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EDITORIAL

Eileen Kinsman

Changing the future, together

One third of the country under water, 33 million people displaced, more than 1,200 people killed, food crops devastated. This isn't a dystopian vision of the future, this is Pakistan in 2022 as it battles to survive devastating floods. This is climate change.

Meanwhile, climate-related impacts on the global food system, exacerbated by conflict, are fuelling rapid increases in world hunger as prices soar. Here in the UK, rapidly escalating global fuel prices are forcing people to choose between heating and eating while fossil fuel companies bring home record profits.

These are complex, interlocking problems, but one thing is abundantly clear: we need action now to break our dependency on fossil fuels.

In the UK, we need investment in home insulation to cut energy consumption and reduce fuel bills, we need to ramp up renewable energy supplies, and we need to transform our failing food system. We must do this in ways that recognise the need for a just transition, address inequalities, create new green jobs, enhance biodiversity, and help us adapt to existing climate impacts, all whilst facing up to our global responsibilities as an historically high-emitting nation.

It is a huge challenge, and it will require transformational change across every sector. We all need to be changemakers now – in our homes, our workplaces, our communities, and as active citizens pushing for action from governments, policymakers and businesses.

Here at CAT, we're focused on helping people to do just that. By providing training, support, inspiration and advice for councils, communities, businesses and individuals, we're helping build the skills, knowledge and networks to start creating a better future, today.

In this issue, you can read about some of our recent work: from providing Innovation Labs and training that supports local authority and community climate action, to equipping the architects of the future with deep knowledge of sustainable design. We look at new CAT-partnered research into alternatives to fossil-fuel-based fertilisers, and explore what's needed at a global level to turn government commitments into effective action at this year's COP27.

Thank you so much for being part of this incredible network of people who are working together to help create a safer, healthier, fairer future for all.

Interim co-Chief Executive Officer Eileen Kinsman

Keep in touch Write to us: Centre for Alternative Technology, Machynlleth, SY20 9AZ

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Celebrating the CAT Class of '22

Images: Elsie Grace

On Saturday 9 July, CAT's Graduate School of the Environment welcomed our 2022 graduates and guests for our very first hybrid graduation ceremony.

The ceremony celebrated 120 graduates completing their studies on our postgraduate courses, with graduates and guests joining us in-person at CAT and live online.

Interim co-CEO Eileen Kinsman opened the ceremony with an inspirational address that focused on the real and lasting impact of CAT graduates.

Eileen Kinsman addresses graduating students and guests

"Studying for a postgraduate degree with CAT is unlike any other experience of higher education. What you learn at CAT – from lecturers, guest lecturers, the wider CAT team, from graduates, from each other, and from the experience as a whole – can be genuinely life changing. The courses are designed to equip you with the skills, knowledge, understanding and networks to become part of the transformational change that we so urgently need.

"As you graduate today, you join a long line of people who are making a tangible difference in helping to create a safer, fairer, healthier future for all."

Patrick Hannay, Editor of *Touchstone*, the Journal for Architecture in Wales, and regular guest lecturer on CAT's MArch Sustainable Architecture course, joined as a guest speaker. Congratulating graduates on their individual achievements, he reminded them to band together collectively to help achieve the scale of impact needed to roll out solutions to the climate and biodiversity crisis.

Some of the graduates in attendance were also given prizes on the day, including those Achieving High Marks Overall on their courses and those with Outstanding Dissertation Submissions. These dissertations will also be submitted to the National Library of Wales archive, where they can be accessed by researchers.

Huge congratulations to all of our graduating students. As Eileen Kinsman said during the ceremony: "During your studies you've become an integral part of the CAT family. As you graduate today, you're not leaving CAT – you continue to be part of an incredible network of passionate, dedicated, knowledgeable people who are absolutely determined to work together to build a better world."

We can't wait to see what you do next!

Students joined us online as well as in-person to receive their awards.

New training for communities and the housing sector

Two new online courses have been added to our suite of Zero Carbon Britain training programmes for 2023, providing tailored inspiration and knowhow to help cut emissions, and supporting the creation of effective action plans.

'Zero Carbon Britain: Carbon Literacy for the Housing Sector', which takes place 24-25 January, has been developed for those working in the social housing sector. The course explores how climate change affects the work and duties of housing providers, and helps participants to explore responses and begin to create action plans.

'Zero Carbon Britain: Carbon Literacy for Communities' is aimed at anyone working within their community to support action on climate change, whether as individuals or as part of groups, organisations or wider networks. Drawing on our Zero Carbon Britain research, we'll look at low carbon objectives in communities and help participants to create a plan for actions they can take and ways they can influence others. This course takes place 9-10 May.

Both courses run online over two consecutive mornings. They join our popular 'Zero Carbon Britain: Carbon Literacy for Local Authorities', which next takes place online on 7-8 February.

Find out more and book your place at cat.org.uk/zcb

If you're working with a local authority, community group or housing project and would like to arrange training for your team, all of these courses can be tailored to your needs and arranged on a date to suit you. Please get in touch to find out more: courses@cat.org.uk

Sustainability in all Policies: CAT to support creation of guidance for local authorities

CAT's Zero Carbon Britain team has been awarded a contract by the Local Government Association (LGA) to create guidance documentation to be used by councils across England to help embed sustainability within all council policies and across all service areas.

Across the UK, more than 300 local authorities have declared a Climate Emergency, and many are now working with partners and their local communities to take urgent action.

'Sustainability in all Policies' is an approach to policies that systematically and explicitly takes into account the environmental implications of decisions, looks for synergies between reducing climate impacts and other core objectives, and tries to avoid causing harm, with the aim of protecting our environment and benefitting society as a whole.

The Climate Change Committee estimates that around a third of the UK's emissions are dependent on sectors that are directly shaped or influenced by local authority practice, policy or partnerships.

CAT's Zero Carbon Britain team will use their Innovation Lab process to engage with representatives of a number of councils, both rural and urban, and covering a wide range of service areas, to co-design the guidance required for councils to embed sustainability across all service areas and policies.

We expect the final guidance documents to be published in spring 2023.

You can find out more about the work of our Zero Carbon Britain Hub and Innovation Lab and read our latest reports at cat.org.uk/zcb-innovation-lab

Positive QAA review for CAT Graduate School

A review of CAT's Graduate School of the Environment by the Quality Assurance Agency for Higher Education (QAA), the UK's independent quality body for higher education, has found that 'academic standards are reliable, meet UK requirements, and are reasonably comparable' – the highest judgement available through the review process.

The review, which takes place every four years, was undertaken in March by a team of three independent reviewers appointed by QAA, with the results published in June.

Head of the Graduate School, Dr Adrian Watson said: "CAT Masters degrees cover a wide range of issues relating to sustainability, and our practical, immersive approach to learning has now helped over 2,000 postgraduate students to gain skills, knowledge and networks to make a real difference in the world.

"Achieving the highest possible judgement from the body that oversees quality and standards for higher education in the UK is testament to the calibre and dedication of CAT's teaching and support staff, showing that our unique approach to education meets rigorous academic standards whilst offering a highly inspirational and empowering student experience."

The end of an era for the CAT café team

Everyone at CAT would like to say a huge thank you and fond farewell to our wonderful catering assistant, Linda Aylward, who retired in August after 22 years.

Linda joined our café team in 2000 for a 12-month placement. She quickly became an irreplaceable part of the team, and loved it so much that she ended up staying for 22 years.

As well as working at CAT, Linda is a champion swimmer, regularly returning from competitions with a clutch of gold and silver medals.

Café and Shop Manager Sandra Cutler, who recruited Linda all those years ago, said: "Linda has been a delight to work with, and will be missed by staff, students and regular visitors to CAT. Thank you, Linda, for all your hard work – now put your feet up and enjoy a well-earned rest!"

The Edwards Bequest towards CAT's work with young people

Thanks to a generous gift from long term CAT supporter Jeni Edwards, we are able to continue hosting school visits and engaging with urban and inner-city schools, inspiring young people to learn more about solutions to the climate and biodiversity crises.

As a school pupil, Jeni's father Arthur Edwards was encouraged by an outstanding teacher, and Jeni wanted to pass on this gift of inspiration through education with a bequest in her father's name. Here, she tells us more about Arthur's life and the reasons for the bequest.

Arthur Edwards was born in 1898, a middle child in a family of five boys and three girls. They lived near the docks in Southampton and his father worked on the railways. He won a scholarship to Bitterne Park School where an inspiring teacher encouraged him to spread his wings. The First World War interrupted life, and Arthur was posted to the trenches in France where he was wounded and gassed.

The young man who emerged in 1918 had ambition. He bought a car and became a salesman. Which is how, in Northampton, he met and then married a grocer's daughter called Connie. By the mid 1930s they had three sons. The next punctuation mark was the Second World War. By its end he was working for the War Agricultural Committee and living as a tenant in part of a rambling country house. In 1944 they had a daughter, and about then he bought a small printing machine which was installed in the back pantry. He began by printing paper bags for the shops he had known, and magazines and seed catalogues for Hampshire Farmers. From the name of the house, Culverlands Press was born.

Arthur died in 1980, still working part-time at his printing factory which was now based on an industrial estate in Winchester, employed about 40 people and was run by his middle son.

In 2021 his grandson decided to sell the factory. I think Arthur, my father, would be chuffed to know that a chunk of this inheritance was being used to encourage young people to develop their own ambitions towards building a better future.
Jeni Edwards

Our heartfelt thank you to Jeni for this kind gift in her father's name.

Experimental gardening in a changing climate

What plants can thrive in hot and dry conditions in spring and summer *and* survive a wet winter? Could they provide a crop? That's what our gardeners have been experimenting with, with our new dry garden, designed with the climate impacts on food growing in mind.

In a sheltered free-draining sun trap on our main visitor route, the team is testing out a few candidate crops, including Fig 'Chelsea', Grape 'Boskoop Glory', Artichoke 'Violet de Provence', Sea Kale, and Mediterranean herbs, to see which of them might thrive and provide useful produce.

The garden is designed to help visitors to think about the impacts of climate change on food growing, what the challenges might be on a global and local level, and potential ways of adapting what we grow to suit our changing climate.

Find out more about how we garden at CAT and what you can do at home on our 'Gardening for Nature Experience Day', next available 8 October, or come for a visit to explore our wide range of gardens and growing spaces, with a variety of trails and information boards providing inspiration and advice along the way. cat.org.uk/visit

CAT gardeners creating the experimental dry garden.

A spring open day gathered input into plans from the local community and visitors.

Thank you for helping to shape the future of CAT

A huge thank you to everyone who has fed in thoughts and ideas to help shape plans for the creation of a new visitor experience and sustainable skills centre at CAT. Over the spring and summer we have had input from a wide range of people, including members, supporters, the local community, students and visitors – with lots of fantastic feedback and suggestions at in-person and online events, through surveys and via email.

Working with the team here at CAT and drawing on everyone's input, architects Haworth Tompkins and project partners have helped to create a new site plan and visitor experience plan, while planning and development consultants Turley have provided support for market research and business planning.

We'll be sharing more details of plans later in the year so keep an eye on our website for updates, and look out for news in the next issue of *Clean Slate*.

Environmentally inspired community art

This summer, CAT has been home to an exhibition of environmentally inspired community art created through a series of local workshops exploring responses to the climate emergency.

Led by community art group Celf-Able, which is run by Montgomeryshire-based disabled and disability artists, the 'DaearGelf/EarthArt' project ran workshops in local communities across Mid Wales from April to June this year, inviting participants to explore how sustainable living can be made possible for all, while expressing their thoughts and feelings on the issues through art. The results were on display at CAT in June and July before going on display in some of the towns and villages involved in the workshops.

Artworks on biodiversity and climate change were created in local community workshops. Pictured: the Celf-Able team with CAT co-CEO Eileen Kinsman.

GALWAD – the future is calling

26 September 2022 – an electrical storm breaks dramatically over Wales. The unthinkable happens – time cracks, the future makes contact.

That's the premise of GALWAD, a ground-breaking new arts event broadcasting online and on Sky Arts and S4C this autumn.

The drama follows the story of Efa, a 16-year-old girl from Merthyr Tydfil, who claims to have swapped with her 46-year-old self from 2052. As we follow her live journey across Wales, she and her teenage friends battle with the dilemma of what to do when faced with your own future. What does 2052 have to tell us, and will we listen?

Created by a pan-Wales, cross-sector partnership led by National Theatre Wales and including CAT, Disability Arts Cymru, Ffilm Cymru and others, GALWAD is inspired by the Well-being of Future Generations (Wales) Act, which puts the rights of future generations at the heart of public policy in Wales.

Drawing on expertise in the climatic, technological and social conditions of the next 30 years, 120 people from communities across Wales came together to imagine life in 2052 in order to create the 'story-world' of GALWAD.

The story unfolds in real-time from Monday 26 September to Sunday 2 October, being live-streamed on digital channels across the week, and culminating in a broadcast on Sky Arts on Sunday 2 October, including a live broadcast of the finale from Blaenau Ffestiniog and a 60-minute TV drama.

An accompanying schools programme designed for pupils aged 7-11 runs from 19 to 23 September, with schools across Wales and the UK invited to join a week of special future-building activities, live interviews and Q&As, including live lessons broadcast from CAT. Pupils will be inspired to explore and question what the future will mean for their schools, their communities and their lives.

Find out more and watch the story unfold at *galwad.cymru*

Bees, bug hotels and building with earth – a summer of inspiration at CAT

A new bee trail explores how we can help these and other pollinators.

Over the summer, visitors to CAT helped to create a new miniature wildlife-friendly garden, complete with lots of ideas to try out at home to help support biodiversity with their own gardens, yards or window boxes. A tiny pond, plants for pollinators, bug hotels, and even a mini veg plot have all been created collectively by visitors over the school holidays, and will now form part of our visitor displays to help inspire many more people.

Other summer school holiday activities included citizen science surveys to help monitor pollinator species at CAT and discover which flowering plants they use, helping feed into national monitoring projects, and a self-led bee trail with fascinating facts and top tips for giving these and other insects a helping hand. Visitors also got hands-on with sustainable building materials, making rammed earth bricks while learning about how we can build in low-impact ways.

We have lots more family-friendly activities planned for October half-term – keep an eye on our website for details: cat.org.uk/whats-on


Learning how to help boost biodiversity on a Gardening for Nature Experience Day.

Short course spotlight: Fixing your damp house

Experienced conservation builder Nathan Goss looks at how to spot and tackle damp problems in old or traditionally built houses, helping create more comfortable, easier to heat, energy-efficient spaces.

The course explores how to recognise the warning signs of damp problems, including where past conservation efforts may have gone wrong, and introduces different techniques and methods for reducing or eliminating the problem.

Key topics include:

- How and why damp occurs in the home, and different types of damp;
- Understanding issues around ventilation, wall breathability and the materials used in construction and renovation;
- Annual maintenance and repair issues associated with damp;
- The dos and don'ts of restoring a home;
- The properties and uses of lime and lime products;
- Building surgery – bring any damp issues, details of restoration projects and conservation plans for discussion and advice.

Suitable for beginners, DIY enthusiasts or professional builders without much experience with older housing, the course takes place over two days at CAT.

Nathan has over 30 years' experience in the construction industry in a variety of roles that have included: carpentry and joinery, historic building surveying, project management, conservation and the restoration of buildings. An experienced tutor, he has taught courses on traditional building methods, traditional carpentry skills, lime work and how to approach costing a heritage project.

Next dates: Saturday 1 to Sunday 2 October 2022.

Fees: £320, including tuition, all materials and full board shared accommodation (single accommodation is available for an additional £20).

To find out more visit cat.org.uk/shortcourses or call us on 01654 705950.


Learn about materials used in construction and renovation of old and traditionally built homes.

Imagining the future at the National Eisteddfod

WCVA

L-r: CAT Marketing Officer Alis Rees, co-CEO Eileen Kinsman, and Architecture Lecturer Gwyn Stacey at this year's Eisteddfod.

In early August a team from CAT joined the Wales Council for Voluntary Action (WCVA) at the National Eisteddfod in Tregaron to share climate solutions and explore what the future could look like when we take action together on the climate and biodiversity emergency.

Imagining the future we want to see can be an important first step towards recognising our own agency and encouraging action, so we asked people visiting the CAT team on the WCVA stand to think about what they would like the future to look and feel like, and then pen a postcard from their future selves. Drawings, descriptions and poems helped to bring their future visions to life.

Also at the Eisteddfod, CAT Architecture Lecturer Gwyn Stacey joined a panel to discuss sustainable architecture in Wales, and gave a talk paying tribute to the life and work of David Lea, co-architect of CAT's WISE building who died earlier this year.

Recent CAT architecture graduate Sonia Cunningham was awarded the 2022 National Eisteddfod Architecture Scholarship, worth £1500, which is aimed at promoting architecture and design in Wales, enabling the recipient to further their understanding of creative architecture.

Inspiring community action with Civic Square

In July, we hosted a visit organised by Birmingham-based community organisation Civic Square as part of their 'Regenerative Neighbourhoods Festival'.

The visit saw more than 60 people travelling together by train from Birmingham for a day out at CAT, with tours and talks on Zero Carbon Britain, retrofit, gardens and growing, the story of water, biodiversity and sustainable buildings.

Civic Square works with communities across Birmingham to collaboratively vision, build and invest in social and civic infrastructure for the neighbourhoods of the future. It is committed to experimenting with new ideas and co-creating the future of urban spaces with local residents. The day at CAT, one of several such visits over the past few months, was designed to inspire people to think about the possibilities of the future, exploring the question: "How can our neighbourhood be a home to thriving people, in this thriving place, while respecting the wellbeing of all people, and the health of the whole planet?"

Charlie from the Civic Square team said:

"At Civic Square in Ladywood, Birmingham, we are working to reimagine retrofit according to the following provocation: What if the climate transition and retrofit of our homes and streets were designed, owned and governed by the people who live there?

"In this way, we are exploring how civic infrastructure can allow neighbours to organise at the scale of the street and neighbourhood to reimagine their built environment collectively. How can a street collective retrofit their homes to reduce bills and carbon emissions? How can we implement green infrastructure within our streets to improve urban biodiversity? How can these neighbourhood transitions be governed at the hyperlocal scale by the people who live there?

"These are some of the questions we brought with us when we visited the Centre for Alternative Technology alongside our neighbours in Ladywood and Balsall Heath. From our perspective, the magic of CAT is the boldness and the capacity of the Centre to answer questions like these through a multitude of methods and technologies. We were able to view first-hand the efficacy of natural building materials, the potential to live a circular lifestyle through composting and growing, and the manner through which skills for retrofit and urban decarbonisation may be disseminated effectively through generous hosting, demonstrating, and climate pedagogy.

Families from Ladywood, Birmingham, exploring biodiversity on their day out at CAT.

Civic Square / www.thombarley.com

"Both the Civic Square team and our neighbours from across Birmingham came away with a renewed sense of what's possible, inspired by the ability of CAT to both visualise and demonstrate the future that we must work towards."

Find out more about Civic Square at civicsquare.cc, and if you'd like to organise a group visit to CAT please get in touch at education@cat.org.uk

Sustainable architecture on display

The new exhibition of student work helps show how we can make a difference through architecture.

An exhibition of Final Design Projects from students on CAT's Masters in Sustainable Architecture (MArch) course has been on display at CAT this summer, highlighting ways in which we can create a more sustainable, regenerative built environment.

Displaying a sample of work from our final year students, and including approaches to retrofitting and re-use as well as low impact new-builds, the exhibition shows how we can 'do architecture differently' in the context of climate change.

Carl Meddings, Programme Leader of the MArch course said: "The work displayed is diverse and challenging, as much critical as it is hopeful, vital yet playful. Each student has respectively wrestled with one of the current political, social and/or environmental challenges facing contemporary society – from homelessness to energy production, natural building materials to cultural and industrial heritage, all the way to historic landscapes."

The modular boards and displays being used in the exhibition were also created and built by students last year. Designed by student Freya Bruce, the modular installation celebrates the sustainable materials used to build it, including rammed earth and re-used timber, and allows the space to become a flexible exhibition hall and an additional workspace for students.

The MArch is a full-time two-year Part 2 architecture course, prescribed by the Architects Registration Board (ARB), helping provide the next generation of architects with the skills and knowledge to help create a more sustainable built environment.

You can view a sample of student work on pages 17-19, and find out more about the course at cat.org.uk/gse

Hands-on learning with sustainable materials

Tim Coleridge

This summer, CAT architecture and MSc Green Building students have been busy gaining hands-on experience with low impact building materials on their 'Build Week' module.

While one group worked on designing and building a new bridge on our visitor circuit, using locally and sustainably grown wood milled by students on a sustainable materials module, another was busy creating a new timber-framed compost toilet for use in our woodlands. A third group decided to try some experimental approaches to using mycelium as a building material, growing a wall and an armchair out of mushrooms!

This hands-on, practical learning-by-doing really helps students to understand the properties, benefits and uses of different low impact materials, helping them to think about how they can be incorporated into future designs.

Climate connections

This summer saw governments, scientists, NGOs and campaigners gathering in Bonn for the latest round of international climate negotiations. **Sarah Briggs** from CAT's Zero Carbon Britain team reports.

Compared to the publicity for last year's COP26 climate talks, the latest key event in the UN climate calendar slipped by almost unnoticed by the national press. The Bonn Climate Change Conference took place in June 2022, bringing together people from across the world to discuss climate action, against a backdrop of soaring energy prices, global food shortages, and the war in Ukraine. Parties from different nations, observers from NGOs, researchers and campaigners all came together for what's known as the 'intersessional': the talks that set the scene for this year's COP27 talks in Egypt.

I was in Bonn taking part in events as an NGO observer. It was an unforgettable experience that highlighted our important place in history, with the opportunity still to prevent global temperature rise above 1.5°C, but with the need for urgent action now.

From the first session I attended, reflections from scientists, representatives from the world's governments and observers alike confirmed the importance of CAT's work, the Zero Carbon Britain Hub and Innovation Lab, and our training and education programmes. The former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC) Patricia Espinosa opened the session stating that, "the key is to support each other." Working with stakeholders to co-design interventions that drive climate action, equipping councils, businesses and organisations with the knowledge, skills and confidence to implement policies and practices, and facilitating collaboration between groups to create networks to tackle climate change together are all part of building our capacity to support each other to make plans and take action.

During the intersessional, the Intergovernmental Panel on Climate Change (IPCC) presented their Working Group reports, published over the past year. The Working Group II report on Impacts, Adaptation and Vulnerability gives a dire warning about the consequences of failing to act – even temporarily exceeding 1.5°C will cause irreversible changes. The report emphasises the importance of action in key areas, including social transformation, marine and land use, equity and justice, and strengthening ecosystems to continue supporting all life, including humans. It also presents the anticipated impacts on food production and economic sectors, highlighting the need for climate resilience to ensure food security and a just transition to sustainable systems where people and communities thrive.

Sarah (right) with members of the International Network for Sustainable Energy – "Sharing strategies, successes, celebrations and challenges with others in the climate movement was incredibly useful and inspiring"

Ensuring that our actions do not have unintended consequences for people and planet dominated the dialogue and were a recurring theme through sessions. Concerns about 'maladaptation' and 'malmitigation' are valid – rushing to implement 'solutions' without considering the full implications can cause new problems to arise. This further highlighted the need for systems-thinking approaches, bringing together people from across communities and sectors to design solutions suited to specific contexts. We need to learn and adapt, review and implement together, seeing the interconnections and complexity as opportunities to solve multiple challenges together.

Despite the dire warnings about the urgent action needed, and despite a lack of any real progress in the talks themselves, I left Bonn feeling heartened by the energy, drive and passion of people gathered in the space. Sharing strategies, successes, celebrations and challenges with others in the climate movement was incredibly useful and inspiring, as were the actions of campaigners and NGOs inside and outside the talks. Silent protests, climate marches and meetings with government representatives all ensured a strong voice from civil society demanding urgent action and just transitions. The unwavering determination, particularly of youth groups, was utterly inspiring, and I was grateful to meet such passionate people who I hope will become future leaders.

Throughout the week, I heard frustrations and concerns, but I also felt a strong connection between the work of CAT and the Zero Carbon Britain team and the required action and change needed. From bringing stakeholders together and exploring social transformation, to considering the complexity of systems to prevent unintended negative outcomes and embrace the co-benefits of climate action, CAT's research and approaches are helping to bring about the change and knowledge needed to tackle the challenges at the heart of the discussions in Bonn. As I sat on the train heading back to the UK, I felt fired up and excited to continue driving the change we need to keep 1.5°C alive.

About the author

Sarah joined the Zero Carbon Britain team in October 2021 as a Research Assistant in the Innovation Lab. She has a BSc in Environment and Sustainability and a Masters in Higher Education Practice with a focus on education for sustainability.

Find out more about CAT's Zero Carbon Britain Hub and Innovation Lab at www.cat.org.uk/zcb

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CAT members everywhere are putting urgent solutions into action.

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For more information please contact us at **members@cat.org.uk**

Meet CAT's Chair of Trustees

Dr Sally Carr has been Chair of our Board of Trustees since March this year, having been involved with CAT in various ways for more than 30 years. A Psychologist by training, she spent many years working as a consultant in leadership development, team-building and coaching, whilst volunteering at CAT in her summer holidays. From 2012 to 2019 she was a full-time staff member, becoming a Trustee on retirement. We caught up with Sally to hear about her involvement with CAT over the years, her new role as Chair, and her hopes for the future.

Clean Slate (CS): How did you get involved with CAT?
Sally: I first came to CAT for a week in the spring of 1986, as a short-term volunteer. I instantly fell in love with the place and felt I'd found a home. At the time I was in the middle of doing a DPhil in Psychology, but I had become increasingly aware of environmental issues over the preceding years, and had felt quite alone in this awareness. Being with others who recognised the problems and were taking creative steps to address these was exciting and inspiring, and something of a relief. I also loved having the opportunity to work as a team with others, doing practical tasks in the outdoors. I returned many times as a short-term volunteer over subsequent years, before moving to Machynlleth to get more closely involved in 2003.

CS: What's your fondest memory of your time working and volunteering at CAT, or your proudest moment?
Sally: In the late 1980s I was invited to come for a special volunteer week in January. The work involved "digging" the trenches for pipework for the Walter Segal timber-frame house. As CAT is built on a heap of slate waste it wasn't so much digging as breaking stones – in the freezing cold. I guess it says something about how much the ethos of CAT meant to me that I still loved being there, being part of a team of people working together, all driven by the same commitment to experimenting with and showcasing solutions to environmental issues.

Later, when I was working in CAT's fundraising team, I was delighted to have played a role in the creation of the Quarry Trail. This was the brainchild of Rob Goodsell, our Woodlands Officer. He saw the potential to open up new areas of the site for visitors and educational groups, allowing them to see the regeneration of the disused slate quarry and get a first-hand view of how we manage our woodlands, other habitats and water systems in ways that benefit people and the other species that share our site. Together we developed a successful bid for funds for the development of the new trail, and the official opening day represents both a fond memory and a proud moment.

CS: What does the role of Chair of Trustees involve?
Sally: As the board of trustees of CAT our role is to ensure that the organisation's strategy aligns with its core purposes, while operating within appropriate frameworks of governance, policies and procedures. It is our responsibility to ensure that CAT acts in the best interests of our beneficiaries. This is a shared responsibility, but my particular role as Chair involves chairing board meetings and ensuring that all members can contribute in the most appropriate ways – both during meetings and in the work that goes on in between meetings. There is also a specific responsibility for the Chair to act as line manager to the CEO – or, at the moment, to our Interim co-CEOs.

CS: What do you hope to see CAT achieve in the next five to ten years?
Sally: Having been involved with CAT for more than 30 years, I can honestly say that its work is more important and urgent than ever. As we all know, this decade is absolutely critical for action on climate and biodiversity. We're going to be scaling up our skills and education provision, creating an inspirational new visitor experience to bring solutions to life, and expanding our outreach programme. I'm really looking forward to working with trustees, staff, volunteers, members, supporters, students and visitors to help inspire, inform and enable many more people to take action on the climate and biodiversity crisis.

This is the first in a new series introducing you to CAT Trustees, staff and volunteers, giving you an inside view of some key aspects of our work.

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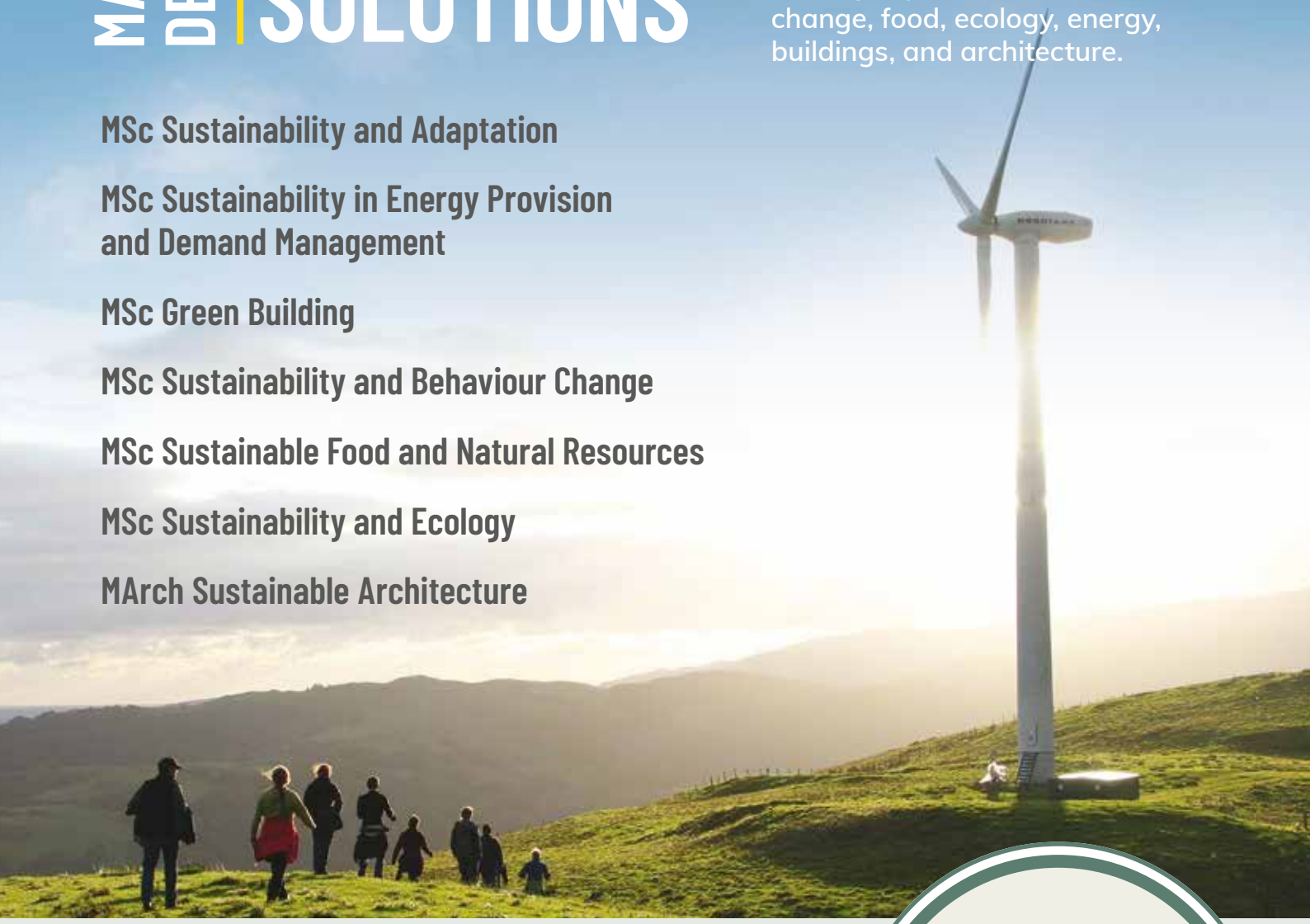

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CAT STORIES

Meet some of our Graduate School of the Environment class of 2022, who are already finding ways to tackle the climate and biodiversity crisis using the skills and knowledge gained on CAT postgraduate courses. They join our inspiring community of members, supporters, students and over 2000 CAT graduates who are already making a real difference in a wide range of fields.

Supporting retrofits: Rebecca Lane

"When I visited CAT, it felt totally different to other learning environments I had been in in the past. The lecturers and student cohort are all welcoming, and [there is] much respect between peers because we are all here with a purpose: to learn a new way of thinking about and doing things to solve the 'wicked problems' we have ahead of us."

Rebecca graduated with an MSc in Sustainability in Energy Provision and Demand Management. Whilst studying at CAT, she designed and led the first 'Net Zero Neighbourhood' programme in the West Midlands, which shaped the region's retrofit grant programmes.

After graduating, Rebecca decided to set up RETRO, a retrofit service company that will help private homeowners and landlords to start their retrofit journey. The company goes beyond helping make a plan, providing all the project support infrastructure to get projects on their way, from building a whole home plan to sourcing and vetting heat pump and solar PV installers and providing a Retrofit Co-ordinator to oversee the work.

Having worked across energy innovation and local energy initiatives, Rebecca brings her breadth of technical and business knowledge and interest in innovation into this new venture, working with the Founders Factory and with investment funding from Nesta to create a service that will help homeowners cut carbon and energy costs.

Combining academia and activism: Jo Becker

Jo graduated with an MSc in Sustainability and Behaviour Change. She says her experience of studying Environmental Science for her undergraduate degree had "dimmed her passion for academia" but her CAT studies reignited her interest. She is now studying towards a PhD with PROSPERA at the University of Vigo in Spain, where her research on autonomy, de/post-growth and feminist studies directly relates to her CAT dissertation and to some of the topics covered in taught modules, such as systems theory for social change.

Jo also continues with freelance projects that combine her passion for activism and academia, and has presented guest lectures and webinars with CAT.

Architect for climate action: Rosie Murphy

Rosie graduated from the Sustainable Architecture Part 2 course at CAT, and since early 2022 has worked for Matt+Fiona, a social enterprise that believes everyone should have the right to help shape their built environment.

She is also part of the Architect's Climate Action Network (ACAN) steering group and is their Coordinator for the Education Thematic Group. For the past year Rosie has helped with our Graduate School Virtual Open Days and helped promote our MArch Sustainable Architecture course.

Many of Rosie's student projects addressed the intersection between social and environmental injustices within the built environment, and, through voluntary work and activism, Rosie seeks to raise awareness of the issues of climate change and ecological degradation, as well as the racial inequalities within the architectural industry and beyond.

Please get in touch with us at members@cat.org.uk to tell us what you are doing – we love to hear about your work, the groups you are forming and how CAT's work is guiding and inspiring you.

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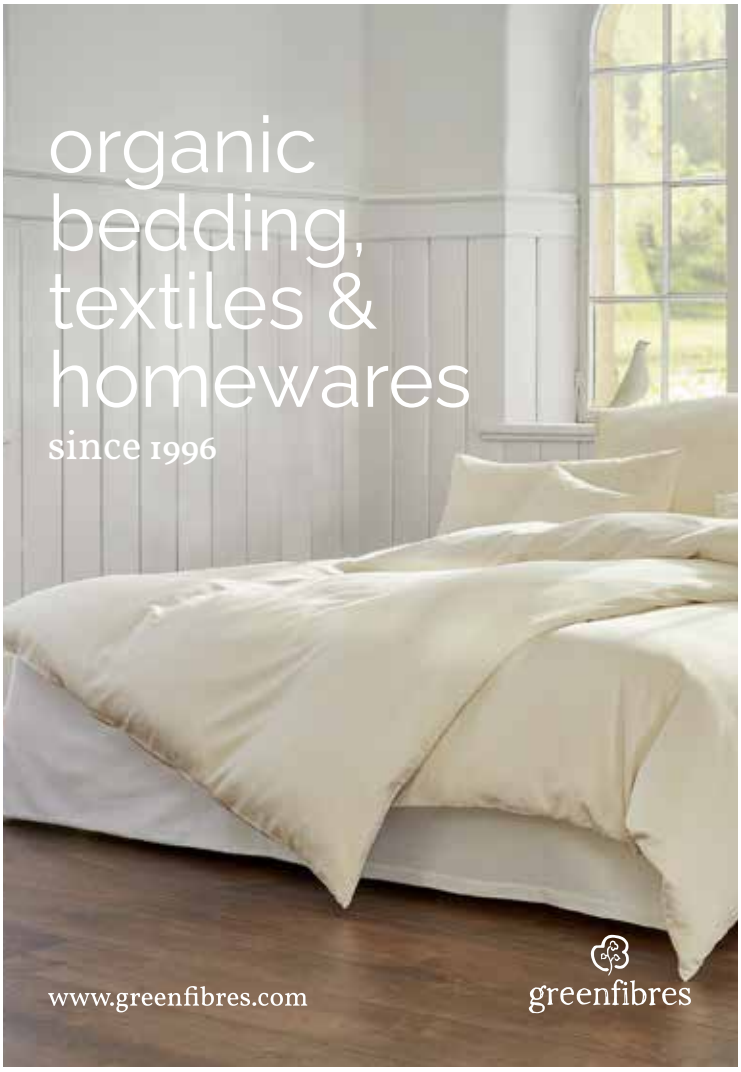

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Sustainable architecture: making a difference

Students on CAT's Masters in Sustainable Architecture course explore how approaches to the built environment can improve the wellbeing of people and the planet. **Dr Alison Pooley** and **Dr Carl Meddings** introduce some of this year's final design projects.

CAT's MArch Sustainable Architecture course strapline is 'doing architecture differently', but in what way do we do architecture differently? The core ethos of the course is the conviction that architecture must address sustainability in its broadest sense, from construction and use through to adaptation, reuse, repurposing and deconstruction. Our students are challenged to design architectural interventions that are at once healthy and uplifting, address the urgent issues of climate change and loss of biodiversity, and support thriving communities. These essential qualities form the foundation of the Final Design Projects, which represent the culmination of each student's time at CAT and the start of their continuing journeys into architectural practice and beyond.

Students select the site and develop their own brief, which allows them to develop their own theoretical and technical agenda as they explore concepts of sustainability and the political, social and environmental challenges facing contemporary society and the built environment. Projects are developed and resolved through a detailed design proposal and an associated technical report. This is a challenging piece of work, and as usual our students have risen to this challenge with a variety of inspiring designs that illustrate some of the many ways that architecture can make a difference.

These and other Final Year Projects are currently on display at CAT; the exhibition is free with entry tickets. You can find out more about our MArch Sustainable Architecture course and other CAT postgraduate degrees at cat.org.uk/gse

About the authors

Carl is the new Programme Leader for the MArch: Sustainable Architecture. He is an architect and educator with a passion for educating architects in a rapidly changing cultural and professional environment. Before teaching at CAT, he was the Subject Leader for architecture at the University of Huddersfield and has taught at all levels from first-year undergraduate to final year at masters and beyond. Carl is an active RIBA member serving on Validation Boards, the New Courses Group and the Membership Eligibility Assessment Panel.

Alison first started teaching at CAT in 2003; after completing her PhD at the Welsh School of Architecture in 2016 she returned to CAT in 2021 as the Programme Leader for the MArch: Sustainable Architecture. She has recently taken on a new role as research fellow at the University of Suffolk, within their Sustainability Institute.

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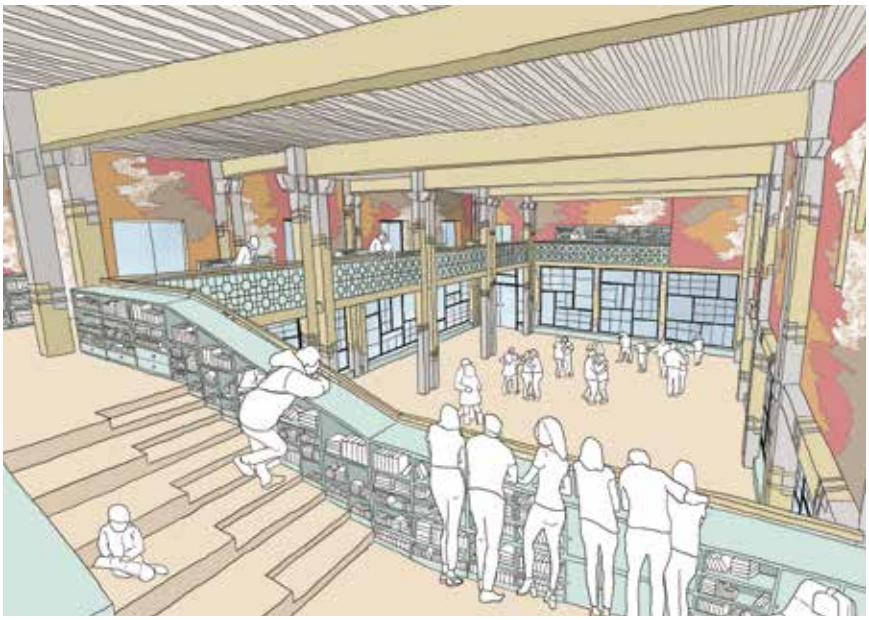
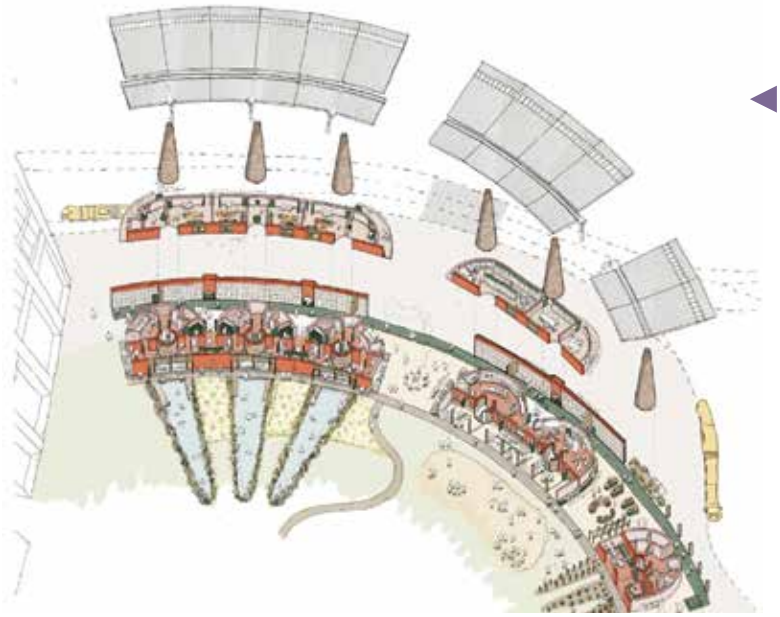


▲ **Ashley Barley – Unity House, Birmingham**

Ashley chose a site in Birmingham, an area of rapid redevelopment where residential use is taking over from industry but where there is a strong diverse existing community. Ashley's project focused on reuse of materials from existing industrial buildings, working these back into his proposal for a community hub built around an existing Victorian pub. We loved Ashley's inventive reuse of locally sourced materials from nearby demolitions and refurbishments, which both celebrates the past and offers a way of thinking about future redevelopments, aesthetically, structurally and in terms of embodied carbon.

▲ **Julian Woods – Community Environment Centre**

Julian's project is in Glastonbury at the Baily's buildings. The proposal regenerates the existing derelict site as a visitor centre, which celebrates the town's industrial heritage and acts as a gateway to the Avalon Marshes. It brings together a local college and wildlife trust in a place to engage, teach and connect people with the natural world. The project also addresses local socio-environmental issues including provision of facilities for a large local travellers' site and community spaces and workshops for material reuse and making. It explores the rewilding of the surrounding landscape, proposes new cycle links, and engages with critical ecological issues to reduce the centre's environmental impact.



Freya Bruce – Engaging communities

Located in Piccadilly Gardens, Manchester, Freya's project addresses several issues of urban living: food poverty, public space, the crisis of homelessness, equity and equality in access to services. She has worked closely with community groups in Manchester to develop the proposal through workshops and engagement. The result is a diverse collection of outputs, including banners, tiles, clothing, drawings, a manifesto and plans for a community building that directly responds to and stems from the community's hopes for the gardens.

Simon Elliston – OtherWISE at CAT

OtherWISE is an imagined intervention on the CAT site, uniquely informed by the teachings and expertise of its Graduate School and designed to be built predominantly with materials sourced or manufactured on site. The project makes use of the wonderful location and the opportunities it presents to build upon the already successful WISE building to provide more student rooms, longer-term accommodation for international students and extended library and archive facility. A new courtyard is created, which opens up access to the restaurant and creates a new sense of arrival at the building. Simon approached this project with great empathy for the site and existing buildings, emulating the same sensitivity as the original architects of WISE, Pat Borer and David Lea.

Lucy Wood – Co-creating the City

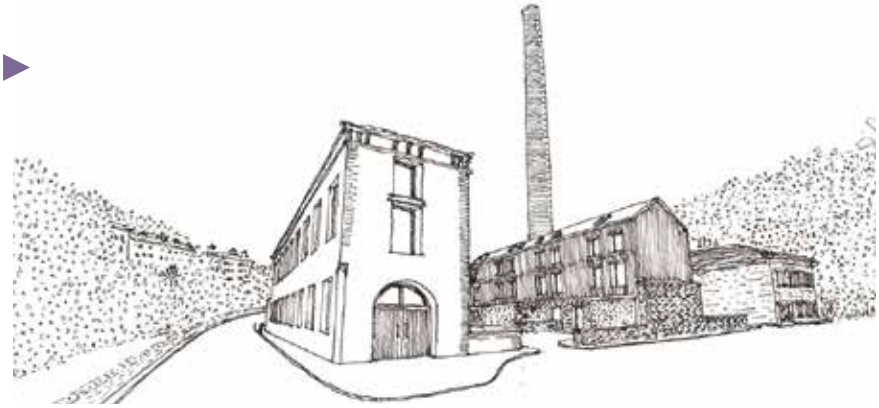
The project explores Lucy's interest in how people currently live in the city. It looks at how a model can be created to allow the people of Bristol to repair broken bits of their streets and homes. It goes beyond sustainable architecture being only about energy efficiency to look at how architects engage with people to co-create their dreams. The proposal includes a cluster of resilient and affordable homes, a community hall (for the sharing of stories and ideas), and common outdoor spaces. The project is envisaged as a model, which might expand across the city, breaking the usual system of development, allowing people to create, repair and care for their shared places and providing a template for community ownership for the future.

Sonia Cunningham – Forestry research centre

The Wyre Forest is the largest contiguous area of ancient woodland in England, of national significance, scale and impact. This project re-imagines the forest of the future, in response to changing climatic and social conditions, and as a catalyst for a sustainable and holistic shift in society's relationship with our country's natural assets. The building is designed to be a significant national centre for woodland learning, research and monitoring, supporting formal and informal learning and skills development in all its forms. It brings world class forestry research and maintenance together with high quality community facilities and low carbon building technologies.

Marcus Goff – Hebden Bridge College

Marcus explores the opportunities for transition towards a bio-based and regional construction economy, with the aim of reducing the carbon emissions of the building industry. The focus of the project is minimising the energy embodied in building materials by using and promoting plant-based or bio-based materials, sourced from the local region. The Hebden Bridge College is envisaged as a centre of excellence for sustainable building. It is designed as a place to research and test bio-renewable material, to teach the use of natural building materials (their performance, properties, appropriate use and installation) and to establish and foster a culture of resilient and inherently sustainable building practice.



Harry Johnson – Bioregional materials, Chichester

What a fascinating and poetic project! Exploring the use of regional materials in construction and retrofitting, Harry's proposal involves a detailed walk from the coast to Chichester, passing through varying landscapes, with a different local material being explored, experimented with and demonstrated at each stopping point on the way. Harry's project is extremely tactile, emerging from and immersed and embedded in the landscape. He investigates the potential of each material through making, by constructing small sections of building along the way and making a film of the journey from sea to town, working with the materials he excavated on the way.

Maximilian Zeigler – Caldè Kilns Park

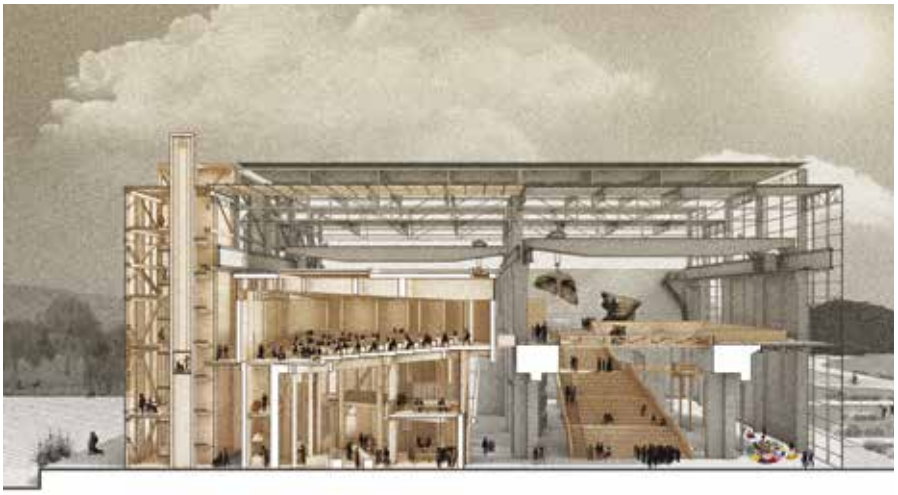
The Fornaci di Caldè Park is located in Northern Italy, on the shores of Lake Maggiore. Throughout the last century it was brutally excavated for the production and processing of lime but has since been neglected and become derelict and dangerous. Locals continue to use the site covertly for recreation, even though it is closed and supposedly off limits. Max's project responds by giving people the chance to enjoy the beautiful landscape, while protecting both the sensitive local ecology and the cultural identity of the site. The result is a series of energy-efficient buildings with a variety of recreational functions, linked by a new bicycle and pedestrian route connecting two local towns along an otherwise inaccessible coastline.

Cara Anwyl Williams – Canolfan Awyr Agored Rhosydd

The name 'Rhosydd' roughly translates to 'moors'. The landscape surrounding Rhosydd is open boggy moorland with crags sloping gently down to Cwmorthin. Cara's project sensitively responds to this unique landscape with the design of a residential visitor and education centre. The project is carefully and delicately incorporated into the stark and evocative existing buildings, extending and reworking them in a way that both respects and illuminates the history of the site, whilst also exposing the beauty of this rugged landscape for future generations.

Will Harvey – People with the Power

Will's project is a re-imagining of the disused power station at Ratcliffe-on-Soar. It is, at once, both an opportunity to mourn the loss of a massive part of our industrial heritage, whilst also recognising that this heritage has been complicit in contributing to global climate change and ecological breakdown. These places, spaces, landscapes and structures are part of our climate change heritage. The proposal imagines the facility to be repurposed to host a regional (and local) citizens' assembly; a place to unlock human potential and celebrate togetherness, to feel connected to each-other and to other species of the natural world. It is a re-setting of power: the power of people; the power of participation and collaboration; the power of natural collective care for each other and for the planet.



From pledges to action – avoiding climate catastrophe at COP27

Over recent months we have all witnessed the increasing frequency and severity of extreme weather events as climate breakdown becomes impossible to ignore. As we approach the next round of UN climate talks, **Paul Allen** looks at the urgent need for joined-up solutions.

This summer, the UK and other parts of Europe have experienced temperatures above 40°C, leading to breakdowns in transport systems and water supply shortages. The Met Office estimates that climate change has resulted in such extreme heatwaves being ten times more likely than they would otherwise have been. And they are not just hotter, they're also longer lasting, with warm spells more than doubling in length in the past 50 years.

Parched ground and dry vegetation caused by longer hotter periods results in an increased likelihood and faster spread of forest fires. Due to its more northerly location, the UK has so far avoided some of the worst wildfire impacts experienced in Europe, but severe fires have occurred in Spain, Portugal, France, Greece, Croatia and Albania – with thousands forced to move and hundreds of deaths.

In other parts of the world things are even worse. China is reeling from devastation from a wave of extreme weather emergencies. During this year's rainy season, heavy rainstorms have brought severe flooding and landslides to large areas of southern China, displacing millions of people and causing huge economic losses. The coastal Fujian province saw record-breaking extreme rainfall in June, whilst a prolonged summer heatwave saw temperatures of over 40°C, and around 65% of China's population living under a heat warning.

These extreme weather impacts are now recognised as a direct consequence of the current 1.1°C warming of the planet above pre-industrial levels. What is really worrying is that they are occurring more frequently and more intensely than most climate models predicted.

Feedbacks and interlinking crises

In recent years, we've seen an increased understanding and recognition of the impacts and threats of climate feedbacks (the effects of global temperature rise that lead to further warming). Former UK Chief Scientific Advisor Sir David King makes the risks clear in a recent report from the Climate Crisis Advisory Group, 'A critical pathway for a manageable future for humanity':

Melting sea-ice transforms ocean surfaces from reflective to absorbing states - as ocean heating speeds up, ice melts more rapidly.

Incredible Arctic/Shutterstock

"As permafrost thaws, explosive releases of methane happen in the Arctic. These explosions increase GHG [greenhouse gas] concentrations, speeding up heating and thawing processes. Similarly, melting sea-ice transforms ocean surfaces from reflective to absorbing states. Ocean heating speeds up, and ice melts more rapidly. Such feedback loops accelerate progress towards tipping points: the chance of slowing or stopping changes slips away."

At the same time as the world wakes up to the urgency of the climate crisis, the impact of rising energy prices on households is ongoing and severe, helping drive a wider cost-of-living crisis leading to serious financial hardship for many, with some research suggesting that more than half of UK households will be in fuel poverty by January next year.

Over the last year, an unprecedented increase in wholesale gas prices has caused significant rises in energy retail prices. The way the UK energy market works means that rising wholesale fossil fuel prices force up the retail price of all energy supplies, despite falling costs for renewable energy generation. Many of the innovative new energy suppliers have gone bust, whilst large fossil fuel corporations are recording record profits.

With rising fossil fuel prices, uncertain supply chains and the rapid fall in renewable generation costs, there is a clear crossover between climate, energy cost and energy security solutions. As well as investing in renewable energy, improving energy efficiency must be a key part of any strategy to reduce UK energy demand and lower energy bills – a home insulation programme is a key missing policy that would provide many co-benefits.

There is an urgent need to link things up, to maximise the co-benefits of our actions and build a wider and more diverse coalition to help accelerate a just transition to a safer, fairer, healthier future for us all.

From Glasgow to Sharm el-Sheikh – towards COP27

As we move on from last November's COP26 UN climate summit in Glasgow, we face a serious gap between the agreed national level commitments and the scale of emissions reduction required to give us a chance to avoid irreversible global climate breakdown.

According to research by Climate Action Tracker, the current combined global emissions reduction targets for 2030 have the world heading towards warming of 2.4°C by the end of the century, whilst current policies and actions have us on track for 2.7°C – far from the 1.5°C target enshrined in the Paris Agreement.

Drought conditions were experienced across the UK this summer. Pictured: low water levels at Elan Valley, Rhayader.

Conor O'Brien/Shutterstock

In light of the growing evidence of the need for urgent and ambitious action, governments across the globe need to move beyond tweaking business-as-usual and embrace an emergency mode, so nations can come to COP27 in Sharm el-Sheikh, Egypt this November with radically increased commitments and the plans to deliver them. Governments must show how they will halve emissions by 2030, with clear commitments to immediate emissions reductions across all sectors.

At the same time, governments need to respond to the worsening impacts of climate change, with national adaptation plans and a delivery plan for providing finance to developing countries to support mitigation and adaptation and to cover loss and damage from climate impacts.

Making change happen

We have the power to make change happen, but to unleash that power there needs to be a new unity of purpose and a belief in our own ability to act. We all must recognise that we are part of an increasingly diverse movement focusing on action, with millions of people from across the globe sharing experiences, knowledge, data and ideas for what we need to do next.

Rather than becoming overwhelmed by the sheer scale of the challenge, councils, businesses, local groups and even individual households can look at where they have influence to make change happen. It can be helpful to think about this in terms of four directions: downwards, making the changes which are within our control; sharing knowledge and working sideways with others; lobbying upwards for necessary policies and resources; and inwards by gaining the skills and knowledge needed to make change happen.

For a family, this might mean looking at where they can act on their household emissions (downwards), talking to neighbours and providing support for others in their community to take action (sideways), lobbying politicians or businesses to do more (upwards), and building skills and knowledge so that they can take more effective action in future (inwards).

As we approach COP27, and the need to move from pledges to implementation becomes ever more urgent, ensuring that everyone has the knowledge and skills to take effective action is a pressing priority. Of course, we need climate-informed activists, scientists and policymakers, in fact we need many more of them. But we also need climate-focused farmers, mechanics, teachers, nurses, lawyers, retailers and chefs.

Here at CAT, our courses, training, workshops and events bring people together in-person and online to explore solutions, providing skills, knowledge, understanding and networks to become part of the transformational change that we so urgently need. By working together in our homes, communities, workplaces and as active citizens pushing for change, we still have a chance to pull the world back from the brink of climate catastrophe and build a better future for all. CS

References available on request.

About the author

Paul is CAT's Zero Carbon Britain Knowledge and Outreach Coordinator. He has been involved with our research into zero carbon scenarios since the beginning, coordinating the development of research reports and liaising directly with government, industry, NGOs and the arts to share findings.

Climate-wise agriculture
– how best to fertilise our crops?

Clo Ward explores the tricky issue of nitrogen in agriculture.

Experimental plot at Bangor University's research farm. Showing chambers in which nitrous oxide is collected and measured.

With the urgent need to restore biodiversity and sequester carbon as well as feed the population, our land has many jobs to do. As we seek to reduce emissions from agriculture, the question of how to ensure ongoing soil fertility without fossil-fuel-based fertilisers and with reduced reliance on animal manures becomes ever more pressing. Green manures can offer a solution, but usually require setting aside productive agricultural land for nitrogen "fixing". Recent CAT-partnered research as part of a PhD at Bangor University looked at alternative approaches, with a focus on trees and shrubs as potential sources of soil nutrients, specifically nitrogen.

Impact of nitrogen supply on climate change

Lack of the nutrient nitrogen is the most common limitation on crop yields. Though nitrogen is everywhere – making up 78% of air, within all living things and in organic matter in soil – crops mostly take it up in the form of ammonium or nitrate. The conversion of nitrogen gas to these forms which are available to plants is a process known as nitrogen "fixing", and it requires a large amount of energy.

The ammonium and nitrate in manufactured fertilisers is fixed from atmospheric nitrogen in an industrial process which uses 1 to 2 % of the world's fossil fuels, with resulting carbon dioxide emissions. In organic agriculture, nitrogen is instead fixed by plants, using photosynthetic energy to power nitrogen-fixing bacteria in root nodules of green manure plants, e.g. clovers or vetches. These are then ploughed-in to increase soil fertility for the following crop. Adding the organic material of leafy green manures improves soil health and can increase the amount of carbon in soil, so reducing atmospheric CO_2. The nitrogen within any other organic material has got there by one of these two routes; for example, nitrogen in animal manure has come from the animals' food. That food, whether it was grazed from a hillside or fed from a trough has been grown by use of either manufactured fertiliser or biological nitrogen fixing.

A downside of biological nitrogen fixing is that it takes up space. Land must be taken out of cropping to grow the green manures. If farmers are not buying in nitrogen e.g. as fertilisers or manure, they will typically use a quarter to a third of cropland for this type of fertility-building at any one time, in a system of rotational leys. This reduces the overall yields per hectare from organic systems. With land in demand, another solution – used alongside organic sources of nitrogen in CAT's Zero Carbon Britain scenario – is that of nitrogen

Dried perennial mobile green manure leaves stored for use as organic fertiliser.

fixing powered by hydrogen produced via electrolysis using renewable energy.

The environmental impact of providing the fixed nitrogen is problem number one. Problem number two is how to keep that nitrogen from leaking out of the agricultural system.

Nitrogen use efficiency

After green manures are ploughed into soil, the proteins in the plant tissues are decomposed by soil microbes, releasing ammonium and nitrate. These are the same nitrogen-containing compounds that are added as manufactured fertiliser. They are easily taken up by plants, but also easily lost by leaching of nitrate or as nitrous oxide (N_2O) gas. N_2O is produced in soil by microbial action, and is a powerful greenhouse gas which makes up a third of the climate change impact of UK agriculture. Emissions are higher in warm wet conditions and when there is more ammonium and/or nitrate in the soil than the crop can take up.

To increase nitrogen use efficiency, therefore, fertiliser nitrogen is usually added in several applications over the growing season to match the crop's needs, and methods of precision agriculture are being developed to increase efficiency further. Organic materials, being bulky and variable are not well suited to techniques of precision agriculture, and ploughing-in green manure can result in too much available nitrogen before the crop is ready for it. With N_2O emissions being higher in warm, wet conditions, the increasingly unpredictable weather makes management of organic nitrogen even more tricky.

Can we grow fertiliser on trees?

To manage organic nitrogen more efficiently, some growers use "cut-and-carry" or "mobile" green manures, by harvesting nitrogen-rich leaves grown in a separate field and adding them to cropland as needed, rather than ploughing directly into the soil prior to planting. This allows better timing to match the crop's needs, reducing excesses in the soil.

Traditionally, green manures are non-woody plants as they need to be dug in, but cutting and adding leaf nitrogen opens up possibilities of using leaves of trees and shrubs. Alder (*Alnus glutinosa*), for example, is a UK native nitrogen-fixing tree which thrives in flood-prone soil and is tolerant of repeated cutting. Other species of alder grow on drier ground, as do the native nitrogen-fixing shrubs gorse and broom. So could we grow our nitrogen on trees, and harvest the leaves to fertilise crops, thereby fixing nitrogen and creating woodland on the same bit of land? A fertiliser-producing forest?

Increased tree cover on farms provides ecosystem services – environmental benefits to the neighbouring crops – including habitat for pollinators and predators of pests, shelter from wind, and intercepting rain to reduce flood risk. Though rotational leys in organic systems can be biodiverse, also contributing to ecosystem services, replacing some with permanent nitrogen fixing areas could result in increased benefits, especially by providing long-term habitats and carbon sequestration in tree roots and undisturbed soil. To free up more cropland in organic systems to increase overall yields they could also be situated on land which is not suitable for crops, such as flood prone areas or steep slopes. Using these areas for nitrogen fixing on conventional farms could reduce the need for manufactured fertilisers. Leaf nitrogen to be dried or pelleted and supplied to arable farms could perhaps become an alternative income stream for farms without land suitable for crops.

Growing a variety of plants together makes most use of sunlight energy, and also including non-nitrogen fixing plants such as deep-rooted grasses or comfrey helps retain nitrogen in the system. These plants mop up any excess soil nitrogen and store it in their leaves to prevent it leaching away. Species need to be carefully chosen to suit their environment; for example on a boggy area alder could be grown together with comfrey, grasses and clovers which all tolerate wet ground. On a dry slope a mix of gorse, broom and drought-tolerant grasses could be grown. We refer to these permanent nitrogen fixing areas as "bio-service areas" due to their multiple benefits to the neighbouring cropland, as shown in the diagram.

CAT-partnered research

To research whether such a system may be possible, I was lucky enough to receive funding for a CAT-partnered PhD at Bangor University which began in 2016. I tested what I called "perennial mobile green manures" (PMGMs) consisting of leaves harvested in summer from trees, shrubs and perennial nitrogen-fixing plants. These were trialled in pot, field and laboratory experiments in comparison to ammonium nitrate (a commonly used fertiliser), and the

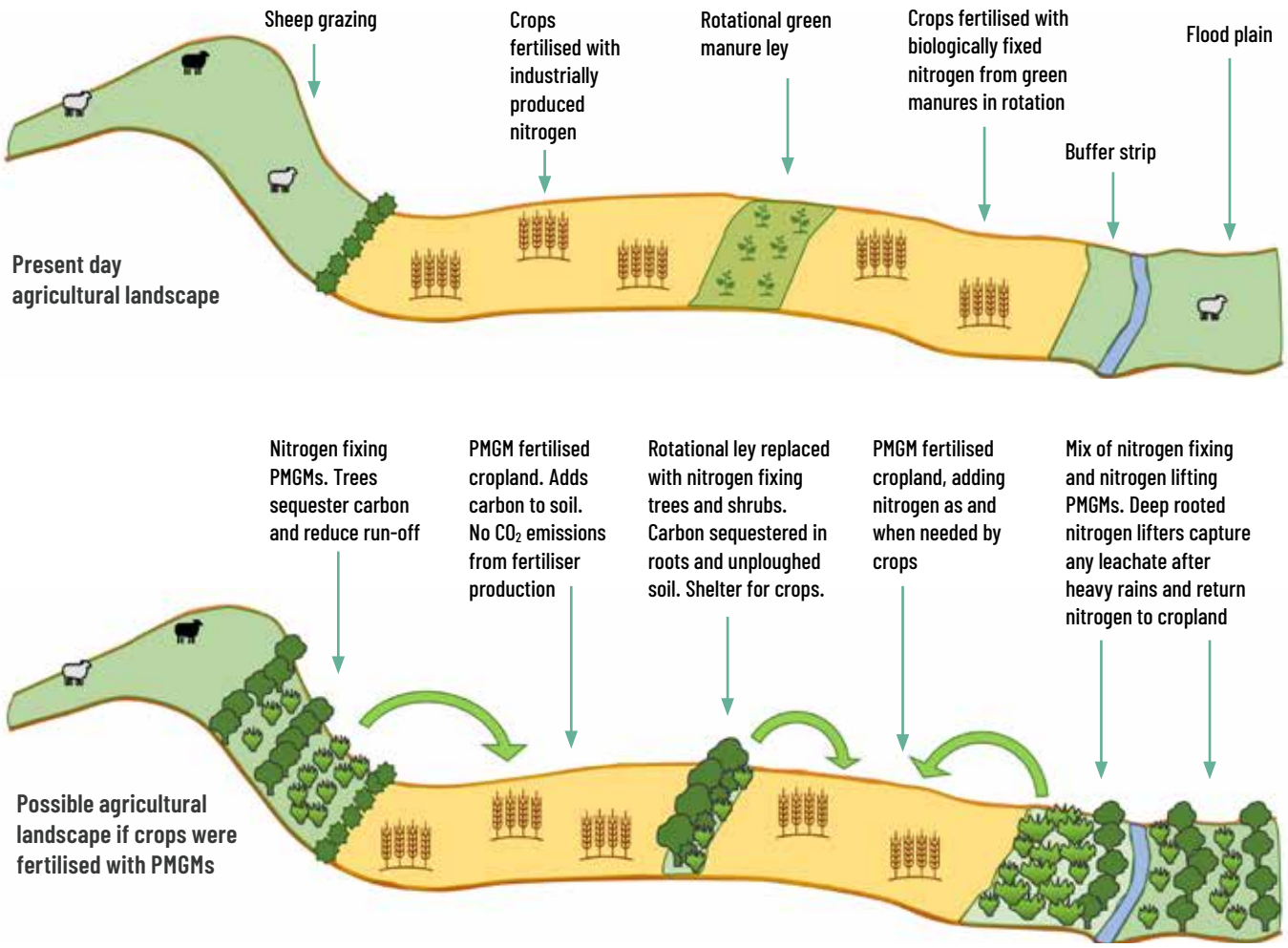
The Nitrogen Problem

Method of nitrogen fixing	Nitrogen fixed by bacteria in the roots of green manure plants, using sunlight energy	Nitrogen fixed industrially, using energy from fossil fuels
CO_2 emissions in production	Carbon neutral ✔	Industrial nitrogen-fixing for fertilisers produces 1 to 2 % of the world's CO_2 emissions ✘
Adding organic matter to soil	Provides organic matter improving soil health and increasing the carbon content of soil ✔	No organic matter provided ✘
Matching of nitrogen supply to the crop's needs	Green manures are usually ploughed in, so it's hard to add exactly the right amount at the right time. Too much nitrogen in soil is prone to losses. ✘	Easy to apply exact amounts of nitrogen at the right times ✔
Use of agricultural land	Green manure systems need to use cropland for nitrogen fixing in rotations, so reducing overall yields per unit area ✘	No extra cropland needed ✔

Crops need to be given nitrogen in a form they can use. This must first be 'fixed' – converted from atmospheric nitrogen into compounds which crop roots can take up. Both industrial and biological methods of nitrogen-fixing have their associated problems.

Present and possible future agricultural landscape using PMGMs to fertilise crops

The amount of arable land remains the same, but the landscape includes more trees and perennials, and less ploughed land.



Amended from a diagram included in a paper currently in review with the journal *Nutrient Cycling in Agroecosystems.*

traditional green manure, red clover. Results showed that the PMGMs could fertilise crops, but released plant-available nitrogen into soil more slowly than clover (when used in the traditional way) or fertiliser, and so had a lower risk of nitrogen leaching and lower nitrous oxide emissions.

The PhD research produced a wealth of data, and my first peer-reviewed paper is due to be published later this year (currently in review). The results showed that such systems may well be feasible and could have many environmental benefits, but as is typical with research it threw up more questions than it answered. For example, I researched the effect of each green manure separately, but combining them together could serve to better match a crop's nitrogen needs. Alder leaves, which supply nitrogen fairly slowly, could be added to soil before crop sowing and then be complemented with a little mulch of dried clover to give quick release nitrogen when needed. Longer term issues to be researched include how best to manage the bio-service areas, such as how and when to cut foliage for least disturbance to wildlife, and whether in the long term the land will need additions of non-nitrogen nutrients such as phosphorous and potassium to replace that removed in vegetation.

The next stage is to try out the technique on real farms, and to this end, the Perennial Green Manures project run by Ecodyfi in Mid Wales has been awarded funding by the Co-op Carbon Innovation Fund to begin trials in spring 2023. In cooperation with farmers and growers we will be looking at practical aspects of the technique - for example: how best to harvest, store and apply the PMGMs; how effective the technique is on specific crops; and which PMGMs or combinations work best. We will also look at the overall environmental impact of the system, for example weighing up the benefits of habitat creation and carbon sequestration against the environmental costs of energy use in harvesting and processing the PMGMs. We hope that by combining agricultural science with farming skills and knowledge we can evolve the technique for the benefit of biodiversity, climate and rural communities.

About the author

Clo (Chloë) Ward has been an organic gardener for 30 years, including a stint as a CAT display gardener from 2007 to 2012. She has a long-term interest in soil health and perennial systems and is now working as a researcher for the Perennial Green Manures project https://www.dyfibiosphere.wales/perennial-green-manures

References available on request. Doctoral thesis available at https://tinyurl.com/4wu9886y

NESTING SPOTS

Once a common sight for garden birdwatchers, the Spotted Flycatcher has suffered serious decline in the UK in recent years. **Joe Downie** looks at some who have found a summer home at CAT, and explores how we can help these and other struggling species.

Erni/Shutterstock

The Spotted Flycatcher is one of the UK's most rapidly declining birds.

One of the last migrant birds to return after over-wintering in Africa, the Spotted Flycatcher (Latin name: *Muscicapa striata*, or Gwybedog Mannog in Welsh) arrives in late April or early May and can be seen across the UK through to September.

Here at CAT we spotted our first of the year on 17 May, closely followed by its cousin the Pied Flycatcher on 21 May. The adult birds quickly got to work building nests to rear their young. Rather unusually, this year we were able to keep an eye on two Spotted Flycatchers nests right in the middle of the CAT visitor centre. The external eves of an engineering workshop were the ideal spot for one nesting pair, and the other made their home above the door of our woodland workshop (which luckily has two doors, allowing us to use a different entrance once the female was sitting on her eggs).

An ideal home

In both cases, the nests were built near woodland edges, giving the adult birds the ideal conditions to be able to perch on a branch and then dart out with deadly accuracy into the clearing to catch some juicy winged insects. This is their main way of feeding, and makes them easy to spot despite their small size (about the same as a house sparrow) and "drab" appearance – well, this is how the guidebooks describe them, personally I think their speckled crown is rather beautiful.

In terms of habitat, the Spotted Flycatcher is one of many woodland birds which really does need the space provided by clearings within and between trees. In prehistoric times, such spaces would have been made by large mammals, such as elephants and wooly mammoths, crashing through the woodland, as well as by natural tree-fall. These days, with large woodland mammals now absent, creation and maintenance of broadleaf woodland glades and rides needs to be done sensitively, by humans (or by re-introduced mammals like bison) as part of a sustainable approach to woodland management that will have multiple benefits for wildlife as well as people. The birds are also found in wood pasture, and in many villages with suitable trees.

Going hungry

But back to those Spotted Flycatcher nests. Sadly, the woodland workshop nest failed, with the three chicks hatching but perishing just a few days before they were due to fledge. More happily, in the engineering workshop nest a successful brood of four chicks was raised over two weeks, fledging on 5 July.

The reason for the first nest failure is likely to be a lack of insects on the wing. Their main diet is flying insects, such as moths, butterflies, damselflies and craneflies. Wasps and bees are made safe to eat by rubbing the sting end on their perch to remove it. If the weather is bad, they can search trees and shrubs for other insects, but if poor weather persists many nests fail as these smaller invertebrates tend to be eaten by the parents rather than fed to the young. It's possible this is what happened in our failed nest.

Certainly, our butterfly surveys so far this year, especially for early June, have suggested very low butterfly numbers overall. We experienced a very dry spring and then a cool and wet spell in late May and early June, which could have had an impact on insect abundance.

In our nearby woodland, Coed Gwern, it was a similar story for the Pied Flycatchers, where only around 20% of chicks fledged. Yet our swallow families, who have been busy since May making dozens of nests all over the CAT site, appear to have had a good breeding season, with some raising second broods. Unfortunately, the Spotted Flycatchers didn't appear to try for a second time as we didn't see them on site after early July.

Long term trends

As ever, it's hard to draw definitive conclusions from one season, but that's where longer term recording efforts come in. Sadly, the long-term picture isn't looking good. Older birdwatchers might remember Spotted Flycatchers as common birds of UK gardens, parks and orchards, but a population decline of between 90 and 94% between 1967 and

2018 has set alarm bells ringing.

Due to the rapid decline, the bird is now a UK "Red List" species, which means it's in big trouble, and needs our help (see box). As with many other migratory species, pinning down the exact reasons for the decline is very difficult. The decline may be due to a number of factors, including: habitat loss and lack of food in their African wintering grounds; difficulties on the migration route; a general fall in the abundance of insects; the changing climate (which underpins many of these factors); increased nest predation; and changes in, or decline of, woodland management in Britain.

A helping hand

To give them a helping hand in the face of these threats, the advice for woodland managers is to:

- Provide open nest boxes and/or half coconut shells in suitable woodland habitats;
- Retain ivy and other climbing plants to provide cover for natural nest sites;
- Create and maintain open woodland features such as glades and rides through selective felling and pruning, and prevent woodland becoming too dense;
- Encourage a diversity of structure within the field and shrub layers, through control of grazing levels (e.g. by deer) to encourage an increase in insects and food availability whatever the weather.

Such measures may also help other woodland birds that are struggling, and give a boost to woodland biodiversity more generally. Here at CAT we manage our woodlands with a nature-first approach, and we provide advice and training to help others to do the same. In gardens, meanwhile, we can help all birds by gardening in ways that support insect life, without the use of harmful chemicals, growing plants that will provide seeds and berries, and creating nesting spaces with hedges, shrubs and nest boxes.

The Spotted Flycatcher is just one of 70 bird species on the UK Red List, accounting for around one in three UK bird species and nearly double the number that were on the list 25 years ago. Also on the list are other species found in the CAT woodlands such at Willow Tit and Woodcock, and species familiar to us all, such as Swift, House Sparrow and Starling. Urgent action on climate change and habitat loss is needed to help them back from the brink, but action at a more local level to provide food, water and shelter can make a big difference for struggling birds. We hope that by managing our woodlands and gardens in ways that support these magical creatures, we'll be providing a summer residence for Spotted Flycatchers for many years to come, whilst inspiring many more people to do what they can to support wildlife in woodlands, gardens and green spaces across the UK.

Chicks being fed at one of the CAT nesting sites (photograph taken from a distance with zoom so as not to disturb the nest site).

References available on request

About the author

Joe is one of our long-term residential volunteers, helping with woodland and other habitat management on the main CAT site and in our neighbouring woodlands. He has a background in environmental campaigning, and is a keen walker, runner, cyclist and (bad) birder.

What do we mean by a 'Red List species'?

Red Lists are globally recognised as a way of identifying the level of threat faced by different species on a national, regional and global level, and are an important tool in bringing attention to areas of concern.

The International Union for the Conservation of Nature's (IUCN) Red List was created in 1964 through a collaboration of worldwide government agencies, conservation organisations, universities, museums, and other members. Categories span a continuum from 'Least Concern' for abundant and thriving species to 'Critically Endangered' for those that are likely to disappear in the near future. A Red List species is anything that is assessed to be Critically Endangered, Endangered or Vulnerable.

In the UK, 'Birds of Conservation Concern', commonly known as the 'UK Red List for birds' is produced by experts from the number of conservation organisations, and is updated roughly every six years. It assesses 245 species with breeding, passage or wintering populations in the UK, designating each as Red, Amber or Green. Birds can be added to the Red List for a number of reasons, including being threatened with global extinction, undergoing severe population decline in the UK, or seeing severe contraction of their UK breeding range.

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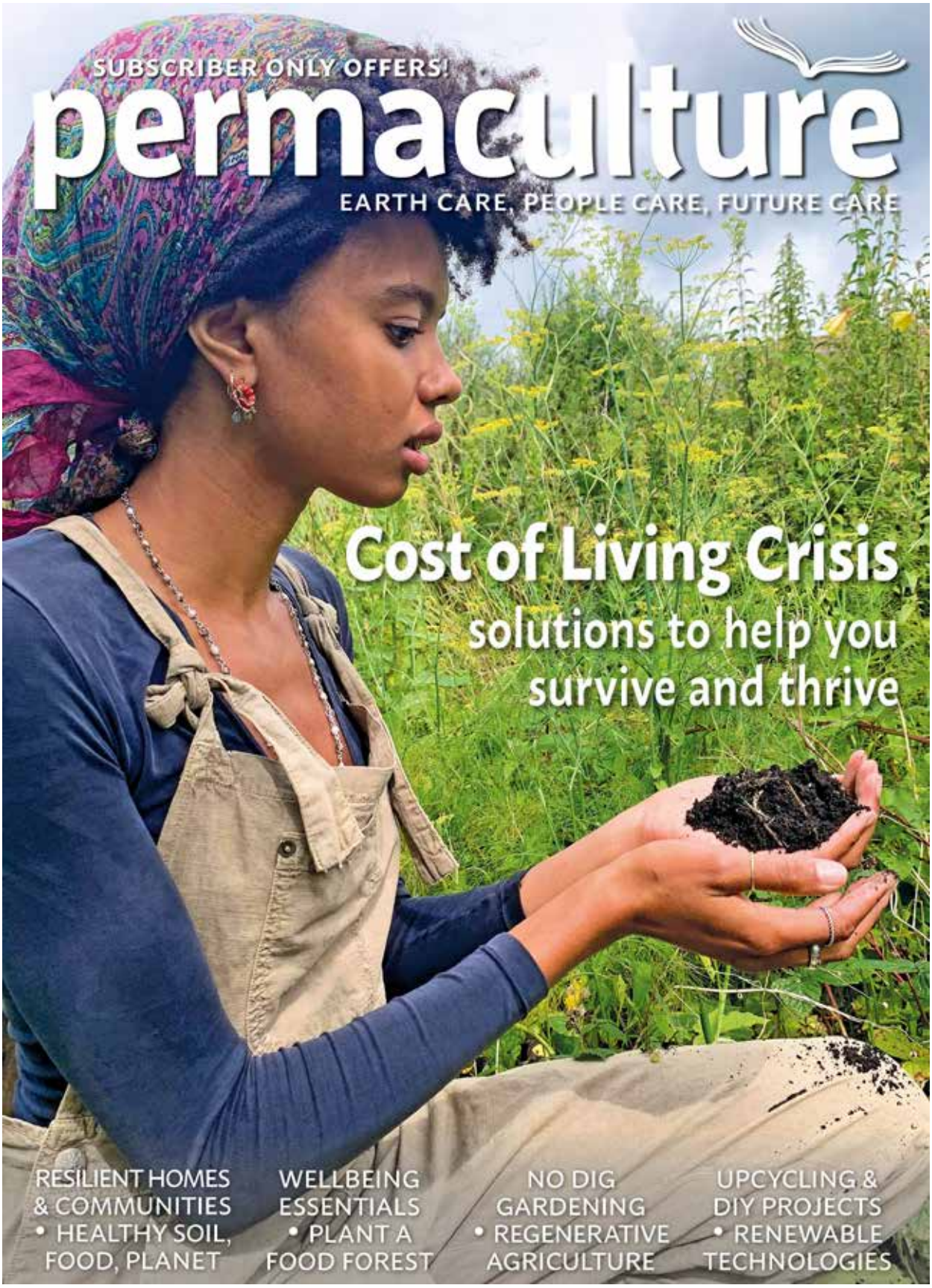

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Store and save?

Will battery storage cut costs and carbon emissions?

We will need energy storage and smart controls to reduce the use of gas-fired power stations, by allowing electricity from renewable energy to be stored and fed back to the grid at times of peak demand. **Joel Rawson** looks at the potential benefits and impacts of one form of energy storage: domestic batteries.

Marcin Rogozinski/Shutterstock

Rising electricity prices mean that storing energy in a battery to use later will save more money than it used to – potentially making a battery a more attractive investment.

However, a careful approach is still required for a decent financial saving and to ensure that the energy and resources invested in manufacture will lead to a worthwhile benefit.

Thinking at the larger community scale is important, as we need energy storage that can buffer the grid between off-peak and peak times, boosting the use of renewable energy.

Carbon impacts

Studies into the carbon footprint of current lithium-ion batteries calculate a figure of around 100kg of carbon dioxide (CO_2) per kilowatt-hour (kWh) of battery capacity when manufactured in factories that use fossil fuels. This is reduced to about 60kg CO_2 per kWh when renewable energy is used in the manufacture. It can be reduced further with the decarbonising of supply chains for raw materials.

Developing new types of battery chemistry will also help. For example, the campaign group Transport & Environment recently reported the potential for solid state batteries to reduce the carbon footprint to below 50g CO_2 per kWh.

New developments should be alongside efforts to improve the recycling of lithium batteries and reduce the environmental and social impacts from extracting raw materials. Reduced costs and carbon emissions need to be achieved through improved processes, not from driving down labour costs or working conditions or creating other long term pollution problems.

Carbon savings

In carbon terms, the most advantageous use of electricity storage in the UK is to reduce the use of gas-fired power stations, because we've virtually eliminated higher carbon coal-fired power now.

Replacing 1kWh of electricity from gas will avoid emitting about 0.35 to 0.4 kg of CO_2. A battery carbon footprint of 80kg CO_2 per kWh is about 200 times as much as that. This means the battery needs to be charged from zero carbon energy and then discharged to replace gas use about 200 times for the carbon savings to outweigh the manufacturing impact.

That's less than one year of use – but is


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of course a very general estimate, and in practice not all output from a battery will be directly replacing gas. But it shows the potential for avoiding gas use and the resulting carbon emissions through a combination of renewable energy and energy storage.

A key step to maximise carbon savings is for a battery to be a buffer for the grid, rather than only meeting your own needs. For example, exporting to the grid in early evening, when overall demand peaks and exceeds generation from renewable energy. Ideally, a combination of smart controls and variable rate tariffs would enable you to receive a better export rate at that time – making it more financially attractive to sell the power than keep it for your own use.

Battery life

The expected lifespan of a battery is key to estimating the financial payback. A storage battery warranty is usually for either 10 years or a minimum amount of energy stored ('throughput'), whichever is reached first.

The warranty will also specify an expected reduction in storage capacity after ten years, to about 60% to 70% as much as when new. A battery that originally stored 5kWh would drop to about 3kWh capacity after a decade of use. Battery life should be a bit longer, depending on usage, but the continued degradation means that the warrantied throughput is a good figure to use when estimating financial savings.

Payback

Comparing a few different batteries, the warrantied throughput is around 2500 to 3000 kWh per kWh of storage capacity. Battery cost is often around £1000 per kWh of storage, but for larger capacity batteries it can be less (perhaps £700 per kWh).

When electricity prices were about 15 pence per kWh and you could export directly for a few pence per kWh, the net benefit of storing energy to use later may have been only £250 to £300 per kWh of capacity, over about ten years of use. For someone on the old feed-in tariff scheme the export rate might not be a factor, so the saving would have been about £100 to £150 more. Either way, that's less than the battery cost.

Prices now are much different, although standard export rates are usually still only a few pence. In summer 2022 the price cap equated to an electricity cost of about 28p per kWh. The proposed October increase could be about 52p per kWh unless a plan comes in to keep the summer price cap in place for a longer period.

With a potential saving of about 28p per kWh, storing 3000 kWh to use later could save from £700 to £850 (depending on whether an export rate could be claimed instead). That's closer to the battery cost per kWh, but still marginal.

Imports and exports

Even with higher energy prices, to get a good financial payback from a battery you really need to make use of 'time-of-day' tariffs for importing and exporting energy at different rates during the day. And this ties in with the approach mentioned above for maximising carbon savings.

For example, it would involve avoiding imports during the early evening peak. Instead, draw only from solar panels and/or battery at that time. Also, exporting excess energy to the grid at peak times can give a better payback than keeping it to use later. A combination of these should give a much better return than the basic payback calculated above – but exact savings will vary.

Getting a good export price for electricity generated from a solar PV array is important because there are seasonal limits on how much you can use directly. In summer a PV roof rated at 4 kilowatts (kW) should produce about 15 to 20 kWh per day. This is about 2 to 3 times as much as average daily electricity use (or more in a very energy efficient home). You'll therefore be exporting most of this electricity – either directly, or later in the day via a battery.

However, at the moment you need to be more careful when choosing and using a time-of-day tariff, because soaring wholesale gas prices can mean that any imports during peak periods could be at a very high cost.

Vehicle to grid (V2G)

For electric vehicle (EV) owners, another option could be to make use of their EV battery as a buffer for the grid, using a charger with 'vehicle-to-grid' (V2G) capability. Car battery capacities are much higher than domestic batteries – about 40 kWh for smaller cars. On a day when you're not driving far you could charge on a cheap night rate or from your solar panels, and sell back to the grid for a high rate.

At the moment you can only get a V2G charger through an approved trial. If interested, you could register with some energy providers and car manufacturers to get updates on these. More widespread deployment should be possible soon.

Again, the main driver of V2G is the need to buffer grid demand at peak times – with exports triggered by a control unit that communicates with the grid. However, a vehicle-to-home approach is also possible with this sort of technology, as is running other electrical devices from an EV when away from home.

About the author

Joel Rawson is CAT's Information Officer, providing free and impartial advice on a wide range of topics related to sustainability. He first came to CAT to volunteer in 2001, and graduated with a CAT Postgraduate Diploma in 2013.

CAT's free information service

Visit cat.org.uk/info for information and advice on a wide range of areas related to homes, buildings, energy and more. You can get in touch with Joel at info@cat.org.uk or call him on 01654 705989.

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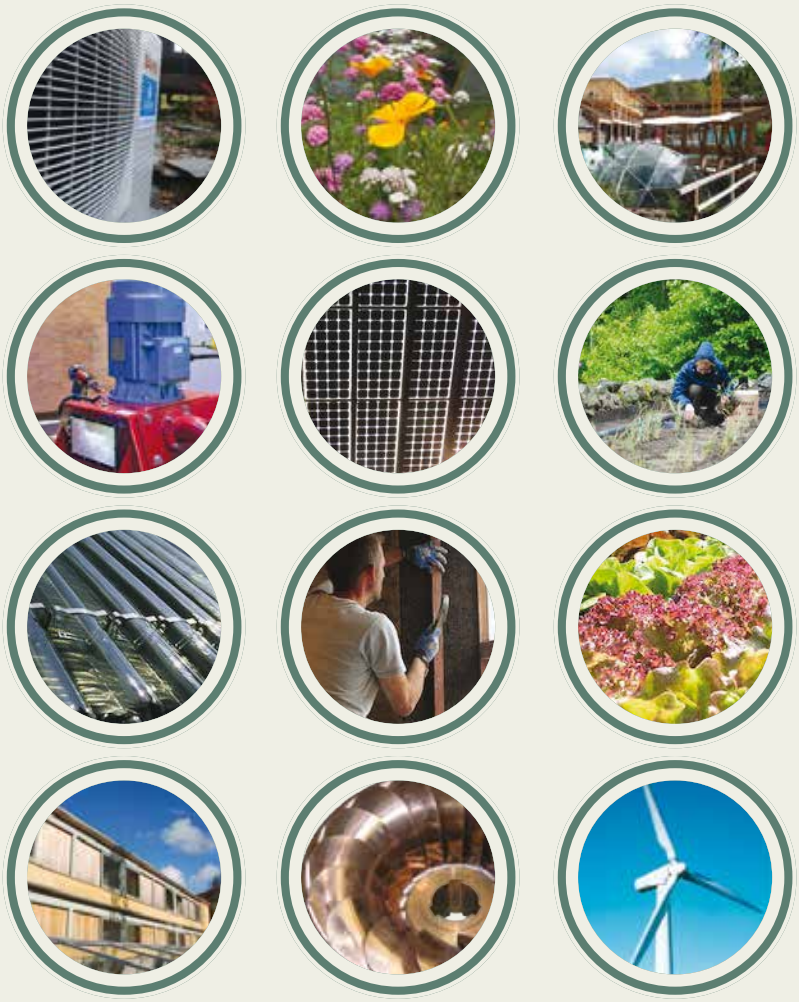

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7 October – Shrink Pot Carving

8 October – Gardening for Nature Experience Day

15-22 October – Eco Refurbishment: ***Live online***

November 2022

11-18 November – Zero Carbon Britain: ***Live online***

21-25 November – Sustainable Woodland Management

January 2023

24-25 January – Zero Carbon Britain: Carbon Literacy for the Housing Sector ***Live online***

February 2023

7-8 February – Zero Carbon Britain: Carbon Literacy for Local Authorities ***Live online***

March 2023

14-15 March – Zero Carbon Britain: ***Live online***

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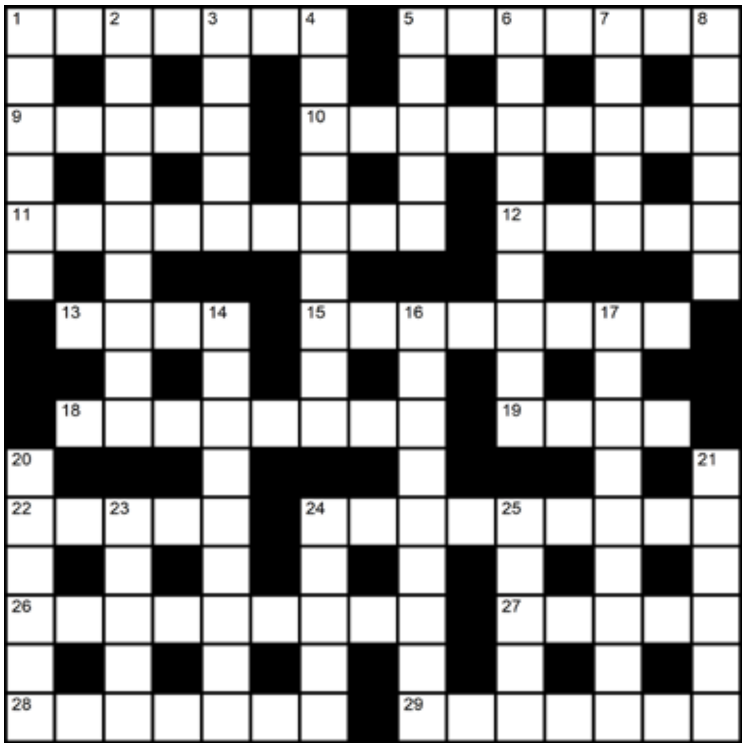

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The first correct entry pulled from a hat wins a £20 voucher for the CAT EcoStore – store.cat.org.uk.

Please send your completed crossword entry by 31 October 2022 to *Clean Slate* Crossword, Centre for Alternative Technology, Machynlleth, Powys, SY20 9AZ.

Solution will be published in the next issue of *Clean Slate*.

Across

1 Close without having one drink, boring! (7)

5 Catches short flight from airport to arrive at Bow Street Station? (3,4)

9 Apparatus used to identify birds' calls (5)

10 Going round Lichtenstein hikers negotiated northern region (9)

11 Playing with a new tee and golf ball, it's a totally different game (9)

12 Piece of electronic equipment no longer in use (2,3)

13 Show off retro-clothing (4)

15 Where you'll find pullover? And gown! (8)

18 Cricket side right to broaden team message (8)

19 Kind of radio hosts reading dull material (4)

22 Exceptionally old craft put back in order (5)

24 Odorous establishment to have drink (full of smoke) (9)

26 Rodents putting Manx cat in shade (9)

27 American woman one regularly seen in court (5)

28 Green agreement makes for an unsatisfactory situation (3,4)

29 They give advice about racing lorries (7)

Down

1 Catch farewell said as a result of this (6)

2 Sadly I agree with soldiers at the front, it's a beastly place (9)

3 Tries to revise for this! (5)

4 Migrant vessel a month on river (9)

5 Voodoo remedy incorporating head of snake (5)

6 Part of engine fluid drips onto (6,3)

7 Militia harangued over occupying island (5)

8 Agent lies about courting umpire for a favour (6)

14 At home surrounded by explosive cocktail ingredient (9)

16 Artist – kind to enter dream state finishing off portrait (9)

17 Book on gardening tools (including spades) – it could end up slowing you down (5,4)

20 Mind one's p's and q's, right? Not hard for a budding scout (6)

21 County player unleashes boundaries appearing for country (6)

23 Project targeting health relies on world leaders (5)

24 A familiar address in China provides container full of medicine (5)

25 At university cuddling, not completely sure that's appropriate (5)

Clean Slate 124 Solution

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Changing the story

Freya Randall, Fundraising Manager

Have you ever enjoyed the sense of immersion in a seemingly untouched natural landscape, only to notice a piece of litter fluttering near your feet? A sobering reminder of the clumsy, big-footed imprint we leave on the natural world – it's a small but jarring experience that seems to epitomise our larger problem.

Much of what human society leaves behind is ecologically damaging, and it is as important to face up to this uncomfortable truth as it is to believe in humans as agents of positive change.

Historically, generation after generation has benefited from the legacy of their elders, with advancements in living standards, technology and medicine. But now our future is deeply uncertain. We face a climate and ecological emergency, and the impacts of this will be our legacy. As individuals, we're limited in what we can do in a system that separates us from nature and demands endless growth at the expense of finite resources, fragile ecosystems and the safety and security of current and future generations. Continuing on our current course will leave very little for those generations.

However we do know it is possible to leave a new legacy. Here at CAT, we believe in changing the story, evolving society to create a healthier, happier, fairer future for all. We are not afraid to be optimistic and ambitious. Step by step, we can use the current, available technology, research and expertise to drive forward change. At CAT, we regularly witness the inspired, compassionate actions of individuals. While we cannot fully undo our impact on the Earth, we can continue to educate, inspire and empower people to change the future. We must continue to lay the path for systemic change across every sector, to slow the trajectory towards ecological tipping points and leave a better story and a legacy we can be proud of.

Leaving a gift in your Will is one way you can help to change the story, and stay a part of it, long into the future. Choosing to leave a legacy gift is an incredibly special gesture, and we know it is a deeply personal choice. You might want to talk this through with our team, to understand the complexities of the types of gift it is possible to leave in your Will, whether to CAT or to another charity.

Many supporters choose to leave a small percentage of their estate to CAT, after all their loved ones are fully catered for and looked after. Others may leave a specific item or a fixed amount that feels right for them. Some may choose to give to CAT for the sake of their grandchildren, future generations and those worst impacted across the world. We know other supporters give for their love of our precious natural world. Whatever your motivations, all of our members and supporters stay a part of CAT's story, helping to offer some security for the future of our work.

We are incredibly grateful you are here, and we are always open to talking, at a time that suits you, should you need more information on this important option for the future. Please reach out to us by emailing me at freya.randall@cat.org.uk to find out more or to arrange a time to talk. Thank you.

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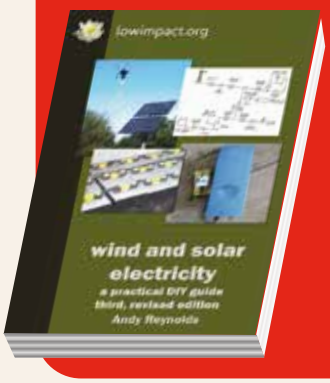

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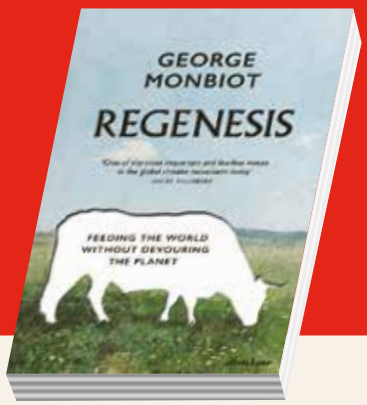

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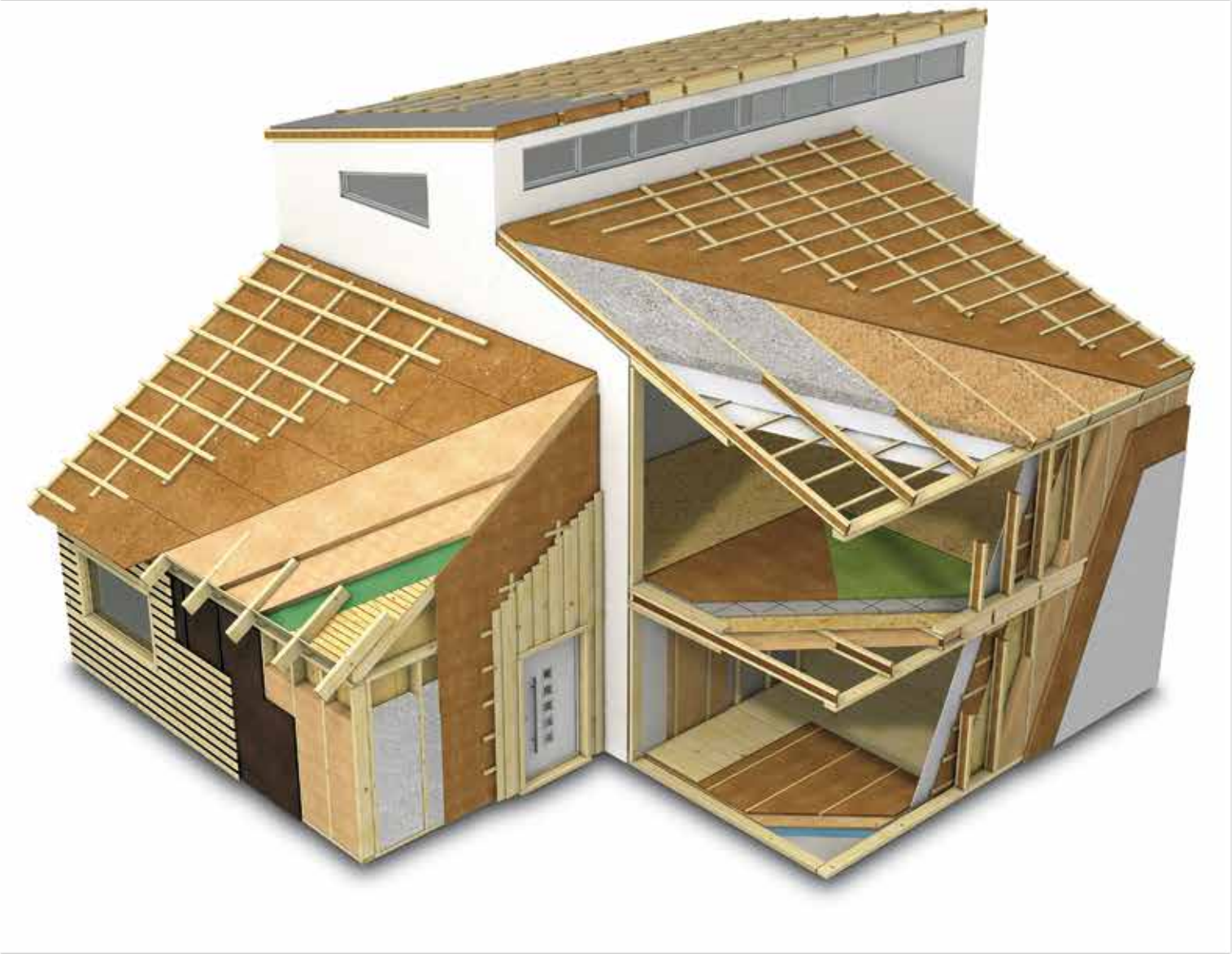

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