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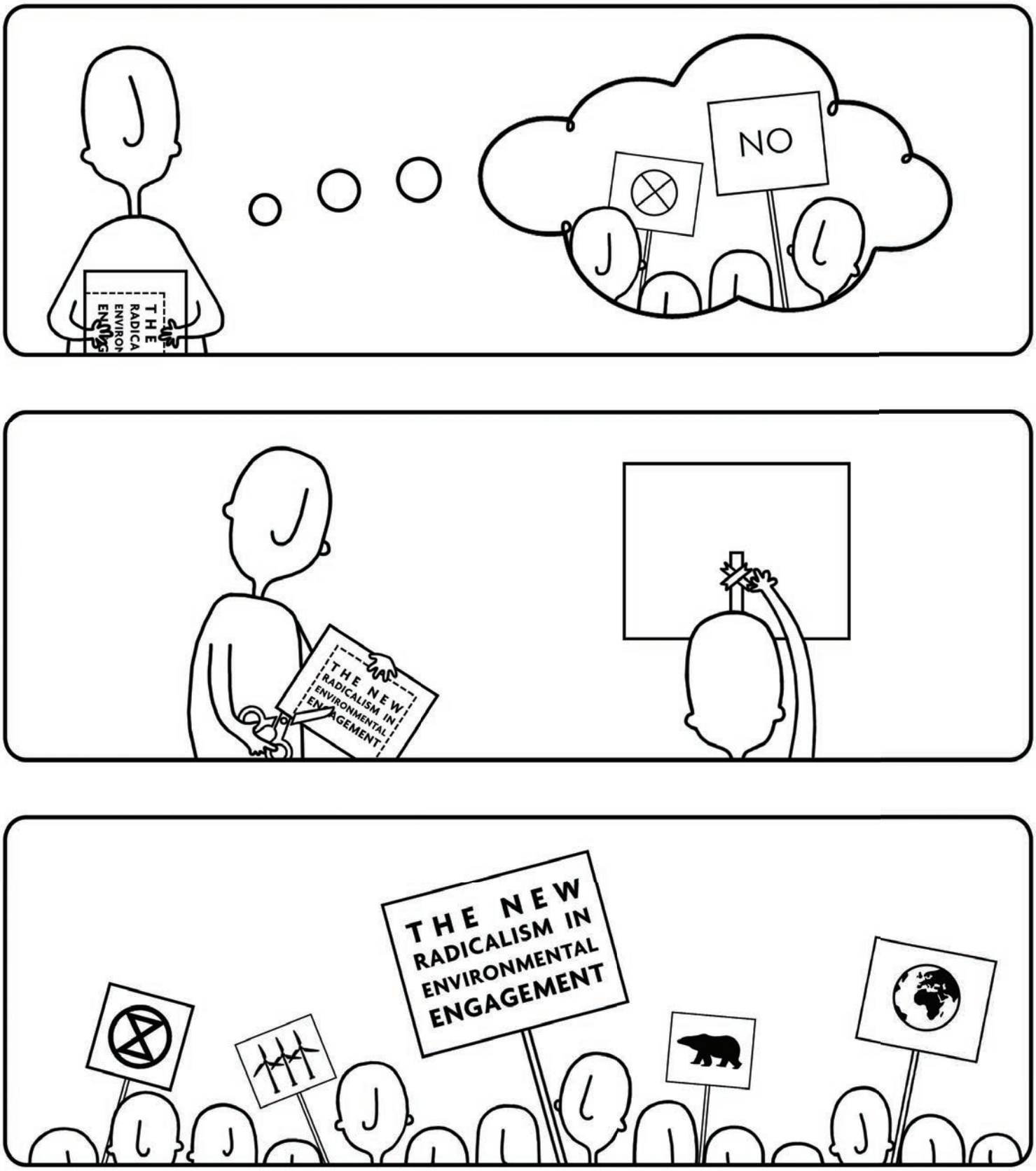


EDITORIAL

Engagement in a new climate

More than 30 years ago, I walked through the doors of Greenpeace UK's offices and offered them my services for free. It was a few days after Reactor No 4 at Chernobyl had suffered a catastrophic meltdown and I wanted to do something. I was comfortable with numbers and ideas – I'd studied maths and philosophy at university – and I believed these were useful assets for a campaigning organisation seeking to change the world. They agreed, and that was it.

At that time, almost all of the work on alternative futures was being done by organisations like Greenpeace and Friends of the Earth. So it was easy enough to see where the battle lay: big business and blind government were the indisputable bad guys. Against 'there is no alternative', we posed 'another world is possible'. And we believed it – passionately.

By the early 1990s, when awareness of climate change first burst upon the world, government and business began to catch up a little. Mainstream institutions started to adopt the language of change. But they undermined its power, robbing it of its electricity and its anger. The nineties and the noughties imposed an optimistic logic of 'ecological modernisation' on things. The bad guys became the good guys. The UK became the first country in the world to publish a sustainable development strategy, the first to pass a Climate Change Act. Campaigners, businesses, academics, politicians: we would all share in the struggle.

By 2009, as Economics Commissioner on the Sustainable Development Commission, I articulated a growing scepticism for relentless economic expansion that struck a chord in a wide variety of places. But within the machinery of the UK government, it was a message too far. It looked too much like system change. System change is disruptive. Yet to assume that we can solve systemic problems without fundamental change is dangerous. In the intervening decade, we have patently failed either to address the flaws in our economic system or to solve the climate crisis.

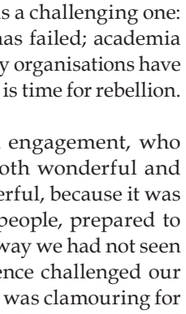
But sometime last year, a lone Swedish schoolgirl went on climate strike. A little while later, people noticed. Out of nowhere came a new and urgent call for us to rebel for life. Tens of thousands of people took to the streets to echo that call. Their message was a challenging one: government has failed; business has failed; academia has failed; even environmental lobby organisations have failed. Change has not happened. It is time for rebellion.

For those of us who believed in engagement, who had embraced activism, it was both wonderful and salutary to see this happen. Wonderful, because it was a movement of mainly ordinary people, prepared to commit themselves to change in a way we had not seen before. Salutary, because its existence challenged our own rationale. Another generation was clamouring for the role we once believed we owned. And now it seemed we had to take up a new position, as bystanders in our own campaign.

In some corner of my mind, I wondered if the time had come to do less, not more, in the battle for change. But it was only a momentary hesitation. Activism never really ends. Engagement is a long-term commitment. You don't always realise that in the beginning and sometimes it takes decades of partial success and confusing reversal to make sense of things. But as the various contributions to this volume show, from research to policy, from art to trade unions, there is something irreversible about the decision to align one's energy and skills with the challenges facing society and to work for change.

Wherever the twists and turns of this latest call lead, there is no denying its urgency, and no more fulfilling way to continue to engage in the world.

Editorial: Tim Jackson is Professor of Sustainable Development at the University of Surrey, Director of the Centre for the Understanding of Sustainable Prosperity and author of *Prosperity Without Growth: Foundations for the Economy of Tomorrow.*



Cover design: Lexie Mac is an illustrator working in London, with a passion for the environment that is explored in her work. She is also part of the IES administrative team and is currently writing and illustrating an educational children's book on ocean plastics. www.lexiemac.co.uk

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The environmental SCIENTIST provides a platform to discuss key issues within the environmental sciences, hosting original articles written by professionals, academics and experts working across the sector.

Against the clock

Joan Walley highlights the changes taking place in our engagement with climate change.

I was brought up in the simply beautiful countryside of North Staffordshire. From very early, on I knew exactly where to go for the glistening celandines and hanging catkins heralding another spring, the ripe bilberries on the geological fault that is Congleton Edge, the cobwebbed swollen blackberries ripening in the August sunshine and, as summer turned to autumn, the mushrooms as big as dinner plates nestling in the meadows of the now-abandoned coal workings. My dad shared all of this with me. I never asked him how he knew what would be flourishing in each season, but I suspect this knowledge was passed on to him, bit by bit, by the older generations. It was just something we took for granted.

However, with the changes over the past few decades, Joni Mitchell's song 'Big Yellow Taxi' could so easily be our anthem:[1]

"Don't it always seem to go
That you don't know what you've got
Till it's gone."

So when scientists and researchers present the peer-reviewed science on the threats our planet faces, when time is running out for the solutions we know we need, why are we still not responding with the urgency required? Climate-change awareness has existed since the early 1990s and now – when the Committee on Climate Change, countless scientists and even our children have called for immediate action – governments and business still wait.

Knowing what we now know, I find it unconscionable that my generation has not done enough to heed and act on the warnings that threaten our common future. Even worse, we are failing to communicate the true enormity of the environmental and climate challenges facing those who come after us. Just how will we use the short time we have to build on scientific evidence, innovation and a deep respect for the planet to create and design the pressure, political will, due process, assurance, business confidence, common understanding, desire to embrace change, infrastructure investment, and determination that is needed to rescue and safeguard our planet?

This edition of the environmental SCIENTIST recognises that if we are to get the corresponding innovation and

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INTRODUCTION

behaviour change to match words with deeds, we need to be better tuned-in to how we communicate and engage with environmental sciences. Our contributors offer a fresh perspective in that they are already alert to the social changes underway and aware of the role of the public voice in making the climate emergency and environmental challenges central to policy-making in our times. The time has gone for talking amongst ourselves; now we must concentrate on getting the message out.

LEGISLATION AND BUSINESS DRIVERS

The environmental agenda was a consistent priority for me throughout my time as an MP and as the chair of the Environmental Audit Committee. I know from my current role chairing the Aldersgate Group (a multi-stakeholder group that focuses on working towards a competitive and environmentally sustainable economy) that the call from the business sector for action is now greater than ever. Our April 2019 event, Zeroing In: Capturing the Opportunities From Going Net Zero, was organised ahead of the Committee on Climate Change's advice to the government on raising the ambition of the UK's long-term emissions. The June 2019 changes to the Climate Change Act and government commitment to introduce a long-awaited Environment Bill now gives us a legislative framework for action. In the coming months, scientists and practitioners everywhere will be called on to adjust from business-as-usual to adopting a new skill set.

For this momentum from the business and policy worlds to be sustained, we need broad buy-in from the public. A new form of radicalism in engagement with environmental science is rising, most visibly manifest in the recent actions of Extinction Rebellion. What is remarkable – given the disruption that they have created in blocking roads and glueing themselves to trains – is the extent to which public support remains strong.[2] This may indicate that the public is already sympathetic to a more radical approach to societal transformation. Some sections of the public can also see the sand in the hourglass trickling away and have committed themselves to *be* the change, to challenge the status quo and seize the moment for the good of those who come after us.

WHERE DO WE TURN NEXT?

It is worth asking how engagement contributes to this transformation. There is no simple trigger to pull in order to communicate these issues. Engagement takes time and must call to our hearts as well as our heads. This is where the real connection lies: with the human impacts and personal experiences. Perhaps an alternative approach to engagement is required – could comedy be a good vehicle for communicating complex science messages? Or could images be more powerful than words, especially if they really can convey a thousand at a time? Perhaps it is the stories behind the science, and behind the scientists, that hold the key to unlocking real, effective and valuable engagement with the public.

Effective transformation takes place in what the philosopher Dick Westley calls 'intentional communities'.[3] As a general rule, as communities grow they lose the social cohesion that brought them together in the first place. A successful mass movement must resolve the tension between growing these communities and maintaining a sense of personal belonging for members. The new radicalism has mostly been driven by the young, who express their common cause in the school strikes of Greta Thunberg. Where else shall we look for leadership? What role is there for faith groups and the trade union movement in rallying us as a whole cohesive group to stand up for the good of our communities?

Finally: how, within our democratic structures, can people express their views and actively participate in creating the solutions and ensuring a just transition? Could citizens' juries and participatory action research lead to better-informed decision-making through the incorporation of local expertise in the environment? The Victoria and Albert Museum has wasted no time in paying homage to Extinction Rebellion's visual impact through acquisitions for its 'rapid response programme'; what role is there for other cultural outlets to be similarly creative and relevant?

This edition of the environmental SCIENTIST highlights a fraction of this movement. It cannot be ignored – it has a strength and vitality that can help shape and energise the defining issue of our time. Now we know the truth about the climate emergency, government, parliament and citizens alike must tap into this emerging energy to help deliver the actions needed to reach net zero by 2050. ES

Joan Walley DL is Honorary Fellow of the IES, Life Member of CIEH, Honorary Doctor of Staffordshire University and Fellow at Keele University. She was the MP for Stoke-on-Trent North from 1987 to 2015, Chair of the Environmental Audit Committee from 2010 to 2015, and she currently chairs the Aldersgate Group. She supports Port Vale FC.

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Rebelling for life

Colin Davis examines the shift in people's engagement with the government to bring about change.

Extinction Rebellion (XR)'s rise to prominence has been so rapid that many observers may wonder where this movement has come from. It has been claimed that XR is just a rebranding of the Occupy movement, that it is composed of unemployed anarchists or unwashed yobs, or that it is the preserve of idle youths or middle-class, middle-aged academics. The truth is that XR has drawn members from all ages and walks of life – academics, actors, archbishops, artists, carpenters, doctors, environmental consultants, gardeners, lawyers, musicians, students, teachers and so on. Some are long-term activists, but most are people who have been drawn to direct action because of the continuing failure to effect urgently needed change via other means.

Over the past few decades, much of the focus on addressing climate change has been on individual actions, especially individuals' roles as consumers. Political action has been marginalised. Elections happen every few years, and when they do, the environment is seen as just one issue among others and tends to be low down the list of priorities. In between elections, many people with concerns about these issues have engaged in 'clicktivism' and outsourced their campaigning to large non-governmental organisations (NGOs): 38 Degrees, Avaaz, Friends of the Earth, Greenpeace and so on. While these organisations have run successful campaigns on a variety of environmental issues, they have not brought about legislative changes to address the climate and ecological crises. Given the urgency of these crises and the scale of the changes required to radically reduce emissions, many deeply concerned people have been left wondering how legislative changes could be made to happen.

HOW IS XR DIFFERENT?

The emergence of XR has spurred another approach: mass civil disobedience. There is a long history in the UK and elsewhere of environmental protesters engaging in civil disobedience and getting arrested as part of non-violent direct actions. However, those actions have typically involved blocking specific developments or components of fossil-fuel infrastructure (e.g., new roads or coal power plants), and those taking part have often been full-time activists (and sometimes professional activists working for NGOs such as Greenpeace). By contrast, XR actions are carried out by everyday citizens, and involve general disruption that is targeted directly or indirectly at the government. Members of XR characterise themselves not as protestors but as *rebels*: they are in direct rebellion against the government, which they argue has broken the social contract through its failure to act on the climate and ecological emergencies.

The movement draws inspiration from the history of social movements and social science research about how change is effected. In particular, research by Erica Chenoweth and Maria Stephan analysing civil-resistance movements over the 20th century[1] suggests that the active participation of 3.5 per cent of the population has historically been sufficient to bring about political change (including toppling dictators). An even smaller fraction of the population can amplify their effect if they are willing to engage in acts of sacrifice, such as losing their liberty for a time. In this respect, the movement draws on ideas and methods employed by suffragists, Gandhi and the US civil rights movement, as well as more recent non-violent resistance movements that have brought down governments in countries as diverse as Armenia, Egypt, Iceland, the Philippines and many others. XR is not seeking to bring down the government, although it is seeking radically different democratic solutions.

WHAT DOES EXTINCTION REBELLION WANT?

In the UK, Extinction Rebellion has three demands:[2]

1. Government must tell the truth by declaring a climate and ecological emergency, working with other institutions to communicate the urgency for change.
2. Government must act now to halt biodiversity loss and reduce greenhouse gas emissions to net zero by 2025.
3. Government must create and be led by the decisions of a citizens' assembly on climate and ecological justice.

▶ **Colin Davis announces that the University of Bristol have decided to declare a climate emergency. (© Colin Davis)**

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The third demand reflects a positive vision for a form of democracy that goes beyond politics. Over the last few decades parliamentary democracy has not succeeded in responding effectively to the climate and ecological emergency. The five-year electoral cycle discourages governments from attending to long-term issues such as climate change. Furthermore, MPs are subject to lobbying from powerful vested interests and are influenced by opinion polls that are of limited value for an issue as complex as climate change. The idea of a citizens' assembly is that the decision-making process would be shifted from professional politicians to randomly selected citizens. XR's mass civil disobedience is not about a small minority attempting to impose specific policy solutions on the majority; instead, it seeks to bring about an informed process in which ordinary people, with the help of expert evidence, decide what policies are required to respond to the climate and ecological crises. The selection process would ensure that the assembly is representative with respect to characteristics such as gender, age, ethnicity, education level and geography. The participants would be unencumbered by concerns about being re-elected, and the process would be carefully facilitated to be inclusive, transparent and non-partisan.[3]

Citizens' assemblies in countries such as Australia, Belgium, Canada, Ireland and Poland have demonstrated how effectively the general public can weigh evidence, engage in careful deliberation, and make fair and impartial choices. For example, the citizens' assembly held in Ireland in 2016–2017 was instrumental in the legalisation of same-sex marriage and the repeal of the ban on abortion, two controversial issues that had been stuck at an impasse in the Irish Parliament for many years.[4] The Irish Parliament is currently incorporating the results of a citizens' assembly into its plan to make Ireland a leader in tackling climate change.[5] Citizens' assemblies may also be useful in addressing topics in other areas of environmental science, as well as broader social issues.

THE DECLARATION OF REBELLION

XR's Declaration of Rebellion was made at Parliament Square in London on 31st October 2018. Many actions since then have directly targeted parliaments and councils. In January 2019, the Scottish Parliament was briefly occupied by rebels; subsequently there were occupations of Norwich and Gloucestershire local councils. In March, rebels poured buckets of fake blood on the road outside 10 Downing Street to symbolise the blood of our children. Most notoriously, on 1st April 2019, 12 rebels disrupted a Brexit debate in Parliament by stripping down to their underwear and gluing themselves to the glass viewing gallery.

Other actions have sought to attract public attention (and indirectly target the government) by causing traffic disruption. On 17th November 2018, in what the *Guardian* described it as 'one of the biggest acts of peaceful civil disobedience in the UK in decades', the five main bridges over the River Thames were blocked in a coordinated action involving around 6,000 people. In the following days small groups of XR activists engaged in swarming roadblocks at multiple traffic junctions, causing gridlock around London.

During a two-week action in April 2019, rebels occupied several sites in London: Waterloo Bridge was transformed into a public garden, Parliament Square became a site for people's assemblies, Marble Arch became a small town powered by a solar array, and Oxford Circus was taken over by a bright pink boat emblazoned with the message 'TELL THE TRUTH'. Over 1,100 arrests took place in London, with arrests taking place in many other countries around the world, including France, the Netherlands, New Zealand and the USA. During this period XR was a staple feature of the news, often on the front page of national newspapers. The visit to London of teenage activist Greta Thunberg and Sir David Attenborough's BBC documentary about climate change[6] helped to further boost climate change on the national agenda.

WHAT INFLUENCE HAS THIS HAD ON PUBLIC OPINION?

Breaking the climate silence is important for overcoming what psychologists refer to as 'pluralistic ignorance', whereby most people are concerned about climate change, but wrongly believe that they are in the minority.[7] If climate change is rarely discussed in the media it is natural for people to believe that others are not concerned about it. This perception discourages people from discussing their own concerns, for fear of expressing unpopular views. This self-silencing reinforces pluralistic ignorance among their peers, leading to a spiral of silence.

XR has been successful in raising awareness and getting people talking about climate change. A University of Colorado study[8] found that climate change was mentioned more in UK newspaper coverage in April 2019 than in virtually any previous month in the last couple of decades (the two exceptions being December 2009 and December 2015, when the United Nations Framework Convention on Climate Change Conferences of Parties were held in Copenhagen and Paris respectively). Nationwide polling shows that there has been a spike in public concern about the environment, with the most recent polling showing that 27 per cent of respondents put the environment among the top three issues facing the country; by contrast, the figure was 9 per cent when the same questions were put to respondents in 2017. YouGov, the polling company responsible, suggests that 'the sudden surge in concern is undoubtedly boosted by the publicity raised for the environmental cause by Extinction Rebellion'.[9] Among young people the figure is higher still, with 45 per cent of 18- to 24-year-olds listing the environment as one of their greatest concerns, making it second only to Brexit (57 per cent).

A poll of 2,000 UK adults in late April[10] found that two-thirds of people in the UK now recognise that there is a climate emergency. Over three-quarters of respondents said that they would cast their vote differently to protect the planet. A separate poll by BMG Research[11] found 59 per cent of voters would support radical action to achieve net-zero-carbon emissions, with only 8 per cent opposing such action. This shift in public opinion played a critical role in pushing Parliament to declare a climate and environmental emergency on 1st May 2019.

A separate question affecting public opinion concerns the public perception of XR. There have been many criticisms of the individuals taking part in actions, but these criticisms have (consciously or unconsciously) attempted to distract from the issues by resorting to narrow and often contradictory stereotypes about protesters. Inevitably, there are criticisms of the actions themselves, and the inconvenience or economic disruption they produce. But of course, that disruption is the whole point. That disruption is how XR has managed to change the conversation.

IS YOUR FLIGHT CANCELLED?

We can anticipate that the disruption to date is only the beginning of an ongoing controversy. It is likely that future actions will target Heathrow Airport. Heathrow is already the biggest point source of greenhouse gas emissions in the UK, and building a third runway will increase the number of flights by 50 per cent. It is difficult to reconcile this expansion with the government's recently declared target to reduce emissions to net zero by 2050.

With the latest High Court ruling, opponents of the third runway have virtually exhausted the legal means of preventing its construction, and thus XR has considered non-violent direct actions aimed at disrupting flights over an extended period. This would be a higher-stakes action in a couple of ways. First, it is likely to be considerably more divisive than the traffic disruption caused in central London. Indeed, draft proposals led to considerable concern within XR membership, as well as outside it.[12] Furthermore, disruption of airports has the potential to lead to severe charges, as the Stansted 15 discovered.[13] Nevertheless, there are members of XR for whom such penalties are not a discouragement, but rather a welcome opportunity to draw attention to the situation. How will the public respond to the spectacle of non-violent protestors serving prison sentences for attempting to avert a climate catastrophe? Such a situation would increase the pressure on MPs to consider how the Heathrow expansion can be reconciled with the climate emergency that Parliament has declared.

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FEATURE

THE REBELLION FORMULA

Civil disobedience is by its nature divisive. Many Londoners celebrated the XR occupation of London; cyclists expressed a preference for Waterloo Bridge without the traffic[14] and a collateral benefit was a sharp reduction in air pollution around the occupied sites.[15] Others were less happy about the disruption of traffic.[16] There will always be people who are opposed to any law breaking, and those directly affected by disruption may, understandably, be annoyed. But that is as it ever was. That initial annoyance may, on reflection, give way to a more sympathetic attitude. During the US civil rights protests, for example, there were no doubt individuals who felt inconvenienced by the sit-ins staged by African-Americans at whites-only venues, or by 15-year-old Claudette Colvin refusing to give up her bus seat to a white woman. The historic march from Selma to Montgomery in March 1965 by Martin Luther King and many thousand other civil rights protestors was objected to by the state governor on the grounds that it involved traffic violations. But history draws a different lesson. In the same way, it is unlikely that people of the future will devote too much attention to the possibility that some Londoners had a delayed commute in April 2019. Instead, the hope of those in XR is that people of the future will look back on this time as the period when normal people began to turn things around. ES

Professor Colin Davis is a cognitive psychologist at the University of Bristol. His research focuses on psycholinguistics, though he has also worked on political psychology, social cognition and the psychology of decision-making. In the past year he has become increasingly involved in climate activism as part of Extinction Rebellion. He initiated a campaign at the University of Bristol that led it to become the first university in the world to declare a climate emergency. He has been arrested twice (so far) for acts of civil disobedience, most recently in London during the International Rebellion of April 2019.

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ANALYSIS

Communicating cutting-edge science

Michael Sulu explains how he uses comedy to engage a diverse audience in science.

Until relatively recently, public engagement and scientific communication (sometimes called PE and scicomm) weren't regarded very highly. Even today, they are still the younger siblings of the older twins of teaching and research within an academic setting. Not all academics focus on sharing their work with the public, so why do some do it? Undertaking either public engagement or science communication can be an arduous task, and it is not linearly scalable. Although the more you do, the more of an information bank you create, eventually making things easier, there is a fair amount of work required to get each presentation polished and ready.

DIFFERENT REASONS FOR ENGAGING

A general theme for many communicators (including me) is the need to show that members of minority groups work in science, so as to get over the 'you can't be what you can't see' aspect of the deficit of different groups within science. One of the arguments for diversity is that a diverse group of people will have diverse ways of thinking and thus create diverse solutions to a problem. If a particular individual can't solve a problem, it is unlikely that a dozen others with the same ways of thinking will have any more luck! A related point is that science and engineering research are often about the pursuit of answers to specific questions, and some of these questions may have been answered elsewhere. So the intelligent first step is simply to go out to talk to people about the problems you are facing, and to listen to how others have solved problems to see if your problem can be solved in the same way.

Another really important facet of science communication is that it often shows the human, error-prone side of science and scientists. Everyone makes mistakes – they are inevitable, but the important thing is to learn from them. When I was lecturing for an absent colleague on the topic of environmental legislation, I found out about an environmental disaster that took place in upstate New York. Having never heard of it, I thought it would be a good idea to investigate it mid lecture and opened up an online image search. It was not until the images appeared that I realised the danger of entering the search terms 'Hooker' (the chemical company) and 'Love Canal' (the location).

DIFFERENT MEDIA

The reason sometimes dictates the medium for communication. Generally, you identify your audience and the reason you want to engage with those particular people first, then you plan your engagement. You might

▶ **Michael Sulu performing at the January 2015 Bright Club at the Bloomsbury Theatre. (© Steven Ullathorne)**

want to communicate widely with the general public, in which case radio and television make sense. Or, if you want to speak to a specific demographic that is already interested in your topic, then a podcast or a lecture could be better. Lectures are more transient, unless videoed, but they do provide the opportunity for more real-time discourse.

So what is Bright Club? It uses humour to engage the public with current research and how it is carried out. To do this, university researchers have to present their research area as a stand-up piece in plain English. The thinking behind this approach is that comedy engages everyone, and once you have engaged someone with a topic, they will be more likely to go on to find out more. Comedy enables people to learn while laughing.

Stand up, though? I was tricked into it! A simple discussion led me to say that I was happy to do stuff, but that I couldn't do the event I was being asked to do because I was busy and it was too short notice. Fast forward a couple of months and I received an email saying I had been accepted for Bright Club training! I had no idea what it entailed, but it turned out to be two sessions. The first one was learning how to be funny and how a joke is constructed; the second was practising and receiving constructive criticism. Learning how a joke is constructed made me far more appreciative and also critically aware of how other comedians work. Practising the material is both essential and soul destroying. It's like imposter syndrome ramped up to the max.

Stand up is daunting, to say the least, and people are often surprised that I do it. These people are often my friends, and they know me well enough to know that I am rarely the funniest person in any social group, although I have my moments. When the actual performance comes it is amazing: you have spent weeks thinking you won't be funny, then you stand up in front of an amazingly kind audience who laugh at everything. (I did get a heckle in my first show, but it was funny so it just made me laugh and everyone laughed with me). After the performance, it is immediately clear why people who do it for a living love it! There is a huge adrenaline rush, so it is easy to see how it can be addictive.

POSITIVE VULNERABILITY

I continue performing at Bright Club mostly because there is something cathartic about the vulnerability of stand up. With or without slides for accompaniment, it is you versus a crowd daring you to make them laugh. Unexpectedly, the experience is completely different in a small pub compared to a theatre. A pub is intimate, and you can see and hear everything and everyone, but a theatre is expansive, and under the glare of the bright lights you feel even more vulnerable, especially when you can't really see who is heckling you.

I think that the vulnerability aspect is the key element of doing stand up for me. The obvious positive is that it is useful practice for public speaking in general – you can take humour into the lecture theatre and to conferences, and you can generally use it to improve all of your public engagement, as humour is one thing that unites us. I have done a fair amount of public speaking and the Bright Club experience is different. As well as a boost to both confidence and competence in public speaking, you gain the ability to think on your feet and adapt to audiences. Equally importantly, you get comfortable with being uncomfortable in public. It is the last part that is key for communication in general – the vulnerability you feel and your level of comfort with discomfort means you have an enhanced ability to have difficult conversations. You also become more adept at reading a room.

WIDENING PARTICIPATION

Some of those difficult conversations have happened when undertaking outreach or widening participation. For example, when I to go a school and talk to minority groups about the experiences in higher education. The ability to speak with passion and emotion about topics that can be difficult is essential, because a key tenet of most jokes is that the audience has to become invested in them and in you, so you have to at least seem as if you have a strong emotion about something or a definite stance on a topic, along with the ability to create a positive emotion (laughter) from a potentially negative space.

So from my perspective Bright Club has been an entirely positive experience. Through listening to other people perform I've learned about other disciplines – the Bright Club plan has worked on me! I've made new friends who are almost all funnier than me. I've bonded with people from a variety of career stages and disciplines, from a variety of backgrounds and with a variety of personal experiences, all brought together by one initiative, Bright Club – the thinking person's variety night. While I don't like the tag line, the experience has enriched my life massively. ES

Dr Michael Sulu is a post-doctoral research associate at University College London in the Department of Biochemical Engineering. His work focuses on three things: growing different types of microorganism, teaching others about growing microorganisms and training people how to grow microorganisms.

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FEATURE

The life and times of the 'alternative' environmental scientist

Jackie Young introduces a variety of ways to engage the public in environmental issues.

I always knew I wanted to be a scientist but I was also pretty certain I didn't want to end up in a lab coat looking down a microscope for the rest of my life. There is nothing wrong with that as a career choice, it just wasn't me. But that's exactly what I was doing when, in a rush of waterproofs, specimen jars, sampling pots, microscopic pond life and A level lecture notes, I met John Bull of Plymouth Polytechnic's environmental science course at Slapton Ley Field Centre. This experience of field work, combined with the polytechnic's location – in a city I'd loved since childhood – meant I applied for their Environmental Science BSc (Hons) as soon as I could. At the time I was too fascinated by what appeared to be the completely unrelated subjects of ecology, geography and physics; and I hadn't even started on geology, economics, fisheries, planning, politics or socio-economic implications! My academic introduction to the underpinning principles of environmental science, its all-encompassing ecosystems and the fundamentals of sustainability – strategic social, economic and environmental impacts – could not have been more significant to me. Through lectures and local field trips, a whole new world was revealed.

In my work in eco-communication, there is no doubt that statistical or scientific evidence changed hearts and minds, influenced budgets, and persuaded decision-makers that change was needed. But, in order to communicate the implications associated with the data, I've needed to use the skills more closely aligned with my A-Level in Drama and Theatre Arts and the campaign journalism training

from working as a press officer with Friends of the Earth. Much of my working life has involved stage management and performance.

EARLY ENGAGEMENT WITH THE ENVIRONMENT

In the early 1990s, community development was a new concept to many decision-makers. Getting people to sit down and talk to each other was a rarity and not something many council officers or elected politicians were used to or had much interest in. 'Consultation' was often limited to planning applications and, I suspect, there are still some who feel it should have remained there as it has given the community a loud, and often pertinent voice.

Then along came Agenda 21 – a product of the UN Earth Summit of 1992 – and all associated principles of consensus building. The groupings that resulted were sometimes as surprising as they were novel. Watching representatives from the Royal Navy face-off against the local Campaign for Nuclear Disarmament (CND) group in the first formal meeting of its type in Plymouth was particularly memorable. We very quickly established that, when it comes to environmental protection, there is no 'us' and 'them'. Everyone in the room that day clearly shared a common desire to protect and improve the city's environment, even if they had different approaches. It took trust, collaboration, shared resources and expertise, inspired leadership and some compromise on all sides to take things forward. A testament to its success is that the strategic environmental forum created that day lives on in a new form 26 years later, and is currently tackling contemporary concerns of climate change and plastics with renewed vigour.

SO HOW DO YOU ENGAGE PEOPLE?

Communication is a key component of engagement, and this is not always about language. Images – turtles wrapped in plastic bags, great tundra aflame, dehorned rhinos – can be more powerful than the words we choose to describe them. Experiences are even more fundamental to change; an emotional and personal connection to an issue can change opinions, but more powerfully, the worldviews that these opinions rest upon.

Getting the message across is not always easy. Engaging people means dealing with a myriad of views and opinions, informed or otherwise. It means resolving complete differences of opinion, reasoning with those who simply don't, can't or won't see things in the same way. At times it can mean offering solutions that don't reflect your own principles.

Of all the 'ologies' I studied for my degree, environmental psychology had to be the most significant, as it helps explain the way in which people perceive the world. As an environmental professional, you will not always be 'preaching to the converted' and, even if you are, individuals come along in various shades of green – from 'dark emeralds' who will never be satisfied with your efforts, to 'pale mints' who don't care that much as 'it's always someone else's problem'. Not everyone shares the same passion for the environment, and it can be difficult to accept that some people simply don't agree. Sometimes you will be right in the middle. Environmental science courses don't prepare you for picket lines, direct action, being arrested (I wasn't) or being blacklisted (I was) – but you l quickly learn that you will never keep everyone happy and that compromise often outweighs consensus in the final analysis.

It is, however, often easy to find a topic in common with most people regardless of their background, social circumstances and educational levels. The environment is one of the most commonly quoted topics in community consultation – someone is always worried about a local park, a tree, litter, or the local squirrels. You can then build arguments and actions from that mutual starting point. Pulling communities together always has the greatest impact.

The ability to get a message across is an essential strategic element. Over the years, a few simple rules have become apparent, lead by example, exhibit professional integrity, know your subject matter, and strive for simplicity and a shared approach. When working with businesses on environmental matters, start with the questions 'What works for you?' or 'What's worrying you?' Working on the basis of 'a problem shared is a problem halved', you might often find solutions are right there in front of you, it just needed a different perspective to bring about a result.

ENGAGE, DON'T FRIGHTEN

The last thing you want to do with a serious issue is frighten people. For many, this is the reason they turned off in the first place. Fear is a paralysing emotion and a lack of understanding often drives it. Sadly, fear and ignorance are often used to control responses and reactions and to encourage the status quo rather than for beneficial change.

A quieter form of engagement is Plymouth's Green Book Club, which meets regularly to review topical publications – a simple and gentle way for like-minded people to meet, share their concerns and openly discuss issues. Communication and knowledge exchange can come from all sorts of worlds, beach litter picks, rockpool rambles, practical conservation work or effective, well-informed lectures and workshops.

There is always the option of introducing the unusual. Sir David Attenborough's portrayal of a polar bear boosted the arguments for action on climate change. Inspired by this, and despite my boss's misgivings, at Plymouth

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City Council we hired two (stuffed) polar bears, Nina and Mischa, from Bristol Zoo's Education Department, to take them on tour around the city to promote awareness of climate change. The project was strongly backed by the technological and scientific evidence of climate change available to the council team but the message was broadcast by the bears – who visited the local shopping mall, a popular hotel, Plymouth City Council's offices and, on request, the nuclear base at Devonport. During the week we met many who knew a little about climate change and even a few who had encountered real bears at a distance. But there was no substitute for the fact that this was the closest most had been, or would ever get, to a fully grown polar bear. The success of this approach was borne out by the three-year-old who clamped herself to Nina's leg and refused to leave her, because "her home was under threat." At three years old she understood why change was needed.

You never know where the next Charles Darwin or Sir David Attenborough will come from, so working with young people is incredibly important. A recent conference on plastics in the ocean attended by 200 young people aged 7–16 years had the adult supervisors in tears of both laughter and compassion. The kids involved knew why plastic was a problem, they knew what to do, and they wanted to know why adults weren't listening. It is my job, as the coordinator of the city's environment network, to ensure that their voices are heard and that their requests for change are acted upon.

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FINDING INSPIRATION

When I was studying it was Rachel Carson's *Silent Spring* and James Lovelock's *Gaia* that spurred action. Great literature and journalism are often cited as sources of inspiration in environmental science. I suspect that the writer George Monbiot currently fits into this category and Greta Thunberg is emerging as an eco-heroine. All have dared to question what we are doing to the planet and our right to do it: leading by example in both word and deed.

"The last thing you want to do with a serious issue is frighten people. Fear is a paralysing emotion..."

Sir David Attenborough's '*Blue Planet* effect' on plastic waste is still gaining strength on a global basis and, unlike the normal trajectory of campaigns – emerge, influence and then decline – this campaign doesn't seem to be showing signs of diminishing. *Blue Planet's* images of the impact of plastic have encouraged millions to take action, with some notable national and international changes in commercial behaviour and production methods. The actions can be global or local but, on this issue, everyone can do something. In Plymouth, we have been working with businesses, communities, politicians and schools in a concerted campaign to tackle the city's single-use plastic waste. In a year-and-a-half, no one we have approached has declined to take part. The only questions asked are versions of 'how to take action' and 'why it's so important'. These emotive issues open the door to deeper engagement with the science.

DEALING WITH VESTED INTERESTS & DETRACTORS

Perhaps the most difficult sector is those with a vested interest – often the reason for campaigns against the fossil fuel companies, logging interests and trophy hunters. Where financial gain – at whatever level – is involved, it is often difficult to second guess how people will react.

Typical tactics include suggesting your opinions are out of date, wrong or far too commonplace to have any impact questioning your principles and discredit your arguments? My advice would be to stick to your guns, stick to the science and persevere.

A VARIED ROLE

There are loads of other examples I could have quoted such as leaping around the city centre dressed in a 'Kangaroo' costume to promote aluminium recycling or dressing as a Womble to promote litter picks. I've been rained on, snowed on, sworn at, cuddled, commended and completely ignored but, in every case, I've always been proud to say 'I'm not just a scientist, I'm an environmental scientist'.

I was never going to be a laboratory or field environmental chemist or biologist – my maths was never that good – but, over the years, the skills we didn't study in class – including working with the media, presentations, working with politicians, making funding bids and coming up with creative ways of getting the complex messages across – have been crucial in my career. I'm a storytelling environmental scientist and I wouldn't have it any other way. ES

Jackie Young was born in West Sussex and brought up on the South Downs. Since graduating in 1986, she has built an award winning reputation for eco-communication focusing on the topics of sustainable development, climate change and environmental management. In the last 30 years she has worked as an environmental advisor for Groundwork, a campaigns press officer, a government advisor on urban sustainability and on environmental projects in Germany, France, Spain and Russia as well as leading numerous local initiatives. Jackie now runs her own sustainability consultancy, leading a local strategic green network with over 300 members and Plymouth's Plastic Free Campaign.

From ice cream to employability: Engaging students in sustainability issues

Rachel Drayson gives an overview of how to help students to be active environmental citizens.

Ever-increasing numbers of young people are taking to the streets, mobilising to voice their concerns regarding the future of our planet and society. The Youth Strikes 4 Climate that have spread around the world, and throughout the UK, are a physical manifestation of the research findings that have consistently shown that young people are comparatively more worried about climate change and think that the consequences will be worse in comparison to older people.[1] Data from the latest British Social Attitudes Survey show 31 per cent of 18- to 34-year-olds to be very or extremely worried about climate change compared with just 19 per cent of those over 65. NUS's own research (with a nationally representative sample of students in higher and further education across the UK) shows markedly higher levels of concern, with 91 per cent saying they are fairly or very concerned about climate change.[2]

"I know that this probably doesn't scream 'sustainability' but actually, it was ice cream that led to my involvement with green issues around the university."

STUDENT AMBASSADOR, STUDENT SWITCH OFF

ANALYSIS

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The government announced its intentions, through the 25 Year Environment Plan, to be the first to leave the environment in a better state than it found it. To enable young people to play an active role, the Department for Environment, Food & Rural Affairs (Defra) is working closely with the youth social action organisation, Step Up To Serve, to put young people at the heart of the UK's Year of Green Action 2019. Research commissioned to support the campaign, in a nationally representative survey, found that 26 per cent of young people (aged 16–25 years) have taken part in environmental volunteering at least once.[3] This same research highlighted educational settings to be a key pathway for engagement with environmental issues, a finding that has long been recognised at NUS.

THE ROLE OF NUS

NUS is a confederation of over 500 students' unions across the UK. We champion students to shape the future of education and create a better world. Our action on sustainability engages thousands of students across the UK and works across three areas: campuses, curricula and communities. We run projects and programmes that help make sustainability part of everyday life on campus, supporting students (and staff) to adopt sustainable behaviours that last a lifetime. We work to ensure sustainability is embedded into the curriculum of every student across every discipline. Our vision sees students' unions as hubs of sustainability at the heart of their wider communities. We help students to thrive as global citizens, as active participants in society and democracy, and as future leaders on sustainability.

From our range of activities designed to empower students to define, shape and lead on sustainability, it is possible to draw out some key points for engaging students and young people across a variety of different opportunities, from campaigning to saving energy.

KEY POINTS FOR ACTIVITY DESIGN

A crucial tool for capturing initial interest, as well as ensuring ongoing engagement with projects and activities, is the use of 'hooks'. In other words, activities and projects should be framed in ways that are relevant to young people's existing interests and priorities – freebies work well too! Once the engagement has been achieved, sustainability content can be embedded within the ongoing delivery.

We have found that focusing on presenting opportunities that offer students the chance to develop new skills that enhance their employability or to put elements of their academic experience into action work well. For example, our European Students, Sustainability Auditing[10] project sees students participate in an international exchange to audit the social responsibility actions of a university different from their own. The week-long audit sees students reviewing documentary evidence and interviewing key stakeholders, culminating in the production of a feedback report. This real-world experience is highly valued by student participants, who can also complete an accredited assessment.

It is also wise not to involve the stereotypical student pastime of drinking alcohol, which only appeals to certain groups of students. For example, our Student Eats food-growing project has been particularly successful amongst international students from non-drinking cultures: they initially get involved thanks to the opportunity to socialise outside of the bar. Projects and activities involving food generally have broad appeal.

When planning an engagement activity with students, taking the peaks and troughs of the academic calendar into account is essential. The fluctuations in availability to engage affect some areas of sustainability more than others. For example, activities involving food growing need careful planning to ensure students are able to be there for the harvest, and also to ensure the project is able to secure sufficient year-round volunteers. Capitalising on the first term of each year is important, with recruiting for projects sometimes proving more difficult in the second and third terms. However, the end of the academic year can be a useful opportunity for recruitment, as students want to finish their year giving something back or adding to their CVs. Linked to this, running projects and campaigns over short periods is often effective, meaning engagement is maintained throughout and turnover of students according to academic years is built into the project or campaign design.

"It's clear that the more intensive engagement, although more difficult to achieve, has the greatest impact on participants' awareness of their own behaviours, but also their ability to affect the behaviours of others. However, this kind of level of engagement is not feasible to achieve with everyone, so it is clear that less intensive methods have a role to play alongside deeper engagement, if meaningful and widespread behaviour change is to be achieved."

SUSTAINABILITY STAFF MEMBER, SHEFFIELD STUDENTS' UNION

Successful projects often include different levels of commitment or involvement ranging from low-commitment, one-off opportunities to those that require more intensive engagement but that are potentially more transformational for the participants. Planning project activities to provide progression routes for participants, leading to more in-depth involvement once they are engaged with the project, is valuable. These more transformational or intensive projects often include an element of student leadership (where responsibility is devolved to students who are able to direct the focus of activities towards the issues that resonate most with them), rather than campaigns and projects being delivered on a top-down basis. Offering a variety of routes to engagement that require different levels of commitment also ensures the engagement of

BOX 1: EXAMPLES OF OUR ENGAGEMENT WORK

In the 2017–18 academic year saw students in further and higher education take action on sustainability in several ways:[4]

- **Green Impact**[5] Around 43,000 people completed over 30,000 actions on environmental and social sustainability issues as a result of 290 organisations taking part in our behaviour-change and engagement programme.
- **Student Switch Off**[6] By supporting student ambassadors to encourage their peers to switch on to saving energy, we saved £218,180 in energy and 828 tonnes of carbon. Over 120,000 students have been reached by the campaign, with 27,000 making a pledge to save energy.
- **Student Eats**[7] Our programme has supported 45 sustainable food enterprises to start trading their produce, selling more than £77,000 of sustainable food. Almost 2 tonnes of food has been diverted from landfill and students have racked up 11,567 volunteer hours.
- **SDG Teach In**[8] At the first annual Sustainable Development Goals Teach In, 255 teaching staff pledged to integrate learning on issues related to the global goals within their teaching, reaching over 16,000 students.
- **My World My Home**[9] This project trains further education students in community campaigning and supports them to take action to improve the environment in their local community, from campaigning for hybrid buses for better air quality to creating plastic-free campuses.

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a broad range of participants, improving accessibility and diversity.

Finding the right level of responsibility is often a fine balance – support should always be at hand to help keep participants on track if needed. An example of this is our work in partnership with the Woodland Trust that is designed to engage the student population in the Charter for Woods, Trees and People.[11] We have recruited a 13-strong council for Students for Trees from universities across the UK, with each member taking on responsibility for overseeing the delivery of an element of the campaign.

Finally, as well as taking all the elements above into account, there is an overarching need to ensure that activities and opportunities on offer are seen as fun things to do. Competing with hectic academic, social and paid-work commitments means that students are often looking for activities that include a way of enjoying themselves and socialising with peers, but this doesn't preclude emphasising the opportunity to make a difference.

KEY POINTS FOR MARKETING AND COMMUNICATIONS

Exciting branding can be an important part of building an identity for projects on campus, so the language used and how this might be interpreted by the target audience is very relevant. The terms 'green' and 'sustainability' can be off-putting for students who lack existing engagement with the subject and therefore believe that the project and its activities are irrelevant to them.

Our projects offer the participants a range of incentives, from ice cream to improved career prospects. Tokens such as T-shirts, hoodies and free food have proved to be good incentives to drive interest, whereas incentives linked to more in-depth engagement include the provision of a certificate to recognise participation or achievement. Whilst using incentives to drive changes in behaviour has its critics (as they can be extrinsic motivations rather than intrinsically doing the behaviour for its own value), our experience has shown that incentives work well to attract students' attention in a crowded arena of different activities and opportunities. Using well-respected and relevant partners to co-deliver projects can also give activities kudos amongst the target audience, although the wrong partner or sponsor will have an adverse effect on engagement.

Linking back to activity design, it is also important to clearly convey the expected outcomes participants will achieve as a result of their participation, be that a chance to make their CV stand out or simply make new friends.

Harnessing the support of their peers for communications and marketing has the effect of triggering further student sign-ups for sustainability projects and campaigns. Finding out about opportunities from the right person can be key to securing engagement. Our Student Switch Off[6] campaign draws on this approach, training students to be ambassadors for the programme, which includes encouraging their peers to pledge support for and action on energy-saving behaviour in their halls of residence. There are of course many other factors that influence the success of sustainability projects and campaigns. However, we've found the elements discussed here to be particularly effective in engaging students with the issue, and they are likely to resonate with young people and the general public as well. ES

Rachel Drayson is the Insight Manager based within NUS's Sustainability team, and oversees the development of the evidence base of student attitudes and behaviours linked to sustainability issues. Her role also includes evaluating the team's work to find out what is and isn't working to engage students on sustainability. For more detailed information about NUS's Sustainability work please visit **sustainability.nus.org.uk** or get in touch at **sustainability@nus.org.uk**

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New members and re-grades

Member

is for those individuals who have substantial academic and work experience within environmental science.

Leo Asuelimen – Principal Environmental Consultant
Dean Atwell – Senior Planning Consultant
Andrew Barrett-Mold – Ecologist
Christopher Barron – Senior Consultant
Matthew Beacon – Environmental Scientist
Sybil Berne – Planning Consultant
Matthew Booth – Geo-environmental Engineer
Jacob Buckingham – Environmental Engineer
Jennifer Chambers – Environmental Scientist
Sophia Clark – Environmental Consultant
Adam Cockayne – Environmental Consultant
Joe Compton – Environmental Consultant
Ancelin Coulon – Analyst Consultant
Amy Cox – Senior Environmental & Sustainability Consultant
Dominic Daly – Environmental Consultant
Aude Delmer – Restoration Manager
Stuart Desmond – Environmental Consultant
Daniel Ditri – Environment Manager
Christina Dow – Ecologist
Sam Driscoll – Senior Consultant, Contaminated Sites
Leila du Toit – Sustainability Manager
Simon Dunstan – Environmental Consultant
Patricia Enot – Senior Environmental Consultant
Jason Fitzgerald – Senior Geo-Environmental Consultant
Scarlett Franklin – Sustainability Consultant
Thomas Gibbs – Group Environmental Manager
Adam Grant – Environmental Specialist
Elizabeth Greenaway – Senior Environmental Advisor
Jason Alexander Hain – Advisor
James Harris – Principal Consultant
Thomas Harrison – Technical Director & Environmental Expert Witness
Harriet Jenkins – Environmental Consultant
Sophie Khomeriki – Principal Environmental Consultant
Nicola Lear – Principal Environmental Consultant
Steven Lees – Principal Environmental Scientist
Goncalo Lemos – Acoustic Consultant
Elena Lo Giudice Cappelli – Marine Environmental Scientist
Alexandra Logan – Senior Geoenvironmental Engineer
Daniel Maher – Senior Consultant
Stuart Martin – Associate
Lisa McIntosh – Contaminated Land Consultant
Alice McLean – Principal Air Quality Consultant
Blathnaid McPolin – Senior Environmental Consultant
Derek Milton – Principal Consultant
Rhona Mitchell – Environmental Consultant
Enrique Moranmontero – Restoration Manager
Sibekile Mtetwa – Environmental Safeguards Specialist
Antony Phin – Environmental Consultant
Adriano Portaluri – Senior Environmental Scientist
Rebecca Price – Senior Geo-environmental Consultant
Richard Price – Project Engineer
Hasitha Rathnek Gedara – Projects Manager - Sustainability
George Salloway – Acting Senior Geo-environmental Scientist
Stephen Sellers – Senior Environmental Geologist
Keeley Seymour – Principal Geo-Environmental Consultant
Graham Stead – Chartered Building Engineer
Natalie Stephens – Environmental Consultant
Keziah Stott – Environmentalist
Nicola Swallow – Project Engineer
Sophie Tankere-Muller – Research Scientist
Marzhan Thomas – Senior Environmental Steward
Vanessa Thorpe – Associate Director
Julia Veerman – Air Quality Engineer
Rachel Vojvodic – Environmental Engineer

Associate

is for individuals beginning their environmental career or those working on the periphery of environmental science.

Ahmed Al Bualy – Environmental Engineer
Rei Bolano – Graduate Environmental Consultant
Jessica Bray – Graduate Geoenvironmental Consultant
Leo Cassidy – Environmental Engineer
David Christie – Active Travel Assistant
Stuart Cook – Sustainable Places Planning Advisor
Matthew Cooper – Geo-Environmental Technician
Alexandra Crawford – PhD Student
Alicia Dale – Graduate Air Quality Consultant
Udeme Ekanem – Environmentalist
Chloe Fletcher – Operations & Business Development Lead
Patrick Fowler – Publications Officer
David Gilfedder – Environmental Consultant
Sofia Gkino – Graduate Environmental Consultant
Beatriz Gordo-Infante – Assistant Air Quality Consultant
Madelan Gowler – Environmental Assistant
Hiu Ming Hugh Guan – Wastewater Treatment Plant Technician
Kathryn Hall – Environmental Consultant
Francesca Hammond – Geo-Environmental Consultant
Jessica Heredge – Graduate Air Quality Consultant
Adam Hills – Loss Adjuster
Alastair Hinchliffe – Geo-Environmental Engineer
Rory Horton – Graduate Environmental Engineer
William Hurry – Seasonal Ecologist
Mohamed Jama – Graduate Air Quality Consultant
David James – Project Manager
Rhianna Jarvis – Events & Training Lead
Edward Jones – Customer Assistant
Christos Katsaros – Graduate Environmental Engineer
Damien Lee – Compliance Officer
Charlotte Main – Geo-Environmental Consultant
Chad Mcdowell – Graduate Environmental Consultant
Kieran McKendry – Graduate Geo-Environmental Consultant
Gillian Montgomery – Graduate Environmental Scientist
Ella Moss – Geo-Environmental Consultant
Benjamin Osborne – Graduate Geo-Environmental Engineer
Megan Pearce – Graduate Energy & Climate Change Consultant
Vincenzo Pellegrino – Engineer
Ruveetha Pereira – Environmental Consultant
Alice Pitts – Graduate Daylight/Sunlight Analyst
Laura Potter – Environmentalist
Pearl Poulton – Air Quality Consultant
Elva-Kate Preston – Assistant Arboricultural Consultant
Tom Richardson – Assistant Consultant
Charlotte Smith – Senior Air Quality Consultant
Alexandra Spence – Graduate Air Quality Consultant
Eleanor Thomas – Graduate Air Quality Consultant
Ryan Thorpe – Environmental Technician
Callum Throw – Associate Arboricultural Consultant
William Totty – Environmental Consultant
Tabatha Trigg – EIA Co-ordinator
Rhys Weir – Environmental Scientist
Rachel Yeldham – Graduate Consultant

Affiliate

is for individuals with an interest in environmental issues but who don't work in the field, or for students on non-accredited programmes.

Nasifat Abdullateef – Crew Member
Lauren Armstrong – Student (PT) / KM Advisor
Callum Askew – Assistant Ranger
Mehrdad Borna – Doctoral Researcher
David Desaur – Student
Pamela Dugdale – Physics & Maths Tutor
Terry Everest – Logistics Worker
Louise Grimes – Geotechnical Engineer
Nikoletta Grydaki – Honorary Associate Fellow
Joshua Hadfield – Student
Michael Hedges – Student
Mark Hinsley – Associate Director
William Hole – Gardener/Groundskeeper
Nigel Hughes – Management Consultant
Geoffrey Lovett – MSc Student
Haris Paruvingal – HSE Superintendent
James Ross – Horticulturist
Jack Shore – UK Scandiniava District Manager
Akansha Singh – Postdoctoral Research Associate
Tobias Smith – Technician
Salina Solomon – Student

Not a member?

Whatever stage of your career you are at, the IES has membership services that will help you gain recognition and progress to the next level. Members come from all areas of the environmental sector, wherever their work is underpinned by science.

Time for a re-grade?

If your career has progressed recently it could be time for a re-grade to reflect your success.

Re-grading can take place at any time of the year. Re-grading from Associate to Full Member means that you can apply for Chartership. There's never been a better time to take the next step in your career.

Eligible for chartership?

If you have been building your career for four years or more, now could be the right time to become Chartered.

Chartered status is a benchmark of professionalism and achieving this will see you join the ranks of the best environmental scientists in the sector. The IES awards two Charterships: Chartered Scientist and Chartered Environmentalist. We also offer the REnvTech register.

Contact Us

To find out more about membership or chartership, get in touch.

info@the-ies.org
+44 (0)20 3862 7484
www.the-ies.org
@IES_UK

OPINION

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Tell it and think it and speak it and breathe it

Mark Edwards recounts the inspiration for his photographs and exhibitions.

Fifty years ago, I got lost in the Sahara Desert. I was rescued by a Tuareg who traded in (among other things) cassette tapes. That evening, by the fire, he put on a tape and Bob Dylan sang *A Hard Rain's-A Gonna Fall*.[1]

DIFFERENT REASONS FOR ENGAGING

It was 20th July 1969. Astronauts Neil Armstrong and Buzz Aldrin were taking photographs of the Earth as it appeared over the edge of the Moon. No evidence of human life could be seen at that scale. Bob Dylan's song provided the close-up, the dark side of planet Earth: 'sad forests', 'dead oceans', 'guns and sharp swords in the hands of young children'. Dylan's rain kills people, animals, plants and the very fabric of evolution. It's best summed up as a wilful, inane and immoral carelessness with regard to both people and the planet by our leaders – and ourselves. But the song doesn't end in wallowing despair; the singer is going to do the job of an artist in threatening times: 'I'll tell it and think it and speak it and breathe it.' It will be well-informed speaking: 'I'll know my song well before I start singin'.'

THE HARD RAIN PROJECT

I had the idea of illustrating each line of Dylan's poetic masterpiece. I was the first photographer of my generation to specialise in environmental issues. As I travelled around the world on assignments for magazines, non-governmental organisations (NGOs) and the United Nations (UN), *Hard Rain* came alive in the viewfinder of my camera. Eventually, Dylan's team saw the PDF I had circulated to friends and, instead of suing me for copyright infringement, invited me to 'do something with it'. Tim Smit of the Eden Project, the wonderful botanic garden in Cornwall, agreed to exhibit the words and images on a huge banner 60 m long by 1 m high.

Hard Rain launched in 2006 and from the moment it was up, it was surrounded by visitors. Requests from school and university students to show it on their campuses followed. City centres and botanic gardens around the world hosted it – it was shown in Trafalgar Square for the London Olympics, at the European Union Parliament and the UN headquarters in New York. The banners

were cheap to print so we could send the exhibition to small venues as well – village halls, community centres, even prisons. Within a few years, *Hard Rain* had been viewed in person by some 15 million people on all continents but Antarctica. It also produced a book and a film, all for a total expenditure of less than £100,000, making it not only the most viewed exhibition on sustainable development, but also the most cost effective.

WHOLE EARTH?

Moved by images of our civilisation in headlong collision with nature (and with human nature) in *Hard Rain,* thousands of visitors to the exhibition emailed me demanding solutions to align human systems and natural systems to create a whole Earth – whole in the senses both of unified and healed. They also wrote to politicians. *Hard Rain* had helped take sustainability out of its box. Now we needed a new exhibition to show joined-up solutions. Lloyd Timberlake, an expert on sustainable development, and I produced *Whole Earth?* in 2016. It presented solutions in the areas of the Sustainable Development Goals, such as climate, energy, fresh water, oceans and agriculture, but also in areas such as human rights and economic rule-making. It offered some new ways of thinking. And it got personal, asking visitors, 'What will you do now?' *Whole Earth?* was produced for universities and colleges and has been shown at over 100 campuses. We insist that each university in Europe and the USA send their banner on to a partner university in Asia, Africa or South America. It is an opportunity to engage with students and tutors in the Majority World.

WHY NOT JUST PUT EVERYTHING ONLINE?

So why an old-fashioned exhibition? Why use the oldest form of storytelling, a tradition that reaches back to the cave paintings at the start of our journey to the modern world? Because… because exhibitions have a presence. It's hard to measure this, but people walk the length of the banners in silence, drawn along by Bob Dylan's words in *Hard Rain* or Lloyd Timberlake's brilliant text in *Whole Earth?*. And there you are, up close and dangerous, with people at the sharp end of the environmental debate in *Hard Rain*. You can't turn away. When you reach the end of the banners you share your thoughts and feelings with strangers. These exhibitions have started a thousand face-to-face conversations.

I think it was the combination of art and science that drew people in to explore issues we would all rather turn away from. Of course, art and science are not on opposite sides of the river. Scientists and artists, if they are any good, are inspired by a sense of wonder, by the workings of nature. Creativity is at the heart of what they both do. It seems to me that that's what's needed now – a surge of creativity. Not just in the sciences, the arts and politics, but in every sphere of human life. A radical transformation along these lines must have taken place in the Renaissance, revolutionising science and ushering in a new view of humanity, culture and society. What's needed today is a new surge like the energy that must have been generated during the Renaissance but even deeper and more extensive. Creativity is essential if we are to come up with new ways of solving our social, political and environmental problems.

THE NEED FOR A CREATIVE WAVE

There was a creative wave in the 60s that caught many in my generation. It wasn't clear what started it; a lot of factors came in to play. At that time, there was a feeling that everyone should re-invent their world. It was OK to make mistakes but not to follow in other people's footsteps, especially those of our poor, bewildered parents. Of course, we tripped up all the time, but we were busy creating what we felt was an exciting, progressive culture, expressed through music, the arts, science and politics. It swept away the lingering constraints that held society to stale, post-war values and it began to break down some of the class barriers that were so prevalent in Britain.

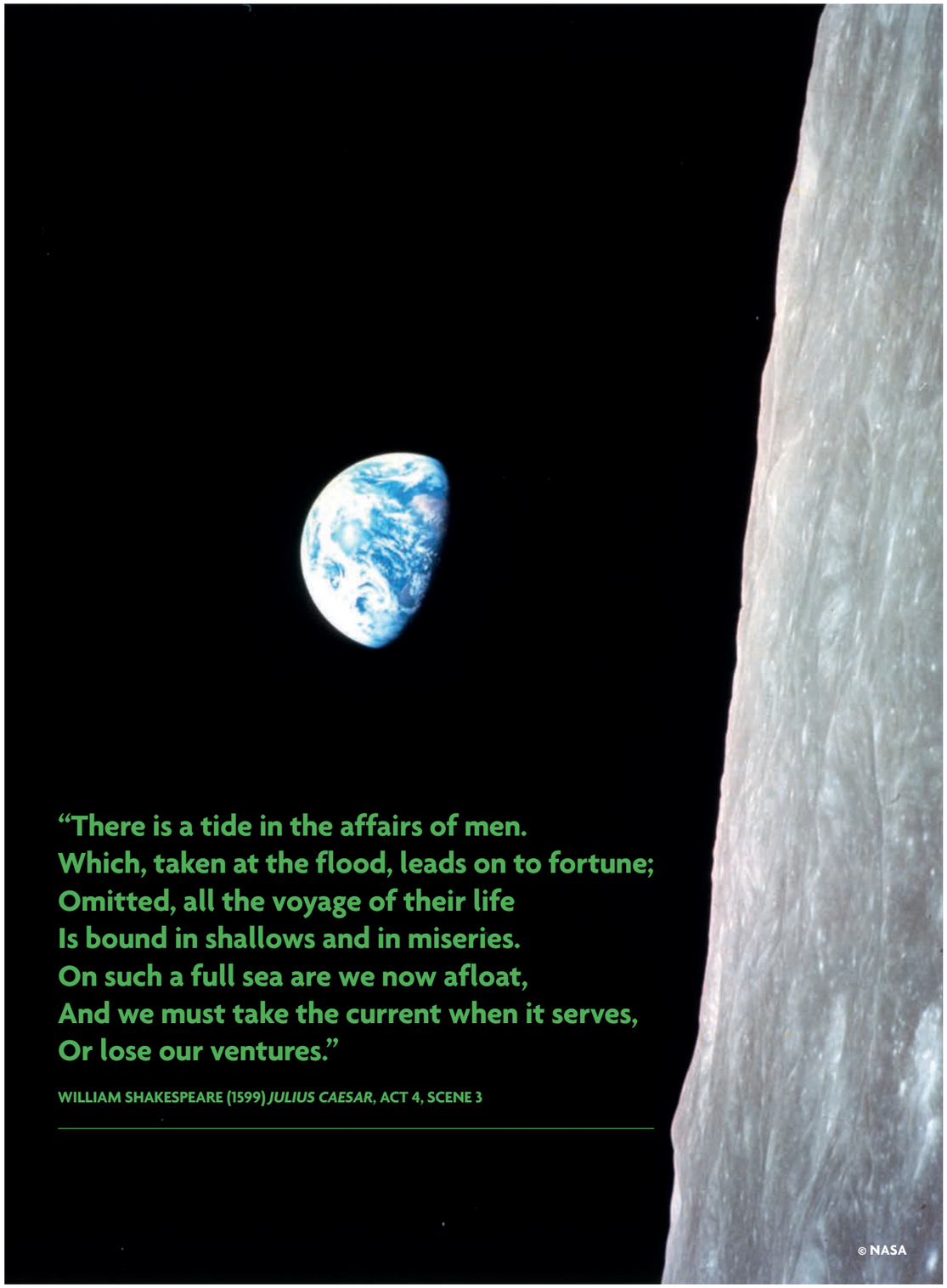
The publication of *Earthrise*, the photograph of Earth from space taken by astronaut William Anders, played a part in opening up a new way of looking at the world and our place in it. For a moment, we were humans first and foremost, living on a planet that looked alarmingly delicate. Can we see deeply that we are all more alike than unalike? Deeply in the sense that action follows from seeing this clearly. If we don't see this with great vitality, we have no future: we don't get peace, we don't meet basic human needs around the world, we don't deal with climate chaos. I'm not suggesting that a photograph changed humanity, but that view of our planet from space was an extraordinary moment that marked the beginning of the contemporary environmental movement. It opened a door to a new way of thinking that put us on the path to a more sustainable society, to an age that aligns human systems and natural systems.

WORKING TOGETHER WITH WONDER AND CREATIVITY

What can we do to accelerate this transition? First, we must make sustainable development interesting, and that requires imagination. We all have a responsibility to bring the challenges around sustainable development vividly to life. We need to bring brilliant artists and scientists together to infect us all with their sense of wonder and curiosity. Shakespeare, one of the most creative men to have lived, sums up our predicament beautifully in his play *Julius Caesar.*

FOR THE PRESENT AND THE FUTURE

If you ever need to be reminded that human planetary abuse is, in a very real sense, child neglect, go to the next



OPINION

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School Strike 4 Climate and read the placards and the faces of the young people holding them. School students and their teachers understand that they must take the current or lose their ventures. At the strike, I climbed on to a statue of Emmeline Pankhurst to photograph the square in front of Westminster packed tight with students. The police officer who was sent to get me down told me off, of course, then turned and said quietly, 'I hope those bloody politicians are watching this. This is the most important demonstration I've ever witnessed'. He had tears in his eyes – we both did. One moment I thought I was going be arrested for sitting on the shoulders of a giant; next, a police officer and I are in tears at the stupidity of our political leaders arguing about sovereignty while they sidestep the greatest threat facing humanity.

Is this the start of a majority movement? Perhaps. Climate change has given us an extraordinary opportunity to rethink what we really want for ourselves and for the world at large. Can humanity put aside the deep divisions it has maintained throughout its history and deflect some of the trillion of pounds spent each year on defence to reinvent the modern world so that it's compatible with nature? Of course, the forces ranged against such a change are formidable. Not least political parties locked into outdated ideologies. But that's how it is during a transition. History shows us over and over again that radical proposals accumulate to a critical mass that succeeds in sweeping away existing structures, assumptions and worn-out political dogma.

THE MAZE

Dylan ends his song with a question, 'what'll you do now?' What we will do now is produce a new exhibition set in a maze to promote the Sustainable Development Goals. Who doesn't love a maze? It's the perfect vehicle to house the humour, quirkiness and surprises that are needed to communicate the tough subject of sustainable development. The cul-de-sacs show how both business as usual and living as usual will escalate our problems.

But we all need to find our voice. If you are part of the silent majority, now is the time to 'tell it and think it and speak it and breathe it'. ES

Mark Edwards as one of the first photographers to specialise in environmental issues. His work is widely published around the world.

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1. Copyright © 1963 by Warner Bros. Inc.; renewed 1991 by Special Rider Music.

ANALYSIS

Extinction engagement – let's turn communication about environmental issues on its head

Tom Wakeford discusses how engagement from the ground up provides a platform that values local cultural knowledge once cast aside by traditional scientism approaches.

Public engagement about environmental issues has just been turned on its head. Environmental activists such as Extinction Rebellion (XR) have recently used radical forms of engagement that, along with the global School Climate Strike initiated by Greta Thunberg, have brought the crisis of climate change into society's consciousness as never before. Gone are groups of scientists going to give talks in schools and at local environmental groups. The monologue of conventional engagement has become a genuine dialogue, which we might call 'extinction engagement'. It's now the grassroots that are taking a lead.

However, overcoming the barriers to the radical policy shifts needed to achieve climate justice requires a more sophisticated approach to engagement. It was with this in mind that XR made its third demand, to have a citizens' assembly on how we can tackle climate change. Environmental scientists could play an important role in supporting such an assembly. However, in order to do this, they must shift from the traditional view of their role in one-way dissemination to an ignorant public. Instead they need to acknowledge that, despite their professional training in particular areas – indeed in some ways because of it – they have their own areas of ignorance. In tackling the big environmental issues facing humanity, everyone in society should be allowed to bring expertise from their life experience.

BLANK AND BLIND SPOTS

Professional researchers, including environmental scientists, are part of a hierarchy of knowledge that arose in parallel with the rise of the modern research university. The institutionalisation of knowledge took place as an integral part of the colonisation of peoples around the world by European powers alongside the industrial revolution. Two centuries of colonial dominance imposed a new world order in relation to knowledge. It systematically denied contributions from those who were not members of the European professional elites. Over the centuries, the hegemony of a single, narrow approach to the production of what constitutes valid knowledge has benefited some but marginalised and excluded many, many more. The process has also been to the detriment of humanity's overall knowledge base, particularly as it has wiped out much valuable indigenous knowledge about the environment.

Educationalist Jon Wagner highlights two different kinds of ignorance: blank spots in existing knowledge – matters scholars know they don't understand – and blind spots, that keep scholars from seeing patterns in the world that they have not yet noticed.[1] While natural scientists are often able to identify blank spots, history is replete with examples where those without formal research training have revealed patterns that the scientists had not noticed. Scientists' existing theories, methods and perspectives have created blind spots that have prevented them from seeing these patterns.

Time and again, knowledge systems existing among non-professionals that could have shown up blind spots were marginalised. People and their systems of knowledge have been oppressed at the hands of European colonists and their descendants in a process that has been called 'epistemicide'. In response, Indian anthropologist Shiv Visvanathan has called for 'cognitive justice', a process whereby societies attempt to recover the systems of knowledge that have been lost or degraded by scientism and its violent cousin, colonialism.[2] Visvanathan is thus

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calling for colonised peoples to have the right to use any alternative ways of knowing about themselves and the environment that have managed to survive the assaults of colonisation.

Philosopher Miranda Fricker has characterised the practice of ignoring the expertise that people have gained from life experience as 'epistemic injustice', while arguing for people's rights to learn and to have their existing knowledge recognised. She also makes a useful distinction between heuristic injustice (the denial of opportunities to develop greater knowledge) and testimonial injustice (where expertise derived through life experience, rather than professional training) is side-lined.[3] With particular reference to his own discipline of psychology, Thomas Teo has described how epistemic injustice often translates into the pathologising of marginalised communities. Academics circulate 'findings' that 'ignore structural conditions, history, and power; and misrepresent (...) outcomes of structural injustice as causes of oppression'. Even projects by socially progressive top-down researchers can reproduce a 'punishing gaze on those who have paid the most severe price for historic and contemporary oppression. These data circulate in ways that falsely confirm deficits and amplify fears that stick to marginalised bodies, justifying the containment and denial of human rights'. Teo has named this all-too-common process 'epistemological violence'.[4]

FORMALISING PARTICIPATION

Participatory action research (PAR) is a set of approaches that has emerged from people who are in, or who are working in close collaboration with, communities experiencing oppression. In PAR, as with indigenist approaches, people who had previously been marginalised are able to designate the focus of the participatory and dialogue processes themselves. Its premise, to be agreed by everyone involved, is that no one group knows everything. PAR has the potential to act as a counterweight to the current spread of fake news and the promotion of populist alternative facts, such as those relating to climate change. Far from saying 'anything goes', PAR calls for research to become more rigorous by eliminating potential blind spots in the perspectives of both professionals and everyday experts.

PAR has thus emerged from many traditions in several different languages over many years. Although it has been academics who have published the most widely cited PAR guidelines and principles, most of those who undertake PAR at the grassroots prefer to base their practice on rules of thumb developed by other members of social movements through lived experience. It is often transmitted peer to peer and through other forms of informal and solidarity-based learning, rather than through written texts. Even if they accept that they need not be seen as universally applicable, some activists have resisted establishing a fixed set of key principles

for PAR. In this spirit, the following six features of PAR are to help orientate the reader and are key for many, but not all, of those who attempt it:

1. PAR attempts to contribute to an improvement of the human condition through repeated cycles of collective action and reflection, with the members of the collective all working on an equal footing.

2. PAR raises two related questions: 'Who has relevant knowledge?' and 'Who should have the power?'

3. PAR answers these questions by challenging assumptions of academic autonomy (i.e. that professional researchers know best and therefore should be in charge).

4. PAR demands that research institutions should decide the agenda of their research programmes in collaboration with others outside the institutions that have relevant knowledge and may be affected by its outcome.

5. PAR aims to support intercultural dialogue between those whose knowledge and interests have historically been marginalised and treated solely as objects of research, and those experts and institutions in dominant positions.

6. PAR encourages professional researchers to abandon the myth of neutrality and become more fully involved in struggles related to people who are experiencing oppression, thereby putting themselves economically, socially and potentially physically at risk.

"While natural scientists are often able to identify blank spots, history is replete with examples where those without formal research training have revealed patterns that the scientists had not noticed."

BOX 1: QUESTIONS ENVIRONMENTAL SCIENTISTS SHOULD BE ASKING IF THEY ARE INTERESTED IN TAKING A PAR APPROACH

Fifteen practical questions for institutionally-based researchers considering participatory and transdisciplinary approaches:

1. Where can I find a mentor in my use of participatory approaches who is trusted by those in the communities with whom I would like to work and, preferably, by sympathetic colleagues in the university?

2. Who is 'I' or 'we' that is undertaking the participatory research?

3. Have those who have traditionally been excluded from research been included at the earliest possible stage?

4. Can I persuade those with power over me to let me resist applying off-the-shelf research methods and instead use creative forms, such as visual arts, dance, performance, Theatre of the Oppressed, and folklorica?

5. What can I learn from the history of the past use of research in this area, and of participatory approaches in particular?

6. Are the sources for this history inclusive of all relevant voices or just elites?

7. If the latter, how can I help widen the range of voices that can be heard?

8. Could there be a retelling of the history, this time highlighting the stories of the people who were previously excluded?

9. How can I remain accountable to, and guided by ethical processes devised with diverse members of popular movements and other communities, whilst also fulfilling any obligations I may have to my institution?

10. Who will own the data produced by the research?

11. Who decides what the products of the research are?
    Is there a commitment to there being products:
    i) for and by movements?
    ii) for transforming how researchers think about expertise and knowledge?

12. Whose language is being relied upon?

13. Who gets the money and credit associated with the project?

14. Who may be vulnerable and how can they be protected?

15. How can the participatory approach influence structural change, such as through shifts in public policy, whilst still maintaining its humility as just one part of wider struggles?


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THE APPLICATIONS OF PAR

Given that our global ecological crisis ultimately has its origins in social problems, it should be no surprise that PAR is often at the forefront of attempts to address urgent environmental issues, such as land grabbing for industrial agriculture, desertification and sea-level rise.

The adoption in Western academia (such as those in Australia, Canada, the EU, the UK and the USA) of neoliberal policies and the government imposition of metrics that discriminate against participatory approaches risks worsening epistemic injustice and various forms of oppression. As we know from history, rampant inequalities and oppression create tension and conflict, the opposite of the conditions needed for equitable dialogue and mutual understanding.

Even after XR and Greta Thunberg turned engagement on its head, those of us working with the public will only make progress by building alliances that allow us to break out of the fugitive institutional spaces in which many of us still find ourselves. Extinction engagement would nurture cross-cultural conversations between those using PAR, the majority who use more conventional engagement approaches and those whose practice comes somewhere in between.

We should encourage our interlocutors who are inclined to be wary of PAR to revisit fundamental questions such as: 'Who is the expert?', 'How should research be conducted ethically?' and 'What should be done with the conclusions?' We should have the humility to welcome questions about participatory approaches. We should also acknowledge that, in such politically difficult times, research and engagement are often just one small element in larger projects for ecological justice and transformation. ES

Dr Tom Wakeford is a staff member of the Action Group on Erosion, Technology and Concentration (ETC Group), a small civil-society organisation dedicated to monitoring and democratising science and technology. He is also Honorary Associate Professor at the Wellcome Centre for Cultures and Environments of Health, University of Exeter, and a Fellow of the Linnean Society.

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FEATURE

Pie in the sky

Ian Hodson charts the way that his trade union has shifted its focus to include environmental engagement.

The Bakers, Food and Allied Workers' Union (BFAWU) was formed in Manchester in 1847 to improve wages and living standards for bakers. Then, around 2014, some of our members also started to become involved in environmental issues, prompted by fracking tests in places such as Barton Moss in Salford (Greater Manchester). Fracking relies heavily on a plentiful supply of fresh water, which is, of course, essential for food production. Fracking test sites seemed to be located near many food production sites. The concern raised by our membership was that if these fracking sites caused a destabilisation of the water table, it would have a direct impact on food manufacturers and therefore jobs.

When the testing started at Barton Moss, our members rallied to support the protestors who had set up camp to frustrate and stop these damaging tests. They organised fundraising events and donated bread and cakes made at our different members' sites, along with tea-making equipment, to keep morale up. Many of our members also spoke at public events to draw the local communities' attention to the risks posed by these test sites.

MOTIONS ON THE ENVIRONMENT

As a national trade union it's now commonplace to see several motions relating to environmental issues at our annual conference. In turn, we ourselves laid down a

motion, which was considered groundbreaking, to the 2017 Trades Union Congress (TUC) conference, (**Box 1**).

ACTION ON CO_2

Following on from the TUC motion, and as a union that represents members from an industry responsible for emitting some of the largest amounts of CO_2, we felt it was our duty to inform and inspire our members to take a more active role in combating the detrimental effects of climate change.

One of our full-time officers, Sarah Woolley, led on this for the union and created a regular news sheet that is distributed to our branches across the country. *Greener Future* provides information on different topics, with practical advice on what you can do at home, at work and further afield to make a difference. Although climate change issues cover a massive spectrum and can easily become overwhelming if you're not sure where to start, it's important to highlight that making a difference can be as big or as small as you can manage – everything helps! The news sheet includes examples of what's already happening in workplaces nationally and internationally, to give our members ideas of how to get involved and get something started in their own workplace.

We have also produced a survey for the workforce, a charter for food manufacturers to sign up to and an agreement for employers to sign. We have started to roll out training relating to the environment for our safety representatives, who are now becoming safety, health and environment (SHE) representatives. All of this is to enable us to engage employers and to push for environmental audits in our workplaces.

ONE MILLION CLIMATE JOBS

As a union we have worked on a number of campaigns with different organisations. We have contributed to and support the One Million Climate Jobs campaign. The campaign links the crisis we are facing due to climate change to the crisis of pay and employment for millions of working people, and offers an alternative. The problems include the prospect of rising food prices, job insecurity and reduced income levels. At the time of writing, it highlighted that nearly two million people are unemployed – a million of them young people. Currently, only 1 in 40 new employee jobs are on secure, full-time contracts. Low pay, unemployment and benefit cuts mean that a million families in Britain have to choose between heating their homes adequately in winter or having regular meals.

The One Million Climate Jobs report[1] was produced by the Campaign against Climate Change Trade Union Group and was backed by eight national unions. It shows that, for a relatively small amount, we can tackle all these problems. We can create a million secure government jobs in renewable energy – by insulating homes and public buildings to increase energy efficiency, by hugely expanding cheap public transport to get people and freight onto cleaner forms of transport, and by developing the green skills that we need through education and training. A million decently paid government jobs, leading to a spin-off of half a million additional jobs, could kick-start the economy and provide a viable alternative both to the current situation and to government inaction as the world slides towards climate catastrophe.

Linking the issues of the economy and the opportunities for more sustainable employment has also been part of our strategy to engage with others to promote the real opportunities that would come about if the government started to invest in green jobs. For example, we launched a campaign in Blackpool to highlight how its economy could be changed from the current low-skilled, insecure, seasonal employment to a planned economy using wind and water to that would breathe new life into the town. We also highlighted that household bills could be reduced through insulating homes, and this would raise standards and long-term job opportunities for the local population at the same time.

The BFAWU started its life as an organisation to defend workers' rights and improve the terrible conditions experienced by bakers. But our history shows that we have always recognised the bigger picture and the issues facing our members and their families. Climate is a real issue, and the failure by governments to deal with the reality of climate change has caused the BFAWU membership to prioritise the issue: they feel strongly that we need a worker-led transformation to a clean, regenerative society that protects the natural world and expands the rights of workers. At our conference in June 2019, the delegates unanimously backed the call to join Earth Strike – the general strike to save the planet – on 27th September 2019. As the saying goes, there are no jobs on a dead planet. ES

Ian Hodson was an employee at Horizon Biscuits when he was seconded to the TUC to a Bargaining for Skills role. He has campaigned to raise the minimum wage to £10 per hour and end exploitative employment practices, such as zero-hour contracts and the youth minimum wage. Ian was one of the three originators of the Fast Food Rights campaign. He is currently President of the Bakers, Food and Allied Workers' Union, having been elected President three times since 2010.
@ianbfawu

BOX 1. 2017 TRADE UNION CONGRESS MOTION

"Congress notes the irrefutable evidence that dangerous climate change is driving unprecedented changes to our environment, such as the devastating flooding witnessed in the UK in 2004.

Congress further notes the risk to meeting the challenge of climate change with the announcement of Donald Trump to withdraw the US from the Paris Climate Agreement. Similarly, Brexit negotiations and incoherent UK government policy risk undermining measures to achieve the UK carbon reduction targets.

Congress welcomes the report by the Transnational Institute, Reclaiming Public Service: how cities and citizens are turning back privatization, which details the global trend to remunicipalise public services including energy and supports efforts by unions internationally to raise issues such as public ownership and democratic control as part of solutions to climate change.

Congress notes that transport is responsible for a quarter of the UK's greenhouse gas emissions and believes that a reduction in carbon dioxide levels must be the basis of the UK's future transport policy in addition to building public transport capacity and moving more freight from road to rail.

Congress believes that to combat climate change effectively and move towards a low-carbon economy we cannot leave this to the markets and therefore need a strong role for the public sector in driving the measures needed to undertake this transition. Congress notes that pension schemes invest billions of pounds into fossil fuel corporations.

To this end, Congress calls on the TUC to:

i. work with the Labour Party and others that advocate for an end to the UK's rigged energy system to bring it back into public ownership and democratic control

ii. advocate for a mass programme of retrofit and insulation of Britain's homes and public buildings

iii. lobby to demand rights for workplace environmental reps

iv. lobby for the establishment of a Just Transition strategy for those workers affected by the industrial changes necessary to develop a more environmentally sustainable future for all, and develop practical steps needed to achieve this as integral to industrial strategy

v. consult with all affiliates to seek input into the development of a cross-sector industrial strategy that works towards delivering internationally agreed carbon emission reduction targets

vi. investigate the long-term risks for pension funds investing in fossil fuels, promote divestment, and alternative reinvestment in the sustainable economy."

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ANALYSIS

Plastic as a fuel, not a foe

Blaise Kelly makes the case for energy from waste in the UK.

The surge of public concern with plastic has been named the *'Blue Planet effect'*, thanks to the role this influential television programme has played in highlighting the scourge of waste plastic on the environment.[1] Along with interest in air pollution and climate change, this clearly shows that the majority of the public do genuinely care about the environment and want to know how they can do their bit. However, as environmental practitioners delivering information to the general public, we must be aware of how quickly enthusiasm for taking action can be lost through confusion and weariness caused by mixed messages. This article provides data on the energy potential of plastic as a fuel to help to clear up some of the confusions and oversimplifications surrounding the use of plastic.

A look around any room at the materials used in products shows that plastics dominate. This is because of the vast range of properties that can be engineered into plastics and the low energy (and hence cost) needed to do so. In most cases, nothing comes close to plastic in terms of weight, toughness and durability. For example, it is estimated that to transport the same number of paper bags as plastic bags requires seven times the number of lorries.[2] For cotton, only 30,000 cotton bags fit on a lorry that could carry 2.5 million plastic bags.[3] A 500 ml glass bottle weighs 10 times as much as the plastic equivalent.

So the public is being encouraged to use plastic-free solutions – but is this going to turn into another mixed message?

▲ **Figure 1. The FSC MIX label. The label states that the product is made from responsibly sourced raw materials, but the huge issue of 'wood laundering' means that it could in fact contain illegally sourced timber. (©FSC)**

THE IMPACT OF PAPER

Virgin paper and cardboard are derivatives of timber. The Forest Stewardship Council (FSC) estimates that demand for timber will double by 2030 and possibly quadruple by 2050.[4] According to Interpol, as much as 30 per cent of all timber is thought to be from illegal logging, including in rainforests.[5] Many paper products now carry the FSC MIX label (see **Figure 1**), which means that the product is made from a mix of sustainably and non-sustainably sourced timber, i.e. potentially from a virgin rainforest.[6]

In deliberations for a proposed plastic bag charge, the Scottish Government issued a full environmental impact assessment report on the alternatives to plastic bags made of high-density polyethylene (HDPE). A specific comparison was made against paper (see **Table 1**). For every element except litter, the HDPE bag was less damaging. Paper decomposes fairly quickly in the environment, but releases methane, a greenhouse gas more than 20 times as warming as CO_2. Plastic decomposes very slowly and therefore creates a lot of litter, with the consequences that are becoming more and more clear to us.

The UK's Environment Agency, the Northern Ireland Assembly and the Danish Government also carried out their own impact assessments on carrier bags.

▼ **Table 1. Comparison of the environmental impacts of HDPE (plastic) bags and paper bags. A score of more than 1 indicates that the paper bag has a greater impact than the HDPE bag.**

Environmental impact indicator		High-density polyethylene (HDPE) bag	Paper bag
Resources	Primary energy consumption	1.0	1.1
	Water consumption	1.0	4.0
Emissions	Greenhouse gas emissions	1.0	3.3
	Acid rain	1.0	1.9
	Air quaility	1.0	1.3
Waste	Eutrophication of water bodies	1.0	14.0
	Soild waste production	1.0	2.7
	Risk of litter	1.0	0.2

They found that in all cases, plastic bags have lower embodied energy and environmental impacts than common alternatives.[7,8,9] Paper bags use more energy and emit more CO_2 in their manufacture than the plastic equivalent. In the UK, less than half the paper used is recovered and only a proportion of that is recycled. Paper can only be recycled about seven times, meaning most paper on sale in the UK will have virgin timber in it, possibly from an illegal and/or unsustainable source. Deforestation alone is estimated to contribute around 10 per cent of all global warming.[10]

THE IMPACT OF COTTON

Approximately 20,000 litres of water are needed to produce 1 kg of cotton.[11] In India, two-thirds of the cotton crop is irrigated with finite groundwater.[12] In Kazakhstan, increasing cotton production has diverted water from the Amu Darya, the main feeder river for the Aral Sea, with the result that it has been shrinking steadily since the 1960s and has now all but disappeared. Another garment manufacturing hub is Indonesia. Along the Citarum River, 400 factories all discard wastewater into the river that locals rely on for bathing and washing clothes. Tests have shown toxic levels of mercury, cadmium, lead and arsenic in the water.[13]

According to the World Wildlife Fund (WWF), bringing cotton production in line with *even minimally acceptable* environmental standards is a challenging task.[11] It is estimated that manufacturing a cotton 'bag for life' uses approximately 1,000 times more energy than a plastic bag.[14] Used once a week for the weekly shop, it would need to be your sole shopping bag for the next 19 years just to break even with plastic on an energy footing.

FAILURE TO DEAL WITH WASTE

Plastic littering our environment has caused the backlash against plastic. This is not a failure of plastic, but of our systems for dealing with waste, which place so little value on it or the damage it causes to our environment. Nothing, be it cardboard or cotton, glass or metal, sunflower oil or soap, should be allowed to escape into our environment uncontrolled, not only because the cost of the damage to the environment and the clean up are so huge, but also because it is a waste of finite resources.

Waste disposal in the UK has been swept under the carpet by consecutive governments for decades. Guy Singh-Watson, the founder of Riverford Organic Farmers, was asked at the end of a speech to the Department for Environment, Food & Rural Affairs (Defra) what single thing he would do to improve the environment. His answer was: a unified kerbside waste collection policy across the country. He received a standing ovation.[14] That was over 12 years ago, yet such a simple measure still eludes us. This is one of the mixed messages that the general public receives: exactly what can and cannot be recycled is not crystal clear – and it could be.

One of the difficulties in recycling plastic is knowing what type it is. Most people can identify the difference between paper or cardboard, but for plastics, labelling is required, which can be extremely confusing. Eminent materials scientist, engineer and co-founder of the Materials Library, Mark Miodownik MBE, thinks that one solution that would help both the public and the recycling industry would be to limit the range of plastic packaging that manufacturers can use to HDPE, PP and PET.[15] This would simplify separation and mean that recycling plants would know exactly what they were dealing with. A further simplification has been introduced by Japan: it has recently banned coloured PET bottles in a bid to boost PET recycling rates to 100 per cent.[16] This might be a problem for soft-drinks marketing departments, but it significantly improves the usability of the collected feedstock.

The production of plastic fuels the demand for oil,[17] so the goal should *always* be to reduce, reuse and recycle as much as possible. Like paper, plastic is composed of fibres, limiting the number of times it can be reprocessed. And waste plastic is also often badly contaminated with food or chemicals. Cleaning up this material to a standard suitable for recycling using current techniques is energy intensive. The same goes for all materials recycling, not just plastic. A recent news story reported on the struggles of recycling plants to deal with contaminated aluminium foil,[18] an increasingly popular, but energy intensive, alternative to clingfilm and other plastic wrapping. Currently, much of this foil is sent to landfill due to the complexities of cleaning.

ENERGY RECOVERY POTENTIAL

Plastic has a calorific value of around 11 kWh/kg.[11] As a comparison, petrol and diesel give up around 12 kWh/kg when burnt and coal 7.5 kWh/kg. Contaminated plastic and items made from unrecyclable combined plastics can, unlike metal and glass, be thrown into a furnace and the energy recovered to offset virgin fossil fuel use. Paper and cardboard also have a very reasonable energy content of approximately 3.75 kWh/kg and municipal waste (everything that goes into black bins) gives up 2.7 kWh/kg. It is no coincidence that countries with higher rates of waste incineration also have higher rates of recycling. The energy recovery potential of municipal waste that has been sorted into different materials is much higher than for non-sorted, so there is an obvious financial incentive.

In England, 10 per cent of municipal waste is incinerated, much of it without energy recovery. By comparison, the European average is 17.3 per cent, with Denmark topping the table at 56 per cent.[19] What if, instead of being shipped around the world or buried for another

ANALYSIS

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▼ **Table 2. Calorific value and heat and electricity generation potential of the municipal waste that was landfilled, as well as the plastic and paper that were exported in 2017.**

Waste	Calorific value (GWh)	Heat recovery (GWh)	Electricity (GWh)
Municipal	17,777	10,666	3,554
Plastic	8,360	5,000	1,672
Paper	15,000	9,000	3,000
Total	**41,137**	**24,666**	**8,226**

generation to deal with (see **Box 1**), the UK's waste were burnt in state-of-the-art waste-to-energy (W2E) incinerators, recovering around 80 per cent of the energy and using it for electricity generation and space heating for our buildings? This could supply nearly 18 per cent of the total electricity and 7 per cent of the space heating consumed domestically in 2017[20] (see **Table 2**). This is a significant proportion of total UK consumption and could help with energy security by reducing the 36 per cent of energy we import annually.[21]

BOX 1: EXPORTING, LANDFILLING AND DUMPING WASTE

In 2017, the UK generated 30.9 million tonnes of household waste, the third highest in the European Union. Around 8 million tonnes were sent to landfill[27] and 20.7 million tonnes were exported.[28] The majority of the exported waste ended up in countries outside the European Union, which do not have stringent emissions and waste disposal laws. Burning plastics, paper or municipal waste without the right facilities has severe consequences for public health: dioxins, acid gases, nitrogen oxides, heavy metals and particulates are released. Some reports have even claimed that shipments simply get dumped at sea.[29]

If plastic is burnt in the correct way, in state-of-the-art incineration facilities and with flue gas treatment, emissions can be almost entirely mitigated, and the fly ash remaining after combustion can be separated and used for other purposes. In many northern European countries, waste incineration plants are often highly integral city centre facilities, providing electricity and district heating, negating the need for residents to bother with the hassle and expense of gas boilers.[22] One huge advantage of district heating systems is that the heating technology can be changed much more easily than having to upgrade individual homes.

WASTED ENERGY

So why does the UK have such a different approach to waste compared to our neighbours? Largely it is down to our failure to develop district heating systems. Using waste heat is almost impossible without a means to distribute it. This can be attributed to a lack of government support. In order to make such schemes happen, developers of power stations and properties have to take on the risk of ensuring demand for the heat and persuade similarly unsupported consumers to enter into long contracts.[23]

Another major hurdle is public opinion. The British public's confidence in industry to design a plant that will not pollute seems to be low, yet it has been accomplished in other European countries for decades (see **Box 2**). The best incinerators have little-to-no impact on urban air pollution, yet every day millions of us barely bat an eyelid at burning virgin petrol and diesel highly inefficiently in our vehicles (with 80 per cent of the energy wasted

BOX 2: SPITTELAU –WASTE INCINERATION IN THE HEART OF THE WORLD MOST LIVEABLE CITY

Vienna's main waste incineration plant, Spittelau, is situated in the 9th district of the city and towers over the most desirable of the city's suburbs, the 18th and 19th districts. It was built in the 1970s, and despite being badly damaged in a fire in 1988, it was rebuilt, mainly because the district heating system was already in place and the plant was situated where most of the city's waste was generated, reducing transport. On refurbishment, the plant was tasked with setting new standards for its emissions. The Viennese were so proud of their waste-to-energy plant that they commissioned the environmentalist, nature lover and artist Friedensreich Hundertwasser to decorate the facade.[30] The golden sphere on the flue is where the emissions monitoring equipment is located and signifies the commitment by the plant to local air quality.[31]

Last year Spittelau burnt around 250,000 tonnes of household waste, generating 120 GWh of electricity and 500 GWh of district heating (it is connected to Vienna's 1,169 kilometre district-heating network, supplying homes with heat on tap). In addition, 6,000 tonnes of scrap iron along with 60,000 tonnes of clinker, ash and filter cake were recovered.

Recently a district cooling network was installed, enabling the plant to operate to full capacity all year round by switching to cooling in warm weather.[32]

as noise and heat), at the same time contributing to well-publicised exceedances of air quality limits.[24] If the external costs (air pollution, noise, accidents, congestion, road damage) of moving individuals around in the huge vehicles we use were incorporated into the price of petrol and compared to the costs of landfilling or exporting waste, the tables would be turned and correct policy decisions would more likely to be made.

If we want to reduce oil consumption, CO_2 emissions and air pollution, we should look at our petrol, diesel and kerosene consumption, which in 2015 used 57 per cent of global crude oil production,[25] compared to only around 4 per cent used to make the entire world's plastic products.[26] Using crude oil to make plastic, and then burning that plastic to make electricity that is then used in a 90 per cent efficient electric vehicle, would stack up quite well in terms of energy consumption and emissions, compared to the current petrol- and diesel-powered vehicles. This is the case even without considering the energy savings that plastics contribute during their pre-combustion life (through avoiding the use of paper, cotton, glass etc.).

ENGAGEMENT STRATEGIES

Despite increasing warnings about environmental catastrophes facing us, notably climate change, the environment barely gets a mention come election time. This is not necessarily the fault of our politicians, who at the end of the day are all vying for our votes and popularity. It is a failure of the environmental sector and the media to accurately communicate joined-up thinking in a way that is relevant to the public.

The Blue Planet was a rare example of a prime-time television programme delivering an effective environmental message, yet despite the bulk of the series highlighting the effect climate change is wreaking on the oceans, the take-home message from the public was that plastic is to be eliminated, which ironically might seriously hinder efforts to tackle climate change. The move by increasing numbers of retailers towards paper instead of plastic bags is because of consumer demand. Early indications are that the public's response is glowing. Riverford, for example, have repeatedly expressed a desire to change their cardboard delivery boxes over to more durable and recyclable plastic alternatives, but are certain it will cost them customers.

The plastic bag charge has shown that even tiny financial incentives can go a long way. The Organisation for Economic Co-operation and Development (OECD) 2014 report on the economic costs of air pollution led with the quote 'money is not the thing being measured but the instrument with which we measure it'.[33] Including environmental costs in economic calculations and explaining the financial benefits to the public might help to get the message across that sound environmental policies can be fundamental to economic competitiveness.

In terms of waste disposal and plastic, this would involve a well-developed recycling and energy recovery industry, creating thousands of jobs, enabling us to recover the assets in our 'home-grown' waste. It would implement the infrastructure to sustainably heat our homes and prevent the escape of plastic into the environment, while helping to mitigate the environmental calamity that is climate change. Ultimately and perhaps most importantly in many people's eyes, it could save us a fortune. ES

Blaise Kelly MIEnvSc MIAQM ProfGradIOM3 is a Senior Air Quality Consultant at Hydrock Building Performance Engineering. He lived in Vienna for nearly five years whilst working on a number of European energy efficiency projects, in particular looking at external costs. He has an MSc in Renewable Energy and the Built Environment and a BEng in Materials Science and Engineering.

✉ **blaisekelly@hydrock.com**

@BlaiseKe11y

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OPINION

Engaging research: NERC and funding

Paddy Fowler speaks to **Hilary Geoghegan, Carl Stevenson** and **Hannah King** about NERC-funded public engagement and the role engagement plays in environmental science research.

Would you be able to give some details about the NERC public engagement funding project?

Hannah King (HK): We worked with Hilary and Carl on Engaging Environments[1], which is NERC's biggest single investment in public engagement to date, at £1.3 million, highlighting how serious NERC is about the importance of high-quality public engagement. The project uses creative approaches, including community development, storytelling and citizen science, to involve people in the critical environmental science issues of our time, such as climate change, air pollution and energy. There is a focus on engaging those typically less represented in public engagement activities, for a specific purpose which is defined by members of the public. Partnership working is at the core of this project, building on the diverse and extensive network that formed in the early stage of the project. Collaborators have put their money where their mouth is, with project partners pledging a further £235,000 of in-kind contributions.

Would you be able to give a brief overview of Engaging Communities with their environment/Opening up science for all?

Carl Stevenson (CS): Engaging Communities with their environment (ENCOMPASS)[2] was a capacity-building project that employed community organising as a way to develop relationships and engagement opportunities with environmental science. The principles of community organising are rooted in what motivates people, their hopes and fears, but mostly what they want to change. Organising involves an approach that listens to people, builds relational power and helps people to act to effect change. We worked with Citizens

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UK[3] in Birmingham to learn about organising practice and build relationships with community groups to explore how environmental science research is relevant to them and how they can benefit from it.

Hilary Geoghegan (HG): Opening up science for all (OPENER)[4,5] and ENCOMPASS were year-long NERC-funded projects to build capacity and consortia as part of the NERC Engaging Environments programme. I led the OPENER initiative with colleagues from Earthwatch, Imperial College London, Newcastle University, University College London and the University of Salford[6] to scope out a national community of practice for public engagement with environmental research. We took a community-of-practice approach, which brings together people of like mind to work together and advance their interest. For us a key element was citizen science, namely the contribution of volunteers to professional science projects, so we developed training for researchers, a website on links between public engagement and citizen science, and four local communities of practice in London, Newcastle, Reading and Salford. Through OPENER we found there was an amazing appetite to work across sectors and disciplines to avoid reinventing the wheel and learn from each other. Last year, our two projects joined forces to develop a bid for the NERC's £1.3 million three-year national programme of public engagement with environmental science.

BOX 1. PUBLIC ENGAGEMENT WITH RESEARCH

As environmental science will continue to be at the heart of some of society's biggest challenges, NERC has an opportunity and a responsibility to engage members of the public in current environmental science research. There is demand: in the public attitudes survey[7] commissioned by NERC in 2017, over three-quarters of the public feel they ought to hear about potential new areas of science and technology before they happen, not afterwards and 74 per cent felt that scientists should listen more to what ordinary people think.

Through our current public engagement with research strategy, we aim to:

- **Convene informed public debate** about contemporary issues in environmental science, such as climate change, air pollution or the future of energy.
- **Inform, interest and inspire** members of the public and future researchers in environmental science and the processes of research in a way that is accessible and relevant.
- **Carry out public dialogue** on complex and controversial issues. Actively listening to members of the public allows NERC to make decisions that are relevant to society.

NERC, part of UK Research and Innovation (UKRI),[8] invests public money in world-leading science designed to help us sustain and benefit from our natural resources, predict and respond to natural hazards, and understand environmental change.

▶ **The RRS *James Clark Ross* on a research trip in the Antarctic. (© NERC Science | Flickr)**

Why is it important that public engagement receives independent funding, rather than using a portion of research funding?

HG: A big issue for many researchers undertaking public engagement is a lack of institutional recognition or value placed on public engagement work by some colleagues and peers. In universities, some of the ways to show that work is recognised is through securing funding, in promotion criteria, and research funders, such as NERC, saying this is important.

Public engagement should receive independent funding so that the work can be recognised, but for many researchers, seeing this work as held apart from research funding is part of the problem. Academia is hierarchical and if we are to really transform how research impacts upon the real world, I don't think these two elements can be held apart. That isn't to say that there aren't benefits – having a separate pot is encouraging and it will hopefully open up the range of people talking about environmental science and reiterate the value of communicating and involving the public in research.

CS: I think that both are important. We should be including adequate resource provision in research grants to support public engagement, but there also needs to be groundwork and general engagement activity that is more about advancing practice and developing relationships and trust with public stakeholders. Project-specific engagement can then be more focused on impact related to the research. While this is valuable, what we also need to be doing is developing a much more meaningful relationship with non-academic stakeholders, which often requires groundwork that cuts across individual projects to help to build that general trust in research and science. These are not exclusive remits and general engagement can refer to specific topics or even related projects, and project-specific engagement can also include relationship building and practice development. Both, I think, should include training of researchers.

What I haven't really said is what the balance should be; this would be different across research councils and you can imagine how this would be a different question for engineering, for instance, or medical sciences, where the impact and the relevance of the research is direct and specific, and people understand and accept it without much convincing. It can be difficult to explain to people why environmental science research is relevant to them, whereas if there's groundwork going on already, then there is a network of institutions and non-academic stakeholders that already have an interest in what is going on. The cultural impact can then be more readily realised.

HK: Firstly, if we are looking to support and encourage engaged research, where researchers consider why, how and who to engage throughout their research, making the interface between research and public open, then we need to make sure that there is funding for this; the main support for that in the UK is called Pathways to Impact.[9]

Secondly, NERC has strategic funding for public engagement, which sits alongside Pathways to Impact funding and pays for specific ways to improve public engagement with environmental science research. Engaging Environments is an example of this.

Thirdly, public engagement covers a wide range of activities, from the level of an individual research project up to a very broad topic level, such as climate change, air pollution or biodiversity. NERC's public engagement programme also covers funding for engagement with these broader topics, for example through the project Operation Earth.[10]

What would be the ideal outcomes of this project: to inform, raise support or receive input from the public?

CS: That research is regarded as relevant and important by the public; that researchers are able to develop an understanding of how research is important from the public point of view that isn't based on assumptions; that the public (diverse communities) have a genuine stake in

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the research agenda. You have also got to think about the general groundwork versus the project-specific stuff, so there may be different contexts where the head and the heart are engaged in different ways and at different levels.

HG: An ideal outcome from this project would be for people to make a link between their everyday lives and the environment. For people to be able to make those kinds of connections through working together and sharing their different ways of knowing the world would be a tremendous outcome for how we will need to live in the future. In a way our project is very risky, as we can't say what the outcome is going to be. I suppose we like to think that if you put enough of the structures in place to connect people, then both the researchers and the public will find ways to help one another.

HK: One thing that is really exciting about this project is that it is very much lead by the research community, including people like Hilary and Carl, so a large component is about highlighting brilliant researchers showing how great public engagement can change the way research is done.

Also, this project is innovative in the way that it is informed by community views – so in some ways, we don't yet know what the outcome will be. This can be difficult but worth the risk, as the impact of truly engaged research is invaluable.

How will NERC respond to the outcomes of engagement and what impact will they have on research?

HK: Our impact team are always looking for examples of where NERC research has had an effect on the economy or society, and engagement work is often a significant part of this. For example, Professors Tamara Galloway, Richard Thompson OBE, Dr Penelope Lindeque and colleagues were the first to predict that microplastics could be widespread in the marine food chain and they provided the proof.[11] They gave evidence to the Environmental Audit Committee in 2016[12] and were part of the team that won the 2018 NERC Impact Awards.[13] Engagement was a key part of the success of this project. This included a citizen science project where students designed, took part in and published the research study concerning whether changes in their lifestyle and diet could have an impact on the level of Bisphenol A (a chemical compound used to make plastics) in their bodies. This work involving members of the public in the research contributed to the wider evidence base around microplastics and improved the research itself.

What do you see as the major challenges when communicating environmental issues to a lay audience?

CS: Often the biggest challenge is that communicating issues is sometimes the limit of understanding in terms of how to engage people with research. The practice of organising people and researchers helped me to realise this. Although the definition of public engagement emphasises that it is two way and that it is not just dissemination of information, it needs to go further to include the building of relationships. If we regard the public as passive consumers of research products (even if we learn from how they consume this) then we critically undervalue the relevance of higher education and research to society. The agency that universities possess to influence policy and enhance business is currently valued as an impact metric that is used in the higher education business model (e.g. Pathways to Impact). However, the social capital that this agency could generate is not well known or used widely in science impact and engagement.

With regards to communication – this isn't so much a direct focus of ENCOMPASS. How it is of relevance to building relationships is that a lot of research is quite abstract. By understanding personal stories (both of the researcher and the community member), the research findings or remit can be connected to the reality, e.g. immigrants from a country at risk of sea-level rise now living in Birmingham, or a small business adversely affected by charges introduced in a clean-air zone.

HG: One of the challenges when communicating environmental issues to a lay audience can be the researcher doing the communicating. One-way dissemination is still prevalent and often means that engagement initiatives miss the mark. The projects funded at Stage 1 of the Engaging Environments programme – the Future of Our Seas,[14] OPENER, Climate Stories,[15] ENCOMPASS, and the Climate Communication Project[16] – have all worked with researchers to build their skills and capacities for public engagement and communication of environmental issues. Led by the public engagement team at NERC and the activities of the Engaging Environments Hub led by the National Co-ordinating Council for Public Engagement (NCCPE),[17] we have been able to share learning across the funded projects to improve. A key motivation for the NERC Community for Engaging Environments is to really deliver two-way engagement and dialogue between researchers and diverse communities.

As a publicly funded body, what ethical frameworks are in place to ensure that within public engagement activities there is a balance between achieving desirable outcomes for the public and potential propaganda for the government to push for outcomes it sees as beneficial but the public does not want?

HK: As part of UKRI, NERC is an independent arms-length body and responsible for delivering our own delivery plan. We follow the Haldane Principle,[18] and our funding decisions are peer reviewed by those who have the necessary expertise and experience. In terms of open access to research, NERC and UKRI have

clear policies on access to research outputs,[19] and are committed to ensuring that the ideas and knowledge derived from its research, survey and monitoring activities are made available as widely, rapidly and effectively as practicable.

We have a responsibility to work in partnership with business, government departments, civil society, the public and the research community and listen to their views on environmental research. For the public, this includes public dialogue: listening to public views and using them to shape our work as a commissioner of environmental science research.

How do you reach uninterested audiences or those that don't typically interact with standard engagement activities?

HG: Our project is about listening, sharing stories and participating in citizen science. It's as much about uninterested researchers or those who don't typically interact with standard engagement activities as it is about diverse communities for whom what's going on in environmental science is not at the top of their priority list. Our new project offers a range of entry points for researchers and members of the UK public and it's built on a set of very strong partnerships between universities, research institutions, and cultural and environmental partners such as museums, NGOs and community groups.

We are currently looking at this from the perspective of how our researchers are already doing this – usually with people who are already engaged. I think Carl's part of the project addresses the question best, it's not about us in NERC trying to find that way in; the ways to engage the public already exist and we need to understand communities in their own terms, their values. This is where the listening and storytelling, the humanising of the expert, come in. You aren't born a scientist in a lab coat, so scientists should be able to share how they have become scientists.

CS: Networks and organising practice, these are the things that link people. This could be faith, where they live, their children; and there are always issues that affect these things like health care, safety, pollution, that are not necessarily environmental science but it's really not hard to see where these things are related to the environment. Even the more esoteric research topics can still use the agency of the research institution to help with relevance by, for example, being strategic in how there is cultural impact or social capital in hiring A-level or college students as temporary lab assistants (much more exciting and with wider reach than a standard one-off lecture to a school class).

We talk a lot about community listening and it is a practice used a lot by community organisers. It's is essentially a qualitative needs analysis. It is part of the training of being an organiser; you are taught how to conduct a one-to-one, and part of being able to listen to somebody, to understand what their hopes, fears and aspirations are, is about reflecting on your own. It is important to focus on your story – it's quite a big thing to do, reflecting on why you are there, why you are having the conversation and what brought you to this point. It can be a lot of small things, but it can also be the big life-changing moments too. Understanding that background gives you an understanding of the context of someone else's story and their motivations and fears. We are encouraging researchers to become community leaders but also to adapt and use the organising methodology and approach to engage people with science and gain the recognition from institutions and the public that is needed for research to be effective. What we want is to find out what is relevant to people and work out how we can adapt to their community needs and wants.

What role do institutions such as the Institution of Environmental Sciences have to play in improving public engagement in the environmental sector?

HG: The Institution of Environmental Sciences, and other subject-specific institutions and learned societies, have a key role to play as bridges between sectors and disciplines. Acting as brokers and gatekeepers between communities, usually with very large networks and plenty of training opportunities at all career stages. To be the Institution of Environmental Sciences at a time like this is incredibly powerful and there's an opportunity to lead the way in talking across science, policy, practice and publics.

HK: The IES has a rapidly growing membership, and so it is important to share with those members the importance of engaged research and support them to overcome barriers to research. I think we are all clear about what those barriers are and, a bit like climate change, overcoming them involves effort from all sectors. Highlighting the great examples out there is one good way to start. ES

Hilary Geoghegan is Professor of Geography at the University of Reading, and specialises in collaborative, interdisciplinary research between the social and natural sciences. She led the social science work package in the Tree Health and Plant Biosecurity Initiative's Protecting Oak Ecosystems project, is PI of the NERC Community for Engaging Environments (2019–2022), and represents social science on the UK Environmental Observation Framework.

Carl Stevenson is a Senior Lecturer in Geology at the University of Birmingham. His research is the flow and emplacement of geological materials from magma to ice to sediment. Carl was PI of the stage I ENCOMPASS project and is Co-Director of the NERC Community for Engaging Environments alongside Hilary. He is public engagement lead for the College of Life and Environmental Sciences, University of Birmingham and Academic Keeper of the Lapworth Museum of Geology.

Hannah King is Public Engagement Programme Manager at Natural Environment Research Council (NERC), and embeds public engagement within NERC as a responsible organisation, and within the research community NERC supports. Hannah works on diverse projects, from creating strategy, to supporting researchers through Engaging Environments, to national-scale projects such as Operation Earth.

To read more of this interview, visit the IES website.

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Editor Paddy Fowler

Guest editor Joan Walley

Subeditor Caroline Beattie
carolinebeattie.editorial@outlook.com

Designer Kate Saker
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Web www.the-ies.org
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