hygroscopic moisture content profiles obtained in wall of the choir of the Trooz Church during a) the 1st winter measurement in 2022, b) the second series of measurement in summer 2023 and c) The 3rd series of measurement in January 2024.
© KIK-IRPA

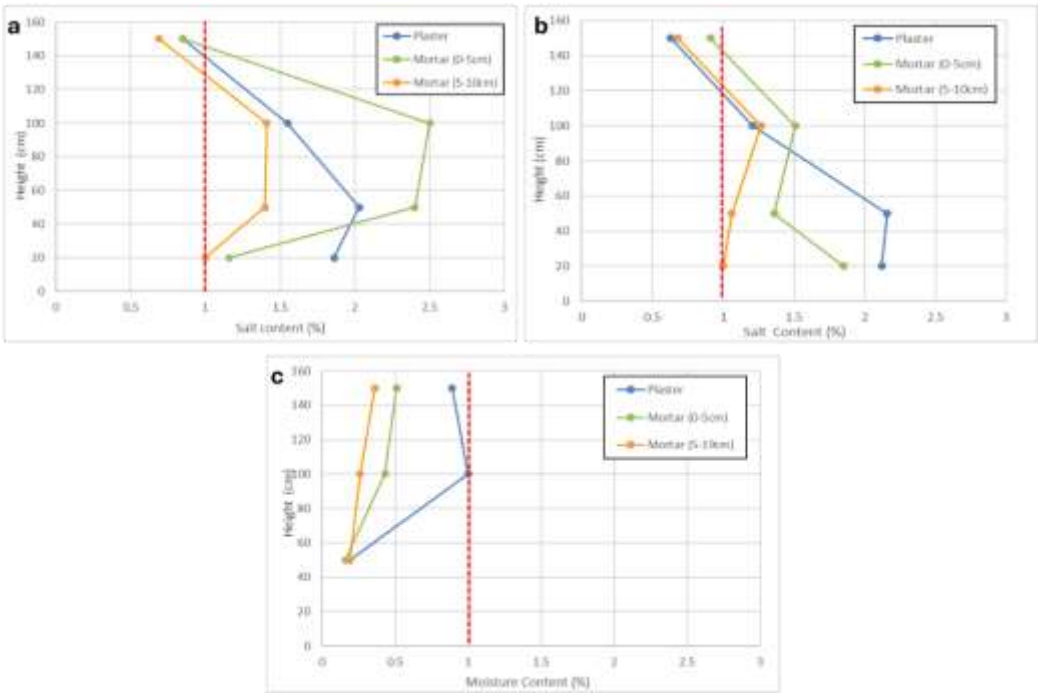


FIG. 11. The salt content profiles of the a) profile of the nave west wall, b) profile of the east nave wall, and c) profile of the choir wall.
© KIK-IRPA

FIG. 12. Crystallization behaviour for a variable relative humidity. © KIK-IRPA

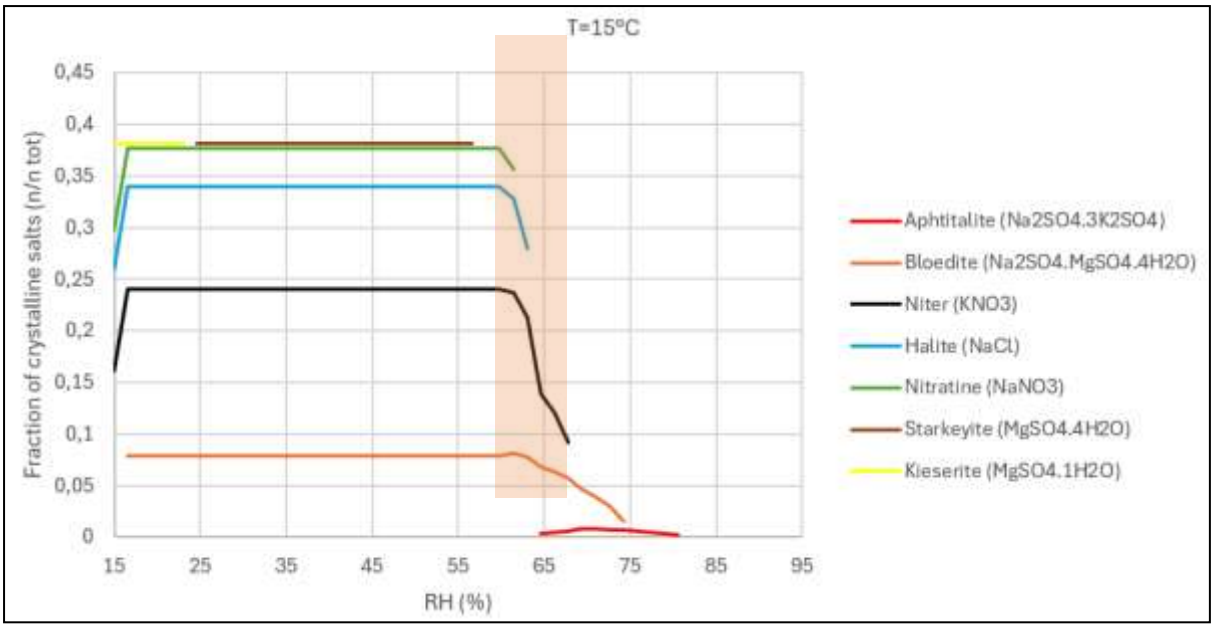


FIG. 12. Crystallization behaviour for a variable relative humidity. © KIK-IRPA

Crystallization behaviour for a variable relative humidity (15-95%) (0.2% resolution) (x-axis) at 20 °C at 15°C, of the mixture of ions detected in a joint mortar sample (after subtraction of an equimolar content of sodium, calcium, and sulphate ions) generated by the ECOS-Runsalt model. The relative amount of substance is given as a fraction of crystalline salt (n/n_{tot}) (y-axis). The sample was taken from the surface of the joint mortar at 50 cm above ground level. The beige areas represent the ranges of relative humidity causing solid/liquid phase changes of the salts present in the sample. Mole fractions: Cl^-: 0.0988, $NO3^-$:0.1989, $SO4^{2-}$ 0.1625, Na+: 0.3063, K^+: 0.2951, K^+: 0.1611, and Mg^{2+}: 0.0833.

The mould growth is the second most important risk in building after floods. Consequently, the mould growth was studied in the 7 buildings using in-situ observation, ATP measurement. The results have been compared to the prediction model of Sedlbauer using the HR and T measurements in the buildings for one year. The mould germination graph method considers temperature and humidity over previous time intervals, allowing for the consideration of fluctuating factors. This is crucial, as certain conditions are conducive to mould growth only if sustained for a sufficient duration. From, under fluctuating humidity conditions, mould germination does not occur outside a specific range of favourable conditions. Within this unfavourable range, a delay in the rate of mould growth is observed if germination has already begun. It is assumed that mould germination will not proceed if environmental conditions fall outside the optimal range for growth and in this case the accumulated exposure time is set at 0. This calculation has been performed on the data (relative humidity and temperature close to the surface) obtained for all buildings. All the data above the Sedlbauer curve-LIM I has been selected. After this step, the accumulated exposure time can be calculated. An accumulated exposure time greater or equal to the required exposure time indicates mould growth risk. The results, as presented in Table 1, are the one obtained in the church of Trooz. In this example

we identified 22 periods classified as 'at risk'; however, when compared to the mould germination graph method, considering the required exposure time, only 7 of these periods can be considered as posing a significant risk for mould growth (highlighted in orange).

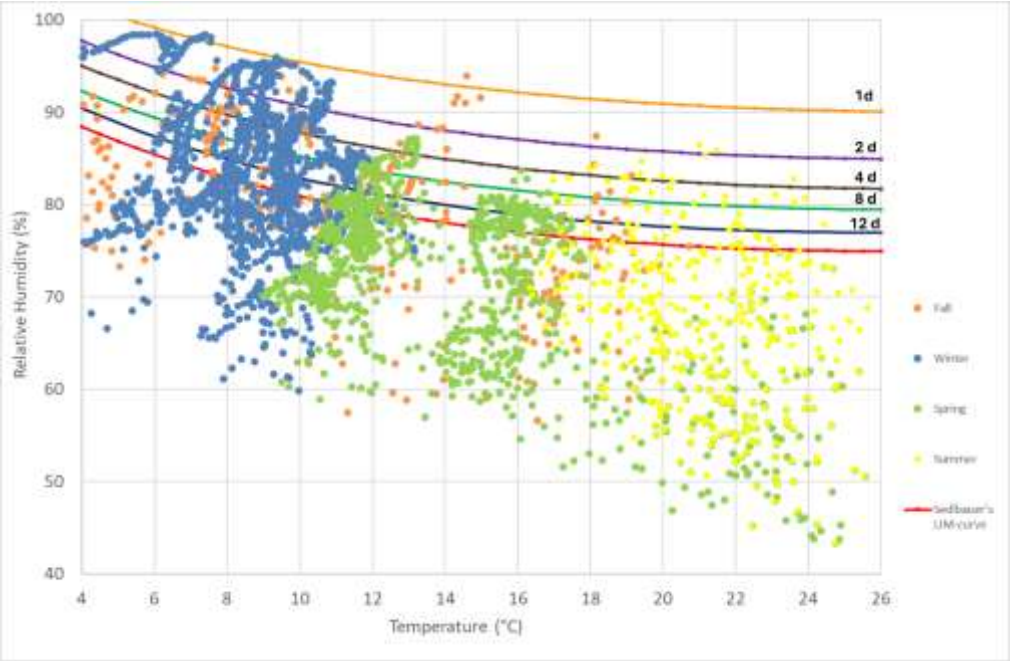


FIG. 13. Relative humidity measured in the choir of the church as a function of the temperature together with Sedlbauer's isopleths for spore germination and Sedlbauer LIM -Curve. © KIK-IRPA

Period	Air Close to the surface		Accumulated exposure (days)	Required exposure time (days)	Mould growth risk	RLU
	T°C	RH %				
1	15.9	77.9	25.25	16	x	1200
2	19.1	77.3	16.1	16	x	750
3	21.4	82.1	1	4	0	900
4	22.9	76.6	6	16	0	900
5	22.3	76.5	1.5	16	0	900
6	18.5	81.4	2.75	5	0	900
7	18.6	75.2	3.75	32	0	450
8	17.8	76.2	6.25	32	0	708
9	13.2	82.8	17	8	x	708
10	9.5	83.2	29	16	x	390
11	4.3	88.9	3.75	24	0	250
12	7.9	88.0	29	7	x	500
13	5.5	96.2	5	2	x	500
14	6.6	87.6	3.2	12	0	544
15	9.0	89.0	21	4	x	1870
16	8.0	82.8	1.4	32	0	2180
17	10.3	84.2	5.5	10	0	2182
18	11.4	80.5	3.1	30	0	2182
19	12.4	79.1	1.6	32	0	2182
20	11.3	79.3	1	30	0	2182
21	13.9	80.6	6.25	15	0	1338
22	15.8	77.5	2	30	0	1750

Additionally, the ATP measurements (RLU) performed once a month are reported in the table above for the church of Trooz; The results indicate 5 periods that can be classified in active sporulation and growth, and 17 as high level of growth. There is no clear correlation between the results obtained in ATP tests and the mould growth risk obtained from isopleths.

The difference between the ATP measurements and the risk prediction based on the Sedlbauer's isopleths for spore germination can be explain by firstly the sampling. Secondly, the relative humidity and temperature plotted in the Sedlbauer isopleths implemented in the model are the measured relative humidities and temperatures measured in the air close to the wall not the surface conditions, while the RLU includes the conditions in the wall to a larger extent.

It is also noteworthy that mould growth was observed as early as February 2023, with a very fast development, two months prior to the beginning of relative humidity monitoring. This indicates that 'Period 1,' identified as a risk period according to the Sedlbauer's isopleths for spore germination, corresponds to ATP measurements taken from surfaces where visible mould growth was present. As

soon as germination has started according to the Sedlbauer's isopleths it is assumed that mould growth can start. Even if later on you have some unfavourable conditions mould spores are still 'active' (germination has started, so mould growth can start); In this way, ATP measurement and Sedlbauer's isopleths are in agreements.

In all cases all the data above the Sedlbauer curve-LIM I, correspond to an active sporulation and high mould growth from ATP results. This means that the humidity and temperature monitoring can be used with the Sedlbauer's curve-LIM I model to predict the risk of mould growth.
Consequently, site managers can use it to prioritize the actions that should be done to mitigate secondary damages in the recovery process after floods.

A report for each building has been written and given to site managers to help them to prioritize their actions.

Development of treatment adapted to buildings after floods

Specific recommendations for each building have been described and sent to site managers.
From the analyses of all buildings a drying plan has been defined. This drying plan in for the recovery phase of a flood disaster. It will be translated into poster and can be an "API" of an emergency plan. This drying plan explains why and how the drying of heritage building should be done after a flood. Moreover, it also set to help site manager the actions should be carried out to perform a balance drying and when it is good to stop.

The output is a poster and the preparation of an article about "drying plan of building hosting collections".

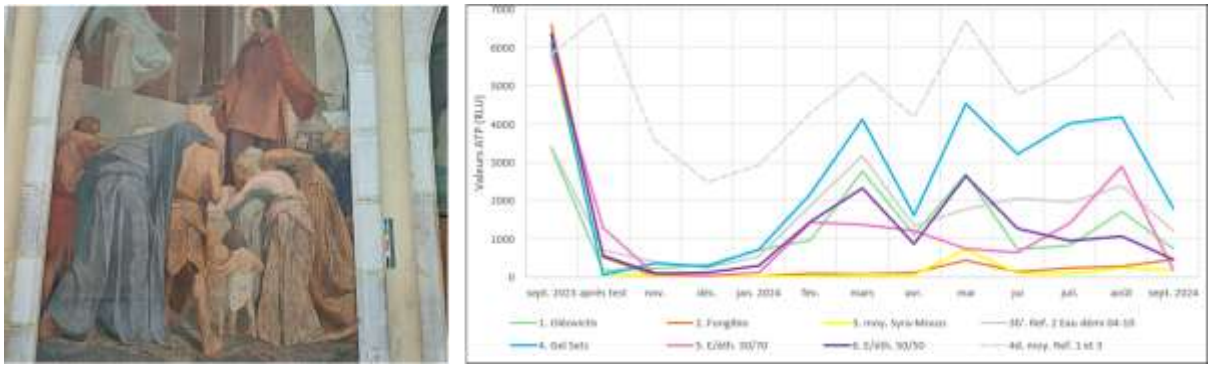


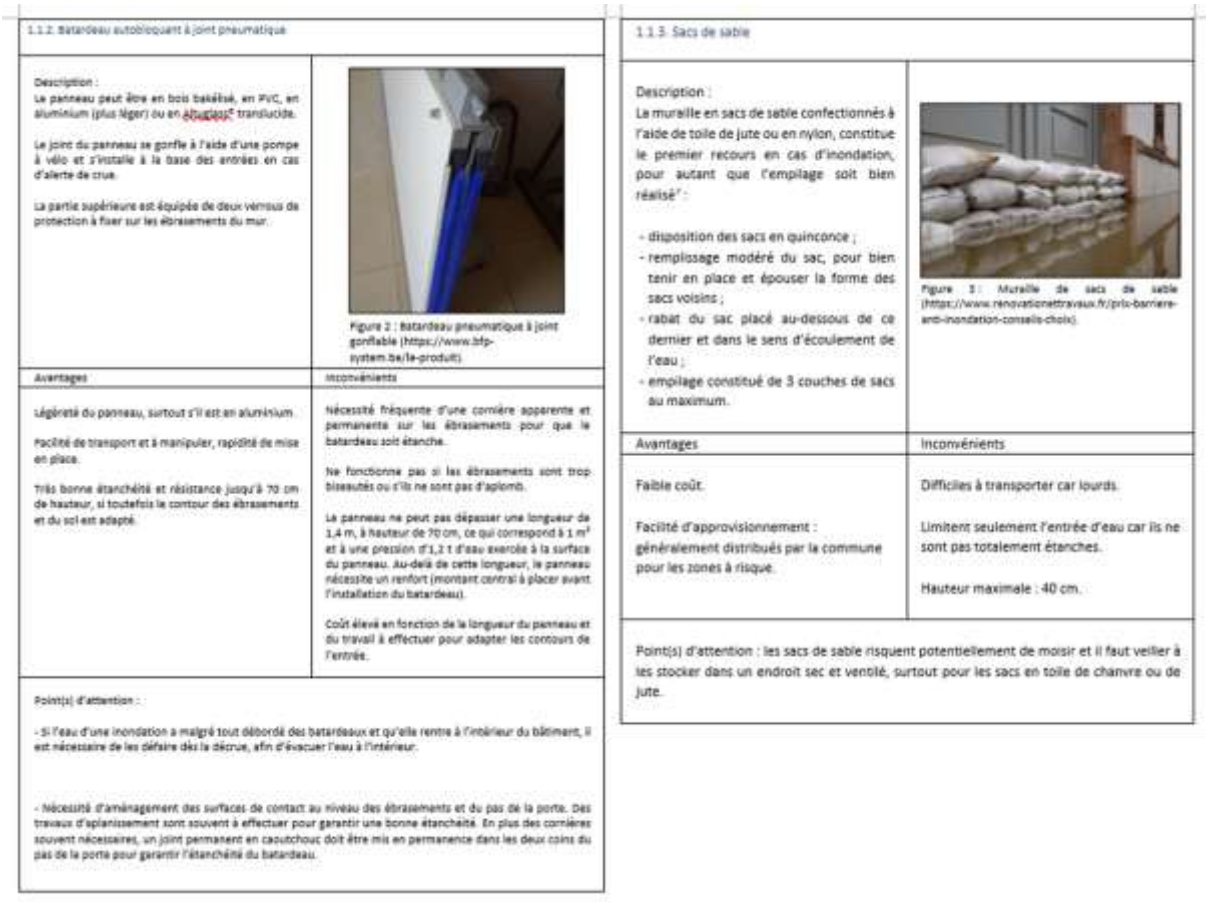
FIG. 14. Left picture of the test in the Trooz church. Right the ATP value during the year of test. © KIK-IRPA

For the mould growth, large number of Biocide products exist as commercial project, but new product based on natural active product are new on the market. A research study on the efficiency of the product has been done. The effectiveness of seven types of products was evaluated on moulds: ethanol diluted with demineralised water (50/50 and 30/70), two quaternary ammonium mixtures, a product based on essential oils and a gel composed of peracetic acid generated in situ. The products were selected on the basis of their biocidal capabilities and are all of the 'broad spectrum' type.

The products have been assessed on short term (3 weeks after application) and long term (One year with a measurement every month). The assessment was done by ATP measurements (Fig. 14), colour measurements, compared to the predictions of the model. The results show all products have a good efficiency on short terms, even a cleaning with water. But on long term the obtained results are presented in the Figure 14. It shows that product like essential oils have a very good efficiency and should be more applied in the case of heritage buildings impacted by floods has a preventive treatment. These results are gathered in a scientific article currently under preparation for submission to a scientific journal (Journal for cultural heritage impact factor 2024 3.1).
Additionally, a note about the most effective and natural products has been written and will be used by the monument Lab to improve their recommendation for the public services.

Concrete solution in preparedness and preventive phase

A series of data sheets has been developed, listing all the solutions recommended for each site incorporating their advantages and disadvantages. These sheets have been reviewed by professionals and are aimed at those responsible for flood management. An example is given in Figure 15 (fig. 15). In total, 21 sheets have been created, distinguishing between solutions based on the resilient approach and those based on the resistance approach.



1.1.2. Batardeau autobloquant à joint pneumatique

Description :
Le panneau peut être en bois bakélisé, en PVC, en aluminium (plus léger) ou en plexiglas® translucide.

Le joint du panneau se gonfle à l'aide d'une pompe à vélo et s'installe à la base des entrées en cas d'alerte de crue.

La partie supérieure est équipée de deux vérrous de protection à fixer sur les ébrasements du mur.

Figure 2 : Batardeau pneumatique à joint gonflable (https://www.bfp-system.be/le-produit)

Avantages	Inconvénients
Légèreté du panneau, surtout s'il est en aluminium. Facilité de transport et à manipuler, rapidité de mise en place. Très bonne étanchéité et résistance jusqu'à 70 cm de hauteur, si toutefois le contour des ébrasements et du sol est adapté.	Nécessité fréquente d'une corrière apparente et permanente sur les ébrasements pour que le batardeau soit étanche. Ne fonctionne pas si les ébrasements sont trop biseautés ou s'ils ne sont pas d'aplomb. Le panneau ne peut pas dépasser une longueur de 1,4 m, à hauteur de 70 cm, ce qui correspond à 1 m² et à une pression d'1,2 t d'eau exercée à la surface du panneau. Au-delà de cette longueur, le panneau nécessite un renfort (montant central à placer avant l'installation du batardeau). Coût élevé en fonction de la longueur du panneau et du travail à effectuer pour adapter les contours de l'entrée.

Point(s) d'attention :

- Si l'eau d'une inondation a malgré tout débordé des batardeaux et qu'elle rentre à l'intérieur du bâtiment, il est nécessaire de les défaire dès la décrue, afin d'évacuer l'eau à l'intérieur.

- Nécessité d'aménagement des surfaces de contact au niveau des ébrasements et du pas de la porte. Des travaux d'aplanissement sont souvent à effectuer pour garantir une bonne étanchéité. En plus des corrières souvent nécessaires, un joint permanent en caoutchouc doit être mis en permanence dans les deux coins du pas de la porte pour garantir l'étanchéité du batardeau.

1.1.3. Sacs de sable

Description :
La muraille en sacs de sable confectionnés à l'aide de toile de jute ou en nylon, constitue le premier recours en cas d'inondation, pour autant que l'empilage soit bien réalisé* :

- disposition des sacs en quinconce ;
- remplissage modéré du sac, pour bien tenir en place et épouser la forme des sacs voisins ;
- rabat du sac placé au-dessous de ce dernier et dans le sens d'écoulement de l'eau ;
- empilage constitué de 3 couches de sacs au maximum.

Figure 3 : Muraille de sacs de sable (https://www.renovationettravaux.fr/prix-barriere-anti-inondation-conseils-choix).

Avantages	Inconvénients
Faible coût. Facilité d'approvisionnement : généralement distribués par la commune pour les zones à risque.	Difficiles à transporter car lourds. Limitent seulement l'entrée d'eau car ils ne sont pas totalement étanches. Hauteur maximale : 40 cm.

Point(s) d'attention : les sacs de sable risquent potentiellement de moisir et il faut veiller à les stocker dans un endroit sec et ventilé, surtout pour les sacs en toile de chanvre ou de jute.

FIG. 15. Example of sheet for preventive solutions to tackle floods. © KIK-IRPA

Context

The floods of July 2021 in Belgium severely damaged the Bethlehem of Verviers, a 19th-century puppet theatre that had long been a cornerstone of local cultural identity. Submerged for forty-eight hours in contaminated water, the Bethlehem's material components were compromised, and its intangible dimension – the living practice of animating the puppets during the Christmas season – was at risk of disappearing. In response, the *Musées de Verviers*, in partnership with KIK-IRPA, ESA Saint-Luc Liège, and local stakeholders, launched a project aimed at revitalising this tradition as a tool for psychosocial and cultural recovery while safeguarding its tangible elements.

KIK-IRPA's Role and Objectives

KIK-IRPA's involvement in the Bethlehem of Verviers project was driven by a dual objective:

- Safeguarding cultural heritage in emergencies by demonstrating that recovery strategies must address both tangible and intangible dimensions. The institute sought to show that revitalising living practices during a crisis can strengthen social cohesion, support psychosocial recovery, and prevent cultural loss.
- Developing and testing methodologies for integrating intangible heritage into disaster response frameworks. This included conducting community surveys, designing participatory processes, and producing a methodological guide for managing cultural objects with intangible dimensions in crisis contexts.

Through this case study, KIK-IRPA aimed to provide evidence that revitalisation during emergencies is not only feasible but essential, and to offer replicable strategies for heritage professionals worldwide.

Why intangible cultural heritage (ICH) matters in disaster response.

Intangible heritage is often overlooked during disasters because emergency efforts tend to prioritise physical safety and the restoration of tangible assets such as buildings and collections. Yet, the living practices, skills, and knowledge that give meaning to these objects are equally vulnerable, and their loss can have profound psychosocial consequences. Waiting until communities return to a "normal situation" (or at least, as normal as possible) risks severing the continuity of these practices, as displacement, trauma, and resource constraints may erode participation and transmission. Addressing intangible heritage during the response phase helps maintain social cohesion, identity, and a sense of belonging at a time when these are most needed. It transforms recovery into a process that is not only material but cultural and human, reinforcing resilience and enabling communities to rebuild with their traditions intact.

Methodology

This report relies on findings from the Bethlehem of Verviers project and seeks to address the central question: How can the revival of intangible cultural heritage enhance social cohesion in a disaster-affected community and aid its recovery? Two sub-questions guide the analysis:

- Can a crisis create an opportunity to revitalise a cultural practice and help communities reconnect with it?
- Can intangible cultural heritage strengthen local social cohesion and motivate citizen-led initiatives to reclaim cultural practices?

The findings align with UNESCO's operational principles for safeguarding intangible cultural heritage in emergencies (UNESCO 2020), focusing on one specific measure: revitalisation. This approach goes beyond preserving existing practices; it encompasses reviving and adapting traditions to contemporary contexts. The study examines the condition of the Bethlehem tradition prior to the flood, the response efforts, and ongoing revitalisation activities. Although the project is still in progress, initial insights offer valuable considerations for future strategies in disaster preparedness and response.

Two complementary engagement strategies were adopted:

- Open participation, through initiatives such as community surveys and open calls for schools, enabling broad involvement.
- Targeted engagement, involving selected actors and stakeholders in workshops dedicated to defining the core values of the Bethlehem tradition that should guide conservation and future safeguarding measures.

This methodological approach was deliberately designed to test replicable strategies for integrating intangible heritage into emergency response frameworks, in line with KIK-IRPA's objective of providing practical tools and evidence for heritage professionals facing similar crises.

Community Perceptions and Expectations

From the outset, the project recognised that revitalisation required more than restoring objects; it demanded reactivating the living practice and reconnecting the community with its heritage. To achieve this, KIK-IRPA conducted a community survey between December 2023 and March 2024 to understand local perceptions and expectations. Of the 164 respondents, 88 per cent were familiar with the Bethlehem, most recalling childhood visits. Puppets, dialogues and music in Walloon, and animating mechanisms were identified as central elements. Seventy-one per cent expressed a strong sense of attachment, and seventy-four per cent believed in its continuity, emphasising intergenerational transmission. The survey also revealed generational differences: older participants showed deep emotional ties, while younger respondents suggested modern approaches such as social media and digital platforms. Expectations for safeguarding intangible heritage during crises

included awareness campaigns, inclusive events, and digitisation, alongside concerns about authenticity.

Educational Co-Creation and Revitalisation

The revitalisation phase took shape through an ambitious educational co-creation project with Saint-Remacle Primary School, located in a flood-affected district. Guided by Atelier du Prince and supported by Pôle PECA, approximately one hundred pupils engaged in an interdisciplinary process that combined heritage learning with creative expression. They explored the Bethlehem's history, learned puppetry techniques, wrote scripts, designed puppets and sets, and collaborated with musicians to compose and record a new song performed by a choir. The resulting playlet, set between the Annunciation and the Visitation, reimagined Mary's journey through the contemporary landscape of Pré-Javais, blending biblical narrative with modern local life. This adaptation reinforced the relevance of the tradition for today's community. A video documented the performance, ensuring accessibility beyond the classroom. An evaluation workshop revealed that pupils most enjoyed puppetry and watching the video, while scriptwriting and composing were more challenging. Their safeguarding suggestions ranged from practical measures such as signage and recording to imaginative ideas like laser protection and bodyguards, illustrating how creative engagement fosters ownership and innovation.

Outputs and Deliverables

These activities generated concrete outputs that serve both as documentation and as tools for future safeguarding. Among the key deliverables are:

- A video recording (by the *Musées de Verviers*) of the children's performance and the newly created playlets, ensuring that the creative reinterpretation remains accessible and can inspire future initiatives.
- A community event dedicated to the Bethlehem tradition, designed to reconnect residents with their heritage and foster intergenerational dialogue (13 December 2025)
- A practical methodological guide for managing cultural objects with intangible dimensions in crisis contexts, offering replicable strategies for professionals and institutions facing similar challenges.

Linguistic and Musical Heritage

Further revitalisation efforts focused on linguistic and musical heritage. Experts in the Walloon dialect worked to preserve and record traditional songs, while the *Maîtrise des Enfants de l'Opéra Royal de Wallonie* prepared high-quality recordings of these songs and spoken texts. Enhanced sound effects and lighting design will create a more immersive experience for future audiences. These initiatives

aim not only to safeguard the language but also to strengthen cultural continuity through performance.

Future Perspectives

To consolidate these efforts, the project organised workshops (coordinated by the *Musées de Verviers* and supported by ESA Saint-Luc Liège and KIK-IRPA) bringing together all relevant actors and stakeholders to define strategies for sustaining the living practice. Looking ahead, the *Musées de Verviers* will relocate to the restored *Hôtel de Biolley* by 2030, dedicating an entire floor to the Bethlehem tradition, including an interactive mediation area to contextualise its revival. However, the project acknowledges the risk of museumification and stresses the need to integrate living-practice activities into daily operations to ensure that the Bethlehem remains a dynamic tradition rather than a static exhibit.

Conclusion

The Bethlehem of Verviers project demonstrates that disasters, while devastating, can serve as catalysts for cultural revitalisation when recovery strategies embrace both tangible and intangible dimensions. By transforming a crisis into an opportunity for renewal, the initiative reinforced social cohesion and local identity. The deliverables such as the recorded performance, the community event, and the methodological guide provide lasting resources that extend the impact beyond the immediate recovery phase. Yet challenges remain: sustaining community engagement, preventing museumification, and ensuring that revitalisation strategies keep the tradition relevant for future generations. This project offers a blueprint for integrating intangible heritage into post-disaster recovery frameworks, affirming that heritage is not merely an object to preserve but a living social asset that fosters resilience and collective belonging.

TASK III: POST-CRISIS ANALYSIS AND RECOMMENDATIONS

Task III was dedicated to analysing the cultural heritage sector's response to the July 2021 floods and to formulating recommendations aimed at improving preparedness and resilience for future emergencies. This work was carried out through a RetEx report coordinated by KIK-IRPA, in collaboration with federated entities, field actors, and members of the Heritage Crisis Committee. The analysis combined documentation compiled during and after the crisis, semi-structured interviews, online surveys, and site visits, complemented by case studies and theoretical reflections on disaster risk management for cultural heritage in Belgium.

Context and Objectives

The floods of July 2021 were unprecedented in scale and impact, causing severe damage to cultural heritage across Wallonia. More than two hundred sites were affected, ranging from parish churches

and museums to archaeological repositories and intangible heritage practices. The Vesdre Valley was among the hardest hit, with water levels reaching up to two meters in some areas. Collections of ceramics, textiles, archives, and archaeological materials were submerged in contaminated water and mud, while historic buildings suffered structural damage, salt infiltration, and mould proliferation. Intangible heritage practices, such as the Bethlehem puppet theatre tradition in Verviers, were also disrupted, threatening cultural continuity.

The cultural sector faced a situation for which it was largely unprepared: fragmented governance, absence of integrated emergency protocols, and limited awareness of disaster risk. Task III aimed to transform this experience into actionable knowledge by documenting what happened, identifying gaps, and proposing solutions to strengthen resilience. The exercise was not limited to technical aspects of conservation but extended to governance, coordination, and the societal role of heritage in recovery. It sought to answer key questions: How did the emergency response unfold? Which factors facilitated or hindered effective action? What lessons can be drawn to improve preparedness and response in the future?

Methodology and Stakeholder Involvement

The RetEx exercise was structured around three components. First, it documented the response cycle, including immediate actions, coordination mechanisms, and recovery efforts. Second, it analysed governance and operational challenges, focusing on the interaction between cultural heritage actors and emergency services. Third, it formulated recommendations based on lessons learned and international best practices.

Data sources included:

- Archival records and meeting reports from the Heritage Crisis Committee.
- Semi-structured interviews with stakeholders from key organizations.
- An online survey conducted in spring 2024 to capture feedback from committee members.
- Site visits and case studies to assess damage and recovery processes.

The Heritage Crisis Committee, convened by KIK-IRPA on 20 July 2021, played a central role in coordination. It brought together a wide range of actors:

- KIK-IRPA (strategic coordination, scientific expertise, protocol development).
- Blue Shield Belgium (BSB) (volunteer deployment, insurance coverage, operational logistics).
- CIPAR (support for religious heritage and parish networks).
- AWaP (Agence Wallonne du Patrimoine, responsible for immovable heritage).
- Fédération Wallonie-Bruxelles (FWB) (movable heritage and cultural policy).
- Musées et Sociétés en Wallonie (MSW) (museum sector coordination).
- ICOM Belgique/Wallonie-Bruxelles and ICOM Belgium Flanders
- ICOMOS Wallonie-Bruxelles
- Monumentenwacht Vlaanderen
- State Archives

- diocesan heritage services
- other professional associations.

This mixed-method approach ensured that the analysis captured both the technical and human dimensions of the crisis.

Findings: Strengths and Weaknesses of the Response

The analysis revealed that the initial response was marked by fragmentation and improvisation. In the absence of pre-approved emergency plans and clear mandates, early interventions relied on personal networks and voluntary engagement. While this allowed some sites to receive rapid assistance (such as the Museums of Verviers, which benefited from early salvage operations) it also created disparities, leaving other sites without support for weeks. Access restrictions, security concerns, and the lack of coordination with civil protection further complicated operations. Cultural heritage was not integrated into national emergency management systems, which limited the sector's ability to access essential information and resources during the acute phase of the disaster.
The governance structure of cultural heritage in Belgium proved to be a major obstacle to swift and coherent action. Responsibilities are divided between federal, regional, and community levels, with no single authority empowered to coordinate emergency response for heritage. This fragmentation resulted in delays, duplication of efforts, and confusion over roles. The Heritage Crisis Committee was an important step toward coordination, but its informal nature and lack of prior training limited its effectiveness. Meetings provided a platform for information exchange, yet operational decisions remained slow, and subgroups struggled to deliver concrete outcomes under pressure.
Resource gaps were another critical issue. No emergency fund or stock of materials was available at the time of the floods, and crowdfunding efforts launched later were insufficient and arrived too late to support urgent needs. Insurance and safety protocols for volunteers were improvised, exposing individuals and collections to risks. Blue Shield Belgium eventually provided coverage, but this solution required weeks of negotiation. Recovery actions extended over several years, as damage continued to evolve long after the initial event. Secondary phenomena such as mould growth, salt crystallization, and structural instability appeared months later, demanding prolonged monitoring and intervention.

The safeguarding of intangible heritage, illustrated by the Bethléem de Verviers project, underscored the importance of community engagement and the need to integrate social dimensions into recovery strategies. This initiative combined technical conservation with educational programs and participatory activities to revitalize a tradition deeply rooted in local identity.
Despite these challenges, the crisis also generated positive outcomes. The creation of a multi-stakeholder platform facilitated dialogue and cooperation, awareness of disaster risk increased across the sector, and several training initiatives were launched, including workshops for museums to develop Cultural Property Protection Plans and similar programs planned for archives. The CHrisis project itself played a pivotal role in consolidating expertise, producing scientific protocols for conservation, and fostering collaboration between institutions.

Recommendations for Future Preparedness

The RetEx exercise formulated a comprehensive set of recommendations to strengthen the resilience of cultural heritage in Belgium. Cultural heritage must be systematically included in emergency plans at all levels of governance, with interoperable inventories and risk mapping to ensure that sites can be identified and assisted promptly. A national heritage crisis unit should be established to provide both strategic coordination and operational response, with clearly defined roles for KIK-IRPA and Blue Shield Belgium. Sustainable funding mechanisms are essential, including a permanent emergency fund and prepositioned stocks of materials, supported by agreements with conservation centres. Training programs on heritage first aid and scenario-based exercises involving civil protection should become regular practice. Evaluation and monitoring methodologies must be standardized to enable efficient damage assessment and long-term follow-up, in line with international frameworks such as the Sendai Framework for Disaster Risk Reduction. Finally, communities should be actively involved in preparedness and recovery, both to accelerate rescue operations and to reinforce social resilience. Intangible heritage must be recognized as a resource for psychosocial recovery, and its safeguarding should be integrated into crisis management strategies.

Recommendations – Summary Table

#	Category	Action	Priority	Responsible
1	**Preparation**	Integrate cultural heritage into emergency plans and risk assessments	Short term	NCCN, Ministry of Interior, Regions & Communities
2	**Coordination**	Establish a permanent national heritage crisis unit	Short term	KIK-IRPA, BSB
3	**Evaluation**	Implement systematic damage assessment and reporting aligned with the Sendai Framework	Medium term	Heritage institutions, NCCN, KIK-IRPA
4	**Preparation**	Leverage intangible heritage and community involvement and raise awareness of the need to take into account both tangible and intangible dimensions of heritage	Medium term	KIK-IRPA, Communities
5	**Prevention**	Develop regular training programs on heritage first aid and crisis management	Medium term	KIK-IRPA, BSB, ICCROM
		Map and inventory heritage at risk using	Medium term	Regions, Communities, Federal level
6	**Funding**	Create a sustainable emergency fund for rapid deployment	Medium term	BSB, King Baudouin Foundation, Public Authorities

ADDED VALUE BEYOND RESEARCH

Beyond its scientific objectives, the CHrisis project delivered several forms of added value that strengthen the cultural heritage sector's capacity to respond to future crises. These benefits are practical, collaborative, and educational, and they complement the research outputs.

Scientific value

The scientific value of CHrisis lies in its interdisciplinary approach to understanding and mitigating flood-related damage to cultural heritage. The project generated new knowledge on degradation mechanisms affecting diverse materials (ceramics, metals, textiles, and masonry),under extreme moisture and contamination conditions. By combining analytical research with applied conservation

science, CHrisis developed and validated emergency treatment protocols, drying strategies, and preventive conservation tools that are transferable beyond the Belgian context. Its integration of laboratory experiments, field diagnostics, and modelling of secondary risks provided a robust evidence base for decision-making during crises. Furthermore, CHrisis bridged scientific research with operational realities, ensuring that outputs such as guidelines and mock-ups were not only academically rigorous but also practical for heritage professionals. This dual focus on innovation and applicability positions CHrisis as a reference model for heritage science in disaster risk reduction. This scientific foundation underpinned the project's training activities, technical tools, and policy recommendations, ensuring that practical outputs were grounded in robust evidence.

Human Capital and Training

The project contributed to building skills among heritage professionals and caretakers. Through workshops and mentoring, site managers learned to reorganize collections using adapted tools such as RE-ORG (ICCROM n.d.) and to apply preventive conservation strategies in emergency contexts. Blue Shield Belgium coordinated volunteer missions and provided insurance coverage, creating a framework that can be reused in future emergencies. Field schools organized with higher education institutions allowed conservation students to gain hands-on experience in post-flood interventions.

Technical Tools and Protocols

CHrisis produced practical guidelines and protocols for emergency treatment and recovery of flood-affected heritage. These include cleaning and stabilization methods for textiles, ceramics, and archaeological metals, as well as drying plans and mould management strategies for built heritage. The Monuments Lab developed recommendations for moisture control and salt crystallization risk, while the textile and ceramics units validated treatment options through case studies. These outputs were shared through workshops, posters, and the CHrisis Bulletin to ensure accessibility for professionals.

Networking and Coordination

The creation of the Heritage Crisis Committee during the emergency fostered collaboration among key actors, including KIK-IRPA, Blue Shield Belgium, CIPAR, AWaP, Fédération Wallonie-Bruxelles, Musées et Sociétés en Wallonie, ICOM Belgique/Wallonie-Bruxelles and ICOM Belgium Flanders, and others. This platform improved information exchange and clarified roles during the crisis. Although temporary, it demonstrated the value of structured coordination and informed recommendations for establishing a permanent mechanism for heritage emergencies.

Educational and Awareness Resources

The project developed didactic materials and shared lessons learned through publications and training sessions. These resources support preparedness by raising awareness of risks and promoting practical measures for emergency planning. Initiatives such as the value assessment framework for liturgical textiles also help heritage managers make informed decisions about prioritization and safeguarding.

Community Engagement

The Bethléem de Verviers subproject illustrated how intangible heritage can contribute to cultural and psychosocial recovery. By involving schools and local actors in revitalizing a traditional puppet theatre, the project strengthened community ties and highlighted the importance of integrating living heritage into resilience strategies.

GENERAL CONCLUSION

The CHrisis project was launched in the aftermath of the July 2021 floods, an event that revealed the fragility of Belgium's cultural heritage when confronted with large-scale disasters. These floods caused unprecedented damage to monuments, museum collections, parish textiles, and intangible practices, and exposed the absence of integrated emergency frameworks for heritage. Against this backdrop, CHrisis set out to strengthen resilience through a multidisciplinary approach that combined conservation science, preventive strategies, and governance. Its ambition was not only to repair damage but to learn from the crisis and build capacity for future emergencies.

From the outset, the project recognised that safeguarding heritage during crises is not solely a technical challenge. It is a societal imperative that involves coordination among institutions, rapid decision-making, and the ability to translate scientific knowledge into practical tools. CHrisis therefore structured its work around three tasks: coordination, advice and protocols, and post-crisis analysis. This structure allowed the project to respond to immediate needs while generating knowledge that informs long-term preparedness.

The methodology adopted was both interdisciplinary and pragmatic. It linked empirical research on flood-induced deterioration with participatory models of recovery. Scientific investigations focused on understanding how water and mud affect different materials (ceramics, textiles, metals, and masonry) and on developing protocols that could be applied under real-world constraints. These protocols were tested through case studies and validated in collaboration with practitioners. For ceramics, the project examined mineralogical changes and deterioration of past restorations, proposing cleaning sequences and poultice applications that proved effective in reducing stains and stabilising surfaces. Textile conservation addressed complex phenomena such as dye bleeding and starch migration, emphasising controlled drying and tailored cleaning strategies. In built heritage,

monitoring and modelling provided insights into moisture behaviour, salt crystallisation risks, and mould development, leading to practical drying plans and comparative biocide testing. These results do not claim universal solutions; rather, they offer realistic, evidence-based guidance for emergency contexts.

Beyond technical research, CHrisis placed strong emphasis on preventive conservation and organisational resilience. The adaptation of RE-ORG tools enabled museums and parish storages to reorganise collections displaced by floods, restoring functionality and reducing risks of further damage. Mentoring and workshops helped site managers navigate complex recovery processes, while psychosocial support elements acknowledged the human dimension of crisis management. These interventions demonstrated that resilience is not only about preserving objects but also about restoring institutional control and confidence.

The project also addressed intangible heritage, recognising its role in cultural continuity and community recovery. The Bethléem de Verviers initiative illustrated how revitalising a traditional puppet theatre could reinforce social cohesion after disaster. By involving schools and local actors in creative processes, the project ensured that recovery embraced both tangible and intangible dimensions. This approach highlights a key lesson: heritage protection in times of crisis must integrate living practices alongside material conservation.

Task III, dedicated to post-crisis analysis, produced a Return on Experience that documented the sector's response in detail. It revealed strengths, such as rapid volunteer mobilisation and collaborative spirit, but also significant weaknesses: fragmented governance, lack of integrated emergency plans, and absence of rapid funding mechanisms. These findings informed a set of recommendations aimed at embedding preparedness into heritage management. They include incorporating cultural heritage into national and regional emergency frameworks, clarifying roles between key actors, establishing a permanent crisis unit, and creating sustainable funding and training systems. These proposals are grounded in real-world experience and reflect what is achievable within existing structures.

The added value of CHrisis extends beyond its scientific outputs. The project delivered practical tools, reusable protocols, and educational resources that remain accessible to professionals. It strengthened networks among KIK-IRPA, Blue Shield Belgium, CIPAR, AWaP, Fédération Wallonie-Bruxelles, Musées et Sociétés en Wallonie, and other stakeholders, creating a foundation for future coordination. It also contributed to awareness-raising and capacity building through workshops, publications, and open-access dissemination. These achievements do not eliminate the need for further investment, but they provide a credible starting point for improving resilience.

CHrisis was not only a scientific and operational endeavour; it was also a test of KIK-IRPA's capacity to manage an interdisciplinary project of unprecedented scale in the field of disaster preparedness. While the Institute already possessed strong scientific expertise, CHrisis provided an opportunity to

integrate this knowledge across departments and align it with governance and societal objectives. This experience helped shape KIK-IRPA's institutional strategy for 2022–2024 and 2025–2029, reinforcing the importance of risk preparedness and interdisciplinary collaboration as core priorities. Internally, the project served as a pilot for refining organisational processes, from project management workflows to cross-unit communication, and these insights have been incorporated into the *maîtrise de l'organisation* initiative as part of a continuous improvement logic. In this sense, CHrisis was not only about protecting heritage: it was about strengthening the Institute's ability to act as a national and international reference point for crisis management in the cultural heritage sector.

CHrisis does not claim to have solved all systemic issues. Funding gaps, governance complexity, and the need for broader training remain challenges. However, the project has shown that progress is possible through modest, well-tested steps: protocols that work under real constraints, networks that understand their roles, and clear tools for those who care for heritage. By turning lessons from the 2021 floods into actionable knowledge, CHrisis has laid the groundwork for a more coherent and proactive approach to risk preparedness and emergency response.

In conclusion, the project confirms that resilience in the heritage sector is built through collaboration, foresight, and sustained commitment. Scientific research must continue to refine treatment protocols and risk models, but its impact depends on integration with governance and community engagement. CHrisis demonstrates that when these elements converge, disasters can become catalysts for improvement rather than irreversible loss. The challenge now is to maintain this momentum, ensuring that the knowledge and networks created by CHrisis translate into durable structures and practices. If these lessons are carried forward, Belgium will be better equipped to protect its cultural heritage against the growing threats posed by climate-related disasters.

5. DISSEMINATION AND VALORISATION

Dissemination and valorisation were central to CHrisis, ensuring that scientific results, technical protocols, and organisational lessons were communicated and embedded into practice. The project adopted an integrated approach combining knowledge sharing with concrete actions to strengthen preparedness and resilience across the cultural heritage sector.

Scientific Dissemination

CHrisis prioritised open and targeted dissemination from the outset. Research outputs were published in the *CHrisis Bulletin* (ISSN 2983-855X), a peer-reviewed series presenting methodologies, case studies, and lessons learned from the floods. Topics included ceramic cleaning protocols, textile conservation strategies, mould risk modelling for built heritage, and the revitalisation of intangible practices. All publications were made available in open access via the KIK-IRPA website and institutional repositories, ensuring accessibility for researchers, conservators, and heritage

managers.
Project findings were also presented at national and international conferences, including ICOM-CC and Blue Shield forums, contributing to global discussions on heritage risk management and disaster preparedness.

Professional Engagement

Beyond academic dissemination, CHrisis focused on practical capacity building. Workshops and training sessions introduced preventive conservation strategies and emergency planning tools. Technical guidelines and posters (such as the *Water Damage Poster* – cf. Infra) provided rapid-response instructions for handling water-related incidents. Booklets and protocols on masonry drying, mould management, and textile prioritisation were distributed to institutions most affected by the floods.
Collaborations with partners such as CIPAR and diocesan heritage services enabled the adaptation of RE-ORG tools for reorganising collections displaced by floods, helping institutions regain control over storage spaces and prioritise stabilisation when resources were limited.

Valorisation and Policy Impact

CHrisis embedded its results into long-term practices and governance frameworks. The Heritage Crisis Committee, initially created during the emergency phase, evolved into a platform for structured coordination among key actors (KIK-IRPA, Blue Shield Belgium, CIPAR, AWaP, Fédération Wallonie-Bruxelles, MSW, and others). This collaboration informed recommendations for permanent mechanisms for heritage emergencies and led to tangible outcomes, such as provincial agreements with Blue Shield Belgium. These achievements demonstrate CHrisis' contribution to policy dialogue and institutional resilience.

Educational Resources

Special attention was given to the valuation and significance assessment of liturgical textiles. Working closely with CIPAR and diocesan heritage services, CHrisis produced tools such as *Key Points for Observing Liturgical Textiles* and a valuation framework for religious textiles. These resources were shared during consultation meetings, integrated into training programmes, and made available through BALaT for continued use beyond the project.
Dissemination also included targeted communication via the CIPAR newsletter (*Les textiles religieux: ignorés et mal-aimés?*, May 2024) and the KIK-IRPA website.

Public Outreach

CHrisis raised awareness of heritage protection through articles in *KIK-IRPA News* and regional press, highlighting recovery efforts and community engagement initiatives such as the revival of the Bethléem de Verviers puppet theatre tradition. Exhibitions and events showcased restored objects and intangible practices, reinforcing the message that cultural heritage is a living resource essential to identity and social cohesion.

Final Event: CHrisis Lunch Talks

The CHrisis Lunch Talks, organized as the project's final event in October and November 2025, exemplify the integration of dissemination and valorisation. Timed to coincide with the International Day for Disaster Risk Reduction, these online sessions targeted heritage managers, conservators, museum staff, local authorities, dioceses, researchers, and students. The first talk, "From Strategy to Action", explored how CHrisis supported the creation of political, organisational, and local partnerships to coordinate heritage crisis responses. The second, "From Crisis to Restoration", highlighted technical actions, scientific innovations, and concrete results achieved for the recovery of flood-damaged heritage. Broadcast via Teams, these talks ensured broad accessibility and encouraged dialogue through interactive Q&A sessions. By combining storytelling with practical lessons, the Lunch Talks reinforced the project's commitment to knowledge transfer and capacity building.

In summary, dissemination and valorisation in CHrisis were not separate activities but complementary dimensions of a single strategy: transforming lessons from the 2021 floods into knowledge, tools, and networks that strengthen resilience. Through publications, workshops, technical guidelines, public events, and digital outreach, the project ensured that its outputs were widely communicated and embedded into practice, providing a foundation for future initiatives and demonstrating that research, when coupled with collaboration and practical application, can drive meaningful change in heritage risk management.

6. PUBLICATIONS

Below is the publications and co-publications directly linked to the CHrisis project (cf. also Annex II). Peer-reviewed articles are distinguished from other outputs (brochures, bulletins, press articles). Open Access links are provided where available.

PEER-REVIEWED PUBLICATIONS

CHrisis Bulletin

The CHrisis Bulletin represents one of the flagship outputs of the CHrisis project. Conceived as a comprehensive resource, it brings together the scientific, technical, and organisational insights gained from managing and protecting cultural heritage in the aftermath of the July 2021 floods in Belgium. This special issue examines the multifaceted impact of disasters on heritage and documents the coordinated responses implemented to safeguard both tangible and intangible assets.

Through an interdisciplinary and pragmatic lens, the Bulletin explores how institutions and professionals mobilised to assess damage, secure collections, and develop conservation protocols adapted to crisis conditions. It provides detailed accounts of treatments applied to ceramics, textiles, metals, and built heritage, offering valuable lessons on deterioration mechanisms caused by water and mud. Beyond material conservation, the Bulletin addresses post-crisis strategies for heritage sites, highlighting efforts to embed risk preparedness into institutional practice and policy frameworks. It also underscores the role of intangible heritage in psychosocial recovery and cultural revitalisation, demonstrating that resilience extends beyond objects to the living traditions that sustain community identity.

By combining case studies, methodological reflections, and practical recommendations, the CHrisis Bulletin offers a unique overview of the challenges and solutions involved in safeguarding heritage during emergencies. It serves as both a scientific reference and a practical guide for professionals seeking to strengthen disaster preparedness and response.

Articles included in the CHrisis Bulletin (Open Access):

- De Bruyn, E., & Olbrechts, A.-C. (2025). *From Lessons Learned to Integrated Crisis Management: The Impact of the July 2021 Floods on Belgium's Cultural Heritage.* Bulletin CHrisis, IRPA, ISSN 2983-855X. Open Access. [kikirpa.be]
- Ceulemans, C., Hanse, A.-S., & Boschloos, V. (2025). *Protecting Heritage: Blue Shield Belgium's Response to Floods.* Bulletin CHrisis, IRPA. Open Access. [kikirpa.be]
- Moriaux, M. (2025). *From Flood to Recovery: Coordinating Crisis Support for Churches in Need in Wallonia.* Bulletin CHrisis, IRPA. Open Access. [kikirpa.be]
- Collanges, F. (2025). *Assessing Damage and Measuring Impact: From Crisis to Recovery – What Is Required?* Bulletin CHrisis, IRPA. Open Access. [kikirpa.be]

- Wagner, J., Bussienne, G., Mederos-Henry, F., Henry, C., Cools, C., Mazzotti, V., & Barnich, A.-S. (2025). *Ceramics Affected by Floods: Insights from the First Response to Conservation Treatment.* Bulletin CHrisis, IRPA. Open Access. [kikirpa.be]
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Other peer-reviewed publications and outputs

Collanges, F., M. Debulpaep, and E. Otten. (2023). *Early recovery after floods for large collections: Towards a toolbox for quicker resilience.* In Working Towards a Sustainable Past. ICOM-CC 20th Triennial Conference Preprints, Valencia, 18–22 September 2023, ed. J. Bridgland. Paris: International Council of Museums.

Collanges Françoise, Marique Laure, *De la gestion de crise au retour d'expérience*, Editeur Association des Cercles francophones d'histoire et d'archéologie de Belgique, in *le patrimoine historique, archéologique et artistique au défi des inondations*, 2025.

De Bruyn, E., & Olbrechts, A.-C. (2025, November). *Protecting cultural heritage in times of crisis: Lessons from the 2021 floods in Belgium*. In *PROCULTHER-NET 2 Technical Bulletin* (Issue 6, pp. 71–82), Union Civil Protection Knowledge Network. Available at: https://civil-protection-knowledge-network.europa.eu/system/files/2025-11/proculther-net_tb6_november-2025.pdf

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To be published:

De Bruyn, E., Deneffe, D., & Marique, L. (2026). *Raviver la mémoire : l'IRPA et la protection du patrimoine culturel face aux crises.* In Eco-conservation : la conservation préventive face aux enjeux du changement climatique (Technè, n° 61, été 2026).

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OTHER PUBLICATIONS AND OUTPUTS

In addition to peer-reviewed publications, the project produced a series of complementary outputs that reinforced its visibility and impact across scientific, professional, and public spheres. These outputs were designed to communicate findings effectively, provide practical guidance, and embed lessons learned into broader discussions on climate resilience and heritage protection.

One of the most practical tools created was the Water Damage Poster, which offers clear, step-by-step instructions for stabilizing heritage objects immediately after water-related incidents. Its visual format makes it suitable for display in storerooms, conservation workshops, and emergency planning offices. By condensing essential actions into an accessible resource, the poster supports rapid decision-making during crises. It is freely available online via the KIK-IRPA website, ensuring wide dissemination among heritage professionals.

FIG. 16. Water Poster. © KIK-IRPA

⇨ Available here: https://www.kikirpa.be/fr/nouvelles/poster-eau

The project also developed technical booklets and protocols addressing specific challenges encountered during recovery. These include guidelines for managing masonry moisture and salt crystallization, drying plans for historic buildings, and prioritization frameworks for textile collections. Each resource was designed to be practical and adaptable, enabling institutions to apply evidence-based methods even under resource constraints. These materials were distributed during workshops and remain accessible through institutional repositories, ensuring continued relevance beyond the project's duration.

To raise awareness and share progress with a broader audience, CHrisis produced news articles and project briefs published in KIK-IRPA News and regional media. Articles such as *"Textiles en péril : du sauvetage à la valorisation"* and *"Rescuing and revaluing textile heritage through CHrisis"* highlighted the challenges and successes of recovery efforts, while *"Two years since the July 2021 floods"* reflected on lessons learned and the importance of preparedness. These publications targeted both professional and public audiences, reinforcing the societal relevance of heritage protection.

CHrisis also contributed to the scientific dialogue on climate resilience through its participation in the Belgian Science for Climate Action Conference (19-20 February 2024). A poster titled *"Developing a Disaster Management Strategy for Cultural Heritage in Belgium"* was presented. This presentation highlighted the strategic dimension of CHrisis, focusing on the integration of cultural heritage into national risk management frameworks and the need for coordinated action between heritage institutions and civil protection services. By engaging with the climate science community, CHrisis positioned cultural heritage as an essential component of broader resilience strategies.

FIG. 17. 'Developing a disaster management strategy for cultural heritage in Belgium' poster. © KIK-IRPA

Finally, the project culminated in the CHrisis Lunch Talks, a two-part online event held in October and November 2025 to coincide with the International Day for Disaster Risk Reduction. These sessions showcased the expertise developed through CHrisis, from strategic coordination to hands-on restoration. The first talk, "From Strategy to Action," explored partnerships and governance mechanisms that enabled coordinated responses, while the second, "From Crisis to Restoration," presented technical innovations and conservation results for movable and immovable heritage. Broadcast via Teams, the Lunch Talks reached a broad audience of heritage professionals, local authorities, researchers, and students. An evaluation conducted at the end of the CHrisis Lunch Talks confirmed their effectiveness, with participants providing highly positive feedback on the relevance of the content. This response underscores the value of combining strategic insights with practical lessons in an accessible format.

FIG. 18. CHrisis Lunch talks dissemination documents. © KIK-IRPA

The project was also featured in the documentary “Au cœur du patrimoine”, directed by Nina Degraeve for KIK-IRPA’s 75th anniversary. This film, presented at CIVA Brussels, highlighted the institute’s mission and included a segment on the CHrisis project, showcasing its innovative approach to disaster preparedness and heritage safeguarding.

The CHrisis project has also been integrated as a case study within the *Rampenstrategie* project (Beyl, Boschloos and De Bruyn 2025), reinforcing its role as a reference for developing disaster risk management strategies for cultural heritage in Belgium. This inclusion highlights CHrisis as an example of best practice for linking emergency preparedness with heritage safeguarding.

Throughout its implementation, CHrisis was presented at numerous national and international events (cf. Annex II), strengthening its visibility and fostering knowledge exchange.

Together, these outputs demonstrate the project’s commitment to ensuring that its findings are not only published but actively shared, discussed, and applied. They extend the impact of CHrisis beyond its research objectives, providing tools, knowledge, and networks that remain relevant for future emergencies and contribute to the ongoing development of heritage risk management in Belgium.

7. ACKNOWLEDGEMENTS

The CHrisis project was made possible thanks to the collaboration and support of numerous institutions, professionals, and communities. We express our sincere gratitude to the Belgian Science Policy Office (BELSPO) for funding, and to the Royal Institute for Cultural Heritage (KIK-IRPA) for hosting the project and providing scientific infrastructure throughout its duration. We also acknowledge the contribution of partner institutions and laboratories for their expertise in conservation science and risk management, and the local communities and parish authorities whose active participation was essential for recovery efforts and the revitalization of intangible heritage practices. Our thanks extend to the emergency services and civil protection units for their cooperation

during the initial response phase, and to Blue Shield Belgium for its role in heritage protection advocacy and operational coordination.

Special recognition is given to the Bethléem de Verviers community, whose engagement in safeguarding intangible cultural heritage exemplifies the resilience and creativity that underpin cultural continuity.

We also wish to acknowledge the members of the Heritage Crisis Committee, whose commitment and collaboration were vital in organizing emergency actions and sharing critical information during the most challenging weeks following the floods. The committee brought together a wide network of actors, including:

- Blue Shield Belgium (BSB)
- CIPAR (Centre Interdiocésain du Patrimoine et des Arts Religieux)
- AWaP (Agence Wallonne du Patrimoine)
- Fédération Wallonie-Bruxelles – Direction du Patrimoine culturel
- Musées et Sociétés en Wallonie (MSW)
- ICOM Belgique/Wallonie-Bruxelles and ICOM Belgium Flanders
- ICOMOS Wallonie-Bruxelles
- Monumentenwacht Vlaanderen
- State Archives of Belgium
- CRMSF (Commission royale des Monuments, Sites et Fouilles)
- AAFB (Association des Archivistes Francophones de Belgique)
- PARCUM
- Royal Association of Historic Residences and Gardens of Belgium

Their collective effort ensured that heritage professionals could coordinate rescue missions, mobilize volunteers, and share resources under extremely difficult circumstances. The experience gained through this collaboration has informed the recommendations and governance models proposed by CHrisis for future emergencies.

Finally, we thank all conservators, volunteers, and students who contributed their time and expertise to recovery operations, as well as the diocesan heritage services and museum staff who worked tirelessly to stabilize and protect collections. The success of CHrisis reflects the strength of these partnerships and the shared commitment to safeguarding Belgium’s cultural heritage.

ANNEX I: TREATMENT REPORTS

Complete treatment reports for the selected objects are archived at KIK-IRPA and can be consulted in KIK-IRPA's archives.

ANNEX II: DISSEMINATION AND VALORISATION ACTIVITIES

A. Presentations

Date	Event / Platform	Title	Speaker(s)
17–19 Sep 2024	ICCROM PREVENT Course	Mitigating Flood Risk for Heritage	Julie Désarnaud
8 Dec 2023	ICOMOS-ICORP Panel Series (online)	Cultural Heritage and Crisis Management in Belgium: Lessons from the 2021 Floods	Laure Marique
15 Feb 2022	AAFB-AAAQ Round Table	L'implication de l'IRPA dans la sauvegarde du patrimoine belge en situation de crise	Estelle De Bruyn
25 Oct 2021	CIDH (Commission Interministérielle Droit Humanitaire)	Report on IRPA's involvement in heritage protection during crises	IRPA Team
Mar 2023 / Jun & Sep 2025	ProCultHer Project Meetings	Project presentations	IRPA Team
28 Nov 2023	6th UCPM Experts Day, Brussels	L'IRPA: notre rôle et notre expertise dans le cadre d'une situation d'urgence	Estelle De Bruyn, Wivine Roland-Gosselin, Françoise Collanges
30 Sep 2022	Emergency Planning Workshop (C2RMF, ICOM WB, MSW)	L'IRPA: notre rôle et notre expertise dans le cadre d'une situation d'urgence	IRPA Team
21–22 Nov 2022	UNESCO, Kyoto	KIK-IRPA's Approach for Protecting Belgian Cultural Heritage Before, During and After a Disaster	IRPA Team
3 May 2022	UNESCO Vlaanderen Trefdag	Nationale calamiteitenstrategie voor erfgoed	Hilde De Clercq

B. Courses

Date	Institution / Platform	Title	Speaker(s)
20 Oct 2021	ENSAV La Cambre	Conservation préventive	IRPA Team
8 Mar 2022	ESA Saint-Luc Liège	Conservation and Crisis Management	IRPA Team
5–6 Dec 2022	ESA Saint-Luc Liège	Gestion des sinistres: le rôle du patrimoine dans le redressement des communautés	Estelle De Bruyn, Wivine Roland-Gosselin
2024 & 2025	Louvain-La-Neuve	Planicrise Training for Emergency Planners and Rescue Services	Estelle De Bruyn, Laure Marique
24 Nov	ULB (Archivistics	Protéger le patrimoine face à la crise	Estelle De Bruyn

2023	Course)	climatique	
22 Apr 2024	University of Antwerp	Cultural Heritage and Crisis Management in Belgium	Anne-Catherine Olbrechts, Laure Marique

C. Media Coverage

Date	Publication	Title	Author
6–7 Aug 2022	*Le Soir*	La Belgique se prépare au prochain cataclysme	Alain Lallemand
6–7 Aug 2022	*Le Soir*	Nous mettons en place une stratégie de protection des biens culturels en cas de sinistre	Alain Lallemand
6–7 Aug 2022	*Le Soir*	Des exercices catastrophes pour mieux se protéger	Alain Lallemand

D. Documentary

Year	Title	Director
2024	Au cœur du patrimoine	Nina Degraeve

E. Posters

Date	Event	Title	Authors
19–20 Feb 2024	Belgian Science for Climate Action Conference	Developing a Disaster Management Strategy for Cultural Heritage in Belgium	Laure Marique, Anne-Catherine Olbrechts, Estelle De Bruyn
23–27 Sep 2024	IIC Lima Congress	Floods and Alluvium: The Case of the Bethléem of Verviers	Laure Marique, Muriel Verbeeck

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