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EDITORIAL

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Aligning Heritage Conservation and Climate Mitigation Through Adaptive Reuse

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Abstract

This thematic issue explores the role of heritage conservation in climate mitigation and adaptation by examining the convergences between retrofitting heritage buildings, the circular economy, urban revitalisation, sustainable communities, and sense of place. The diverse contributions focus on the place of heritage in circular economy policies, retrofitting, and climate adaptation. Collectively, the articles set out the contribution of heritage conservation as a resource for economic growth, employment, and social cohesion, and as a form of climate action by diverse actors at different scales in the low-carbon transition.

Keywords

adaptive reuse; circular economy; climate resilience; embodied carbon; heritage conservation; life cycle analysis

1. Introduction

The built environment has a huge impact on the biosphere, affecting multiple planetary boundaries (Kuittinen, 2023). For example, urban settlements contribute an estimated 70% of global CO_2e (carbon dioxide equivalent) emissions (IPCC, 2023) and the buildings and construction sector is responsible for an estimated 34% of global CO_2e emissions, reflecting insufficient progress in meeting Paris Agreement targets (UNEP, 2025).

There is an urgent need to decarbonise, as reflected in ambitious policy targets for the built environment such as the revised European Performance of Buildings Directive, which stipulates that "new buildings

should be zero-emission buildings by 2030, and existing buildings should be transformed into zero-emission buildings by 2050" ("Directive (EU) 2024/1275," 2024, p. 4). However, many countries are experiencing continued urban expansion to meet housing needs, which can be in conflict with these carbon targets if sustainable solutions are not implemented (OECD, 2024). For example, in Ireland the current Programme for Government includes a plan to deliver more than 300,000 new homes between 2025 and 2030 (Rialtas na hÉireann, 2025). It is recognised that unless there is significant reuse of vacant buildings and accounting for whole life carbon in construction and retrofits, Ireland will not nearly meet carbon targets of a 51% reduction (on 2018 levels) by 2030 (O'Hegarty & Kinnane, 2022). The IPCC's Sixth Assessment Report considers that established cities "will achieve the largest GHG emissions savings by replacing, repurposing, or retrofitting the building stock, targeted infilling and densifying, as well as through modal shift and the electrification of the urban energy system" (IPCC, 2023, p. 864), and there are calls in the literature for the avoidance of new construction, particularly in the Global North, and instead a focus on adaptive and sufficient use of existing buildings (Kuittinen, 2023).

Vacancy and underuse are persistent issues in many countries, for example throughout Europe (Turnbull, 2023), where an estimated 20% of the total stock of dwellings (including second homes) were recorded as vacant in national censuses (Eurostat, 2021; FEANTSA, 2025). Vacancy is associated with negative impacts on placemaking, sense of belonging, and community well-being (Armstrong et al., 2023). However, vacant sites and buildings can be framed as spaces for change and transformation (Pagano & Bowman, 2004) and to represent the spatial dimension of adaptive capacity in an urban area (Crowe & Foley, 2017). In older, established urban settlements in Europe and elsewhere, many of these buildings are recognised in conventions and legislation for their architectural quality and heritage value.

Increasingly, the commonality of purpose between heritage conservation and the circular economy has been recognised in relation to retaining heritage assets in use without losing what is understood as their integrity or character (Huuhka & Vestergaard, 2019; Wise et al., 2021), which helps define and differentiate places. Heritage conservation practice can promote a sense of belonging and a sense of place (Vafaie et al., 2023), and in recent years the emphasis has shifted from the heritage of an individual building to a systems approach that recognises the cultural and natural heritage of a place, as promoted in the recommendation on the historic urban landscape (UNESCO, 2011) and in the Burra Charter (ICOMOS, 2013).

Perhaps less accounted for is the contribution of heritage conservation to climate mitigation through adaptive reuse (Baker et al., 2021), principally because heritage buildings represent a store of embodied carbon, and their reuse requires significantly less environmental resources compared to the demolition and construction required for an equivalent new build (ICOMOS, 2019; O'Hegarty & Kinnane, 2022), particularly when siteworks (infrastructure, landscaping, and land use change) are taken into account. However, the process of renovating a building does contribute to embodied carbon emissions (Mastrucci et al., 2020), and in Europe, the requirement to assess embodied carbon emissions has recently been introduced in the revised Energy Performance in Buildings Directive (EPBD; "Directive (EU) 2024/1275," 2024).

The adaptive reuse of heritage buildings also promotes a culture of stewardship through good maintenance (Historic England, 2019), and often involves the use of local, reclaimed, or recycled materials alongside traditional industries and skills (ICOMOS, 2019), in line with principles of the circular economy and key policy initiatives such as the European Green Deal (European Commission, 2021). It also fosters the efficient

use of urban centres through compact urban growth, reducing urban sprawl (Giraud-Labalte et al., 2015; ICOMOS, 2019) and facilitating more people to live in town centres, potentially leading to urban revitalisation, improved social cohesion, and sustainable communities (Crowe, 2019).

This thematic issue, "Aligning Heritage Conservation and Climate Mitigation Through Adaptive Reuse," sets out to provide some insight into the role of heritage conservation in the urgent task of decarbonising the built environment. The five articles included broadly cover three areas: adaptive reuse, climate adaptation, and synergies between heritage conservation and the circular economy.

2. The Environmental Case for Adaptive Reuse

There is now a considerable accumulation of life cycle assessment studies of buildings (Ferreira et al., 2015; Marique & Rossi, 2018; O'Hegarty et al., 2020) which support the well-established titular finding that "the greenest building is the one that is never built" (Lucuik et al., 2010). However, this generally accepted finding is being mediated and shaped by larger discussions on how results are dependent upon methodological choices (Moncaster et al., 2018), upon the ability to reuse materials and components (Akhimien et al., 2021; Weiler et al., 2017), and enmeshed with the complexities of altering protected heritage structures (Baker et al., 2021).

In Europe, there have been successive policies on the circular economy as it relates to the built environment, including the European Taxonomy and the revised EPBD, previously mentioned. There is also considerable opportunity to build cohesive approaches to adaptive reuse that combine reduced greenhouse gas emissions from the built environment with architectural conservation. Donarelli (2025, this issue) explores the implications of the revised EPBD for heritage and circular economy policies in Sweden. The author notes how definitions of zero energy may work together with heritage values to create measured approaches to heritage buildings that move towards a more sustainable built environment.

Further complexities arise when consideration expands to newly developed policies to tackle urban vacancy and a recognition that adaptive reuse of underutilised urban units and buildings reduces our need to extract and manufacture materials for new buildings or wholesale replacements of buildings. Warda et al. (2025, this issue) discuss approaches to adaptive reuse in Germany, taking as examples the Denkmalverein Hamburg (Society for Architectural Heritage) and Denkmalverein Sachsen, which actively map existing heritage structures and their status as well as materials. They explore the potential for extended concepts of the circular economy, which seek to maintain and reuse existing built fabric in alignment with heritage values.

While partly in response to urban shrinkage, the German approach shows authorities can plan for future growth by actively banking both buildings and materials for future adaptive reuse. Such approaches broadly cohere with an increasing focus on neighbourhood-scale retrofit programmes (Hofman et al., 2021), particularly when looking to the embodied carbon savings that can be potentially made through such programmes. Scaled approaches to adaptive reuse at the neighbourhood and settlement scales (Crowe, 2019) can help build climate and social resilience alongside urban improvement, preservation of heritage, and modernisation.

3. Adapting Heritage Settlements

The climatic conditions to which vernacular settlements are attuned are changing due to anthropogenic greenhouse gas emissions, which shift the experience both at the regional scale and in the microclimates experienced in urban settlements (Oke et al., 2017). In this issue, Cherchi et al. (2025) consider thermal comfort in a traditional Sardinian village which has undergone various changes to its urban fabric over the centuries. They explore low-tech approaches to increase thermal comfort in small urban public spaces during high background temperatures, while respecting the historical fabric and morphology of the settlement.

The oil-rich nations of the Middle-East are undergoing large-scale changes as the world economy moves away from fossil fuel dependency. Iran, historically a major exporter of crude oil but now partly locked out of trade, also has a recent context of social and military conflict and large demographic growth. Gharaati et al. (2025, this issue) evaluate the prospects for the adaptive reuse of a former 1930s German-built iron foundry to the west of Tehran. Their study employs innovative future visioning and "imaginary future generations" methods through workshops to map out future possibilities for this large-scale industrial heritage site. Their two-part method of adaptive reuse possibilities and then future scenarios allows them to find paths that negotiate climate impacts, energy consumption, and societal change.

4. Synergies Between Heritage Conservation and the Circular Economy

Linking many of the articles in this thematic issue is the overlap of heritage conservation and circular economy principles and practice. Purposeful measures towards climate resilience and mitigation, protection of nature, and preservation of built and cultural heritage, all suggest a reverence for sense of place and the delicate foundations upon which this sense is built.

Vieveen et al. (2025, this issue) provide four empirical case studies of recently retrofitted listed heritage buildings in the Netherlands. For each, they cover the following both before and after the retrofit: architectural and heritage appraisal, energy consumption, and CO_2e emissions. They find that, on average, "energy performance improved with a CO_2 reduction of approximately 52%," with the CO_2e results shaped heavily by changes in energy usage. They note that this efficiency gain does come at a cost of their measured heritage values, but that on the whole, the changes were modest and respectful of the buildings' identity and history.

5. Conclusion

As discussed in this issue by Warda et al. (2025), Donarelli (2025), and Gharaati et al. (2025), our built heritage forms part of a shared resource that can further our goals for the circular economy and the climate challenge. Key future developments will be to integrate life cycle assessment considerations into combined energy performance and heritage value assessments. For instance, the development of building renovation passports in Europe (Buchholz & Lützkendorf, 2023) may provide international templates that might be adapted elsewhere for energy pathways for existing buildings to meet climate goals. Approaches to vacancy management in France, Scotland, and Germany (Warda et al., 2025) can also be developed further to quantitatively recognise the embodied carbon emissions that are saved through reuse of both existing

buildings (including heritage structures) and the urban services with which they are already integrated as compared to further greenfield and edge development.

Finally, we note that while we have looked at alignments between heritage conservation and climate policies through adaptive reuse, a further consideration will be that of the expanding policy space to halt and reverse biodiversity loss (Humphrey et al., 2025). Reusing and reinvigorating our urban places and buildings is also critically important for minimising human encroachment into our dwindling biodiversity reserves.

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Conflict of Interests

The authors declare no conflict of interests.

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