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Reimagining homes: How regenerative retrofitting can foster sustainability, Ecological Citizenship, and resilient communities

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ABSTRACT | Retrofitting residential houses is still an underutilised option for addressing the climate crisis and meeting the growing demand for more sustainable housing. While energy efficiency is a significant focus of many retrofit efforts, popular techniques often overlook the broader ecological and social dimensions of sustainability, such as the reduction of embodied carbon and the enhancement of connections between people and the environment. Concurrently, fostering Ecological Citizenship, where individuals actively engage in environmental stewardship and contribute to community resilience, is critical in addressing systemic challenges like biodiversity loss, social inequality, and climate adaptation. This article investigates how regenerative retrofitting, an emerging approach to retrofit design, can bridge this gap by transforming homes into active agents of ecological renewal. By incorporating nature-based solutions, circular material strategies, and participatory design practices, regenerative retrofitting not only mitigates carbon emissions but also nurtures a deeper sense of environmental responsibility among residents. Through a case study of the *Wildhouse* project in Brighton, this work explores how one initiative integrates retrofit practices with the principles of Ecological Citizenship and sustainable living. By examining the project's design, its mechanisms to facilitate human (as) nature connections, and its mission to define more tangible links between the homes of people and other forms of nature the research demonstrates how regenerative retrofits can reframe housing as a locus for ecological restoration and as a route to tackle some societal issues. In doing so, it highlights the potential for scaling such interventions to create more resilient, nature-integrated urban environments that contribute positively to

environmental sustainability, social equity, and long-term climate resilience. Furthermore, the research emphasises how regenerative retrofitting can influence housing policy, urban planning, and broader systemic change, offering a holistic approach to sustainability that addresses both the physical and social fabric of cities. Through its exploration of the intersection between retrofit design, ecological engagement, and community empowerment, this work contributes valuable insights into how residential retrofitting can play a pivotal role in advancing both ecological and social sustainability in urban settings. The future research directions informed by Wildhouse offer space for further exploration of the long-term, wide-ranging impacts of regenerative retrofitting in social housing. By addressing questions about the agency of domestic objects, spaces and interactions as route to ecological citizenship, economic viability, institutional barriers, community engagement, health outcomes, and climate adaptation, future work can deepen our understanding of how regenerative design can be implemented on a large scale, ensuring that it contributes to both ecological restoration and social well-being for generations to come.

KEYWORDS | REGENERATIVE RETROFIT, ECOLOGICAL CITIZENSHIP, RECIPROCITY IN DESIGN

1. Introduction

The retrofitting of domestic properties remains an underutilised yet crucial strategy for addressing the climate crisis and promoting sustainable urban living. Despite increasing recognition of the need to reduce energy consumption in the built environment, retrofit adoption rates remain low (Fawcett & Killip, 2019). Many existing retrofit initiatives focus primarily on operational energy efficiency, such as insulation, heat pumps, and solar panels, without addressing the full environmental impact of buildings, including embodied carbon and biodiversity integration (Pomponi & Moncaster, 2017). As a result, retrofit policies often fall short of fostering a deeper engagement with sustainability, both at the level of material choices and community involvement. For retrofitting to become a transformative tool, it must move beyond mere technical upgrades and be reframed as a regenerative process that not only reduces emissions but also strengthens the ecological and social fabric of urban areas (Hill and Mazzucato, 2024).

Alongside the need for greater retrofit adoption, there is an urgent requirement to cultivate Ecological Citizenship, wherein individuals and communities take active responsibility for environmental stewardship and resilience. Ecological citizenship goes beyond traditional civic obligations to include everyday behaviours that promote sustainability, such as energy-efficient living, material literacy, and involvement in local ecological restoration initiatives (Light, 2006). Engaging citizens in regenerative retrofit procedures can help to raise environmental awareness and enable communities to play a part in the larger transition to sustainability (Seyfang, 2010) and may offer pathways to (UK, legislative) demands for Biodiversity-Net-Gain. This transition is especially significant in the context of social housing, where marginalised populations frequently experience the brunt of climate change's effects while having limited access to sustainable living options (Shaw, 2012).

Regenerative retrofitting offers a means to bridge these gaps by redefining the role of buildings within natural systems. Unlike traditional retrofitting, which is frequently limited to increasing energy efficiency, regenerative approaches combine circular economy principles, biodiversity enhancement, and participatory design to create living

environments that actively contribute to ecological and social well-being (Reed, 2007). This involves prioritising bio-based and reused materials, applying natural solutions like green roofs and living walls, and creating adaptive, climate-responsive structures (Mang & Reed, 2012). By incorporating these ideas, regenerative retrofits may not only reduce embodied carbon but also turn houses into ecological engagement zones, where people can feel a physical connection to nature in their daily lives. Regenerative retrofitting has the potential to promote place-based sustainability by encouraging urban inhabitants to connect with and care for their local surroundings (Beatley, 2011). Biophilic design principles, which emphasise the integration of natural elements into built environments, have been shown to improve mental well-being, enhance indoor air quality, and strengthen community bonds (Kellert & Calabrese, 2015). Moreover, research suggests that participation in the design and implementation of sustainability initiatives increases long-term engagement and adoption of pro-environmental behaviours (Middlemiss & Parrish, 2010). As such, regenerative retrofit projects that involve residents in co-design processes not only improve physical infrastructure but also cultivate Ecological Citizenship, ensuring that environmental benefits extend beyond the material transformation of buildings (Wells & Lekies, 2006).

The *Wildhouse* project in Brighton serves as a case study for exploring the intersection of regenerative retrofitting, Ecological Citizenship, and sustainable housing. This initiative reimagines retrofit as an active agent of ecological renewal, integrating bio-based materials, passive ventilation strategies, and green infrastructure to create a model that extends beyond conventional energy retrofits (Smith & Stirling, 2018). Moreover, by embedding co-design methodologies with social housing residents, *Wildhouse* demonstrates how participatory processes can enhance both social equity and environmental outcomes. Through this case study, this research aims to illustrate how regenerative retrofits can be scaled and adapted to different urban contexts, contributing to a broader paradigm shift in sustainable housing policy (Rydin, 2013).

In light of the pressing need to decarbonize the housing sector while fostering community-led sustainability initiatives, this paper suggests that regenerative retrofit represents a critical strategy for achieving these dual objectives. By linking nature to the built environment and emphasising participatory approaches, regenerative retrofits can transform domestic properties into catalysts for ecological and social regeneration. This research underscores the importance of integrating embodied carbon reduction with community engagement, demonstrating that housing retrofits are not merely technical interventions but opportunities to cultivate ecological responsibility and resilience within urban populations.

2. Underlying themes

2.1. The need for retrofit

The built environment is a major contributor to climate change, accounting for almost 40% of worldwide energy-related carbon emissions (Huang et al., 2024). Historically, sustainability initiatives in this industry have focused on operating energy (used for heating, cooling, and lighting). Embodied carbon, which includes emissions from material extraction, production, transportation, and construction, is a frequently underestimated aspect of a building's total environmental effect (Pomponi & Moncaster, 2017). The

necessity of decreasing emissions has prompted greater focus on retrofitting existing housing stock, as the bulk of structures that will be in use by 2050 have already been built (Ürge-Vorsatz *et al.,* 2020). Unlike new construction, which allows for the use of energy-efficient designs and materials from the start, existing buildings pose a unique challenge in balancing historical preservation, affordability, practicality, and carbon reduction (Fawcett & Killip, 2019). Despite general agreement on the need for retrofitting, adoption rates remain low due to financial, regulatory, and logistical hurdles (Killip, 2013). Many property owners and landlords may not have access to the required financing or incentives to implement full retrofitting measures, especially when the initial expenses are seen as excessively expensive (Galvin, 2014). Furthermore, retrofit programs have frequently been fragmented, with an emphasis on operational efficiency rather than overall sustainability, limiting their capacity to bring broader environmental and social benefits. For retrofitting to be truly transformative, it must evolve beyond technical energy upgrades and be reframed as an opportunity for ecological and social regeneration (Dixon and Eames, 2013).

2.2 The importance of sustainable retrofitting

While conventional retrofit approaches have primarily aimed at reducing energy consumption, there is growing recognition that these strategies must also address embodied carbon, material circularity, and ecological impact (Cabeza *et al.,* 2014). Traditional retrofitting methods often rely on industrially produced, high-carbon materials, which can reduce operational energy use but contribute significantly to lifecycle emissions (Chastas *et al.,* 2016). For example, the widespread use of cement-based insulation materials or synthetic polymer window frames may improve energy efficiency but simultaneously increase embodied carbon and environmental degradation (Pomponi & Moncaster, 2017). A shift towards sustainable retrofit materials and approaches is essential. Bio-based and reclaimed materials, such as timber, hempcrete, mycelium insulation, and straw bale, offer significant carbon sequestration potential and can be sourced from local, circular supply chains (Wilkinson & Remøy, 2018). Research suggests that adopting a circular economy approach to retrofitting, where materials are reused and repurposed rather than disposed of, could reduce the built environment's carbon footprint by as much as 50% by 2050 (Gallego-Schmid *et al.,* 2020). Beyond material choices, sustainable retrofitting also requires nature-based solutions, such as green roofs, passive cooling strategies, and water recycling systems, which enhance biodiversity, improve urban resilience, and promote ecosystem services (Franco *et al.,* 2023). However, for these approaches to gain traction, policy interventions and financial incentives must support their adoption. Government-backed retrofit grants, low-interest loans, and carbon taxation schemes could accelerate market transformation, while new building regulations that consider both operational and embodied carbon would ensure that retrofit efforts align with long-term sustainability objectives. The transition towards sustainable retrofitting requires not only technical advancements but also a cultural and behavioral shift towards ecological responsibility (Seyfang & Smith, 2007).

2.3 The role of ecological Citizenship

One of the core barriers to widespread retrofit adoption is the lack of quality engagement with residents and communities. Retrofitting is often implemented via top-down decision-making processes, where tenants and homeowners are passive recipients rather than active participants (Walker *et al.,* 2014). Research has shown that sustainability initiatives are more likely to succeed and have lasting impact when individuals feel a sense of ownership and agency over environmental decision-making

(Middlemiss, 2010). This underscores the requirement to cultivate ecological citizenship, where people are actively participating in sustainability efforts at both individual and community levels. As such, ecological citizenship extends beyond legal or economic incentives to encompass civic responsibilities that support long-term environmental resilience (Light, 2006). Citizens who engage in sustainability initiatives, such as energy-efficient home retrofits, material recycling programs, and urban rewilding, lean towards developing stronger pro-environmental values and behaviours (Stern, 2000). Plus, studies indicate that when individuals co-design their living environments, they are more likely to adopt sustainable habits, such as energy conservation, waste reduction, and responsible consumption (Janda, 2011). This participatory approach not only enhances individual sustainability efforts but also works towards fostering collective action, which is critical for addressing systemic environmental challenges (Seyfang, 2010). By embedding community-driven approaches into retrofitting initiatives, policymakers and urban planners could ensure that sustainability measures extend beyond technical interventions and become embedded in everyday habits and life. This aligns with social justice principles, as marginalised communities, who are often most affected by climate change, can have greater agency in shaping their living environments (Shaw, 2012).

2.4 Nature connectedness and the built environment

Another critical but often overlooked dimension of retrofitting is its potential to reconnect people with nature. Urbanisation has led to an increased disconnection from natural systems, contributing to both environmental apathy and declining mental well-being. Research has detailed that exposure to nature enhances psychological well-being, fosters pro-environmental behaviour, and increases resilience to climate-related stressors (Heilmayr and Miller, 2021). Biophilic design principles for instance, which integrate natural elements into built environments, have been demonstrated to improve indoor air quality, thermal comfort, and occupant satisfaction (Kellert & Calabrese, 2015). Measures such as green walls, daylight optimisation, natural ventilation, and biodiversity corridors, as such not only enhance human well-being but also contribute to broader ecological benefits, such as pollinator habitats, urban cooling, and improved stormwater management (Beatley, 2011). These interventions can be particularly transformative in social housing contexts, where residents often lack access to green spaces but could benefit most from healthier living environments (Wells & Lekies, 2006). Retrofitting with nature-connectedness in mind offers a powerful means of addressing both climate adaptation and human well-being. When combined with community participation, these approaches reinforce Ecological Citizenship, making sustainability an active and experiential practice rather than a passive policy goal (Kibert, 2016)

2.5 Regenerative retrofitting as a holistic solution

Regenerative retrofitting redefines the role of buildings within natural and social systems, shifting from a model that merely reduces environmental harm to one that actively restores ecosystems and strengthens community resilience (Mang & Reed, 2012).

Table 1. Impacts and benefits of regenerative retrofit.

Circular economy & biodiversity	Unlike conventional retrofitting, regenerative approaches integrate circular economy principles, biodiversity restoration, and participatory design to create built environments that contribute positively to ecological and social well-being (Reed, 2007).
Materials, nature, and engagement	Emphasising materials, nature, and community engagement, regenerative retrofitting moves beyond technical solutions to address deeper systemic transformations for sustainable urban living.
Low-carbon, bio-based materials	Key features include the use of low-carbon, bio-based, and reclaimed materials, which reduce embodied carbon and promote circularity within the construction sector. These materials improve thermal performance and occupant health (Pomponi & Moncaster, 2017; Cabeza *et al.,* 2014; Chastas *et al.,* 2016; Hammond & Jones, 2008; Pittau *et al.,* 2018).
Nature-based solutions	Nature-based solutions such as green roofs, rain gardens, permeable surfaces, and passive ventilation systems mitigate urban heat island effects, improve climate resilience, and create habitats for biodiversity (Beatley, 2011; Kellert & Calabrese, 2015).
Health and pro-environmental behaviour	Nature-based interventions improve physical and mental health, foster pro-environmental behaviours, and reinforce the social dimension of sustainability (Wells & Lekies, 2006; Lumber *et al.,* 2017; Bratman *et al.,* 2015).
Community participation and co-design	Regenerative retrofitting is grounded in the principles of co-design and community participation, ensuring interventions are contextually appropriate and fostering a sense of ownership and stewardship (Seyfang & Smith, 2007; Middlemiss, 2010).
Sustainability and social cohesion	Participatory sustainability initiatives lead to long-term engagement, increased adoption of pro-environmental behaviours, and stronger social cohesion. Participatory governance enhances legitimacy and effectiveness of sustainability transitions.
Social and ecological equity	Integrating participatory governance with ecological design ensures sustainable housing transitions are inclusive and empowering, aligning environmental restoration with social equity (Rydin, 2013).
Transforming housing	Regenerative retrofitting transforms housing into sites of ecological regeneration and social transformation, positioning domestic properties as active contributors to climate resilience and community well-being (Holmes & Pincetl, 2012).

2.6 Approach: Advancing the role of regenerative retrofitting

Despite the clear benefits, the integration of such solutions remains sporadic due to fragmented policy support and a lack of standardised design guidance. Demonstrating the multi-functional benefits of nature-based retrofit interventions through pilot projects and evidence-based research is essential in strengthening the case for their inclusion within regulatory frameworks and incentive schemes.

Perhaps the most transformative aspect of regenerative retrofitting is its capacity to engage communities in the co-creation of sustainable housing solutions. Retrofitting has

historically been a top-down process, with interventions imposed on buildings and residents without meaningful involvement. A regenerative approach, by contrast, views residents as key stakeholders in shaping their living environments, recognising that participatory design processes lead to greater long-term engagement, stronger social cohesion, and an increased sense of ecological responsibility. Community-led retrofit initiatives not only enhance the social impact of sustainability transitions but also provide valuable insights into context-specific design adaptations, ensuring that interventions are both functionally effective and culturally appropriate.

To move from conceptual discourse to widespread implementation, regenerative retrofit approaches must be supported by robust case studies that demonstrate their feasibility and scalability. This is where experimental projects such as *Wildhouse* become crucial. By applying regenerative principles to real-world retrofit scenarios, these initiatives offer a platform for testing innovative materials, measuring ecological impacts, and refining participatory engagement models. The insights gained from such projects can inform broader policy and industry transitions, providing a roadmap for integrating regenerative principles into mainstream housing retrofit strategies. As the urgency of climate action intensifies, it is critical to push beyond conventional retrofit paradigms and embrace an approach that is not only sustainable but regenerative. Scaling up the presence of regenerative retrofit requires a concerted effort across research, industry, and policy spheres, supported by real-world examples that illustrate its tangible benefits. The *Wildhouse* project, as a living case study, embodies this transition, demonstrating how homes can become sites of ecological and social regeneration rather than mere consumers of energy.

3. Wildhouse

The *Wildhouse* project XXXX in Brighton represents an approach to regenerative retrofitting, demonstrating how housing can move beyond energy efficiency and carbon reduction to actively contribute to ecological and social regeneration. Situated within the Brighton and Lewes Downs UNESCO Biosphere Reserve, *Wildhouse* challenges the dominant extractivist model of construction, offering an alternative vision where homes function as dynamic interfaces between people and the natural world. By embedding regenerative design principles within an urban social housing context, the project showcases how ecological restoration and community participation can be integrated into the retrofit process.

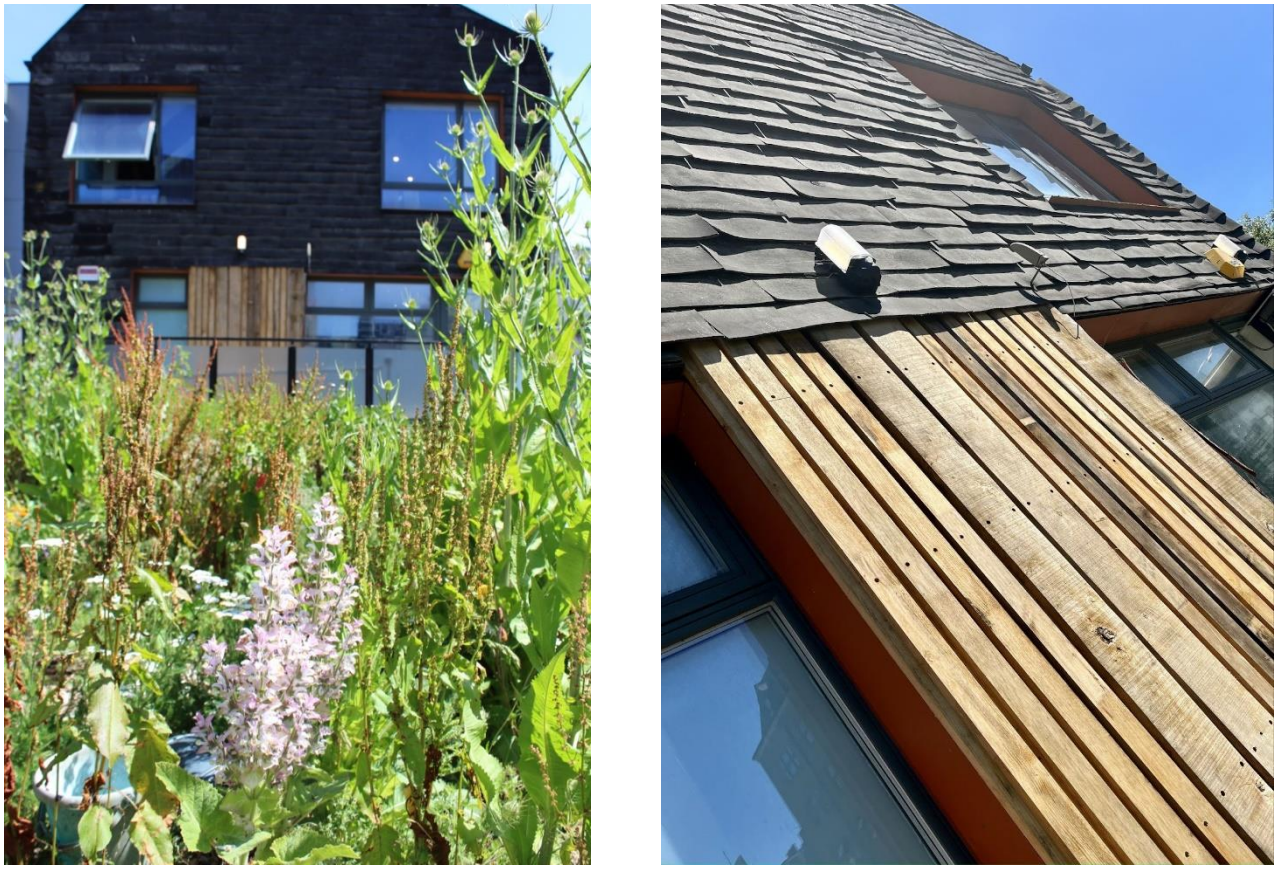

Figure 1. The WildHouse retrofit of the Brighton Waste House, mixed species and sized timber cladding and dye garden for the development of wood stains, dyes and paints for the house. Images xxxx

Unlike conventional retrofitting approaches that prioritise technical efficiency, *Wildhouse* looks to imagine housing as a living system inextricably linked to the landscapes from which its materials are sourced. The project is installed in the established Brighton *Wastehouse* (Baker-Brown, *et al.,* 2013). The *Wastehouse* was built by community volunteers and local trainee tradespeople and is constructed from the waste that other building sites throw away. The new Wildhouse regenerative retrofit further enhances Wastehouse's circular economy credentials by providing insight into the possibilities of turning an ordinary home into an immersive, interactive space that fosters ecological awareness and agency among its residents. It challenges the assumption that regenerative design is a luxury reserved for high-end architecture or niche communities, instead advocating for its widespread adoption within social housing. At its core, *Wildhouse* seeks to redefine retrofitting as an inclusive and participatory process, ensuring that the benefits of nature-first design are accessible to all.

A central feature of *Wildhouse* is its commitment to using Making Nature Principles (MNP) xxx where the design and making methods seek to more clearly define how and where materials may provide landscape improvement and the potential for increased diversity. These materials not only store carbon but also improve indoor air quality and foster healthier living environments and (it is hoped) those of other forms of nature. The relationship between the domestic space and the landscape from where the house is sourced is deliberately enhanced and amplified through the design of the objects as an 'Ecology of Things' [EoT] xxxx

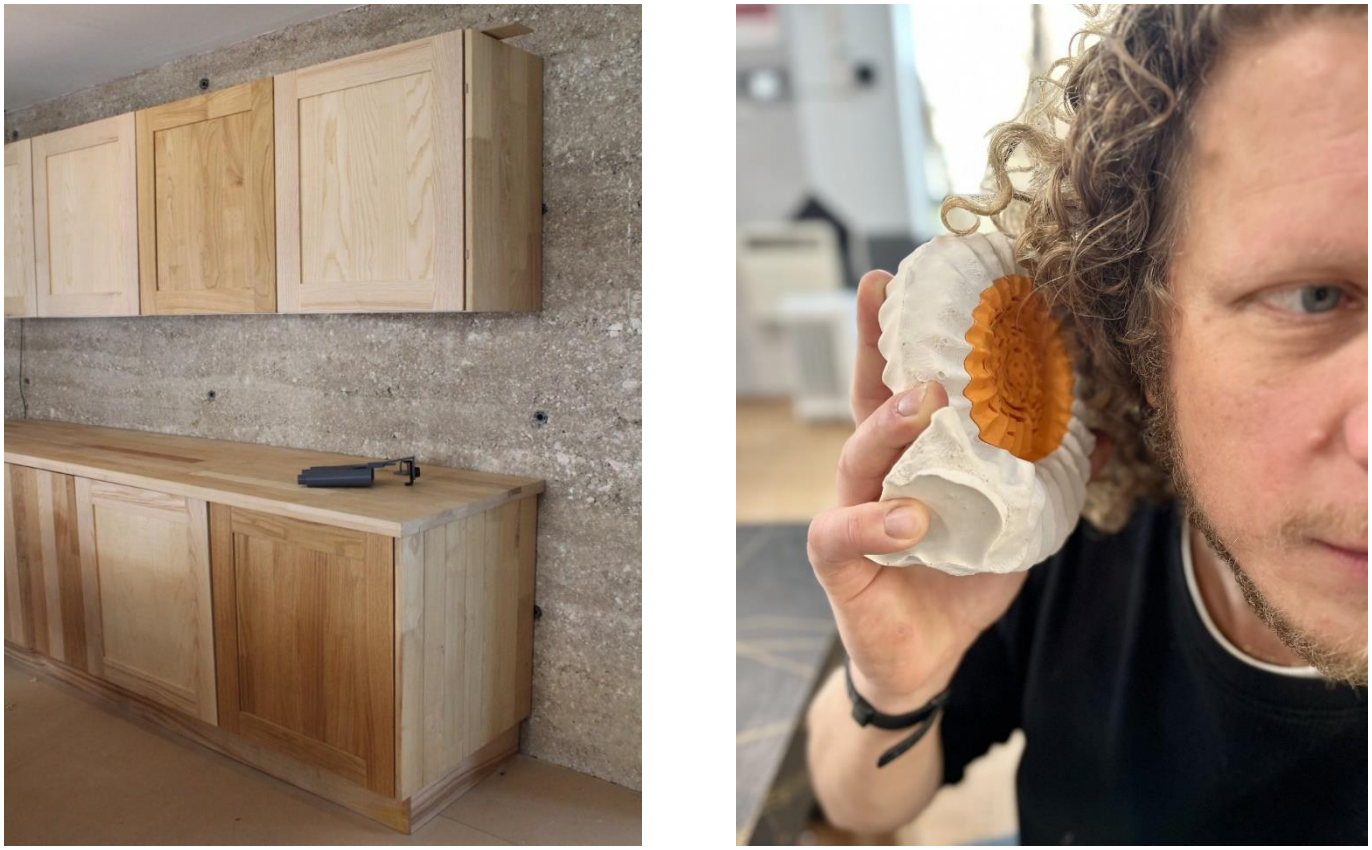

Figure 2. Mixed species timber kitchen and rammed chalk wall with chalk ammonite listening device beaming live sounds from chalk 'dew pond' on south downs Waterhall rewilding site. Image xxxxx

Objects and interactions within the space use both digital and material means to enhance this connectivity. For example, a rammed chalk wall is linked to a chalk dew pond dug into the South Downs chalkland that provides a thriving habitat for nature. By using hydrophones connected to an ammonite 'telephone' in the house users, can hear the live sounds of activity below the surface of the pond. An orthodox array of kitchen cupboards demonstrates how mixed species, ages, and dimensions of wood, sourced from more diverse, less monocultured woodlands can provide both an aesthetic benefit resulting from better woodland management xxxxx. Open a kitchen door and it also provides a chorus of birdsong sourced from the same healthy, woodland as the materials. By demonstrating the viability of nature-based, circular solutions within a real-world housing context, *Wildhouse* signposts practices that could be (re) interpreted across the social housing sector. The project highlights how regenerative design is not simply an aesthetic or ideological choice but a practical strategy for reducing carbon emissions, conserving resources, and creating healthier, more resilient living environments. Moreover, it provides tangible, everyday interactions and a more relatable environment through which to propagate Ecological Citizenship and proposes more direct engagement between people and the wider environment that may benefit from regenerative retrofitting.

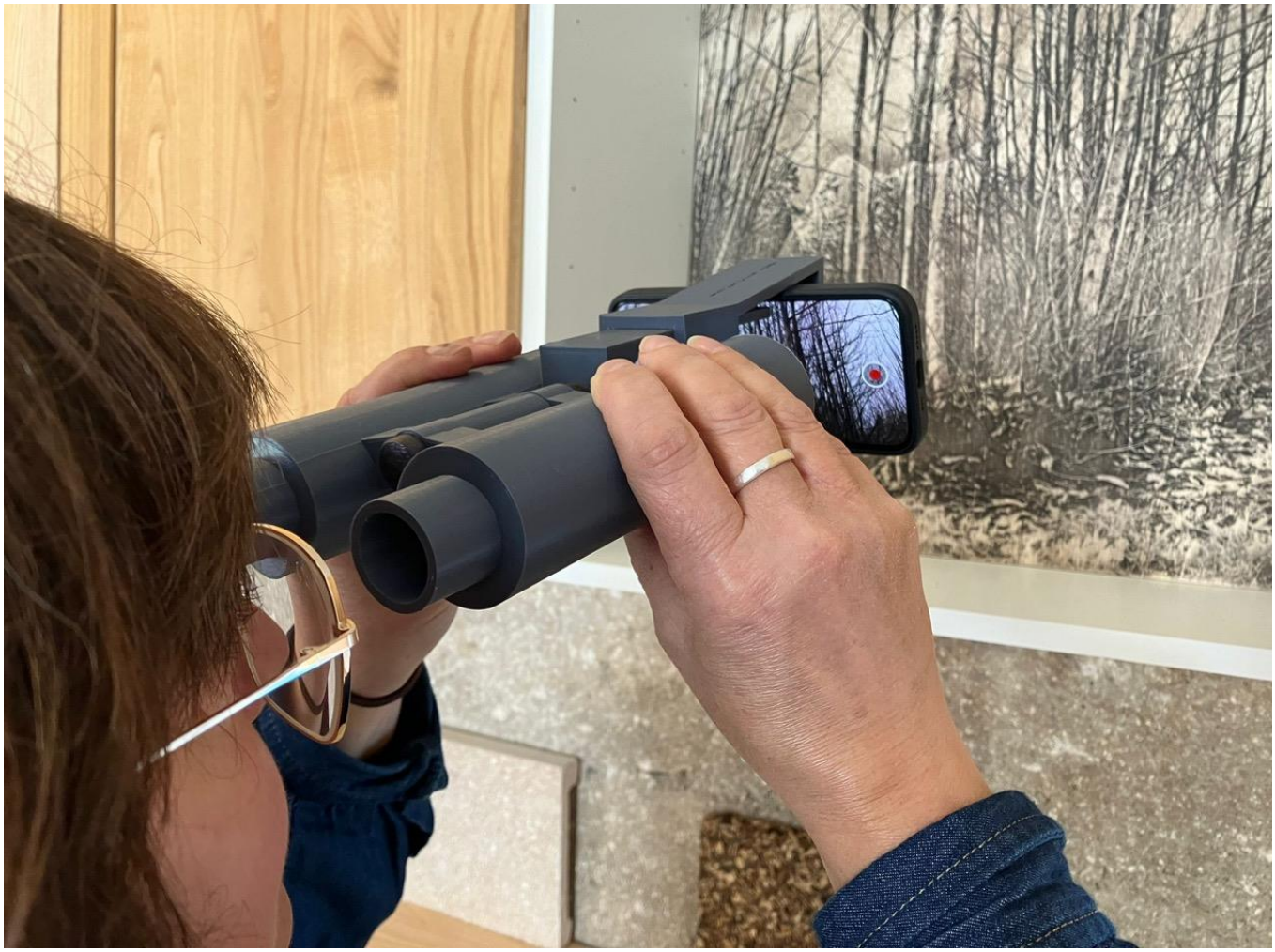

Figure 3. Augmented reality kitchen and binoculars enable moving image and sound access to woodland environment that is benefiting from timber rotational resource management. Image xxxx

Unlike top-down retrofitting schemes that impose solutions on residents, *Wildhouse* actively involves stakeholders in shaping the living environment. Through co-design workshops, residents, service providers and suppliers collaborate with designers, ecologists, and material innovators to envision homes that reflect their values and aspirations. These workshops explore how regenerative resources, objects, and interfaces can forge meaningful, educational, and joyful relationships between people and nature, ensuring that sustainability is not only practical but also desirable.

Wildhouse serves as a testbed for exploring the feasibility of integrating regenerative design into mainstream housing policy and supply chains. Through collaborations with local councils and other key stakeholders, the project generates critical insights into the economic, ecological, and social viability of regenerative retrofitting. It raises fundamental questions about the accessibility of regenerative materials and design processes, challenging the assumption that such approaches are only viable within high-end, bespoke architectural projects.

One of the project's key research inquiries is whether nature-prioritised products and materials can be integrated into mass social housing supply chains, or whether they remain confined to the margins of design culture. Additionally, *Wildhouse* examines how social housing providers can leverage regenerative resourcing methods to meet legislative requirements for carbon reduction, local employment, and biodiversity net gain.

By aligning ecological regeneration with pressing policy and economic considerations, *Wildhouse* positions regenerative retrofitting as a practical, future-proofing systemic opportunity. Through its participatory approach, the project seeks to cultivate a community of practice around regenerative design, engaging social housing tenants, policymakers, and industry stakeholders in a shared vision for ecological living. It also produces critical insights into the desirability, feasibility, and real-world impact of regenerative housing, generating data that can inform future policy and investment decisions.

Figure 4. WildHouse work in progress of regenerative retrofit. Image xxxx

4. Implications for Ecological Citizenship and retrofit

One of the most profound contributions that Wildhouse looks to make is its ability to embed ecological citizenship into the everyday lives of homeowners and residents. Traditional sustainability initiatives often frame environmental responsibility as a series of abstract or distant actions, such as reducing emissions or supporting biodiversity through conservation efforts. However, Wildhouse has the potential to challenge this separation by demonstrating that Ecological Citizenship can be cultivated through direct, material interactions within the home. By situating regenerative design within social housing, Wildhouse seeks to also ensure that ecological engagement is not confined to a privileged few but is made accessible to a diverse range of residents. The inclusion of

immersive, sensorial experiences could create a tangible sense of interconnection between human habitation and the ecosystems from which building materials originate. This shift from passive awareness to active participation has the potential to act as a critical step in fostering a sense of stewardship and long-term engagement with ecological principles. Moreover, the co-design and participatory elements of the Wildhouse project could further empower residents to take ownership of sustainable living practices. This approach would challenge the conventional top-down model of social housing retrofits, which often neglects the agency and lived experiences of residents. Instead, Wildhouse could cultivate an inclusive, place-based form of Ecological Citizenship where people are encouraged to shape and live in their built environments in ways that support both human and non-human life.

The project also has the potential to highlight how regenerative retrofitting could go beyond efficiency to actively restore ecosystems, enhance biodiversity, and create spaces that contribute positively to human well-being. This broader perspective on retrofitting could have significant implications for housing policy and urban sustainability. If adopted at scale, regenerative retrofitting could shift the construction industry away from a linear, extractive model towards a circular, place-based approach that considers aspects such as the entire lifecycle of materials and their more direct relationship to local ecologies. This would not only reduce the environmental footprint of the built environment but could also offer up opportunities for new forms of economic and social value, such as local material supply chains, community-driven innovation, and nature-based employment opportunities. Furthermore, the project raises critical questions about the accessibility and affordability of regenerative design. One of the key barriers to implementing nature-prioritised products in mainstream social housing is the perception that they are costly or impractical at scale. Wildhouse could challenge this assumption by demonstrating that regenerative retrofitting can be both viable from an economic perspective and socially beneficial, particularly when framed as an investment in long-term resilience rather than as an upfront cost. The project's partnerships with local authorities and social housing providers looks to illustrate the potential for aligning ecological restoration with existing policy frameworks, including Local Nature Recovery Strategies (LNRS) and Biodiversity Net Gain (BNG) requirements for instance.

What’s more, a key challenge in scaling regenerative retrofitting lies in overcoming institutional inertia and shifting industry habits and promoting sectoral collaboration. Retrofitting at scale is often dictated by standardised procurement processes that too often prioritise ‘cost’ and budgets over long-term ecological benefits - these can and should coexist and provide complimentary benefits across a range of metrics. Wildhouse could demonstrate the need for new approaches to procurement that consider the full life-cycle impacts of materials and the potential for regenerative design to create social and environmental co-benefits. By engaging policymakers, housing providers, and supply chain actors in the design and implementation process, the project could highlight a pathway for integrating regenerative practices into mainstream housing strategies.

Table 2. Implication of regenerative retrofit- informed by *Wildhouse*

	Implications of Regenerative Retrofitting
Ecological Citizenship	Regenerative retrofitting could foster deeper connections between people and their environment by integrating nature into everyday living, encouraging stewardship and sustainable behaviours.
Beyond energy efficiency	Unlike conventional retrofitting, which focuses on reducing energy use, regenerative approaches could enhance biodiversity, restore ecosystems, and promote circular material flows.
Scalability & policy influence	Demonstrating successful regenerative retrofits could inform housing policy, influencing large-scale implementation and regulatory support for nature-based solutions.
Social housing & equity	Regenerative retrofits could ensure that sustainable, nature-integrated design is accessible to all, reducing the gap between eco-conscious housing and social housing sectors.
Community-led design	Engaging residents in co-design processes could lead to more contextually relevant solutions, fostering a sense of ownership and long-term commitment to sustainable practices.
Holistic well-being	By incorporating natural materials, biophilic design, and ecosystem services, regenerative retrofitting could improve mental and physical health outcomes for urban populations.
Future-proofing urban spaces	As climate resilience becomes critical, regenerative retrofits could provide adaptive, low-impact solutions that benefit both people and the planet.

5. Informing the future

Informed by this discussion and the *Wildhouse* project, a primary area for future research could involve understanding how the principles of ecological citizenship evolve over time when residents are embedded in regenerative living environments. While *Wildhouse* introduces this concept in a tangible way, long-term studies are needed to assess the depth and sustainability of ecological engagement as well as the impacts of resourcing in the (resourcing) landscape. Research could track how residents' relationships with nature develop, moving from abstract awareness of environmental issues to active engagement with the environment. This could include further studies into how the scale and demand for social housing may stimulate disruptive models for better landscape management and resourcing and the potential for the delivery of Biodiversity-Net-Gain through social housing resourcing models itself rather than landscaping and offsetting. By examining the social dynamics of communities living in regenerative homes and their appreciation (or not) of more 'natural' interactions, researchers could identify key drivers of long-term behavioural shifts, informing strategies for fostering wider Ecological Citizenship beyond the boundaries of the individual home. However, the long-term ecological benefits of such interventions need to be accurately assessed. Future research could track changes in local biodiversity and ecosystem health as a result of regenerative retrofitting. This would involve long-term ecological monitoring, looking at factors such as wildlife populations and air quality over time. Understanding the broader ecological impacts of these designs, and comparing them with more traditional approaches, could build a compelling case for adopting regenerative

practices at a larger scale, influencing urban planning and policy frameworks.

One critical challenge to scaling regenerative retrofitting is economic viability, particularly in social housing contexts. The initial perceptions of high costs often hinder the uptake of nature-based solutions. However, as presented here, regenerative retrofitting could offer long-term savings in terms of maintenance and energy use, if framed as an investment in resilience and better programmed and collaborative use of landscape resources that are undermanaged. Future research could delve deeper into the financial models that would make regenerative retrofitting economically feasible at scale. Additionally, research could explore alternative funding mechanisms, such as community-based financing and agribusiness models, to make these practices more accessible to low-income and marginalised communities.

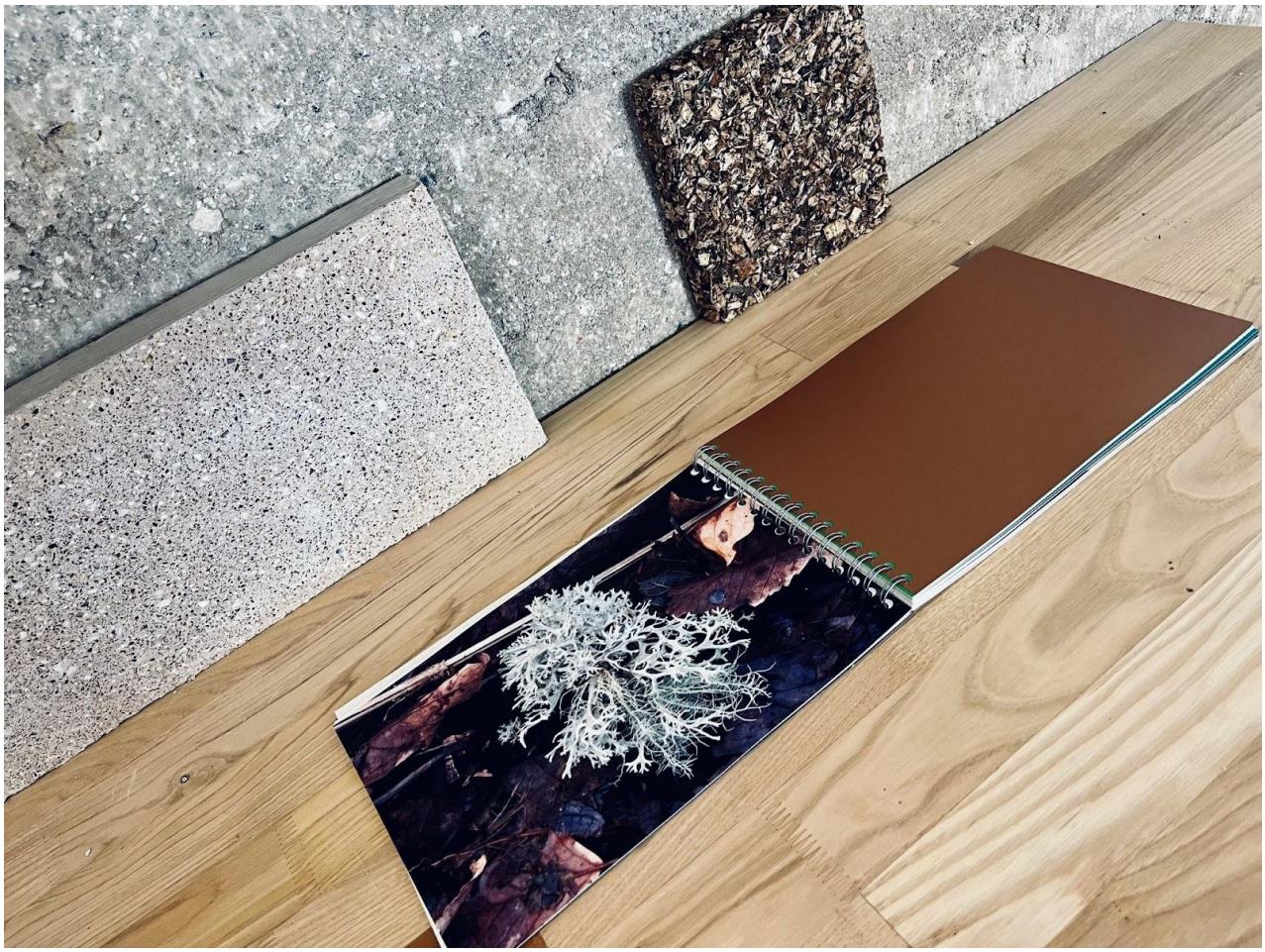

Figure 4. Wild House - Materials and resource site sample book. Image xxxxx

As noted above, institutional inertia within the construction and housing sectors presents a significant barrier to scaling regenerative retrofitting. Future research could further highlight mechanisms to overcome the institutional barriers that inhibit the adoption of these practices. This includes examining procurement processes, regulatory frameworks, data-sharing, collaborative stockpiling and the lack of joined-up mindset of industry stakeholders who may prioritise short-term cost and speed over long-term ecological and social benefits. Research could investigate new models for policy and procurement that ‘value’ regenerative design, highlighting successful case studies where such models have been implemented. Additionally, exploring how these frameworks can be integrated into existing urban policies, such as those relating to climate resilience and biodiversity,

could provide a pathway for shifting industry norms and institutional behaviours towards more sustainable practices.

On a broader scale, future research could explore how regenerative retrofitting practices can be adapted to different cultural and geographical contexts. *Wildhouse's* impact could be more widely understood by comparing how similar principles of ecological design are implemented in various global regions. Cross-cultural research could highlight region-specific challenges, from climate considerations to local construction practices, providing a more nuanced understanding of how regenerative retrofitting can be adapted and scaled across diverse contexts. This transnational exchange of knowledge could play a critical role in shaping global standards for regenerative housing and fostering international collaboration on sustainability initiatives.

6. Conclusion

Regenerative retrofitting represents a transformative shift in how we approach sustainable housing, offering a solution that looks to extend beyond energy efficiency and carbon reduction to actively contribute to ecological and social regeneration. By integrating nature-based solutions, circular material strategies, and participatory design, regenerative retrofitting offers a redefinition of the role of buildings within natural systems, transforming them from passive structures into active participants in ecological renewal. This approach forefronts the use of bio-based materials, promotes potential pathways to biodiversity, and fosters a tangible connection between residents and their ecosystem. Regenerative retrofitting also opens pathways to Ecological Citizenship by engaging communities in the design and implementation and even long-term monitoring of their environment and the broader ecosystems they inhabit. This participatory approach not only improves the physical infrastructure but also provides a route to strengthen social cohesion, hopefully encouraging long-term commitment to sustainability and environmental stewardship. By moving beyond conventional retrofit models that prioritise operational efficiency, regenerative retrofitting highlights the importance of embodied carbon reduction, biodiversity enhancement, and the creation of resilient, nature-integrated urban environments.

Additionally, regenerative retrofitting attends to practical and scalable solutions to the pressing challenges of climate change, biodiversity loss, and social inequality where it is needed most. By generating a demonstration that sustainable housing can be both affordable and accessible, this approach challenges traditional notions of retrofitting as only open to the able-to-pay and instead paves the way for its widespread adoption in social housing and beyond. The *Wildhouse* project signals how regenerative retrofitting might be implemented within social housing, offering a model that blends ecological restoration with community empowerment. Ultimately, regenerative retrofitting has the potential to catalyse a broader cultural and policy shift towards more sustainable, resilient, and community-centred urban living. This model presents an opportunity to bridge the gap between environmental responsibility and social equity, creating spaces that contribute positively to both human well-being and ecological restoration.

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Author 1 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE] [_P/RoD Author Bio and Acknowledgements]

Author 2 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE]

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