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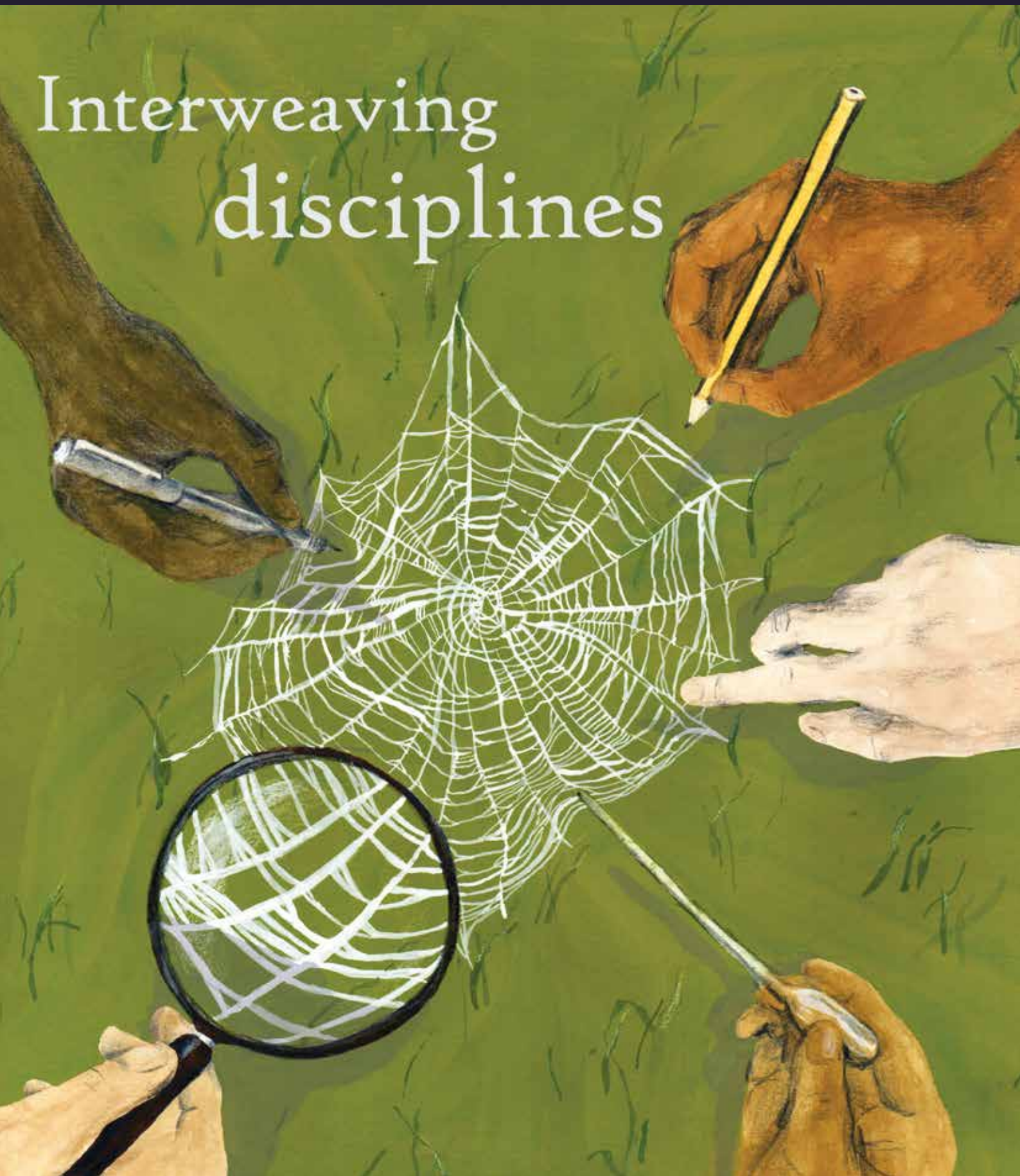

Foreword

Interdisciplinarity: from inception to day-to-day applicability

Twenty-five years ago, in September 2000, a new experimental interdisciplinary research centre began operations: the Tyndall Centre for Climate Change Research. Funded by three of the UK research councils covering natural science, economics, social science and engineering, the centre's aim was 'to create a novel interdisciplinary research programme involving climate scientists, technologists, engineers, economists and social scientists' and to 'develop new research that would meet the needs of business and government in relation to climate change'.

Twenty-five years on, the success of the centre in meeting these goals is debatable. But what is clear is that when researching deeply embedded and politically complex environmental phenomena such as climate change, water pollution or plastic waste, knowledge-making individuals, practices and institutions need to escape the confines and limitations of conventional discipline-based modes of inquiry.

Towards the end of my seven years as the centre's director, I highlighted three conditions that were necessary for successful interdisciplinary research. First, assemble research teams containing suitable combinations of people who are natural integrators and holistic thinkers with people who delight in digging deep into specialist and technical disciplinary knowledge. Using Isaiah Berlin's metaphor of the fox and the hedgehog, executing successful interdisciplinary research needs combinations of foxes (intellectual scavengers) and hedgehogs (well-drilled specialists).

Second is the need for incentive structures that define success in appropriate ways for interdisciplinary ventures. Most higher education research environments are still biased towards rewarding academic publication in specialist journals, although this has changed slightly for the better in recent years.

The third condition is to recognise that researching interdisciplinary solutions to environmental challenges inevitably exposes underlying differences about ethics (e.g. social justice), politics (e.g. the role of the state) and value systems (e.g. the value of a human or other sentient life). Solutions to complex environmental challenges like climate change are always going to be multifaceted, conditional and framed in terms of political and social acceptability. Neither researchers nor stakeholders should endow science – even interdisciplinary science, and either explicitly or tacitly – with greater power or authority than it has.

Reflecting on the early years of the Tyndall Centre, I believe our greatest success was nurturing a new generation of interdisciplinary scientists, engineers, social scientists, problem-solvers and integrators who subsequently made significant differences to the environmental challenges in which they invested their professional lives. This issue of *environmental SCIENTIST* shares the Tyndall Centre's aspirations: in this edition, you will find case studies in interdisciplinary practice alongside tools, frameworks and approaches for environmental scientists to engage with interdisciplinary thinking and working. The hope is that shared interdisciplinary missions will encourage all environmental professionals to work beyond conventional disciplinary boundaries and respond to the world's environmental challenges together.

Mike Hulme is Professor of Human Geography at the University of Cambridge. From 2000–7, he was the founding Director of the Tyndall Centre for Climate Change Research, a national interdisciplinary research consortium, and from 2008–20 was founding Editor-in-Chief of the interdisciplinary review journal *WIREs Climate Change*.

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Cover design: Claire Lavelle is an illustrator based in Brighton. A recent graduate from the Cambridge School of Art, she works with a variety of analogue media from ink to coloured pencils to collage. **clairelavelle.com**

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environmental SCIENTIST explores key issues in environmental science research and practice, featuring original articles by professionals, academics, and experts from across the sector.

The views expressed in the journal are those of the authors and do not necessarily reflect IES views or policy.

Frontiers of interdisciplinarity in the environmental sciences

Catherine Butler asks how we can push the boundaries towards greater collaboration in the need to tackle global problems.

The importance of interdisciplinarity has long been recognised as crucial to addressing environmental challenges. Responding to issues such as climate change clearly requires both the natural and technical sciences to develop a deeper understanding and to create possible solutions. However, it also requires important insight from social sciences and humanities, reflecting the recognition that the causes and necessary changes are inherently social, political and economic. This is echoed in both the funding and research landscapes in the UK and globally, with many of the major research centres that work to address environmental challenges being interdisciplinary in nature. Indeed, research has moved a long way from critiques of tokenistic interdisciplinarity in the environmental domain to much deeper forms of collaboration and boundary crossing in the contemporary context.

Alongside this, important developments have been made to connect through to wider expertise, going beyond more narrowly defined academic research teams to include practitioners, policy-makers, industry and wider research communities within projects from inception to delivery. Through these longer-term shifts, a wealth of literature has evolved addressing questions of interdisciplinarity in environmental science, reflecting on the challenges that remain for achieving the possibilities such forms of collaboration are hoped to engender, and proposing new ways forward.

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Numerous terms have emerged to capture different aspects of these collaboration processes between and among disciplines and practice, with cross-disciplinarity, multi-disciplinarity and trans-disciplinary being the most cited. Though there is little agreement on precise definitions, more generally, these terms seek to characterise different aspects of what interdisciplinarity has meant or could mean. This encompasses varied forms of working, such as bringing multiple disciplines to bear on a particular problem but without making connections between them or integrating them, through to transcending disciplinary knowledge fields to lead to the emergence of new world views.[1] These considerations around how to define or understand the ideas and manifestations of interdisciplinarity are matched by a large body of work covering attempts to achieve and enact it.

In this respect, the literature has addressed key themes of what has been referred to as border trouble, with many analyses raising issues relating to the differing assumptions, languages, methods, and understanding of knowledge that delay and prevent genuine interdisciplinarity.[2] These difficulties have long been discussed as being compounded through studies that confine interdisciplinary interactions to narrow project aspects rather than allowing it to more fully shape projects in their totality.[3]

As environmental issues have become increasingly urgent, researchers have been called upon to shift from merely providing knowledge about the problems to helping to define and develop solutions for them. This has further heightened the importance of interdisciplinarity, as it is widely recognised that solutions depend on context and require engagement with questions of implementation, which by necessity draw in social science and humanities expertise.[4] However, the shift to solutions-focused research also brings more challenges, particularly around the dominance of technical and quantitative research in some policy and practice cultures, and a tendency to narrowly frame research insights in ways that can privilege natural sciences.

Added to this, for some the move towards solutions-focused research has dampened the critical spirit that imbued interdisciplinarity at its outset.[5] Here, analysis cautions that interdisciplinarity risks becoming a mere fad, with instrumental or strategic reasons for engaging with it superseding its original inception as a critical–reflexive practice that responded to the apparent disciplinary blindness regarding human–nature relations.

Out of these more critical assessments of interdisciplinary practice have come calls and identification of possibilities for ways forward. Analyses suggest the need to prioritise communicative and reflexive approaches that engender openness, humility and respect for methodologies used in other disciplines.[5,6] This requires attention to the relational aspects of interdisciplinarity and the importance of recognising that success arises not simply out of assembling different disciplines and practitioners but in finding processes that enable them to work together.

"Researchers cite humility, creativity and flexibility as cultural qualities that can engender conditions for fruitful interdisciplinary collaborations."

For this, researchers cite humility, creativity and flexibility as cultural qualities that can engender conditions for fruitful interdisciplinary collaborations. Emphasis is placed on the importance of understanding these not as individual qualities but as aspects of the

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cultures we are creating. In practice, this means building research cultures that can do multiple things, including supporting openness to other perspectives and ways of knowing; self-awareness and abilities for critical reflection on disciplinary assumptions and ideas; and recognition of differences in power and privilege within teams.[4,6] These ways of working represent key developments in the nature of interdisciplinary working, recognising the difficulties and departures from early intentions to where we are today.

This *environmental SCIENTIST* issue comes at an important juncture in the development of interdisciplinarity for environmental science, when significant progress has been made in taking forward truly open and integrated approaches. Contemporary research in the environmental sciences is marked by deep forms of interdisciplinary collaboration, producing insights that otherwise would not have been possible and advancing solutions to some of our most pressing problems. The funding landscape has advanced this too, with many making interdisciplinarity essential to application eligibility and success.

While the research world has moved on, however, the nature of academic posts and careers can often feel staunchly disciplinary, with lecturing posts tied to teaching on programmes that often mirror the subject distinctions of old. This creates ongoing challenges for truly interdisciplinary teaching, careers and forms of research practice. The nature of publishing and academic quality assessment processes also reflect disciplinary conventions. Though interdisciplinary journals are widespread and successful, careers are often still perceived as best advanced through publishing in ways that develop bodies of work along disciplinary lines.[7] These abiding aspects of academic worlds rub up against the ongoing progress within research to foster interdisciplinarity and to advance the cumulation of knowledge outside of disciplinary boundaries.

In this issue, authors offer insights into this contemporary context, discussing diverse forms of work that involve, advocate for and consider the consequences of interdisciplinarity in environmental science research and practice. The articles provide understanding of projects and processes through which interdisciplinarity is being advanced, the opportunities that arise from such forms of collaboration and the challenges it presents. They address contemporary themes and concerns relating to the continuing importance of different disciplinary perspectives for working towards generating solutions within environmental sciences. They bring focus on different concepts that are important to interdisciplinary work, such as care and the kinds of careful labour required to enact responsible, respectful and reciprocal relations within interdisciplinary contexts.[8] They also address key questions about interdisciplinarity in learning and teaching, in careers, in funding and in different forms of partnership working.

From these articles what is clear is the enduring centrality of interdisciplinarity for the environmental sciences and its value in advancing the knowledge required to address environmental issues. However, they also open questions that remain about how interdisciplinarity can be taken forward in ways that will support careers within contexts still dominated by disciplinary structures, and how the full potential of interdisciplinary knowledge cumulation can be realised in and through practice. ES

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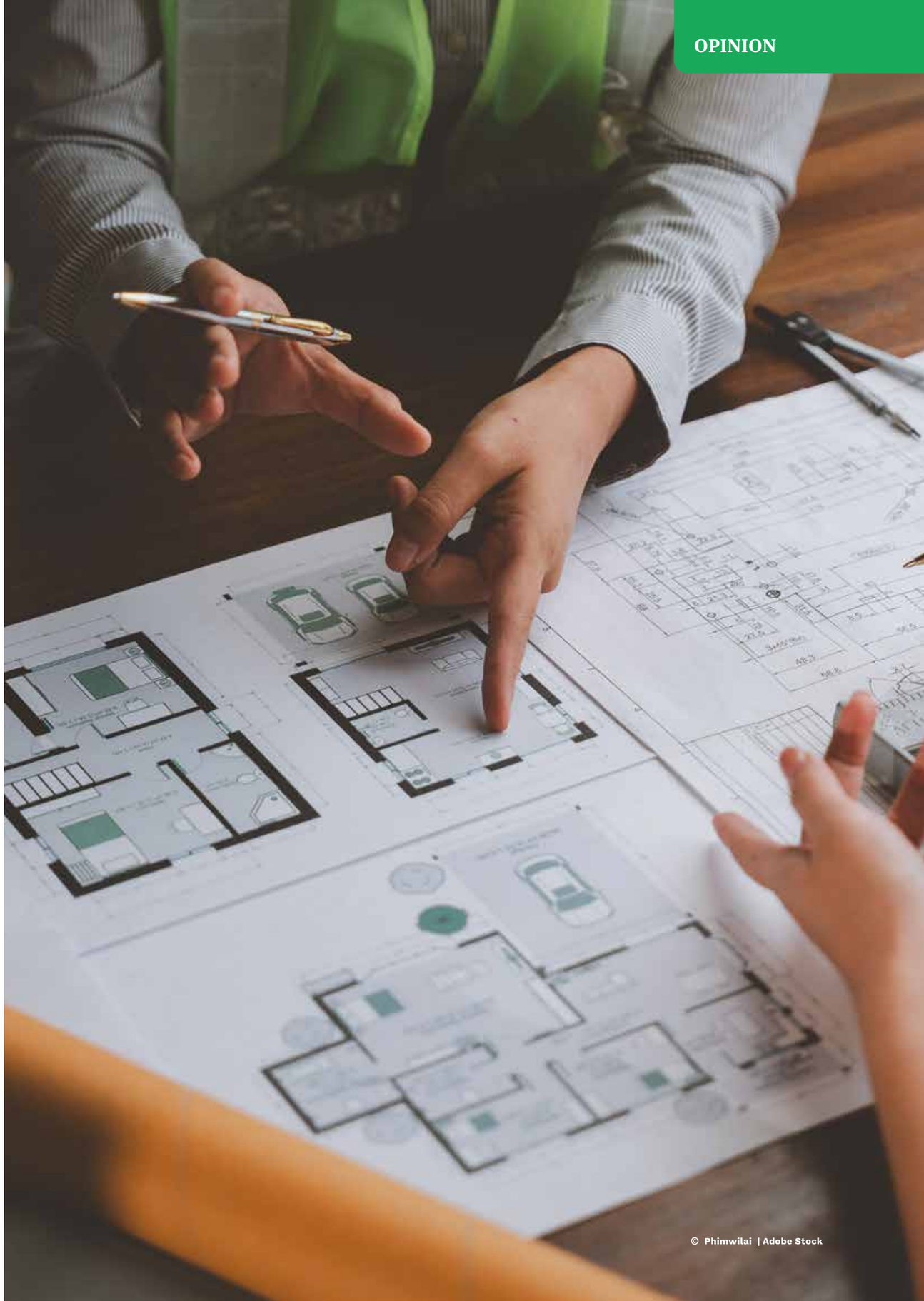
Interdisciplinary research: more than just a good idea

Jo Patterson examines the benefits of collaborative working through a sustainable built environment lens.

Together, we face many global challenges. Population growth, for example, is driving an increasing use of resources and resulting in unprecedented levels of waste and water pollution, creating social and health inequalities. All these challenges need to be dealt with urgently. They are complex and system-based, with intertwined social, environmental, economic, technical and political issues, and they have an impact across spatial and temporal scales.



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Complex issues require insights from multiple fields rather than single academic disciplines, taking a whole-systems approach to minimise negative impacts elsewhere within the system and cannot be solved by experts from one discipline alone. ‘We are not students of some subject matter, but students of problems. And problems may cut right across the borders of any subject matter or discipline.’[1] Multiple disciplines, therefore, need to contribute, along with a range of participants from across society, to ensure that solutions to the problems we face are relevant, appropriate and achievable.

Interdisciplinary research is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts and theories from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline.[2] Interdisciplinary research plays an essential role in addressing the complex problems and research questions posed by global social, economic, ecological and political challenges.[3]

Collaborative working is critical for adaptation or mitigation actions across complex ecosystems if they are to survive and thrive. To be successful, collaborative working must be interdisciplinary. Multidisciplinary research is not enough for the necessary interactions to take place that will ensure complex systems are considered fully and for skills and consistent adaptation to be embedded within research processes.

BOX 1: DEFINING INTERDISCIPLINARY RESEARCH

‘Interdisciplinary research is understood to achieve outcomes (including new approaches) that could not be achieved within the framework of a single discipline. Interdisciplinary research features significant interaction between two or more disciplines and or moves beyond established disciplinary foundations in applying or integrating research approaches from other disciplines.’

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The benefits of interdisciplinary research can include a shared vision, inclusivity and a place to address wider challenges; it also has a wider effect on the economy, society, culture, public policy or services, health, and the environment or quality of life beyond academia.[5] A number of actions are required to enable mission-focused, interdisciplinary research to take place.

INTERDISCIPLINARY INTELLECTUAL ACTIONS

Consistent co-design and flexibility. Co-design of research applications, problem-solving and agenda setting are key for interdisciplinary research.[6] When a research problem has been jointly formulated and driven by the research topic, ownership and responsibility are embedded across the partnership. By focusing on a narrow theme, such as a particular age and ownership of housing, or a specific challenge, such as barriers created by connecting to the energy grid, certain evidence that is required to overcome these challenges can be identified. By discussing evidence from across disciplines, appropriate methods and knowledge exchange can be programmed into the application.

Collaboration throughout the early stages allows for systems thinking and initiates consideration of the use of different language. A clear programme of work with a well-defined framework co-designed by all involved can ensure that challenges are faced fully rather than in a piecemeal way, leading to more efficient and cost-effective ways of working. Face-to-face brainstorming activities with a range of expertise and at various career levels can bring valuable insights from different perspectives, enabling ownership, responsibility and connections to form.

Co-design must continue throughout and beyond the duration of interdisciplinary research, allowing for a cyclical development of intellectual study. Research approaches should be flexible and dynamic to allow any new knowledge generated to be discussed and adapted. The framework developed should be flexible enough to be revised when participants agree that impacts from an identified modification will have an overall positive or neutral effect.

Through the Transforming Homes project, using social science methods revealed that residents highly valued having a dining space, which gave them a focal point as a family to come together and for children to learn hygiene and table manners.[7] Capturing this knowledge early on resulted in dining spaces being worked into transformational designs where possible.

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Conventional physical scientist approaches – using more formal quantitative questionnaire and survey methods – would not have captured this valuable insight, which led to the design having a positive impact on family well-being as well as on children's social skills. Flexibility that is considered and built into co-design enables adaptation, if needed.

Flexibility within interdisciplinary research funding can support flexibility within the research itself, with a proportion of funds allocated to agile spending for any necessary work programme adaptation.[4] Within the Energy Revolution (EnergyREV) research consortium project, for example, small calls for additional supportive research were released, such as for literature reviews to support research gaps, for demonstration projects to provide case studies or for communication activities to showcase work to a wider network.[8] This is particularly relevant for early-career researchers and helps to develop management skills.

Reciprocal benefits. The aim of research is to provide evidence for change. With a wider, interrelated scope of evidence and inquisitiveness across a range of disciplines, adaptation and mitigation can be widened. Sharing disciplinary insights, creating common ground and a more comprehensive understanding of a problem widens knowledge.[9]

For example, residents are a critical part of a home and have a high influence on how it, and the systems within it, perform. Understanding the behaviour and characteristics of residents is critical to understanding how a home works and what needs to be done to improve it: How warm do residents like their home in winter? How often do they like to shower, and for how long? Do they regularly use medical equipment that requires high levels of energy?

Social scientists can engage effectively and sensitively with residents to obtain personal data, and work with physical scientists who collect building and technical data such as temperature and humidity variations and air quality within homes. Bringing this knowledge together can inform decisions on housing transformations that work for both homes and residents.

Interdisciplinary research enables all participants to exchange knowledge and to benefit from wider learning, supporting academic curiosity and initiative. Typically, academics can be reluctant to share details during the research process and only do so following study completion. Dr Allen Repko has suggested that the ideal model is where individuals suspend their disciplinary or professional world views in favour of the global question grounded in the problem to be solved.[9]

Physical scientists have been able to carry out laboratory tests on cavity wall insulation products alongside thermographic imaging, which confirmed that they had been poorly installed, with large uninsulated areas and water ingress. As a result, insulation was damp, resulting in mould. This evidence helped social scientists to demonstrate a link between cause and effect, which in turn meant that they could communicate the next steps with residents.

Working in this way allows for lessons to be learnt throughout the research process. Adapting research methods provides opportunities for reciprocal benefits to all involved. The opportunity for peer-to-peer learning can take place at all

levels when participants including researchers, support staff and technicians are open to it and can result from pre- to post-research disciplines being modified by working together.

All team members should want to work collaboratively and see the value of it. Working together should be about solving a problem together, not about career development or facing a research challenge individually. If participants do not engage fully, gaps will form in the partnership and the outcomes will not be systems-based. This will affect trust and respect across the project team, and research outcomes will fall short.

INTERDISCIPLINARY ORGANISATIONAL ACTIONS

Interdisciplinary research must be supported by consistent and organised operational structures that offer open and honest collaboration. Regular inclusive meetings, a single multi-organisation online location for storing and sharing documents, and collaborative planning and preparation of outputs all encourage connection that supports communication and, therefore, collaboration. Such an approach – with all staff fully engaged, including senior, mid-level and early-career researchers, technical and support staff – is essential to building and maintaining trust and respect. Negotiation and diplomacy are required to ensure a fair and equitable balance of power across the partnership.[10]

Roles and responsibilities. Leadership and management play a critical role in the successful preparation, delivery and completion of interdisciplinary research partnerships. Roles and responsibilities should be discussed and clearly set out within a framework during application development to enable clarity throughout the process, bringing ownership and placement of responsibility. Negotiation and diplomacy are often necessary through appropriate communication channels, with in-person or online meetings preferable to email. Similarly, the ability to nurture and show empathy through leadership and encouraging others across the partnership to do the same is also important.

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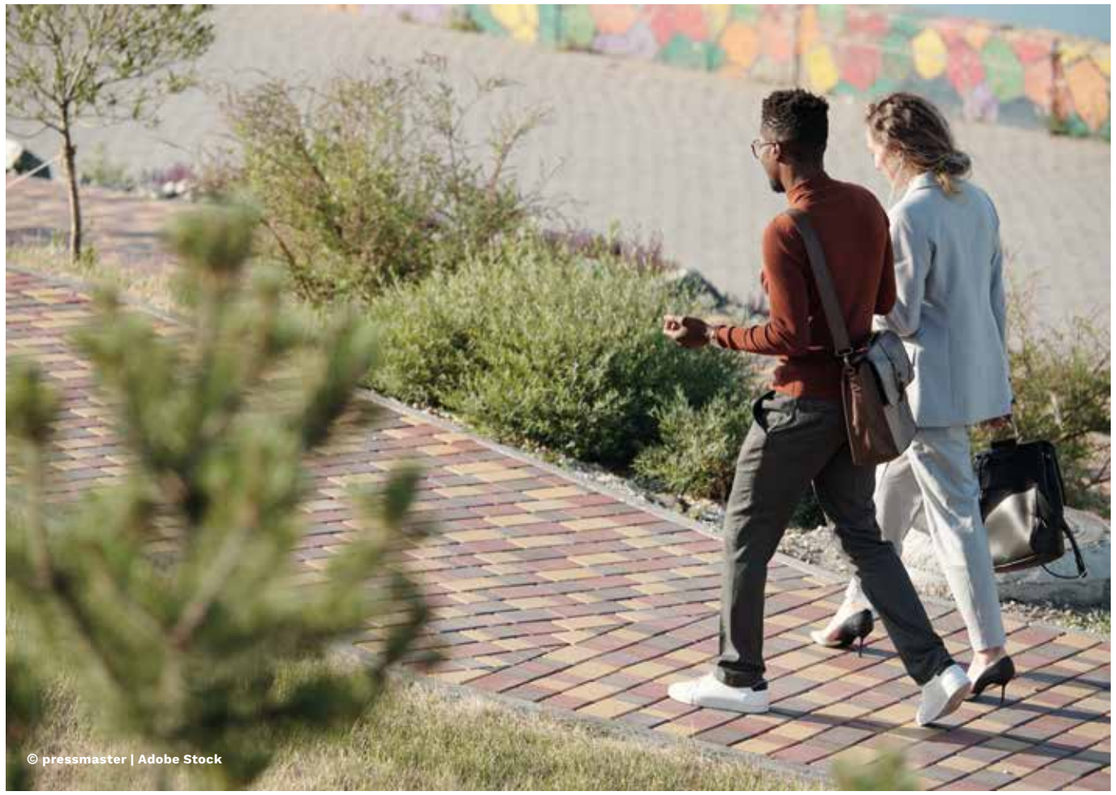
Interdisciplinary partnerships are often geographically scattered, which requires operational structures that enable effective and efficient communication. Finding a balance between intellectual and operational activities enables the research to take place and interdisciplinary benefits to be realised. For example, frequent communication supports knowledge transfer and the overcoming of language barriers. However, if meetings take place too often, the time to carry out intellectual research is reduced. All participants need to learn to prioritise time spent on intellectual and operational activities and what needs to be communicated with others across the programme and when.

Participants should also be able to ‘listen’ and ‘hear’ in both formal and informal situations and to have an opportunity to engage and have a voice. Academically this enables early identification of research challenges so that plans can be put into place to overcome them before they create issues. It also allows early-stage researchers to share insights, problems and research outcomes with mid-level and senior colleagues who may be less involved on a day-to-day basis. Regular contact in informal settings helps to remove hierarchy, leading to free-flowing discussion while generating respect.

Interdisciplinary research should result in a range of engagement activities and outputs. Clear guidance should be put into place to ensure processes for identifying authorship contribution across a partnership are used – such as using Contributor Role Taxonomy and the International Committee of Medical Journal Editors guidance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– for consistency and for establishing and maintaining trust.[11,12]

Skills and training. Communication and language skills are fundamental to the success of interdisciplinary research. All participants should have access to what is happening in other disciplines for better knowledge integration. For example, the use of acronyms should be limited, particularly at early stages, and a glossary of terms can be developed to negotiate and agree common meanings for terms that differ across disciplines – such as infrastructure used in both the built environment and information technology but with different meanings.[6]

People are different; not everyone is suited to frequent collaborative teamwork and may want to focus on a single discipline. With so many challenges and problems to be resolved, there is a place for all. Similarly, not everyone has the skills to be fully interdisciplinary. This should be recognised by leaders and individuals across the partnership. Skill sets should be identified through leadership, enabling all to play a role in the success of interdisciplinary research, with clear of ways of working being developed and followed across the partnership.

Networks between early-career researchers should be encouraged, with a budget for training and skill development included within the research funding application. Collaborative tasks that support the overall research objectives, such as the production of a glossary of terms and the collation of an image library, can support cross-disciplinary communication that is facing language challenges.

Respect should be given to those who have the skills to bring about and support interdisciplinary working. These skills are often not found in a conventional (academic) career pathway but are critical to successful collaborative working.[13] Consistent training and skill development across both intellectual and organisational areas should be embedded into projects enabling participants who are prepared to undertake research challenges – as well as for future interdisciplinary working and leadership – to develop.

CONCLUSIONS

Successful interdisciplinary research requires co-designed intellectual and organisational structures from the outset. Integration across disciplines will not happen without strong, continual organisational leadership and support throughout the whole partnership.[14] Regular, open and focused connection, communication and collaboration are key for trust and respect to become established and to flourish, producing long-term relationships and recognising the skill sets and contribution of all participants.

There is some resistance to interdisciplinary research by some who believe that it could stifle productivity. Also noteworthy is that the process of producing interdisciplinary scholarship – learning new concepts, literature and techniques, and working with a diverse group of collaborators – is challenging and takes up research time.[15] While spanning disciplines is beneficial because it allows scientists to see connections across fields, the categories literature suggests that such research is penalised because the results may be of a lower quality or confusing to categorise.

Interdisciplinary research can be one of the most productive and inspiring human pursuits, providing a format for conversation and connection that leads to new knowledge.[2] Therefore, there is a need to strike a balance between interdisciplinary and single-discipline research to ensure that both continue. ES

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Bridging the gap between the natural and social sciences in sustainability education

Claire Hughes and **Lynda Dunlop** explain how interdisciplinary teaching can inspire and empower higher education students to address environmental challenges.

The biggest environmental challenges of our time – climate change, biodiversity loss and pollution – cannot be understood and resolved by a single disciplinary perspective. There are economic, social and political conditions that produce environmental harms, and there are issues of social justice associated with environmental protection measures. For example, the global shift to renewables requires the large-scale extraction of critical minerals including cobalt, copper, lithium and cadmium. Mining for these minerals produces pollution and waste, often experienced by marginalised communities with least access to the technologies the minerals are used to produce.[1]

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▲ **Cobalt miners in the Democratic Republic of the Congo. (© The International Institute for Environment and Development | Wikimedia Commons | CC-BY-2.5)**

This raises a number of questions:

- **Scientific:** How can global greenhouse gas emissions be reduced?
- **Social:** How does mineral extraction (re)produce inequalities?
- **Political:** How are local decisions about resource extraction shaped by national and international policies?
- **Ethical:** How should the risks and benefits of the energy transition be distributed?

Grappling with environmental challenges requires approaches, knowledge and methods from across the natural sciences, social sciences, and arts and humanities.

WHAT IS INTERDISCIPLINARITY?

Interdisciplinarity has a contested definition, but can broadly be expressed as:

'Two or more disciplines or established areas of expertise [applied] to produce a cognitive advancement – such as explaining a phenomenon, solving a problem, or creating a product – in ways that would have been impossible or unlikely through single disciplinary means.'[2]

There are varying degrees of interdisciplinarity: from approaching a problem from multiple disciplinary perspectives, to sharing research questions and integrating knowledge and methods, to trans-disciplinarity, which relates to the cooperative interaction between researchers and practitioners.[3] All these approaches involve breaking out of conventional university silos and going against the usual grain of higher education practices and norms.

Higher education is typically structured around disciplines with associated epistemologies and cultures into which students are socialised, shaping their thinking and orientation towards learning and the world.[4] In recent years, there has been growing attention to interdisciplinarity in higher education, with various academies also encouraging interdisciplinary research through grant schemes and new journals. This includes the Academies Partnership in Supporting Excellence in Cross-disciplinary research (APEX) Awards, which are delivered through a partnership between the Royal Society, British Academy and Royal Academy of Engineering with support from the Leverhulme Trust. There have also been calls for opportunities that allow students to see their own discipline more critically, that reflect more disciplinarily diverse workplaces, and which tackle complex and pressing challenges such as climate change, food and water security, and pandemics.[5,6]

Much has been written about the challenges of interdisciplinarity in higher education including institutional inflexibility, the logistics of resource allocation and timetabling, workload modelling, student choice architecture, and disciplinary differences in culture, terminology, pedagogies and assessments.[7] Degree standards are set by disciplinary experts – in the UK this is done through the Quality Assurance Agency – and are often regulated or accredited by professional bodies, which typically confer discipline-specific requirements on providers. Going beyond their discipline can be perceived as risky even by curious and keen students, who may be reluctant to experience another discipline, particularly in a high-stakes modular system where they might feel disadvantaged by being newer to the subject.

To tackle these barriers, the University of York has developed a range of interdisciplinary programmes and modules. One particular teaching innovation is the development of a novel suite of interdisciplinary modules focused on sustainability – designed to be taken by students from any department, putting all students on a more-or-less equal footing. The modules formally sit outside departments, are governed by an interdisciplinary board of studies, and are taught by staff from different disciplines including biology, business and society, chemistry, education, environment and geography, law and politics. The modules include the 'Climate Crisis Action Lab', 'Future of Food', 'Sustainability and Policy' (led by the Stockholm Environment Institute – York) and the 'Sustainability Clinic'. The modules share a common design framework and enable students to tackle real-world problems, participate in interdisciplinary dialogue, and engage with business, charitable, community and cultural organisations beyond the university (see **Box 1**).

REAL-WORLD PROBLEM-SOLVING

How can we transform the food system?

The 'Future of Food' is a second-year module, developed and taught by academics from the Department of Biology and the School for Business and Society. The module tackles the real-world problem of the food system and its links to social, health and environmental crises. It is inspired by the multidisciplinary Fix Our Food research programme, which aims to transform the

BOX 1. DESIGNING INTERDISCIPLINARY MODULES

All sustainability-related interdisciplinary modules have been designed to:

- Focus on key contemporary issues that require a multidisciplinary approach;
- Carry 20 credits (there are usually 120 credits in one academic year);
- Support students from different disciplines;
- Feature teaching staff from at least two disciplines, supported by buyouts (i.e. time bought from the home department to work on a central university project or initiative);
- Include a significant group component to address a particular problem – bringing skills, knowledge and experiences from different disciplines; and
- Use assessment criteria designed for interdisciplinary modules by academics from different faculties.

Students also have access to guidance on studying outside their department, and to advice on expectations for producing different types of assessment – from reflective essays, reports and policy briefs to posters, presentations and podcasts. Crucially, these interdisciplinary modules give students experience with real-world problem-solving, interdisciplinary dialogue and community engagement.

Yorkshire food system to a regenerative one that benefits both human and planetary health.[8]

In the first half of the module, students develop an understanding of food systems, exploring agricultural inputs and soil management, environmental impacts, healthy and sustainable diets, and food waste. Based on this understanding, they produce a trade-off analysis report for a real-world challenge – for example, changing menus or land use change. The module also features guest lecturers and a short field trip. In the module's second half, students develop solutions to a food system challenge in interdisciplinary groups, producing a podcast to share their ideas.

This module helps students to solve real-world problems by giving them an authentic experience in understanding the food system, creating system maps, making sense of trade-offs and presenting possible solutions using a podcast or vodcast. It also gives them experience of applying their knowledge and skills to produce media content – skills that can be used beyond the module's context and the topic of food. Students from diverse departments including arts and creative technologies, chemistry, environment and geography, language and linguistic science, and philosophy and psychology have taken the module.

▲ **Scoop, a student-run not-for-profit cooperative shop supplying local and ethical food to students on campus. (© Alex Holland | University of York)**

▲ **Development of digital creativity skills in the production of podcasts. (© Alex Holland | University of York)**

INTERDISCIPLINARITY DIALOGUE

How can evidence be communicated in the most appropriate way to make the biggest impact on environmental and social challenges?

Given the complexity of climate change, biodiversity loss and chemical pollution, and the role that politics, economics, ethics and other disciplines play in shaping societal response, there is a need for dialogue across disciplinary boundaries, not only to understand systems from different perspectives, but to identify the strengths and limitations of different ways of knowing the world. Dialogue can help identify the different framings, interpretations, vocabulary and methods that are used to generate evidence, and to identify absences and weak spots. For example, interdisciplinary dialogue can help explore the value that both big data (often coming from the sciences) and thick data (often coming from the social sciences) can contribute to tackling global challenges and lead to the generation of new knowledge and new questions that support meaning making.

In the 'Sustainability & Policy: Research, Engage, Change' module, students learn to communicate and collaborate across disciplinary boundaries in the context of policy engagement. The module is taught by a team from different disciplinary backgrounds based at the Stockholm Environment Institute – York.

The aim of the module is not to have all the answers but, rather, to explore the right questions that can help us address the greatest challenges of our time.

Students investigate how evidence can inform policy and how to maximise the impact of evidence-informed policy at different levels – from local communities to national governments and transnational organisations. Assessed by the production of a group report, students from different disciplines including biology, environment and geography, global development, history, physics, and philosophy have produced professional reports on themes including private sector transition pathways, urban air pollution, and rural water and sanitation solutions, experiencing the peer-review process in relation to research, writing and project management.

COMMUNITY ENGAGEMENT

What role do universities play in developing community resilience? Sustainable societies need resilient infrastructure, communities and ecologies. The third theme that features in the interdisciplinary sustainability modules is community engagement. The 'Sustainability Clinic' module gives students experience in working on behalf of community clients on live, real-world sustainability problems. The module is taught by a team of academics from biology, education, environment and geography, law, and politics disciplines, and draws on expertise in community-engaged learning from the careers department.

▲ **Living Roof at California Academy of Sciences, USA. (© Anna Fox | Climate Visuals | CC BY 2.0)**

Over the course of the module, students respond to a brief from a business, charity or community organisation, supporting them to achieve their sustainability goals. This module helps students to understand community needs, listen to and respond to feedback, and take responsibility for their own work and ultimately make a difference in the real world.

Organisations including the Rugby Football League, the Yorkshire Wildlife Trust, Explore York Libraries and the River Foss Society have been engaged as community partners. Outcomes for students include teamwork and communication skills, multi-perspectivity, employability, creativity and confidence to develop their own ideas. The 'Sustainability Clinic' module won a national Green Gown Award in the student engagement category for its benefits to stakeholders and its adaptability by other institutions. There is now a dedicated sustainability clinic space for students to work in groups, meet partners and host events to create a bridge between the university and wider community.

CONCLUSION

These new university modules have been designed to value and develop interdisciplinary working, and to give students experience in real-world problem-solving, to create dialogue across disciplinary boundaries and to participate in community engagement. These experiences bring the natural and social sciences together on an equal footing to benefit students and bring about more sustainable societies. ES

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Dialogue Between Disciplines Conference, June 2025: roundtable discussion

Sian Davies-Vollum, Denis Thompson, Carla Washbourne and Dan Carpenter consider how interdisciplinary work in the environmental sciences is changing, and how we can support interdisciplinary working and collaboration through conferences like this.

ENVIRONMENTAL SCIENTIST (ES): Why is interdisciplinary working so integral in the environmental sciences?

SIAN DAVIES-VOLLUM (SD-V): I think interdisciplinary working is integral in environmental sciences and ally subjects. Personally, I wear three hats: environmental science, geography and geoscience, and they're all very interconnected. The challenges that we see in the natural environment of our current world and how humans interact with it are complex, so we need interdisciplinary approaches. Not just lip service between experts and different disciplines coming together but understanding how those disciplines can collectively help to address the challenges that we face today.

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DENIS THOMPSON (DT): I completely agree. The big thing that I'm currently learning about is the distinction between interdisciplinary and multidisciplinary approaches, alongside the fantastic scientific disciplines working in the environmental sciences. The interaction and the dialogue between these disciplines is really, really important, as is being able to learn from each other and to integrate new approaches as we tackle complex issues together.

CARLA WASHBOURNE (CW): Agreed. The challenges are so large, multifaceted and fast-evolving. But we should be focusing on the meaningful engagement that can come from interdisciplinary working. In the main Dialogue Between Disciplines (DBD) conference, there was such a nice focus on connecting with current issues in environmental science across lots of different domains. So research, education, practice, and understanding how to go about creating a shared language and actually being able to have those conversations. As Denis said, we need to really try to fundamentally understand where everyone is coming from and learn from those different perspectives.

DAN CARPENTER (DC): That's one of the reasons I like the IES: because it is inherently interdisciplinary. I'm an ecologist and while there are other institutions or groups that I could join, the IES is so broad. And that's why I wanted to be a part of it: so that I have opportunities to talk to people who do very different things. That's really key, particularly on the sorts of projects that I do, because I'm talking to people like that [from other disciplines] all the time. Having the opportunities to talk to the types of people that I'm going to meet on a on a project is really important *outside* of the project itself; you end up having a different conversation than just a very project-focused one.

To follow up on what Carla said about the DBD conference and how it helps in moving towards interdisciplinarity, I think there's this misconception that you can bring people from different disciplines into a room, and they'll just talk and 'it'll happen': they'll have these interdisciplinary conversations and there will be positive outcomes. But in my experience, you actually need to be able to support and manage that interaction, and to have people engaging in meaningful activities, as we did at the conference, to be able to create that connection across disciplines. It needs to go deeper than just: 'Hello, how are you? Which discipline do you work in?'

ES: Is there a key takeaway from DBD that you think every environmental professional working in the sector should know?

DC: For me, the most interesting thing was about how to go about establishing shared understanding or values. We did some exercises where we had to think about an issue – flooding or sewage or whatever else – and it showed how everybody's opinions and viewpoints came together, and the practical element of this. It was very accessible and it allowed everyone to be involved, rather than having one person or one discipline leading a conversation and others trying to find a way in.

CW: I agree with Dan on this. Another thing I found really useful was hearing from people about projects: looking at cases where trans-disciplinary approaches had been used, seeing how that worked and hearing about the struggles as well. I joined the IES in December, so my real key takeaway was that there are always great people and communities to engage with who are really doing excellent work. So many came up in the conference that I had never heard of before. And I thought I was reasonably well-networked! For example, I had no idea the Advancing Capacity for Climate and Environmental Social Science (ACCESS) programme existed, but they're doing really important work.[1]

DT: I'm a very practical person, and my takeaway from the conference was the practical tools that people discussed. The systems thinking tool was great for being able to break down a product, project or problem, and being able to integrate or invite other people into that discussion.[2] Another very simple thing I thought was fantastic: using diagrams to communicate. I think communication is such a difficult thing in this space, and communicating in simple ways like using diagrams, I think, is really important. Certainly, both of those tools are things that I want to develop within my skill set and use in my day-to-day work.

SD-V: Speaking as somebody that was on the organising committee, we did really try and focus on making it practical so that people could leave and think: 'OK, I've learnt that; I can go and take that away and do that'. You can't just have minimal discussions and interactions around working across disciplines. You need to have deeper work and understanding of practical skills.

ES: Since we're halfway through the 'decisive decade', a critical time for decision-making, do you think perceptions of interdisciplinary work in the environmental sciences have changed?[3]

SD-V: I don't think we would have had this conference 10 years ago. I'm an academic and I remember doing a project on interdisciplinarity about 10 years ago, and it was viewed as being quite 'out there'. But I think it's a lot more understood now that this is important. As an academic, you might do some biology and some chemistry and some physics, so your understanding of the subject itself allows for working with different disciplines, but I think that more coordinated interdisciplinarity has evolved.

DC: I agree. The other thing I've noticed is that it's not just working between scientific disciplines that's changed. It's also bringing together people from outside environmental science: for example, geographers, social scientists, psychologists and those who are doing a non-environmental science. It's also changed in how we engage with communities – the arts help to communicate the science, the issues and the options as well. So it's not just interdisciplinarity within science that's growing – it's much wider than that. I've certainly seen a lot more of that in the last five years or so than I would have done at the start of my career.

SD-V: As Dan says, involvement of communities is something else that has changed over this decisive decade: mainly in the understanding that we need to acknowledge and use the voices of people that interact with the environment. I'm now working with a sociologist for exactly those reasons. Trans-disciplinarity also covers this need to use different sources of knowledge and different understandings about the environment.

CW: My main habitat is also within academia. We're definitely getting better at recognising the importance of interdisciplinarity in the UK higher education space, and of being ready to experiment with it more. I have been based in interdisciplinary

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departments for the last 12 years, first at University College London and more recently at the University of Warwick. Having moved to Warwick in January, it's been really interesting to see that there are more and more institutional activities explicitly focused on interdisciplinary working. Academia as a sector is probably still a bit better at talking about doing it than doing it, but I think we're moving in the right direction!

DT: I'm a consultant and work a lot with industry and commercial customers, mostly small to medium-sized businesses. It's exciting to see how universities are beginning to work more with industry, and a necessary development here is how we can get industry increasingly involved. I found the environmental psychology part of this conference so interesting. Working in the environmental field, we are obviously very passionate about the environment, and that's often our main focus. But as a businessperson working with industry, it would be so interesting to see how we can bridge that gap between each of our priorities, or the world's wider priorities around environmental protection, and bring industry into that conversation as well. I think sometimes there's a bit of an 'us and them' mentality; so how do we get those within industry to bring their understanding and their influence, and the impact that they can have, to the table? I really do believe that industry can bring solutions to the table.

ES: What are the main barriers faced by environmental professionals today when it comes to interdisciplinary working, particularly early career professionals?

DC: I think the main barrier is a cost–benefit one, which is often related to the scale of a project. The bigger a project, the more likely it is for there to be an acknowledgement, a desire and an ambition to be more interdisciplinary, and to really make sure that everyone involved in that project is talking and focused on getting the best outcomes they can for the environment.

In smaller projects, cost is often a prohibitive barrier; yet, sometimes scale actually reduces our ability to work collaboratively together. With really big teams involved, people are working on so many different things at the same time. In relatively small groups, people have more time and energy to spend on talking to each other and understanding context and different viewpoints when working towards solutions. As demonstrated [in the conference], a big skill is being able to start the conversation and decide how to do things, and to set up the conditions for the desired outcome. That needs to be invested in up front, from day one of a project, and then brought together at the end. I think maybe the early career professionals will have an advantage here, because if that's being embedded in how they start projects, then it's more likely to happen. There's a real value in taking a step back and thinking about things before we start.

CW: Academia is understandably very interested in impact, and I think markers of impact are more easily demonstrated within a certain discipline: this might take the form of publications, grants or funding, for example. But in interdisciplinary and trans-disciplinary work, this is harder and takes longer to do in a meaningful way, and for this reason interdisciplinary working can be a disadvantage in terms of the traditional shape of grants or studentships. The time periods and the types of funding that can be awarded for certain work can be a constraint.

I think for early-career people coming into interdisciplinary work within higher education, there are lots of positives to having an interdisciplinary orientation, but it's also challenging. With colleagues, I've done some work on competencies for people coming into a career in infrastructure with a sustainability focus, and what came up here was the challenge of feeling that you need to be a 'unicorn': in other words, you need to be an individual who could in theory do everything, because you're interdisciplinary. This detracts from the idea that interdisciplinarity is not about an individual being interdisciplinary, but about being part of a process, and part of a team that is doing interdisciplinary work.

DT: Carla has said something so important here around competency. Obviously we want people working in this field; we want them to be competent, and we want them to be credible. But I think sometimes that can have a negative side. As an example, I'm going to be involved with the Marine and Coastal Science Steering Group at the IES, which I'm really excited about. But before I put my application in, I wondered how I could possibly get involved when I'm not a marine biologist and I don't have any marine qualifications. I've got a master's in biochemistry and did my thesis on treatment of industrial effluent. How can I get involved in marine and coastal science? So I wrote to the IES, which encouraged me to apply, as they want people with different skill sets and perspectives in that community. While I don't think competency is the barrier itself, sometimes the way we think about competency is a problem. Actively encouraging young professionals to work outside of their core skills and engage with other professionals in a different discipline is very important.

SD-V: This has made me think about the whole pipeline of how we get to become environmental scientists. Interdisciplinary thinking is really quite stymied early on in an individual's learning. We narrow down our educational focus between the ages of 16 and 18, and if you're going for an environmental science degree, you have to be thinking in an interdisciplinary way, outside the box, when applying to university. If you look at the Scottish system, though, people take a broader range of subjects and that supports more interdisciplinary thinking. If we don't encourage this, we're battling against the education system. Expecting young people to come to university and then deal with lots of different subjects around environmental science – it's quite challenging.

ES: What support do you think is most needed from organisations, companies and institutions to help environmental professionals embed interdisciplinarity into their day-to-day work?

SD-V: I think they should make sure there are structured ways to meet and discuss and work with colleagues who are from different disciplines, but who have the same broad interests. For example, I work in coastal science – to do with sea level rise, physical processes and the environment – and, as I mentioned before, I've been working with a sociologist recently. When telling the sociologist about this work, she reminded me to think about the people living with sea level rise as

well as about the environment. We must have the space to have those conversations, and to let that relationship and that interdisciplinarity evolve and happen. It doesn't happen by itself; it needs those structured situations.

CW: Yes, definitely. There's a certain element of empathy needed. Very few of us started studying in an interdisciplinary way, particularly in our higher education institutions. Most of us did a discipline and then started doing inter- and trans-disciplinary work. Therefore, there's a need to recognise and empathise with the fact that it's not going to be easy to come in and study in an interdisciplinary way, particularly if you've come from an educational context before higher education where you were encouraged to choose particular topics, themes or focus areas. So it's about recognising that we're supporting people in that journey, when it's not the journey that we necessarily had ourselves, and then working to understand how to develop courses, and how to support skill development within and beyond their time within our education institution.

ES: What current environmental challenge needs more interdisciplinary working to develop solutions to address the issue? And why do you think interdisciplinarity is particularly relevant to that specific challenge?

DC: All of them!

CW: I also think all of them. An interdisciplinary approach is powerful in letting us see the systems view when there's a temptation to atomise things. There's a pattern of 'here we're focusing on climate, here we're focusing on biodiversity, here we're focusing on something else'. And while there's a psychological and practical necessity for this, it doesn't reflect the reality of what's going on. In the DBD conference itself, there were practical exercises in understanding and mapping systems, looking at causality and thinking about how you prioritise different elements of those systems in the project or programmes that you're focused on. At the same time there was a clear message around doing this in a way that doesn't artificially break the system down into existing or familiar categories or silos. These sorts of approaches are crucial in enabling or allowing you to act, and not to just feel immobilised because it's all so big and complicated.

DC: Exactly that. Sometimes, when you do take a step back, you get overwhelmed just by the sheer complexity and scale of a problem. There's a natural tendency to try and narrow down to something that you feel you can do something about. But all those things – climate, biodiversity, all the rest of it – they also have a social element. These are people's lives we're talking about. Lots of this is about fundamentally changing the way we, as humans, operate on this planet. When you start to think about those systems, you start to really understand that a lot of the time, as an environmental scientist, you can't solve the problem that would actually make the biggest difference. You then get into much more trans-disciplinary conversations by talking about societal problems, and all those other things that create environmental impact in the first place. Sometimes it's too much and you think 'I'll just focus on this bit of grassland over here, because at least I can deal with it; I'm trying not to shy away from those big, big problems, but work out where my place is in that system'.

DT: I would also say everything, definitely. But two things have caught my attention recently. One is regional planning from an environmental point of view. I live in Hull, which is in the Greater Humber area. There are multiple issues: flooding, industry, agriculture and declining biodiversity. So from a regional point of view this would really benefit from an interdisciplinary approach.

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Two is a more specific issue that's caught my attention recently: legacy landfill. Within that topic, there is so much expertise – waste management, contaminated land, ecology, coastal and marine science, chemical expertise. It's a major issue that is only going to have more impact as sea level rises and flooding issues increase with climate change.

SD-V: I think, Denis, the way you framed that in terms of scale – you said 'region' – is how we often tend to think in terms of planning, whether it's local, regional or national. And they all have those environmental challenges that are involved at different scales, and you're just thinking about coastal settings with climate change and resource management and biodiversity. Those environmental challenges are also interconnected. You can't talk about biodiversity changes at the coast without talking also about climate change. The correct answer to the question is that all environmental challenges need interdisciplinary work, whether you're looking at how we approach that from planning or management, or whether it's local, regional, national or even international agreements – such as the United Nations Sustainable Development Goals.

ES: Has attending the conference influenced your understanding of the skills and approaches needed for successful interdisciplinary work, and if so, how?

DC: Yes, absolutely. Coming back to our takeaways from the conference, the tools that were demonstrated in those workshops have really made me think about how I can apply them to projects I'm going to be working on – how I'll try to bring those into project discussions – and outside of that work as well. I started thinking about how to apply them in change management types of projects too. It's interesting because they're kind of similar. You've got a lot of different components, but those, I think, are the kind of things that I think will help unlock, for me, some of the benefits, some of the outcome benefits that can be had from better working with people from across disciplines. I must admit I thought 'Oh, it looks like fun; I'll turn up', not really knowing what to expect. And I took a lot away from the conference in the end.

CW: I'd had some sense of what the day was going to be, but it was so much more than I could have known in advance. Particularly in terms of the practical skills and approaches, there's a couple of key things for me. I do teach things like rich pictures and systems mapping with students at master's level working on interdisciplinary challenges. It was really good to see those play out in the conference setting, and to see different people facilitate them. It's always inspiring to see different people facilitate and learn from that and to see how they land, and to speak to so many people in the room at the conference about how useful they were. When designing these learning experiences for students, you're always questioning whether they are really useful in the real world. Having that validation was really helpful.

SD-V: For me it was the practical skills and approaches that were very helpful. Not just in thinking about how I can approach work with my interdisciplinary research team, but also (as Dan said) more broadly in terms of change management and management in general. So that was a bit of a bonus. I think the other thing that was useful for me as an academic was seeing how this plays out in industry and government agencies, and being able to bring that back into classes and also my own practice. That crossover between different parts of the environmental sector and higher education and industry, that was really helpful for me. I mostly go to academic conferences, so going to a conference where there were hardly any academics was really instructive and useful.

DT: I think just being part of the conversation was hugely important and educational to me. Having the conversation gives us the awareness that we can actually work outside of our discipline. The other thing that will be important going forward is all of us are going to come across projects or work or problems that will require different disciplines. Attending a conference like DBD, meeting new people, and getting to know people in something like that is a great advantage, because you can meet people that you can work with in the future or that you can call on to get involved to help you tackle the problems that you come across.

ABOUT DIALOGUE BETWEEN DISCIPLINES

Dialogue Between Disciplines is an annual conference run by the the IES. DBD is dedicated to fostering collaboration and knowledge-sharing between environmental professionals from across specialisms and sectors, and welcomes environmental scientists, practitioners, policy makers, engineers and social scientists from across specialisms to come together to champion solutions and practical action to combat the triple crisis of climate change, biodiversity loss and pollution. ES

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Winning Photo

'Sleeping Northern Saw-Whet Owl' by Nicola Turner

Photography Competition

Dark

The IES's annual Photography Competition is always anticipated with excitement by the IES team, members and non-members alike, and this year was no exception. For the 2025 round, we received even more entries than last year; and as demonstrated by the excellent assortment of photos selected to be published in this year's September issue, the submissions were as varied, eclectic and original as ever.

Responding to this year's (slightly moodier) theme of 'Dark', the entries explored many different connections between the environment and darkness, with some photographers taking inspiration from night skies, others from dark plumage on birds (such as the photo 'A Night Hunter' by Simon Williams) and others from pitch-black seas. Others still experimented with the contrast between light and darkness, inviting the viewer to consider darkness punctuated by moments of light, and how this can be used to throw shapes, colours and subjects into stark relief (including Ben Yeates's Highly Commended photograph, 'Cableguy').

Judges in this year's competition were particularly inspired by the skill and effort demonstrated by contestants in capturing the briefest of moments on camera: see for example Aida Khalil's 'The Dancing Squid', taken during a night dive in the Philippines in 2023, where the squid, attracted by the torchlight, approached the photographer to investigate. Underwater photographs were popular with both entrants and judges this year, with some remarkable environmental phenomena captured: one excellent example is Seb Hibbs's photo 'Portal to a Universe', which depicts a Moon jellyfish (*Aurelia aurita*) being consumed by Snakelocks anemone (*Anemonia viridis*) on Chesil Beach.

2025's winning photograph by Nicola Turner, 'Sleeping Northern Saw-Whet Owl', enthralled the judges with its attention to detail, use of rich dark colour and the subtly obscured face of its subject – perfectly capturing the owl's enigmatic pose. Taken at a wildlife sanctuary in Hokkaido, Japan, Nicola explains: 'Northern Saw-Whet Owls are tiny, nocturnal owls that rely on forests for shelter during the day. Their secretive nature and excellent camouflage make them easy to overlook, and it was a privilege to be able to capture the peacefulness of this sleeping owl.'

Highly Commended

'Cableguy'
by Ben Yeates

'A Night Hunter'
by Simon Williams

'Portal to a Universe'
by Seb Hibbs

'The Dancing Squid'
by Aida Khalil

Other Entries

'Things that Go Bump in the Night'
by Douglas Tilbury

By Kitty Kielthy

'Lights in the Sky'
by Douglas Tilbury

'Flowers'
by Ashish Kumar

'Dumbbell Nebula'
by Kristopher Rodway

'MacLeod's Tables'
by Emily Pears-Ryding

The Valuing Nature Programme: what has it taught us?

Rosie Hails talks to **Bea Gilbert** and **Lucy Rowland** about how the programme has positively changed interdisciplinary working for the benefit of nature.

LUCY ROWLAND (LR): Could you tell us how the Valuing Nature Programme came about, and how it has changed over time?

ROSIE HAILS (RH): The Natural Environment Research Council (NERC) has always been quite forward-thinking in developing interdisciplinary research; it's had the space to be quite generous with its budget in terms of funding other disciplines as well as environmental science.

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Originally, there was something called the Valuing Nature Network, which was led by Ian Bateman, and I was on a small team of people (with Georgina Mace, Dave Raffaelli and others) who helped him run it.[1] This network was about bringing together the disciplines of environmental economics and ecology for the first time. The interactions between environmental economics and ecology had been limited; environmental economics include ecological dynamics in their consideration of costs and benefits. There were missing pieces on both sides.

We had a very small budget for this network, but the idea was to really stimulate the research community to start thinking about this interface between two disciplines.

The Valuing Nature Programme followed on from the original network, and it was a much bigger exercise. There was recognition that while this was encouraging thinking around estimating the economic costs and benefits of nature, there were other ways of valuing nature that drew on arts and humanities and the social sciences. So that's when the research programme expanded to include those other disciplines as well.

I think that NERC had quite a lot of foresight at this time to see that the endeavour was going to be quite challenging, and it put aside about £1 million to fund the coordination team that I led, which included all those different disciplines and people: for example, Robert Fish, as social science lead; Ece Ozdemiroglu, chief executive officer of eftec [an environmental economics consultancy]; Michael Winter, land use policy, arts and humanities lead; Guy Duke, business champion; Charles Godfray as policy champion; Jonathan Porter from Countryscape as communications champion; as well as a support team led by Anita Weatherby.[2]

▲ **The Demystifying Nature booklets produced as part of the Programme. (© The Valuing Nature Programme. NERC grant NE/M005410/1)**

Because we had the funding to do it, we could be quite imaginative in the activities that we could create to stimulate that interdisciplinary community. For example, Ece [Ozdemiroglu] came up with a great idea about creating a 'demystifying' booklet series, and edited the first one around demystifying environmental economics, drawing upon expertise from across the wider network. Other titles followed – there were nine in the end – and these drew on many different disciplines to explain specific concepts in ways that could be understood by people across all disciplines, all co-written with Valuing Nature Programme members.

In addition to the coordination team, there were about seven research projects that went through the usual competitive process and that were funded. As time went on, the coordination team could therefore also draw on all the physical and social scientists who were in those different research programmes to participate in our activities.

LR: Could you tell us a bit more about how the Valuing Nature Programme supported interdisciplinary work in practice, and what kind of benefits it had for people working in the environmental sciences?

RH: Robert Fish had a great idea about 'discipline hopping' fellowships. We advertised for people to apply for a discipline hopper, where they could immerse themselves in another discipline for three or four months, developing a piece of work in the valuing nature space that drew on the expertise of the host organisation. It proved really popular, so we ran three competitive rounds of this initiative.

We also had an annual meeting that focused on interactive events: at these, we would stimulate the community to come up with some of the ideas that later became part of the demystifying booklet series, for example. There was a real emphasis on spending time together and talking across the disciplines, and on getting comfortable with the language of those different disciplines.

"There was a real emphasis on spending time together and talking across the disciplines, and on getting comfortable with the language of those different disciplines."

BEA GILBERT (BG): Could you tell us the biggest challenges you face when facilitating interdisciplinary work that crosses the traditional barriers between social and physical sciences?

RH: In trying to solve real-world problems, physical scientists think about variation and replication to try to distinguish signal from noise. Social scientists are very much more focused on case studies. But to an ecologist, doing in-depth case studies seems like research that isn't repeatable or replicable.

This can create tension across disciplines, but there are other tensions as well. For example, academics are often sufficiently removed from the practical world that they don't necessarily understand or have deep insight into the urgent problems that need to be solved here and now. On the other hand, if you're in the practitioner world, you haven't necessarily spent time trying to craft questions in a format that works for doing research. The length of time that is needed for co-design should not be underestimated. What I also find now, through working in the practitioner world, is that you become immersed in the fact that there is a climate and nature crisis, and this gives you a sense of urgency. Eco-anxiety is a real thing.

If you're in the academic world, you are to some extent insulated from that sense of urgency, which I think can lead to impatience in the practitioner world: practitioners often have the attitude of 'we know what to do, so let's just get on and do it; let's not waste resources on monitoring whether it's been effective or not'. But of course you have to monitor your research and progress to know whether you're on track to deliver, and to check that you really are getting the outcomes you intend. Crucially, you have to monitor to demonstrate to people – funders and anyone else who wants to invest in nature – that this is providing evidence of what works and is worth the investment.

BG: What do you think the legacy of the Valuing Nature Programme is? Are there any key lessons that we can take from it?

RH: Even though it was a six-year programme, that's not very long. It's always very hard to trace back and say: 'That happened because of the Valuing Nature Programme'. But I think it was part of the whole appreciation of the need for interdisciplinary work, which has grown and continues to gain momentum. For example, the British Ecological Society launched the *People and Nature* journal a few years ago. I was involved early on as one of the founding editors, and it's been very successful in publishing work at the interface between social and environmental sciences.

The journal has shown that there's been real demand for this kind of discipline merging, and I'm not sure that kind of work has had a dedicated outlet before. The Valuing Nature Programme was part of the world we're moving towards. ES

Professor Rosie Hails, MBE DSc hc FRSB, is an ecologist and the National Trust's first Chief Scientist, appointed in 2018. Rosie leads the Trust's Nature and Science team, working to meet its strategic objectives of restoring nature, ending unequal access, and inspiring people to care for nature and developing its research portfolio to ensure that key decision-making is backed by scientific evidence. Her research career spans over three decades, which includes over 200 publications, five books and more than £44 million in grants. She is Chair of the Biodiversity Expert Committee, serves as one of three NERC-funded RENEW directors and has been a member of Defra's Science Advisory Council. She was awarded an MBE for services to environmental research in 2000.

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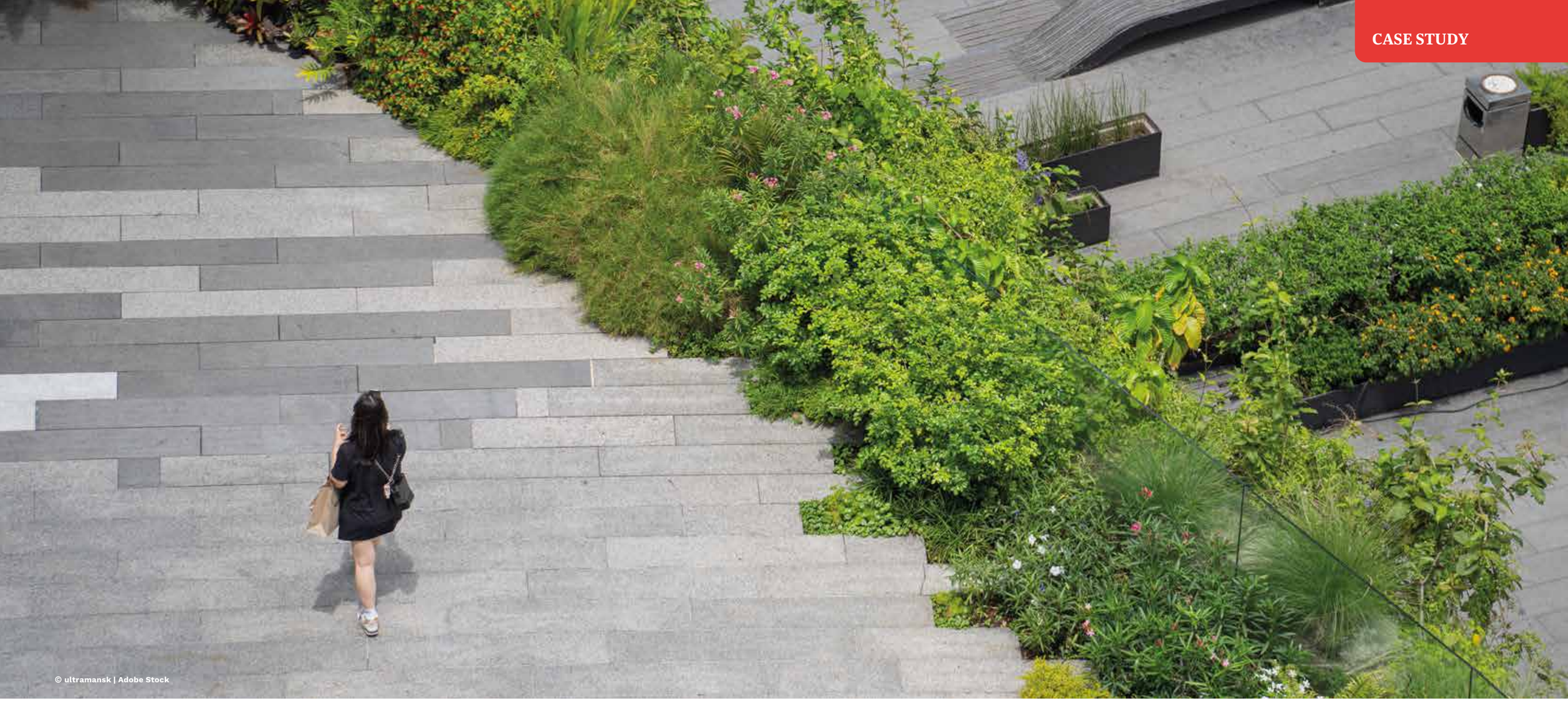

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Cultivating interdisciplinary communities of practice

Ethny Childs reflects on the IES Community model and its role in developing effective networks.

There is wide recognition of the importance of interdisciplinarity and systems thinking for developing solutions that effectively address the complex and interconnected challenges facing our environment, society and economy.[1] However, despite the change in rhetoric within the environmental sector, interdisciplinarity in practice is still the exception rather than the rule. Many of our workplaces, educational institutions and job roles have been built around disciplinary difference, reinforcing boundaries and embedding silo mentality.

Challenging this status quo requires a concerted effort across the sector to develop and signpost structures to support interdisciplinarity – including convening spaces and methodologies for collaboration, alongside good practice case studies showing the benefits that it can bring. Effective interdisciplinarity can nurture innovative and creative problem-solving. It challenges disciplinary norms, fosters lateral thinking and supports a more holistic understanding of a topic.

BRIDGING BOUNDARIES

Embedding systems approaches into environmental work is contingent on interdisciplinarity: it is grounded on the understanding that no single discipline can fully understand a system and that multiple viewpoints and expertise are needed to understand a

system's components and dynamics. It is worth remembering that systems are not discrete and objective; instead, they are ideas used to make sense of complexity and therefore need to be defined, with clear boundaries and limits so that they can be used to interrogate a particular concept or challenge. Establishing boundaries at the outset is critical for determining what will and will not be included in a project.

Systems approaches require not just interdisciplinarity but also collaboration and knowledge exchange across multiple axes: disciplines (e.g. air quality, land condition, social science); sectors (e.g. consultants, local authorities, industry); experience levels (e.g. early careers, directors); and regions (e.g. local, national and international). It is also essential that they foster the inclusion of marginalised voices. The different types of expertise and input needed will vary based on the project or challenge at hand but will likely need a mix of these elements.

However, building these links can be challenging, especially in the context of limited resources, project timelines and commercial interests. Having access to established, neutral and facilitated interdisciplinary networks can therefore be vital for accessing new knowledge, forging connections and discussing challenges in a friendly environment.

Professional bodies have a clear responsibility for convening and facilitating networks of this type. They provide a neutral and trusted space to bring together experts from across fields, sectors and regions, and have the resources in place to support the delivery of related outputs. These types of networks require careful facilitation and management so that they can deliver on goals and allow for effective knowledge exchange.

When done effectively, interdisciplinary networks bring myriad benefits:

- Greater connection across sectors, providing opportunities for professionals to expand their networks and build new partnerships;
- Upskilling professionals in interdisciplinary communication and collaboration;
- Providing a vital contribution to the learning and development of members;[2]
- Opportunities for professionals to feed into the development of sector-leading resources, such as professional guidance;
- Increasing knowledge and awareness beyond respective fields, allowing for the cross-pollination of ideas across disciplines and sectors;

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- Supporting the delivery of more robust decision-making by helping to identify potential unintended consequences and opportunities for multiple benefits; and
- Increased influence through development of a unified voice across the profession.

No one organisation or network can achieve everything, so it is also important to ensure facilitation across networks, taking a 'network of networks' approach that can tap into specific expertise where needed and reduce duplication.[3] It is also important to note that, to an extent, disciplines are always likely to exist in silos, so activities to support their connection and collaboration are key.

THE IES COMMUNITY MODEL

IES networks are called communities – groups of members brought together around a shared professional interest, goal or challenge. Historically, IES communities were only for specific fields, providing a space for subject specialists to come together from across organisations and sectors to develop tailored resources for professional development, to feed into policy and to develop partnerships. While these are still an important part of the IES Community model, there was recognition of the need for an additional format that supported environmental scientists to come together around a shared challenge and was built on the premise of interdisciplinary knowledge exchange.

With this in mind, in 2021, the IES launched the challenge-based Climate Action Community that could mobilise the diverse knowledge and expertise of its members to drive IES climate-related activities. The development of this community provides a great opportunity for reflecting on the process of cultivating communities of practice that can support interdisciplinary knowledge exchange and collaboration. Professor Gary Kass outlines four conditions that he has observed as necessary for inter- and cross-disciplinary working.[4] These are used as the basis for reflecting on how the initial Climate Action Community was established.

BUILDING INTERDISCIPLINARY COMMUNITIES

Intention. Interdisciplinary groups often require more direct intervention in the earlier stages, as they are less likely to spontaneously form and manage themselves given the diversity of experience and perspectives involved.

The Climate Action Community was consciously developed as a forum for bringing together those with different expertise; having this intention from the outset was critical for laying the foundations for interdisciplinary working. This intention was underpinned by the need for a specific space to support subject specialists to come together within the environmental sciences and discuss a cross-cutting challenge that affected their work and required insight across fields in order to develop effective solutions.

Settings. The external and internal contexts are essential factors to consider. Internally, it is important for buy-in across the organisation, including at the leadership level, for the need and benefits of creating interdisciplinary groups. This will ensure appropriate resource allocation, such as the establishment of a dedicated role to support community activities.

The external context can also be critical: topical challenges and dialogue in the wider sector can provide an effective rallying call for establishing new groups and launching new projects. The United Nations Framework Convention on Climate Change's (UNFCCC) COP26 was held in the UK for the first time in November 2021. The Climate Action Community was launched that year and was initially developed as a time-limited COP26 Community, designed to steer the IES's activities in the run-up to the conference.

Linking the formation of this community with a clear external need was a vital component in gathering interest and buy-in across stakeholders. It also provided a clear timeline and structure for bringing members together and developing clear community goals and activities. This maintained momentum and allowed members to prioritise their engagement with the group alongside other commitments.

Questions (and shared goals). Kass observed that 'boundary-crossing was stimulated and enabled by developing and pursuing questions that cannot be addressed adequately through a single discipline'.[4] Climate action is inherently interdisciplinary, so asking questions around how to develop effective climate action and exploring how it can be embedded into, and informed by, environmental work provided a solid basis to support the community's establishment.

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Developing agreed goals and targets, alongside ways of working to support group dynamics, was an essential step in supporting cohesion, allowing all members to provide input and feel a sense of ownership of the community and its activities. Agreeing the group's terms of reference and other supportive structures is important for managing member involvement, articulating the scope of the group and setting expectations.

Developing shared goals provided an avenue for outlining the activities that the community wanted to focus on. Having these goals and questions from the outset also supported the identification of the appropriate methodologies for the community to use to address them. It is important that the methodologies used are led by the questions or goals rather than the other way around.[4] For the Climate Action Community, this led to the development of the STAGES on the Road to COP26 project, which featured a series of discussion events on thematic topics, such as sustainability, transformation and adaptation.[5] These events provided space for key questions within these themes to be explored in an interdisciplinary setting and provided community members with the opportunity to develop consensus on a complex, interdisciplinary topic and inform related recommendations.

People: the most important ingredient in ensuring interdisciplinary groups are successful. IES communities are also volunteer-led, so their success is contingent upon member engagement and dedication. There needs to be a good balance of different expertise represented in a group and, critically, the inclusion of people who are open and committed to engaging in interdisciplinary dialogue.

At the establishment stage, proactive engagement and recruitment are necessary to get the right mix of people involved and to support the further co-development of goals and activities. Identifying who should be involved will be led by the boundaries used to define the system and challenge. For the Climate Action Community, the IES intentionally considered the initial group's composition and proactively reached out to key contacts to build a group of first movers.

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Effective communication across disciplines is a particularly challenging barrier to facilitating such groups, so involving members experienced in interdisciplinary working is valuable. A neutral chair, who does not represent a particular field or specialist background, can be supportive, as they can encourage open and clear communication and limit bias towards a specific field or discipline. Having a dedicated person to support engagement of the community is also key to driving community activities and maintaining momentum.

MAINTAINING AN INTERDISCIPLINARY GROUP

Building a shared mission across an interdisciplinary group that allows members to shape and refine priorities increases buy-in. Once an interdisciplinary group is established, it is essential to maintain momentum and engagement by continuing to invest time and resources into its facilitation and into activities that are aligned with this shared mission. A key part of this is ensuring there is a clear and consistent calendar of activities and touchpoints that are informed by member needs and interests.

After the Climate Action Community launch, regular events were held and communications sent to the wider IES membership, all aimed at growing engagement. As the group grew, it was important to revisit the community's terms of reference, activities and priorities so that new members could provide their input and feel part of the development of shared goals. Each year, community members feed into the development of an annual work plan, outlining the community's priorities for the following year. The community also collaborates with the wider IES family, including in the development of its priorities for the UK Government's shared mission for sustainable well-being, helping to support the development of joint goals across the IES ecosystem.[6]

When it transitioned from the time-limited COP26 Community to the permanent Climate Action Community, the terms of reference underwent a full review, reflecting the group's refreshed shared mission and providing space to develop new structures and procedures to support ongoing engagement, management and governance. As a group matures, developing governance structures that allows them to work more autonomously is a key milestone. The Climate Action Community now has a dedicated steering group that oversees community activities and works with the IES to take forward workstreams.

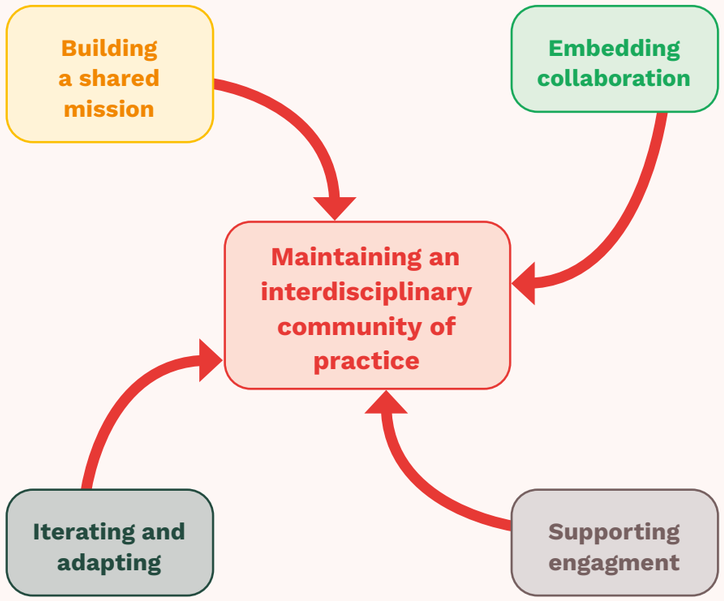
Embedding collaboration. Groups do not exist in isolation, and it is important to consider the wider ecosystem within which they sit to maximise their impact and to identify collaboration opportunities. Stakeholder mapping should be done to identify other groups that may be strategically aligned and to shape community priorities so that they are filling a specific sector gap or need.

Climate action requires collaboration and coordination across multiple sectors and stakeholders, so external engagement was a key goal for the Climate Action Community. As such, the group sought to develop ways to work with and to influence others across the sector. The IES became an observer organisation to the UNFCCC, helped to develop the Professional Bodies' Climate Action Charter and partnered with other organisations for specific events or activities. This increased the community's reach and influence, as well as supported it to access wider expertise and welcome new perspectives. There is dedicated time within community meetings for members to feed back on their external engagement, keeping all members informed and engaged.

Importantly, the Climate Action Community also works closely with other IES communities on shared workstreams, such as the IES's annual Dialogue Between Disciplines Conference.[7]

Supporting engagement. Interdisciplinary communities should be accessible and inclusive to encourage engagement and to allow for productive discussion (see **Figure 1**). Considering how to embed accessibility and inclusivity should be a priority when developing community activities. For example, Climate Action Community meetings are held virtually and there are multiple options for how members can engage with community activities.

In an interdisciplinary setting, discussion and collaborative working can be harder to initiate and



▲ **Figure 1. Maintaining a community of interdisciplinary practice.**

maintain. Active facilitation can therefore be an important tool for supporting meaningful dialogue. For the Climate Action Community, leaving time for open discussion could be unproductive, with members less likely to actively engage. Instead, using active chairing methods and facilitation tools is more constructive for eliciting engagement and participation, and for sparking discussion on a topic.

For established member-led communities it is also important to have multiple levels of engagement. For example, some members may only want to attend community meetings twice a year, whereas others will want to play a leading role in particular workstreams. Having different options for engagement will reach wider audiences and increase participation.

Iterate and adapt. Managing and supporting interdisciplinary communities is not a linear process. Continual learning and adaptive management is needed to maintain and support groups so that they can continue to blossom and build on their goals.

Trying new methods and techniques for engaging and managing groups is a great way of finding the most effective methods of working, and there should not be a fear of trying, failing, iterating and succeeding, and sharing these lessons widely.

"There should not be a fear of trying, failing, iterating and succeeding, and sharing these lessons widely."

Embracing change is essential for maintaining groups – community structures and procedures need to evolve and adapt to remail relevant and useful. Changes should also be member-led and evidence-informed, further reinforcing the need to engage with multiple perspectives.

A key focus for the Climate Action Community moving forward is solidifying its links with the other IES communities to develop collaborative workstreams and to support interdisciplinarity at a wider scale.

A LEGACY OF INTERDISCIPLINARITY

Developing, launching and growing the Climate Action Community over the past four years has been a steep learning curve. The journey is by no means over, and the IES continues to explore how it can best support interdisciplinarity through both its communities and its wider work in the sector. The IES's *2024–27 Strategy* is centred on interdisciplinarity, and the organisation will continue to embed new activities and workstreams to support this, including its pioneering Dialogue Between Disciplines Conference.[7,8]

Communities are central to this goal: interdisciplinary groups and forums are an integral vehicle for bridging boundaries and breaking silos. Only through investing in structures to support this type of work will we be able to effectively integrate knowledge and methods to develop innovative and creative solutions, foster shared understanding across disciplines and develop new evidence bases for solutions that truly deliver for our environment and society. ES

Ethny Childs is Head of Communities and Partnerships at the IES and is responsible for supporting the IES communities and building relationships with partners and stakeholders. She is also a Trustee for Charityworks, sits on the Specialist in Land Condition (SiLC) board, and is on steering groups for the Professional Bodies Climate Action Charter and the Media Trust's Communicating Climate Programme. She has co-authored multiple publications, including *Transforming the Planet: Our Vision for the Future of Environmental Science*.[1] In 2024 she was listed on the ENDS Power List as one of the UK's 100 most impactful environmental professionals.

Acknowledgements

Professor Gary Kass, FRGS FIEnvSci CSci MSc BSc (Hons), is an environmental and sustainability researcher, educator and knowledge broker, with nearly 40 years' experience in academia, policy and industry. Gary is Visiting Professor in Sustainability Science, Policy and Practice at Imperial College London, and Honorary Professor in the School of Geography at the University of Nottingham. He is a Vice-President and Chair of the External Policy Committee of the IES and is a member of the Office of Environmental Protection College of Experts.

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Collaborative land and water management through the Catchment Based Approach

Rob Collins examines how interdisciplinary working across civil society and the public and private sectors can support holistic and sustainable water management.

The Catchment Based Approach (CaBA) was established over 11 years ago by Defra with the aim of embedding a collaborative approach to land and water management across England. Globally unique in its catchment-scale national coverage and framework of support, CaBA arose from the realisation that while top-down government regulation has a role to play within land and water management, on its own it cannot address the breadth and complexity of the issue or fully realise the range of achievable environmental benefits. To do so 'requires a more decentralised and holistic approach' that engages all sectors of society.[1] CaBA's collaborative bottom-up approach aims to address this by bringing local knowledge, data and expertise to bear and empowering individuals, organisations and communities to take ownership of river catchment issues and to implement locally appropriate solutions.

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Today, more than 100 CaBA partnerships encompass river catchments across England and cross-border with Wales and Scotland. Partnerships are typically hosted by an environmental non-government organisation (eNGO) and supported by a catchment coordinator from the Environment Agency. The partnerships integrate the public and private sectors with civil society through the participation of a diverse range of organisations including eNGOs, water companies, local authorities, government agencies, businesses, landowners, academia and local community groups. These partner organisations collectively pool and review evidence, plan and deliver interventions to realise environmental and social benefits.

CaBA's innovative model applies local knowledge and expertise – empowering individuals, organisations and communities to take ownership of local issues – and provides the catalyst to implement cost-effective delivery. Improvements to water quality, reduced flood risk, increased climate resilience, nature recovery and more sustainable businesses are all part of this integrated approach. Moreover, CaBA partnerships deliver health and well-being benefits for local communities, including volunteer and citizen science opportunities that connect people with nature and improve the local evidence base.

FRAMEWORK OF NATIONAL SUPPORT

The CaBA National Support Group (NSG) constitutes approximately 30 active members who represent many of the organisations engaged in partnership working. The NSG plays a key role in supporting CaBA activity and promoting it across key stakeholders, aiming to strengthen the diversity of the wider initiative and to secure new funding sources. The NSG also supports partnerships by identifying gaps in knowledge or process and resolving barriers to delivery. Communication with the partnerships is undertaken via national conferences, workshops, newsletters, webinars and the CaBA website.

The NSG also oversees a programme of support across a wide range of technical areas including modelling and spatial analysis, and via a series of thematic working groups across key areas such as data, urban water management, chalk stream restoration and agriculture. Additionally, a water stewardship service raises awareness of CaBA among businesses, highlighting the available opportunities for water stewardship strategies, and assisting catchment partnerships to develop collaborative projects with businesses.

CATCHMENT PLANS AND INFORMATION PLATFORMS

The data made available to CaBA partnerships through a dedicated hub and captured locally (e.g. through eNGO monitoring and citizen science) are used to underpin catchment plans.[2] These plans are developed through a participatory approach, whereby the partnership organisations collectively agree priorities for action – for example, the Eden Catchment Partnership and the Tweed Catchment Management Plan.[3,4] The data are also incorporated into shared online information platforms (also called hubs or story maps) developed at the catchment scale – such as the Hampshire Avon Catchment Partnership hub and the Wear Catchment Partnership online portal.[5,6]

These require no specialist software, and through combining the data with a narrative they maximise the wider community's access to, and understanding of, the local evidence base through a visually appealing approach. The process of populating and building each platform also drives a participatory and collaborative approach across partner organisations and facilitates knowledge exchange. Both the plans and story maps offer the potential to combine data from regulatory and other sources to make it freely accessible to all. They therefore improve local understanding of pressures on the water environment and help to identify solutions across all stakeholders.

COLLABORATIVE ENVIRONMENTAL DELIVERY

Substantial time and resources within CaBA are targeted at building social capital, establishing relationships with a diverse range of partners, building trust and providing a foundation upon which collaborative delivery of environmental projects can follow. CaBA has implemented hundreds of projects nationwide since its inception, addressing a range of catchment and riverine issues – including habitat restoration, climate resilience, improved water quality and better community engagement with nature.

Urban water management. Delivery in the urban environment includes nature-based solutions to reduce flooding and improve water quality, tackling road run-off and misconnections, and raising public awareness.[7,8] The Chamber Mead wetland is a recent example of a strongly

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collaborative urban water management project funded from multiple sources.[9] This series of wetlands protects the Hogsmill River, a chalk stream, through the attenuation of untreated sewage and road run-off pollution, reducing the health risks posed to children who play in the river and enhancing biodiversity.

Multiple local authorities contribute funding to CaBA hosts in recognition of the importance of the partnerships in helping them meet their environmental objectives. In the case of the Bristol Avon Catchment Partnership, several local authorities contribute to a fund that provides small grants for scoping, feasibility and community engagement projects.[10]

Rural land management. Across the catchment partnerships nationwide, rural land management projects encompass farmer engagement and a variety of on-farm activities that address diffuse agricultural pollution. These include sustainable nutrient and soil management, riparian management (including planting and fencing), the creation of wetlands and other features to attenuate pollutants, and farm infrastructure improvements.

The ability to engage with landowners is a critical part of this work, and the partnerships can act as an intermediary – for example, with water companies where farmer engagement is key to reducing pollution of raw drinking water supplies such as in the case of Bowscar in the Eden catchment.[11] In the River Beult, flowing through farmland in Kent's Low Weald, a partnership approach addresses land drainage challenges, which have left the river vulnerable to drought and floods, and pollution from farmland.[12] Nature-based solutions have been implemented that hold water, recharge groundwater and filter pollutants, while the establishment of a farm cluster has supported the implementation of more sustainable farming practices, including with respect to pesticide use.[13]

Habitat restoration. Habitat restoration, both terrestrial and freshwater, is another key focus for CaBA partnerships. This includes the creation and protection of wetlands and priority habitats, river restoration including re-meandering, and interventions to support river connectivity. The Cornwell River Restoration and Wetland Creation project, for example, has re-naturalised the river channel, creating wetland habitat, reconnecting the river to its floodplain and providing substantial flood storage.[14] Similarly, the Saving the Saffron Brook project focused on restoring a heavily modified river ecosystem in south-east Leicester via re-naturalisation, floodplain reconnection and the creation of diverse natural habitats including wetlands and ponds.[15] A range of educational and social activities were also undertaken to bring the local community closer to nature.

Numerous collaborative natural flood management projects have also been delivered through CaBA partnerships, supported by the creation of a dedicated hub to capture details, including monitoring and evaluation.[16]

Citizen science. Volunteer and citizen science opportunities are a key CaBA strength, helping to improve the local evidence base as well as connecting people with nature and enabling them to take ownership of environmental issues. In the Crane Valley Partnership, a comprehensive citizen science programme has been ongoing for over a decade to assess the health of the River Crane.[17] This includes application of the Riverfly Monitoring Initiative to record the presence and abundance of pollution-sensitive invertebrate groups as an indicator of river pollution and change in local environmental conditions.[18] It also encompasses the monitoring of misconnections, where incorrect plumbing means that untreated foul water from homes discharges into rivers via the surface water drainage system rather than to the sewage network, detrimentally impacting the freshwater ecosystem.[19] Additionally, a citizen science method, known as outfall safari, has been undertaken for locating, assessing the impact of, and reporting on polluted surface water outfalls along the River Crane.[20] These techniques have been used to target investigation work and remedial action.

Delivering at scale: resilient Glenderamackin. West Cumbria Rivers Trust, Nature Finance and The Rivers Trust, supported by the West

Cumbria Catchment Partnership, are developing an ambitious project to deliver nature-based solutions at a whole-catchment scale.[21] These are designed to reduce flood risk, restore nature, mitigate against climate change and support farmers in the Lake District's Glenderamackin catchment.

Building on the success of earlier projects to implement natural flood management and enhance habitat, the objective is to implement measures at scale, such as wetland and pond creation, tree planting, peatland restoration and reconnecting rivers to their floodplains. This will address the multiple challenges of flood risk, drought, poor water quality, degrading habitats and peatland erosion. An innovative financial model has been established that links buyers and sellers of ecosystem services, and a blend of public and private funds will finance farmers to host and maintain nature-based solutions on their land for more than 20 years, thereby supporting upland farming and ensuring sustainability of their farms.

TOWARDS A HOLISTIC APPROACH

With its facilitating and convening power, CaBA can play an important role in driving a much more holistic approach to land and water management over the coming years. Such an approach has been given recent impetus by the Independent Water Commission Review, which proposes an innovative new water planning framework.[22] Within this framework, CaBA can drive integration across the myriad existing piecemeal plans and policies, including local nature recovery strategies, the water industry's national environmental programme, flood plans and agri-environmental initiatives, thereby supporting the smart targeting of outcomes that realise multiple environmental, social and economic benefits.

Part of this integrating role for CaBA includes harnessing a nascent commercial interest in how catchments function in order to drive investment and innovation in strategic natural capital assets. However, fully realising the potential for synergistic outcomes under a new framework will require a marked increase in funding for CaBA partnerships to continue to build capacity and expertise, coupled with a more formalised recognition and legitimacy of their role. ES

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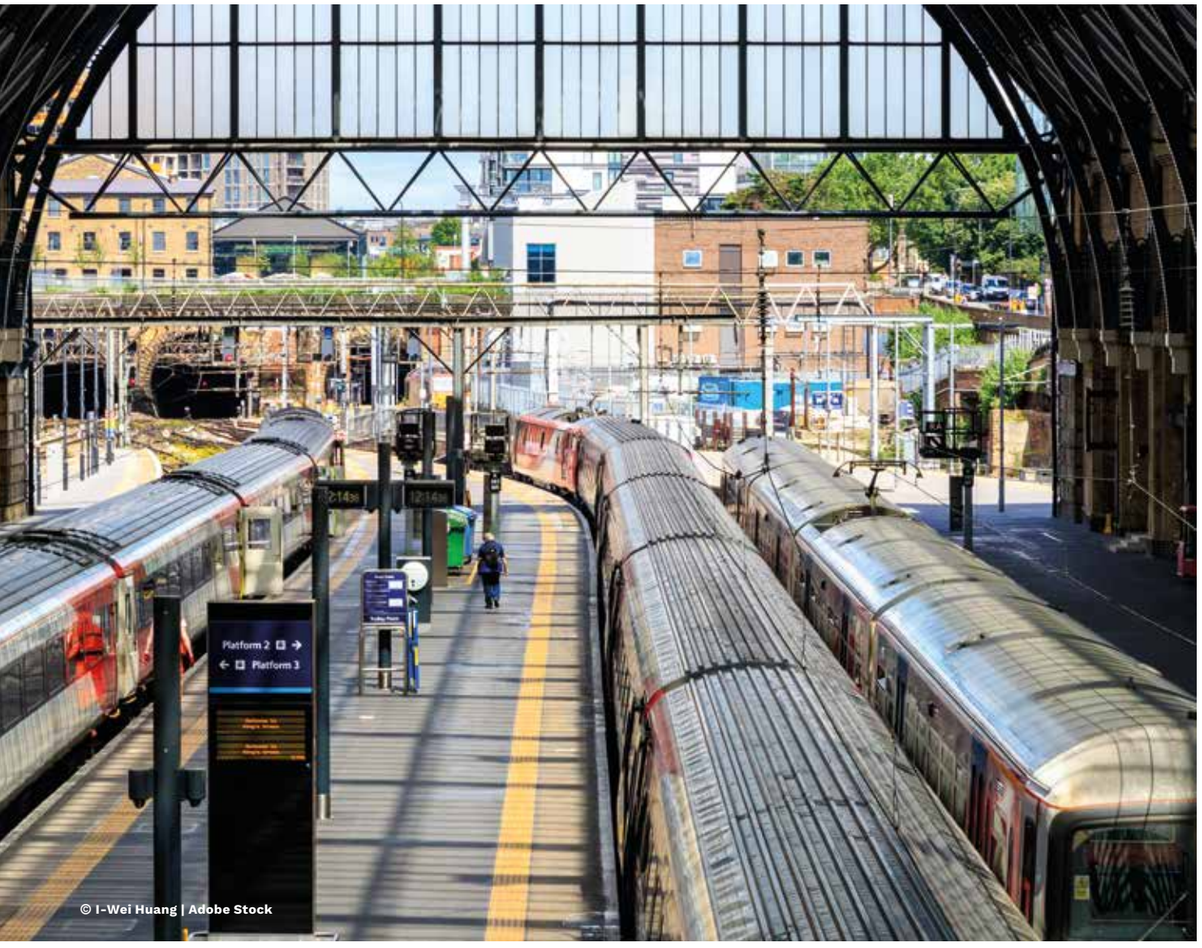
In-between worlds: the lived experience and skills of interdisciplinary career professionals

Alexandra Budjanovcanin
discusses the virtues and difficulties of pursuing a career that is outside the norm.

'I've never quite belonged anywhere.'
'I sort of sit across different areas.'
'It's a bit complex to describe.'

Explaining what you do can be surprisingly difficult when your career does not fit neatly into a single field. These are the kinds of comments often heard from people whose work spans multiple domains – that is, those navigating what is often called an interdisciplinary career. While much has been written about the promise and challenge of interdisciplinary research, the focus tends to sit at the level of projects, funding calls or methodologies.[1] Far less attention is paid to the person living this interdisciplinarity: someone whose work, identity and credibility stretch across disciplines, institutions or sectors.



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For these professionals, building a career often means inhabiting a kind of in-between space: one that can feel rich and expansive, but also ambiguous and isolating. It requires navigating shifting norms, justifying one's path repeatedly and living with a persistent sense of not quite belonging anywhere.

WHY ARE SUCH CAREERS NECESSARY?

It is increasingly recognised that addressing the world's most intractable issues requires drawing on diverse forms of knowledge. So-called wicked problems – like climate change, biodiversity loss and environmental injustice – are complex, systemic and resistant to single-discipline solutions.[2] They often involve multiple root causes, non-linear dynamics and unpredictable consequences.[3] In the case of environmental degradation, for example, acting in one area may solve one problem but worsen another. This is why systems thinking and collaborative problem-solving are essential, and why careers that span disciplinary boundaries are becoming more necessary. Interdisciplinary professionals bring together insights from different fields to help society navigate complexity.

For many, this work can be deeply meaningful and intrinsically rewarding. It also offers opportunities for variety and an expanded skill set. But the challenges it can pose should also be acknowledged: the discomfort of crossing boundaries; the difficulty of building credibility in multiple communities; and the sense of loss, sacrifice and regret that can accompany a non-linear career path. While regret can, of course, emerge from pursuing a narrow, specialised path, it may feel more pronounced in interdisciplinary careers because of the comparative lens through which they're often viewed. Comparison with a perceived 'better' alternative is central to how regret operates – and with fewer clear benchmarks and more visible peers in conventional roles, the sense of having chosen a harder or less-recognised route can be particularly acute.

IN-BETWEEN WORK: EMOTIONS AND IDENTITY

For those pursuing interdisciplinary careers, one of the most persistent challenges is the feeling of not quite belonging. Without a clear disciplinary 'home' many experience a kind of professional rootlessness and a sense of liminality: being betwixt and between identities. The difficulties of inhabiting what is known as a liminal space – ambiguous, shifting, and neither here nor there – are well documented.[4] However, much of our existing understanding focuses on liminality as a temporary condition: a transitional phase to be moved through on the way to something more stable. For interdisciplinary professionals liminality is often a chosen state, one they commit to inhabiting to pursue work that bridges domains, challenges boundaries and reflects the complexity of real-world problems.

Without a clear professional home, interdisciplinary professionals may struggle with career progression, building a peer network and navigating unclear evaluation criteria. While the specific benchmarks vary by sector, interdisciplinary work often sits awkwardly within established systems of evaluation – whether in academic publishing, institutional hierarchies or performance management frameworks. Conventional disciplinary metrics do not always

apply (or apply unevenly) to those working across boundaries. These connected challenges are ever-present in a permanently liminal space. But this is more than a practical problem; it is an emotional and cognitive one too.

The sense of ambiguity is a fundamental element of what makes interdisciplinary careers so rich. This ambiguity can be difficult for some. Sustaining an interdisciplinary career demands a capacity to tolerate contradiction and to make peace with complexity – what the poet John Keats famously called negative capability: the ability to remain 'in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason'.[5] To cope with this, instead of seeking to draw conclusions immediately, Keats advocated for first being able to reside in a place of ambiguity and embracing the possibility that answers may come later. For interdisciplinary professionals, developing this capability is both intellectually useful and emotionally protective.

EXPERIENCING OCCUPATIONAL REGRET

In addition to sitting with uncertainty, part of the emotional experience comes from questioning whether this was a smart career move. Choosing an interdisciplinary path can mean having to forgo the depth, prestige or clarity that comes with a single-field career – in other words, career sacrifice.[6] This can lead to occupational regret and wishing you had chosen a different career path, back when you were making important fork-in-the-road decisions.[7] This may not necessarily be because the disciplinary fields you straddle are a poor fit, but because pursuing them simultaneously is not always recognised, rewarded or supported by conventional systems.

Recently, the idea of lesser-evil decision-making in careers has been written about – where individuals choose the path that better aligns with their values, even if it involves giving something up. For many interdisciplinary professionals this trade-off is real.

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Yet so is the sense of integrity and purpose that comes with it, meaning that many will still choose this path, which is richly required. For those who do choose it, how do they make sense of their careers when the path is non-linear, ambiguous or marginalised? One strategy is the use of career storytelling.

BECOME A BETTER STORYTELLER

Storytelling is an important skill in contemporary organisations, and not only in leadership, where it is often discussed, but also for shaping career narratives.[8] For those in interdisciplinary roles, crafting a compelling story about one's path can be transformative. Firstly, it can build confidence. For example, being able to clearly explain the in-between role you inhabit – and the value it brings – strengthens your self-concept: how you see yourself in terms of abilities, roles and contributions. Research shows that a coherent self-concept is closely linked to higher levels of self-confidence.

Secondly, developing a narrative helps to counter feelings of misfit, a perceived lack of expertise and feeling like an imposter. If your path does not follow a standard trajectory, that does not diminish its value. Your distinctiveness lies in your ability to traverse worlds and to move between fields, perspectives or systems, and this should sit at the heart of your narrative.

However, it is important to prioritise contribution over coherence. Rather than apologising for a non-linear path, highlight the integrated value you bring to solving complex problems. It is not about tidying your story into a conventional shape but about articulating the unique kind of sense-making and bridge-building that your career enables.

PRIORITISE BRIDGE-BUILDING CAPABILITIES

At the heart of a successful interdisciplinary career is the ability to connect ideas, people and resources across boundaries. This demands many skills, but central among them are emotional

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intelligence and a specific form of leadership known as cross-silo leadership.

Emotional intelligence (EQ) is the ability to understand, regulate and use your own emotions while recognising and influencing the emotions of others. This is critical when navigating the ambiguity and emotional complexity of boundary-spanning work. When developed intentionally, EQ helps you move through the aforementioned psychological discomforts that can arise in interdisciplinary settings, both in yourself and in others. The subskills of empathy, adaptability and stress tolerance are especially important when working with people who bring differing assumptions, priorities and ways of thinking.[9]

Equally important is how leadership is approached. Interdisciplinary professionals benefit from developing cross-silo leadership: the ability to build trust, translate across perspectives, and collaborate across functional, disciplinary or organisational boundaries.[10] As complex challenges increasingly require knowledge integration, this form of leadership becomes a strategic asset, not just a collaborative tool. It enables professionals to bridge gaps between people and domains, fostering innovation and generating impact that no single silo could achieve alone.

This boundary-spanning role may not represent a formal leadership position but, nonetheless, provides leadership through the time spent with different constituents to understand each group's language, concerns, and incentives to mediate discussions and keep collaboration on track. The ability to empathise with groups, explain their perspectives to one another and defuse misunderstandings makes this an invaluable cultural-broker position – not by virtue of technical expertise alone, but because of interpersonal skill and leadership at the interface.

FIND YOUR CLUB

In an interdisciplinary career, your club may not be neatly defined by disciplinary boundaries, and that can make it harder to find. But it exists.

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What binds this interdisciplinary community together is not a shared field, but a shared experience – specifically, the challenge (and richness) of navigating across multiple domains. Interdisciplinary professionals often find common ground not in what they do, but in how they work: integrating perspectives, building bridges and making sense of complexity.

You are most likely to find this kind of club in communities of practice, at interdisciplinary conferences, within professional networks focused on systems change or in informal peer groups built around shared ways of working, rather than through titles or credentials. Seek out the spaces where boundary crossers gather; if they do not exist yet, consider creating one.

IS IT WORTH IT?

An interdisciplinary career may sound daunting or hard work to pursue. While these paths may lack ready-made maps, they are far from directionless. By crafting personal narratives, building relational anchors and developing skills for boundary work, professionals can transform a fragmented terrain into one of purpose and possibility. These careers can be deeply rewarding and, when nurtured well, highly impactful.

We should recognise and support those who choose to reside in these liminal spaces, because it is they who will be integral to addressing the world's most pressing, wicked and intractable challenges. ES

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Transformative change: how can meaningful trans-disciplinary approaches accelerate housing decarbonisation?

Louise King considers the role of interdisciplinarity in transforming the UK's existing housing stock.

Retrofitting the UK's housing stock is one of the most urgent and complex challenges on the pathway to net zero. The housing sector is responsible for around 20 per cent of the UK's total carbon emissions, and with 80 per cent of the homes that will be occupied in 2050 already built, retrofitting the country's existing housing stock to improve energy efficiency and reduce carbon emissions is critical to achieving net zero targets.[1]

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Yet despite this urgency, the UK has struggled to deliver the necessary retrofit at the pace or scale required. Policy interventions have been fragmented and short-term, focusing on single measures or financial incentives.[2] Responsibility for retrofit is often placed upon individual households, underpinned by theories of rational choice, while the delivery of such measures is constrained by underdeveloped supply chains and skills shortages.[2] As a result, progress is frequently inconsistent and opportunities for coordinated, systemic change are missed.[3,4]

Furthermore, retrofit is often framed in terms of achieving decarbonisation through technical or economic intervention rather than as an inherently social process that has important implications for health, equity and community cohesion. Retrofit can deliver improvements in health by reducing damp and mould, tackling fuel poverty, generating local jobs, preserving and enriching biodiversity, and developing community resilience in response to climate change.[5,6] This is particularly pertinent across the UK's social housing sector, where the urgent need for improvement in quality and energy efficiency is well documented.[6] In order to achieve these transformational benefits, coherent systems are required, with clear governance and funding frameworks, alongside mechanisms to enable meaningful resident engagement.

GOVERNANCE, PLANNING AND POLICY

National government has the capacity to set binding long-term targets, provide consistent funding, and coordinate data collection and standards – for example, through Energy Performance Certificates and publicly available specifications. However, with more than 50 policies, schemes and strategies introduced or trialled, the direction of UK retrofit is unclear and uncertain.[7] National schemes often overlook local diversity, imposing one-size-fits-all solutions that fail to capture local context. High-profile schemes such as the Green Deal and the Green Homes Grant, for example, collapsed amid design flaws, short-termism and a lack of public trust.[8]

The complex nature of retrofitting UK homes encompasses diverse disciplines across architecture, engineering, environmental science, sociology and psychology. Policy that supports and enables interdisciplinarity is critical. While there is evidence of innovative retrofit approaches at local levels (e.g. some local authorities and housing providers have developed retrofit programmes engaging directly with residents) the capacity to deliver more broadly is, of course, constrained by policy instability and affected by inconsistent funding streams and limited local resources.[9,10]

Unsettled retrofit policy exacerbates the integration of interdisciplinary expertise and perspectives.[2,11] Short-term policies focused on discrete technologies such as heat pumps or cavity wall insulation may increase uptake across households, but they offer little for the development of retrofit governance structures, supply chains and skills necessary for sustained transformation.[8,12]

Residents, meanwhile, must navigate an uncertain and often contradictory information landscape, which rarely aligns with lived experience. One study found that homeowners in the able-to-pay market struggled to make sense of retrofit advice, leading to piecemeal upgrades and undermining whole-house energy savings.[2] Information overload, alongside a lack of trusted messengers, further damages public confidence and uptake of retrofit measures.

There is a clear need for interdisciplinary systems thinking: an approach that frames retrofit not in terms of isolated single measures but, rather, as an interconnected set of interventions spanning building fabric, energy efficiency, thermal comfort, health, behaviour and governance. Such a whole-house, socio-technical perspective integrates technical upgrades within the context of cultural practices, regulatory frameworks and social dynamics. For example, installing low-carbon heating systems requires not only the relevant technology, installation capability and quality assurance, but also a shift in how residents use and perceive thermal comfort in their homes.[13,14]

EQUITY AND SOCIAL JUSTICE IN HOUSING

The risks and benefits of retrofit are unevenly distributed: poorly designed interventions can increase housing costs, exacerbate fuel poverty or displace vulnerable tenants through gentrification.[15,16] Conversely, well-designed and coordinated retrofits can improve health outcomes,

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reduce energy poverty, and create safer, more comfortable living conditions.[17,6] This is particularly salient in the social housing sector, where retrofit can have wide-ranging impacts on residents and communities – from improving well-being to providing economic benefits through local training and delivery. Equity and social justice must, therefore, be embedded into standards and governance frameworks. This requires technical excellence as well as attention to lived experience, affordability and accessibility. Retrofitting the most vulnerable homes and households first, those most at risk of fuel poverty and poor health, can deliver immediate social benefits while also achieving significant carbon savings.

MEANINGFUL SOCIAL CONSENT

While governance provides a retrofit framework, social consent provides critical legitimacy. Retrofit cannot succeed without the consent and participation of residents, whose homes and lives are directly affected. Historically, engagement within social housing has often been limited to consultation, with residents informed about proposed measures but rarely given meaningful influence over decisions. This risks treating households as passive recipients or even as test subjects for new technologies.[18,19]

Transformational retrofit depends on forms of social consent that enable residents to participate as equal partners in design and decision-making. This involves moving beyond passive household preferences towards cultivating cultures where knowledge is co-produced, data shared and collective decisions made about trade-offs and priorities; in essence, truly sharing power. For example, working with residents to interpret data on damp or carbon dioxide levels can contextualise problems as structural rather than individual, enabling solidarity and collective problem-solving.

Evidence demonstrates that participatory approaches build trust and increase retrofit literacy and uptake. Local organisations and community groups, often seen as more trustworthy than national agencies, are particularly important in bridging gaps between policy and practice.[2] Empowering these participants, and resourcing them to sustain engagement over time, is essential for embedding legitimacy and accelerating acceptance.

THE CHALLENGE: SCALING WITH MEANING

The challenge of retrofit is therefore twofold: achieving pace and scale, while also ensuring depth and meaning. Pace is critical, as the window for decarbonisation is rapidly closing, while scale is necessary to achieve climate targets. Yet neither pace nor scale will be possible without legitimacy, trust and collaboration.

This requires a shift from framing retrofit as a series of short-term, siloed and energy-efficiency focused interventions to a force for collective social good: indeed, from retrofit to transformation. Policy must provide consistent, long-term funding that gives certainty to supply chains and creates conditions for workforce development. Local authorities and community organisations must be resourced and empowered to deliver context-specific solutions. National campaigns should promote retrofit literacy and highlight co-benefits, while governance frameworks must integrate technical, social and environmental priorities.

A TRANS-DISCIPLINARY APPROACH

Progress requires the integration of technical expertise, governance structures and lived experience through collaborative systemic approaches – bringing together designers, planners, social scientists, policy-makers, community groups, residents and housing providers. National government must provide consistent policy and funding frameworks, while local leaders must be resourced to deliver trusted, context-specific programmes. Most importantly, residents must be engaged as co-creators, not passive recipients, ensuring that retrofit is underpinned by social consent and multidimensional benefits.

Accelerating housing transformation at scale is essential for meeting climate targets. Successful transformation, however, will be contingent on embedding trans-disciplinarity principles to ensure a genuinely sustainable future for UK homes. ES

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Advancing interdisciplinary work on climate change and health

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Tim Taylor, **Cornelia Guell**, **Helen Macintyre**, **Katharine Earnshaw**, **Liz O'Brien** and **Benedict Wheeler** talk about early lessons from the Net Positive Centre.

Addressing the complex linkages between climate change and human health requires interdisciplinary working. In October 2024, UK Research and Innovation (UKRI) funded the Centre for Net Positive Health and Climate Solutions (or Net Positive Centre for short), a multi-sectoral and interdisciplinary collaborative research centre cutting across the University of Exeter, the UK Health Security Agency (UKHSA) and the National Trust and Forest Research.

Environmental sciences – and environment–health research specifically – have long promoted the value of interdisciplinary thinking and working. However, the complexity and challenges of working in a truly interdisciplinary fashion are acknowledged, and in developing the Net Positive Centre there is an understanding that this requires being proactive and more than just 'people from different disciplines working together'.[1] There are critical challenges in considering how different research approaches and epistemologies can genuinely be brought together to be more than the sum of their parts in addressing climate change and health issues. This extends beyond the (now relatively common) integration of natural and social sciences to develop truly inclusive research that values all disciplines and a plurality of knowledge and goes beyond research institutions to include delivery partners and communities.

FOSTERING RELATIONSHIPS

The Net Positive Centre is founded on relationships between organisations and individuals, one-to-one, and with communities. The academic and non-academic centre partners collectively have a substantial range and depth of experience in cultivating and maintaining relationships across climate change and public health research. However, there was a desire to ensure the centre started the process by thinking about what the nature of those relationships might be and how they might contribute positively

to the climate change and health discourse, rather than only prioritising which relationships to pursue. Shifting the emphasis in this way allowed consideration of how a plurality of voices might contribute, and how more can join across the centre's lifetime.

Early on, the team recognised the need to foster a sense of community. Before the call had come out, colleagues at the University of Exeter were looking to develop further research on climate change and health: they had held an open workshop to enable early discussions and get an overview of the different disciplines either already engaged or interested in work on climate and health. This internal academic networking was used to build a cross-faculty group of investigators to respond to the UKRI's call for a centre, and a broad consortium was built with UKHSA, the National Trust and Forest Research with the aim of developing a highly applied, policy-focused centre.

Along with numerous online meetings, two hybrid workshops were held to develop the proposal, acknowledging the value of investing in-person time to build a community, and to hold discussions ranging much wider than the specific application of particular methods (e.g. climate modelling or economic approaches) and work packages. Facilitated group discussions focused on developing novel ideas for model projects and PhD studentships. Open discussions were held on how the different disciplines could be brought together – with expertise cutting across the classics, social sciences, computer science, mathematics, public health, geography, economics and epidemiology – and there were inevitable questions around ways of working and ensuring fairness in the allocation of resources. Those working in the humanities, for example, needed further allocation of time for investigators to help with the development of single-author scientific publications to meet disciplinary norms. Through these meetings the team developed a sense of community, which has continued to deepen in the delivery phase.

DEVELOPING THE VISION

Building on the workshops, the team decided on a challenge in the form of a question that would underpin and inspire activities in the Net Positive Centre, and which arguably would necessitate an interdisciplinary approach for success: How can the UK capitalise on co-benefits (or deal with co-effects) of climate mitigation and adaptation strategies to address environmental, social and health inequalities across the lifecourse?

A vision for how different themes might come together to address this challenge was developed (see **Figure 1**), and four key themes were identified and given one-word titles that summarised their focus:

1. To **conceptualise** and identify key issues and priorities in climate change and health, and to map the complex systems, structures and values that underpin them.

2. To **understand** current and potential health and environmental impacts of adaptation and mitigation approaches within critical systems (urban, green and blue infrastructure, and food systems) across the lifecourse.

3. To **evaluate** feasibility and potential health and environmental co-effects of implementing inter-sectoral adaptation and mitigation responses to climate change.

4. To **build** UK cross-sectoral capacity and create ongoing dialogue on climate change and health solutions through engagement between researchers, communities, industry, government and third-sector organisations.

WHAT DOES NET POSITIVE MEAN?

The term net zero has dominated the carbon mitigation agenda, and it was apparent that the centre's ambitions go beyond this, aiming to develop solutions for climate change mitigation and adaptation that deliver positive benefits for health, health equity, the environment and biodiversity. For example, the design of sea defences needs to consider not only the physical needs of protecting infrastructure and, ultimately, health risks associated with coastal flooding, but also recreational users and their need to benefit from continued access to the blue space. In addition, the needs of different communities should be considered (e.g. different ethnic minority groups, those with jobs related to the coast, older or younger people) as well as the impacts on habitat provision.

ESTABLISHING FOUNDATIONAL PRINCIPLES

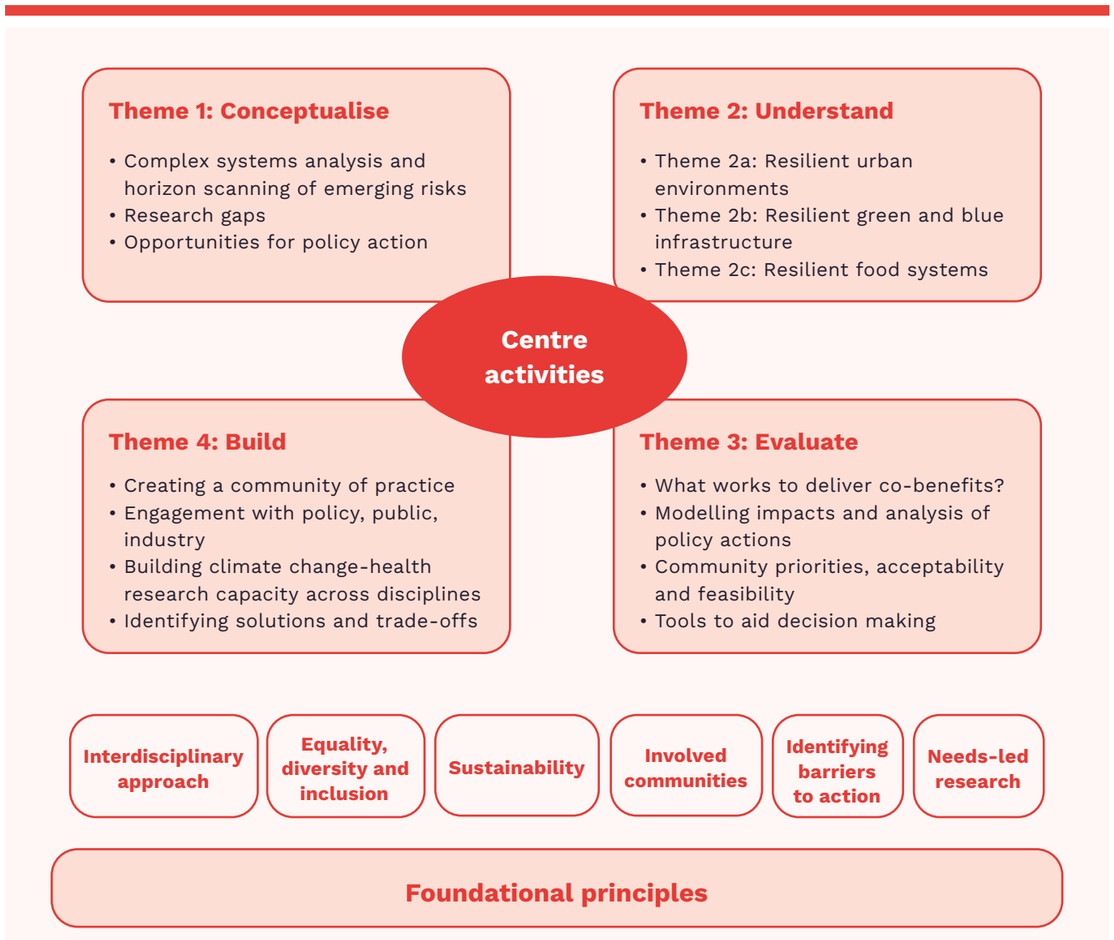
There was a realisation that this centre needed to 'walk the talk' with how it approached its research in terms of sustainability and equity – and this drove the integration of six foundational principles in its vision (see **Figure 1)**. Several team members had previously worked on the Advancing Capacity for Climate and Environment Social Science (ACCESS) project, and built on this to establish the following principles:[2]

1. Strong interdisciplinary approach. This includes professions beyond academic organisations and is essential to address climate change and health challenges.

2. Equality, diversity and inclusion (EDI). Understanding the impacts on the most vulnerable population groups and directly involving those groups in solutions-driven co-production of research is critical to ensuring that actions empower communities and co-benefits are maximised in a socially just manner. EDI reflection and action, and a positive research culture, will be embedded throughout operations and partnerships.

3. Sustainability. The Net Positive Centre will focus efforts on sustainable solutions that deliver net positive impacts for health with environmental co-benefits and uphold best practice in terms of the centre's own environmental footprint.

4. Involved communities. The involvement of the public, including those affected by change (such as residents), those who implement change (including local authorities) and other stakeholders will ensure that research is embedded in the lived realities and concerns of different groups.



▲ **Figure 1. The Net Positive Centre's vision. (Source: The Net Positive Centre)**

▲ **Figure 2: Art activities at a Net Positive Centre meeting. (© Harry Corden-Lloyd for the Net Positive Centre)**

5. Identifying barriers to action. The centre will identify barriers that otherwise constrain effective solutions and seek to support opportunities to overcome them.

6. Needs-led research. The research will be based on the needs of policy-makers, government agencies and communities.

EMBEDDING THE ARTS

Integration of the arts into this type of research centre can often end up being watered down to arts-based dissemination and communication of the research findings. One of the ambitions of the Net Positive Centre is to bring together a community of practice around climate change and health, with arts-based practices being as integral to the research ecosystem as climate modelling and public health sciences are.

> **"Arts-based practices [are as] integral to the research ecosystem as climate modelling and public health sciences."**

In other words, to build on the range of recent studies that show research-led methodologies from the arts – and humanities – should be of equal importance as other disciplinary expertise.

In addition, the centre is using creative practices in positive disruptive ways to foster spaces for creatively considering the needs and solutions among academic and stakeholder communities in order to address net positive benefits or co-benefits. At the centre's first annual meeting, workshops led by local artists were used alongside more conventional discussion sessions (see **Figure 2**).

The centre will have several creative fellowships and community-based arts projects and will use creative facilitation across different elements of outreach, engagement and involvement in research development. This will include the use of design thinking, which orientates effort around need, mobilising creative, experimental and visual approaches to finding solutions.

PUBLIC ENGAGEMENT

The centre is adopting a holistic approach to engaged research, recognising that engagement is itself a creative, dynamic intervention that serves to construct the public groups with which it engages.[3] A deeper insight into diverse experiences, expertise and beliefs means that both the research design and resulting recommendations will be fairer, more sustainable and effective. The centre adheres to the ethos that communities and research participants need to be acknowledged as co-producers of knowledge drawing on their forms of experience and expertise.[4]

Across the centre's projects and activities, the aim is to plan and undertake engagement from the outset to ensure that it is a core part of how research is carried out and to avoid tokenistic engagement. The centre welcomes wide and diverse collaborations with different groups affected by climate change and from those in positions to effect change. It aims to notice and remove barriers to engagement, being alert to the multiple structural and personal inequalities and barriers that people face in participating in this work, and acknowledges and respects the trauma people have, and face, in relation to climate change and health. In doing so, the centre's work will be needs- and evidence-led, listening to different communities (public and professional) to understand their expertise, experience, and what they need and want in order to make life healthier, fairer and more sustainable. Engagement is therefore not a discrete process or element of a larger workflow; it is the philosophical and theoretical grounding for the Net Positive Centre.

CHALLENGING COORDINATION

The activities of the Net Positive Centre are impact-focused, including policy engagement, running summer schools for PhD students, engaging with secondary schools, working with artists, researcher-in-residence programmes in both policy and industry settings, and creating a challenge fund to support seed corn projects on climate change and health across the UK.

A challenge in delivering such an ambitious array of activities is to not lose sight of the need for developing world-leading interdisciplinary research. Each centre researcher is assigned two managers from different disciplines and allocated to specific research projects as well as having to engage in other activities. Care is taken not to overfill researchers' schedules to allow time for responsive and co-creative research across the centre partnership. With 16 research fellows across different disciplines, and across a variety

▲ **Figure 3. The Net Positive Centre team. (© Harry Corden-Lloyd for the Net Positive Centre)**

of organisations and locations, there are some logistical challenges – but these will be addressed through a mixture of hybrid and in-person meetings and by fostering a culture of care and collaboration across the centre (see **Figure 3**).

THE FUTURE OF INTERDISCIPLINARY RESEARCH

Our world faces complex challenges in tackling the climate crisis – and we need meaningful and effective collaboration across academics, practitioners, decision-makers, policy stakeholders, industry, artists and communities to address them. Siloed working is a long-standing challenge for cross-cutting societal challenges like climate change and health, and it must end – the problems and needs are too great and becoming ever more urgent. We need to be open to addressing the challenges of working across disciplines by building spaces where care and openness can facilitate meaningful dialogue and interaction. As part of that, the hope is that others will engage with the centre, join the journey and build better networks to be able to deliver a net positive vision for the future. ES

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