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ROUNDTABLE

Nature-Based Solutions to Promote Just Transitions for Climate Change and Antimicrobial Resistance: Reflections from Multisectoral Roundtables

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Abstract

Nature-based solutions (NbSs) are increasingly recognised for their potential to address climate change and biodiversity loss, but their role in mitigating antimicrobial resistance (AMR) remains underexplored. AMR and climate change share environmental drivers, such as pollution, ecosystem degradation, and industrial agriculture, yet responses often remain fragmented and technocratic. This paper draws on a global roundtable series convened under the British Academy's "Just Transitions for AMR" initiative to explore how NbS can support more just, equitable, and integrated responses to these intersecting crises. Bringing together 46 experts from public health, environmental science, agriculture, governance, and social sciences, the roundtables facilitated interdisciplinary exchange across Africa, Asia, and Europe. The paper synthesises insights across four thematic areas: conceptualising Just Transitions in NbS, identifying co-benefits for scaling NbS for climate and AMR mitigation, addressing implementation barriers, and proposing future directions. Findings emphasise the need to reframe NbS as socially embedded practices co-designed with communities, rather than as technical fixes. Participants called for investment in place-based approaches, participatory monitoring, and governance structures promoting inclusion. The paper concludes by aligning NbS with One Health and Just Transition principles, urging a shift from isolated interventions to systems-oriented transformations that redress power imbalances in environmental and health governance.

Keywords: antimicrobial resistance; climate change; Just Transitions; nature-based solutions; roundtables

1. Rethinking planetary health through nature-based solutions

Nature-based solutions (NbSs) are approaches that protect, restore, and manage ecosystems to address societal challenges while promoting biodiversity and human well-being. From

constructed wetlands that filter pathogens to agroecological practices that reduce chemical inputs and carbon emissions, NbS have gained global attention as integrated responses to the climate crisis, biodiversity loss, and other planetary health threats that stipulate the importance of equitable and just solutions.[1]

While the climate-related benefits of NbS are widely recognised, their potential for mitigating antimicrobial resistance (AMR), a parallel and urgent global health threat, remains underexplored.[2] The importance of catalysing action to address environmental drivers of AMR was recognised in the 2024 Political Declaration from the United Nations General Assembly.[3] AMR and climate change may exacerbate each other, as well as sharing overlapping drivers such as environmental degradation, water pollution, industrial agriculture, and overuse of antimicrobials.[4] Climate change can influence AMR directly through its impacts on microbial and host–pathogen dynamics. Climate-related stresses on microbial ecosystems can accelerate bacterial replication and mutation rates, thus enhancing the abundance, richness, and diversity of antimicrobial resistance genes (ARGs) in the environment. Furthermore, climate change modifies the habitat, distribution, evolution, and transmission of climate-sensitive pathogens, altering host–pathogen epidemiology and antimicrobial use. Extreme weather events such as floods and droughts can create socio-environmental disruptions, affecting sanitation systems and access to clean water, heightening infectious disease burdens, complicating access to healthcare, and fostering conditions that can lead to greater antibiotic use and misuse.

These cascading and interconnected effects underscore the need to address AMR not only through biomedical interventions but also by tackling broader ecological disruptions linked to climate change and environmental degradation.[5] Addressing these challenges in isolation has led to fragmented responses that overlook the generative potential of natural ecosystems.[6] Additionally, most existing environmental responses to AMR have focused on technological innovations, such as advanced wastewater treatment systems designed to remove antibiotic residues or the development of synthetic antimicrobial agents to reduce reliance on existing antibiotics.[7]

A roundtable series was held as part of the British Academy's "Just Transitions for AMR" global convening series.[8] This emerged from a growing recognition that both climate change and AMR require systemic, equitable, and cross-sectoral solutions.[9] The concept of "Just Transitions," originally rooted in labour and climate justice movements, emphasises the importance of ensuring that sustainability transformations promote fairness, inclusion, and participatory governance.[10] Equitable change requires inclusive decision-making and policies that do not exacerbate inequalities in benefits and harms.[11] Within this context, NbS offers a valuable, yet underutilised opportunity to promote integrated action on planetary health.[12]

[1] Cohen-Shacham et al. 2016; Huxham et al. 2023; IUCN 2020.
[2] UNEP 2023.
[3] United Nations 2024.
[4] Magnano San Lio et al. 2023; van Bavel et al. 2024.
[5] Magnano San Lio et al. 2023; van Bavel et al. 2024; Zhou et al. 2023.
[6] Hajjar et al. 2023; Visca et al. 2024.
[7] Zhou et al. 2023.
[8] British Academy n.d.
[9] Lewycka et al. 2025; van Bavel et al. 2024.
[10] Swilling and Annecke 2022.
[11] Leal Filho and Pons-Giralt 2024.
[12] Turner et al. 2022.

2. Purpose and scope of the manuscript

This paper draws on insights from a series of multisectoral in-person and hybrid roundtables that brought together multidisciplinary experts, practitioners, researchers, and policymakers from Africa, Asia, Europe, and international organisations to explore how NbS interventions can mitigate AMR risk through ecological processes while simultaneously addressing climate change. Participants were encouraged to look beyond techno-centric interventions and consider NbS as transformative tools for planetary health rooted in justice and systems thinking.[13]

More than a showcase of interventions, this paper synthesises key insights from the roundtables, highlighting underlying assumptions, blind spots, and aspirations shaping how NbS are conceived, implemented, and evaluated in response to climate change and AMR. The roundtables were positioned not simply as technical forums, but as deliberative spaces for reimagining the epistemologies, justice-oriented principles needed to align environmental sustainability with health equity. The paper also informs researchers, policymakers, and practitioners about opportunities and challenges of adopting NbS as part of just transitions, particularly in low- and middle-income countries where both AMR and climate threats are acutely felt (See Appendix: Methodological Approach).

3. Key thematic insights from the roundtables

3.1. Conceptualisation and operationalisation of just transitions in NbS implementation

Across all roundtables, participants emphasised that implementing NbS must not be seen merely as a question of how efficiently they support ecosystems; rather they must be considered within the broader concept of Just Transitions. This includes consideration for procedural justice (inclusive decision-making), distributive justice (fair distribution of benefits and harms), and restorative justice (addressing historical inequalities).[14]

In Hanoi and Pretoria, participants highlighted how interventions to reduce antimicrobial use in agriculture can unintentionally burden smallholder farmers if not designed with economic and cultural sensitivity. Beyond economic risks, the politics of NbS also raised questions of legitimacy: Who defines what counts as a valid NbS? Who benefits? Who is excluded? Several participants critiqued externally designed "green" projects that overlook indigenous environmental systems, risking alienation of local actors and poor uptake.

"Procedural justice" emerged as a recurring theme. Calls were made for transparent governance structures, meaningful community consultation, and adaptive feedback mechanisms. Across all roundtables, "Just Transition" was seen as both aspirational and methodologically challenging. Participants cautioned that NbS cannot simply be "plugged in" to existing systems, but must instead be embedded in broader social, ecological, and economic transformations that confront root causes of inequality.

3.2. Co-benefits, opportunities, and motivators for scaling NbS

Participants across all roundtables discussed context-specific examples of NbS that show promise in addressing AMR and climate change simultaneously. In Vietnam, mangrove

[13] UNEP 2023; WHO 2016.

[14] Leal Filho and Pons-Giralt 2024; Varadan et al. 2024.

forest restoration was mentioned as an example of ecological and health benefits with the potential to reduce antibiotics residues. Previous studies found that mangrove forests might reduce salinity and microbial load in aquaculture environments, lower antimicrobial use, and act as carbon sinks and storm buffers.[15] Similarly, constructed wetlands were cited as promising interventions for treating hospital and agricultural wastewater. Participants discussed a case example from Vietnam that illustrated how wetlands could reduce pharmaceutical pollutants, including antibiotic residues, while restoring biodiversity and enhancing carbon sequestration in wetland soils.[16]

Furthermore, agricultural interventions featured prominently, including improved manure management strategies such as composting and anaerobic digestion, which can reduce antibiotic residues in soil and water while simultaneously enhancing carbon sequestration and soil fertility.[17] Biochar production from livestock waste was also cited for its dual ability to enhance soil fertility and capture antibiotics and greenhouse gases during adsorption processes. These discussions provided insights into how regenerative practices can deliver environmental and health benefits simultaneously.

Moreover, the discussions revealed clear enablers and motivators that could accelerate the uptake of NbS for climate change and AMR mitigation. One key driver was cited as the growing awareness and political traction of the One Health approach, which promotes integrated action across human, animal, and environmental health sectors. Participants noted a rise in political interest in sustainable farming, partly driven by international climate commitments and food system reform movements. In some cases, NbS are gaining attention because they align with multiple national priorities, including food security, biodiversity conservation, rural livelihoods, and disease prevention, making them more attractive to policymakers and development partners.[18]

Policy integration was seen as a key opportunity. Embedding NbS within national climate action plans, food security strategies, and AMR action plans was viewed as essential for coordinated, cross-sectoral action. Participants agreed that framing NbS as "win-win" strategies, improving productivity, reducing antibiotic use, and contributing to climate goals were effective for advocacy and engagement.

Education and farmer-led innovation were also highlighted as powerful grassroots drivers. Cited examples include farmers adapting composting into low-cost biochar production techniques or coastal aquaculture groups experimenting with mixed seaweed and fish systems to restore nutrient balance and reduce disease burden. Market-based mechanisms such as eco-labels, certification schemes for antibiotic-free products, and ESG-linked investment (environmental, social, and governance) strategies were highlighted as incentives that could support wider uptake.

3.3. Barriers to implementation and critical gaps

Despite promising examples, participants were frank about the persistent barriers limiting wider adoption of NbS interventions. Many challenges extend beyond technical limitations,

[15] Asari et al. 2021.
[16] Roundtable Discussions, Hanoi, 2024.
[17] Hanoi Roundtable, January 2024.
[18] Cohen-Shacham et al. 2016.

reflecting structural blind spots in how environmental and health interventions are designed, financed, and governed.

A key concern was the dominance of short-termism in donor cycles and policy planning. Most NbS, especially those involving ecosystem restoration or microbial ecosystem recovery, would require long timelines to deliver measurable ecological or health benefits, but most funding and reporting mechanisms are constrained to one- to three-year periods.[19] This misalignment hinders long-term investment, monitoring, and scalability. Participants highlighted that without adequate resources and sustained support, many interventions remain confined to pilot projects with limited reach.

Evidence hierarchies also emerged as a critical issue. Participants noted that knowing "what counts" as evidence in global funding and policy spaces tends to prioritise quantitative metrics and cost-effectiveness models, often at the expense of indigenous ecological knowledge and lived community experiences. This reflects broader issues of epistemic injustice in climate and AMR fields, where certain knowledge systems are systematically undervalued or excluded from decision-making processes.[20] Such epistemic bias not only limits understanding but also excludes key perspectives needed for inclusive NbS implementation. The co-benefit framing, while seen as rhetorically powerful, also brought up tensions. Some participants warned that emphasising "win-win" strategies can sometimes obscure trade-offs, such as competing land and water uses, or the exclusion of local communities from restored ecosystems.

Traditional knowledge and community-led practices in NbS planning and implementation were repeatedly highlighted as critical yet undervalued components of successful interventions, especially in Hanoi and Pretoria roundtables. Participants critiqued externally imposed models that prioritise "technical innovation" over lived knowledge, risking interventions that are ecologically sound but socially misaligned.

The disproportionate concentration of NbS research in regions such as Europe and China, which together would likely account for more than half of all peer-reviewed publications on NbS for climate change and AMR was also highlighted, demonstrating geographical disparities in existing evidence. Participants voiced concern that this uneven distribution not only limits the geographical and ecological scope of available evidence, but also reinforces existing imbalances in knowledge systems validation, limited transferability of the knowledge, local innovation, and reinforcing power asymmetries in knowledge systems.[21]

Participants highlighted persistent data gaps, particularly the lack of integrated and cross-sectoral data linking NbS, AMR, and climate change. Despite these gaps, it was mentioned that even in the absence of comprehensive datasets, action can and must proceed. A major barrier identified across all roundtables was the absence of standardised, multi-dimensional monitoring frameworks. Current evaluation systems tend to prioritise quantifiable environmental indicators such as carbon sequestration, vegetation cover, or water retention capacity while neglecting health-related outcomes, particularly those relevant to AMR.[22] Although climate benefits of NbS are increasingly measured, AMR outcomes such as the reduction in antibiotic residues in soils or water, the decline of antimicrobial resistance

[19] Chausson et al. 2020.
[20] Cheah, Lewycka, and de Vries 2025.
[21] Roundtable Discussion, Pretoria, November, 2024.
[22] PAHO/WHO | Pan American Health Organisation 2017.

genes (ARGs), or changes in infection burdens in surrounding communities remain poorly captured, despite being critical for policy and funding decisions.[23]

Furthermore, advocacy for AMR faces distinct challenges. Unlike climate change, which benefits from defined benchmarks and global agreements, AMR lacks comparable frameworks, making coordinated actions and political traction more difficult. Participants also noted that even in the climate space, where data is abundant, progress is often stalled by limited political will, underscoring that evidence alone is not enough without public mobilisation and leadership.

Institutional fragmentation emerged as a persistent barrier. Participants across all roundtables described how ministries of health, environment, agriculture, and infrastructure often operate in silos with separate budgets, mandates, and data systems resulting in missed opportunities for coordinated action. As one participant noted: "*We have the pieces of the puzzle, but no one is assembling the picture.*"

4. Integrated recommendations and reflections on future directions

Rather than producing a fixed set of recommendations, the roundtables surfaced strategic tensions that future research, policy, and practice must grapple with if NbS are to address both AMR and climate change meaningfully. What follow in this paper are not prescriptive action points, but key thematic directions drawn from participants' reflections, proposals for how the field might advance with greater equity, rigor, and contextual awareness.

4.1. Reframe NbS beyond technocratic tools

Participants across all four roundtables stressed the need to reframe NbS not merely as technical fixes or ecological "interventions," but as socially embedded, culturally meaningful, and politically situated practices. This shift requires moving away from viewing NbS as isolated and technical tools and instead recognising them as part of complex socio-ecological systems shaped by history, power, and place. This reframing is particularly relevant for AMR mitigation, where narrow technological responses, such as improved sanitation or waste treatment, often overlook the social, governance, and ecological systems that shape antibiotic use and resistance. By embedding NbS within just and inclusive systems, they can contribute more meaningfully to long-term AMR containment.

Participants cautioned against what some termed the "mechanical logic of green development," interventions that replicate ecological functions such as carbon sequestration and water filtration while ignoring the communities and governance systems that sustain them. This critique echoes broader literature warnings that when NbS are implemented through purely technocratic or efficiency-driven frameworks, they risk ignoring local realities and exacerbating existing inequalities.[24] For instance, a constructed wetland might be lauded for its ability to treat pharmaceutical waste and sequester carbon, but if it displaces customary land users or redirects scarce water resources, it may unintentionally undermine local livelihoods or fuel conflict. Participants warned that focusing solely on biophysical metrics like "tons of carbon stored" sidelines questions of who gains, who loses, and who decides. The London roundtable echoed these critiques, highlighting how

[23] UNEP 2023; Wall et al. 2016.

[24] Hellin et al. 2022; Seddon et al. 2020.

over-technologising NbS, akin to past reliance on engineering-based climate solutions, risks repeating governance failures. NbS should instead be embedded in broader societal transformations that centre equity, justice, and co-governance.

Participants called for a re-grounding of NbS within local systems of stewardship and care, sharing examples of traditional practices such as rotational grazing, sacred groves, or mixed aquaculture systems that exemplified nature-based principles long before the term gained currency. These practices are not only ecologically sound but also embedded in cultural worldviews, collective labour arrangements, and spiritual relationships with land and water.

This broader framing challenges the dominance of technoscientific expertise and opens up space for plural knowledge systems, including indigenous ecological knowledge and local experimentation. As other authors argue, resilience-oriented strategies that emerge from lived experience are often undervalued in global policy discourses, despite being crucial for adaptive capacity and social legitimacy.[25]

Importantly, participants questioned the prevailing emphasis on "scaling up." Rather than scaling up through replication, they proposed thinking about "scaling out," supporting networks of context-specific practices, peer learning, and distributed governance that strengthen the collective ecosystem of NbS actors without erasing local differences.

In ecosystems heavily affected by factors such as aquaculture or livestock farming, this distributed model can support locally grounded solutions that reduce antibiotic reliance while maintaining ecological balance. Participants highlighted that designing NbS as socially grounded processes also means involving communities as co-designers and stewards, not just beneficiaries. This requires investing in participatory planning, inclusive feedback loops, and governance structures that reflect procedural justice, a core tenet of Just Transitions. Without this, NbS risks replicating the same top-down exclusionary models that have historically undermined sustainability efforts. For NbS to support lasting transitions, they must reflect and reshape the social and political systems in which they operate.

4.2. Build a research agenda that prioritises under-represented contexts

Participants consistently emphasised the urgent need to shift research priorities towards regions where the intersection of ecological vulnerability, AMR burden, and climate impacts is most acute, notably sub-Saharan Africa, Southeast Asia, and parts of Latin America. These regions hold the greatest potential for transformative NbS, yet they remain significantly under-represented in funding pipelines, academic outputs, and global partnerships. This concern was particularly strong for AMR. As one participant noted in Pretoria, "*We still don't know enough about how resistance is spreading through our soil and water systems because most studies are being done elsewhere.*" Several participants pointed out that research on NbS for AMR and climate change is heavily concentrated in regions like Europe and China, with limited attention to tropical ecosystems, small-scale farming, or informal waste systems that characterise many low- and middle-income settings.[26]

[25] Gómez-Baggethun, Corbera, and Reyes-García 2013; UNEP 2023.
[26] Roundtable Discussion, Pretoria, November 2024; van Bavel et al. 2024.

Rather than applying NbS models developed or tested in high-income contexts, participants stressed the importance of co-creating context-specific solutions with local researchers, farmers, fishermen, and indigenous knowledge holders. Research must respond to community-defined priorities and ecological realities, not merely imported from elsewhere.

This call resonates with broader global calls for epistemic justice in environmental health research, which entails not only diversifying who conducts research, but also rethinking how research questions are formed; whose knowledge is legitimised; and how findings are interpreted, shared, and acted upon.[27] Without this critical lens, NbS research risks replicating extractive models in which communities are treated as passive data sources rather than co-producers of knowledge.

Participants in Hanoi and Pretoria gave several examples of practices that remain invisible in mainstream research, including herbal livestock treatments or community-managed aquaculture, both of which may contribute to reduced antibiotic use while supporting ecological resilience.

In practical terms, participants recommended several strategies to rebalance the research landscape:

- Invest in long-term research capacity within low- and middle-income countries (LMICs), including through funding regional research hubs and building graduate training programmes embedded in local institutions;
- Support South–South collaborations and regionally led networks that prioritise locally defined research agenda;
- Develop context-appropriate success indicators that capture social, cultural, and ecological dimensions beyond standardised global metrics;
- Encourage transdisciplinary approaches that bridge ecology, public health, traditional medicine, economics, indigenous studies, and environmental justice.

London discussions reinforced the need for flexibility in defining success, recognising that effective NbS may look different depending on the place. Participants stressed that outcomes cannot always be measured in the same way across diverse settings. In the case of AMR, this means that counting antibiotic residues or resistant bacteria is important, but so is listening to how farmers, health workers, and households perceive and manage resistance. Understanding these social dynamics can offer powerful insights for reducing unnecessary antibiotic use and building trust in nature-based practices.

4.3. Advance monitoring frameworks that capture co-benefits and trade-offs

Participants across all roundtables emphasised the need for integrated indicators that align with the One Health paradigm, capturing environmental, human, and animal health outcomes simultaneously. Suggested measures included reductions in microbial loads and greenhouse gases emissions, improvements in soil health, and social science-informed indicators such community satisfaction, behavioural change, and governance effectiveness.

[27] Topp 2020.

Literature also highlights the potential for adapting existing environmental impact assessment models to include AMR-specific parameters and integrated One Health metrics.[28] However, many participants noted that AMR-related outcomes are still rarely included in NbS monitoring frameworks. Indicators such as reductions in antibiotic residues, ARGs, or changes in infection patterns in nearby communities are often missing, despite being critical to understanding co-benefits. This was identified as a significant gap that limits the ability to advocate for NbS as tools for AMR mitigation.

Effective NbS, participants argued, must be socially and culturally embedded, drawing on indigenous knowledge systems and participatory governance structures rather than externally imposed technical models. This perspective was echoed in calls for monitoring and evaluation frameworks that reflect diverse knowledge and complex realities. Participants stressed that understanding the co-benefits and trade-offs of NbS requires blending quantitative metrics with qualitative, context-specific social insights, such as perceptions of fairness, trust, and power dynamics, to inform equity, governance, and social transformation.

In contrast, the London roundtable revealed a tendency to prioritise quantifiable outputs and surveillance systems, illustrating regional differences in evidence preferences and policy framing.

A key recommendation was to develop localised and context-sensitive monitoring frameworks. While standardised global indicators can support coordination, they may overlook local ecological conditions, priorities, and culturally embedded notions of success. To address this, participants advocated for participatory, community-led systems such as citizen science, community health worker reporting, and local ecological monitoring as essential tools to ensure relevance, accountability, and legitimacy of NbS monitoring. One participant in Pretoria noted, "*Monitoring should not be something done to communities, but with them, especially when it comes to issues like antibiotic use or farming practices that people manage daily.*"

4.4. Invest in collaborative governance and economic innovation

While technical feasibility and ecological performance are often emphasised in NbS discussions, the roundtables revealed that governance and financing models are equally critical to long-term success. It was emphasised that NbS must be intentionally embedded within intersectoral governance platforms such as One Health coordination bodies, national task forces, or local multi-sectoral planning councils. These structures can facilitate alignment of priorities, joint resource mobilisation, shared monitoring, and collaborative intervention design. Beyond efficiency, such platforms are also seen as essential for fostering co-ownership and adaptive learning across sectors.[29] The discussions stressed that multisectoral governance must institutionalise procedural justice by ensuring that local communities, farmers, and indigenous groups participate in decision-making processes as co-creators of NbS strategies.

Integrated governance is particularly relevant to AMR. Participants noted that decisions related to antibiotic use, waste management, and environmental regulation are often made in isolation by different ministries or agencies. Without shared planning, promising

[28] Sutherland et al. 2022; WHO, 2016.
[29] Nilsson 2016.

interventions, such as improved wastewater reuse or sustainable aquaculture, can fall through the cracks.

Economically, participants called for the adoption of full-cost accounting frameworks that capture environmental and public health co-benefits, such as reduced infection rates, lower antibiotic use, improved food security, and enhanced resilience. Although these models are closely aligned with planetary health and Just Transition goals, they remain underused in most donor and policy evaluations systems.[30]

To support NbS at scale, participants advocated for more innovative and inclusive financing mechanisms, including:

- public-community partnerships, where local governments and grassroots organisations jointly fund and manage NbS initiatives;
- performance-based payments, with funding tied to demonstrated health and climate outcomes over time; and
- blended financial models, combining donor grants, private investment, and national budget to reduce risks and promote equitable implementation.

The relevance of these models for AMR and climate change mitigation was underscored in discussions around long-term infrastructure. Participants noted that NbS with health and environmental co-benefits often require sustained investment; short-term grants are insufficient, particularly when results may take time to emerge.

Across all roundtables, there was consensus that governance and financial mechanisms must be intentionally designed to promote equity and inclusion. Ensuring access for smallholder farmers, indigenous communities, women, and other marginalised groups, who often face barriers to formal financing yet stand to benefit significantly from NbS, is essential. Mechanisms for equitable benefit-sharing, tenure security, and democratic oversight were identified as key conditions for socially just and sustainable NbS scale-up. As one participant noted, "*Farmers can't be expected to reduce antibiotic use unless we support the systems that allow them to do so.*"

5. Conclusion and closing reflections

The roundtable series presented in this paper was not only a platform for exchanging ideas; it opened a space to re-imagine NbS as a means of addressing the intersecting crises of AMR and climate change through a Just Transition lens. Participants consistently challenged dominant paradigms that frame NbS as political tools or scalable technologies, emphasising instead the importance of lived experience and social, cultural, and governance dimensions that shape NbS.

One of the most resonant messages across all discussions was that effective NbS cannot be designed in isolation from the communities they are meant to serve, nor can they succeed without confronting systemic inequalities in knowledge, power, and resource distribution. Rather than adopting a standardised model that overlooks contextual differences, participants highlighted the need to centre NbS within place-based systems of care, drawing on plural knowledge systems and participatory governance.

[30] Dasgupta 2021.

The series also revealed the structural challenges that continue to hinder progress: short-term funding cycles, evidence hierarchies that marginalise community knowledge, and institutional silos that hinder collaboration. Yet participants also identified clear entry points, such as aligning NbS with existing policy mechanisms, scaling out locally rooted practices, investing in inclusive research, and embedding social equity into monitoring and financing frameworks.

As climate threats intensify and the burden of AMR increases, the imperative is not only to act, but to act differently. NbS holds transformative potential, if approached as part of broader societal transitions toward justice, equity, and ecological stewardship. Realising this potential demands more than technical solutions; it calls for fundamental reorientation in how we conceptualise sustainability, design interventions, and share power.

These roundtables offer more than a record of insights. They present a collective call to action to reshape the field of NbS through shared learning, distributed leadership, and a deep commitment to planetary and social health. In advancing this agenda, we must listen not only to data, but also to the marginalised voices, to the landscapes we depend on, and to the lived experiences that illuminate the path towards more just and resilient futures.

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Appendix A. Methodological approach

Methodological approach

The four roundtable discussions that inform this paper were designed not simply as consultative meetings but as reflective spaces to interrogate assumptions, foster interdisciplinary exchange, and surface cross-regional learning, bringing together sectors working on climate change, AMR, and environmental sustainability to explore NbS through a just transition lens.

In total, 46 experts participated, representing diverse professional backgrounds including veterinary medicine, public health, aquaculture, agriculture, environmental sciences, food systems, governance, antimicrobial stewardship, social sciences, and policy advisory.

Each roundtable was contextually distinct and grounded in its regional priorities:

- The first roundtable was held in hybrid format at the Royal Society in London, United Kingdom on 19 October 2023. It brought together experts working on NbS, AMR, and planetary health to discuss synergies across the triple planetary crisis (climate change, biodiversity loss, and pollution), and barriers to cross-sectoral integration.

- Two roundtables were held in Hanoi, Vietnam (on 21 December, 2023 and 18 January, 2024), focusing on Southeast Asia's practical experiences with integrated aquaculture, wastewater management, and One Health strategies by engaging participants from regional research institutions, UN agencies, donor organisations, and government ministries.

- The final roundtable was held on 21 October, 2024, at the Future Africa Campus of the University of Pretoria, South Africa. It convened a diverse group of researchers, public health experts, and environmental policymakers to explore potential NbS co-benefits for AMR and climate mitigation, with particular attention to multi-sectoral governance and justice-based approaches.

All discussions were facilitated through a semi-structured format grounded in literature-informed themes:

- Conceptualisation and operationalisation of Just Transitions in NbS implementation;
- Co-benefits, opportunities, and motivators for scaling NbS;

- Barriers to implementation and critical gaps;
- Integrated recommendations and reflections on future directions.

Facilitators employed participatory methods including thematic breakouts, structured brainstorming, and guided plenaries. Notes were captured in real time and later collaboratively reviewed and inductively synthesised to identify common themes, shared concerns, and tensions. Rather than producing consensus recommendations, the process prioritised reflection, critical engagement, and transdisciplinary co-production.

This process was not without limitations. The relatively short duration of each convening constrained deeper engagement with frontline practitioners and civil society actors. Although sectors were well represented, participation from smallholder farmers and local health workers was limited, restricting insights into on-the-ground implementation. Additionally, the absence of formal mechanisms for sustained post-roundtable collaboration underscored the need for more participatory follow-up processes to translate these reflections into actionable strategies.

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