



Chief Scientist's Annual Review 2025

Chief Scientist's Group report

March 2026



We are the Environment Agency: guardians of homes and habitats.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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Foreword



Dr Robert Bradburne FRSB

Chief Scientist and Director of the Chief Scientist's Group, Environment Agency

The Environment Agency exists to support a healthy environment that protects our homes, our health and the places we depend on. This review shows how we're using science to strengthen that mission. It also explains how our work supports the country's ambition for sustainable growth that respects the nature that underpins it.

This year we mark 30 years as the Environment Agency. Three decades of learning have taught us that progress is possible when we act with purpose and stay rooted in evidence. As we look to the next 30 years, we know the pressures on people and nature will grow. Climate change, population growth and ageing infrastructure demand our focus and honest reflection. By understanding what has worked well and where we must do better, we can face these challenges with confidence.

The results of long-term investment are clear. In the 1990s, fewer than half of England's coastal bathing waters would have met today's minimum standards. Today, 96% do. Pollution from heavy metals, phosphates and ammonia in major rivers is several times lower than it was 3 decades ago. These improvements show what determined regulation, better infrastructure and strong partnerships can achieve.

New investment gives us the chance to go further. Water companies plan to invest £104 billion to improve water quality and reduce environmental pressures. Government has also committed £500 million to support nature recovery at a landscape scale across England. These steps matter because a cleaner environment underpins a stronger economy. When we reduce pollution, manage waste well, improve air quality and cut flood risk, we create the conditions for healthier communities and long-term growth. Green and blue spaces also support local economies by attracting visitors and giving people places to exercise and connect with nature.

Our science sits at the heart of this work. We use the latest data and technology to track early signs of change and guide our decisions on planning, investment and regulation. Our scientists work with universities, industry and local partners to build a shared evidence base that is trusted and practical. This collaboration helps us act decisively, target resources where they are needed most, and prepare for what's coming next.

This review shares just some of our scientific achievements from the past year. It also sets out how we will deepen our partnerships and strengthen the evidence that guides our work. By doing so, we will continue to protect people and nature today, and help build a future that is worth handing down to future generations.

Introduction

As guardians of homes and habitats, what we do matters more than ever. Our new corporate strategy, EA2030 puts sustainable development at the heart of our actions. Its 3 goals – healthy air, land and water; resilience for nature and society; and sustainable economic growth – guide how we help communities and the environment thrive together for the long term.

This annual review shows how our scientific knowledge is critical to achieving our strategic goals. We use it to reduce the harm and cost of flooding and to help local economies stay resilient. A changing climate brings more unpredictable weather, which makes preparing for flooding harder and more expensive to manage. But strong evidence helps us act early and with confidence. Our air quality research does the same. By tracking how pollution moves, we help plan cleaner infrastructure and respond quickly when problems arise, reducing risks to people and businesses.

We protect public and environmental health by working with others. With the Health and Safety Executive, we advise Defra on the safe use and regulation of chemicals. This year we focused on per- and polyfluoroalkyl substances (PFAS) and other emerging chemicals. Our evidence helps government act decisively so chemicals can be used safely to support society and the economy without harming people or nature.

We also work with farmers through schemes such as Landscape Recovery to promote sustainable land management. Reducing nitrogen and phosphorus waste supports productive farming and healthier ecosystems. Our scientists monitor these nutrients across the country so communities can benefit from cleaner, more resilient landscapes.

Sustainable development depends on managing the scarcity of resources as well as excess. Drought risk remains a priority for our Chief Scientist's Group. The driest spring in a century in 2025 left reservoirs and rivers at critical levels, even after national efforts to cut demand. With the Met Office, we study climate impacts and explore new options to tackle national challenges, such as desalination and water transfer. This work helps to secure enough water for homes, nature and the economy in a warming climate.

Our research helps prevent local and national impacts and supports the essential transition to net zero. We test new approaches to make sure industrial growth does not damage the environment. Working with our Chief Regulator, we turn scientific insight into modern, effective regulation that supports innovation and protects communities.

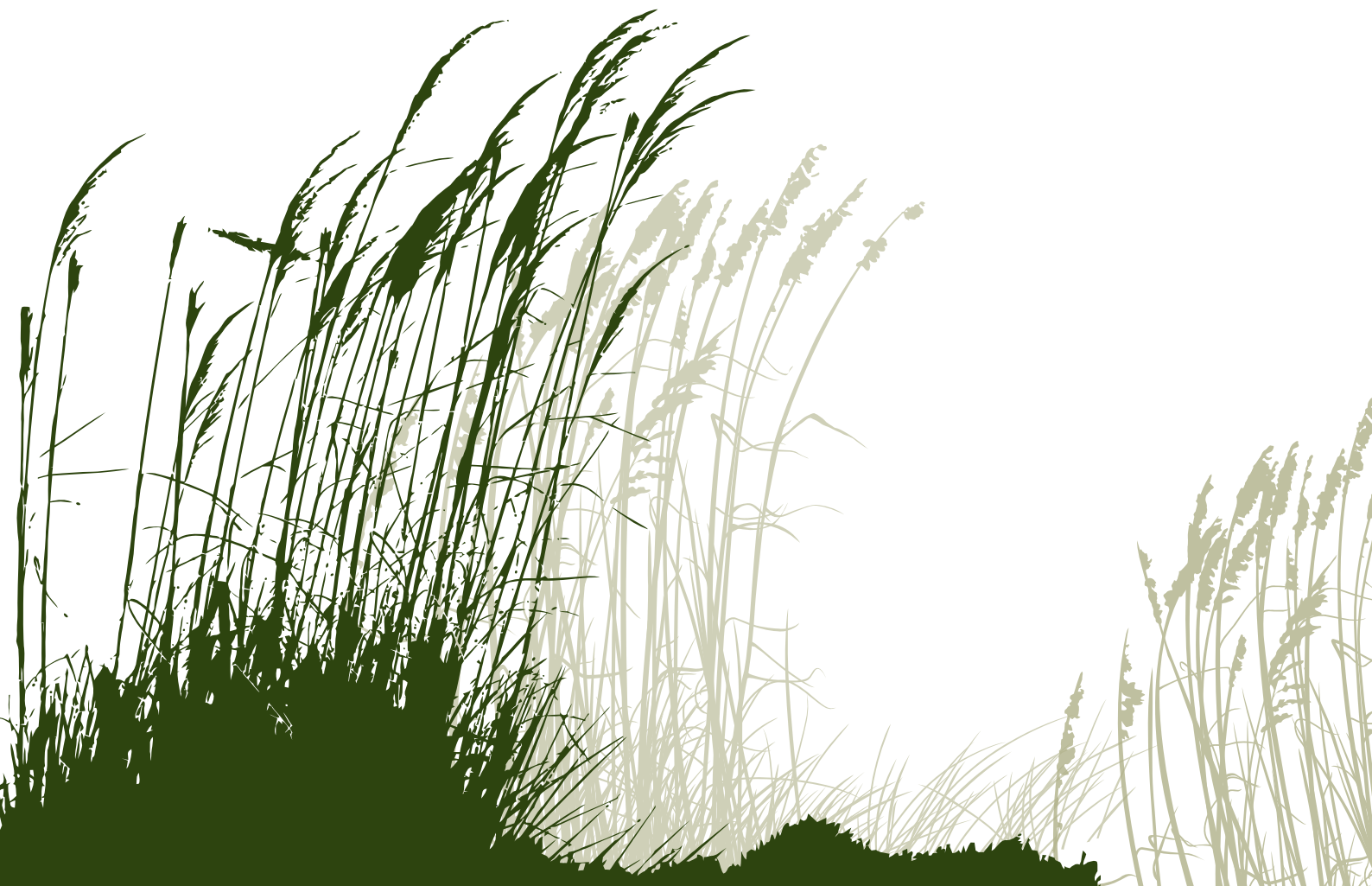
Science also helps us unlock opportunities. Nature provides clean air, food, materials and places that support our wellbeing and strengthens local economies, especially in rural areas. Green and blue spaces improve health, reduce pressure on services and attract visitors. Understanding their value and how to grow it helps people and nature thrive together.

Data is central to our science strategy. Long-standing data sets, such as bathing water records, sit alongside new tools that give fresh insight into water and air quality. We test new methods, including satellite monitoring, environmental DNA and citizen science to understand environmental change. We are also building systems that bring data together and use artificial intelligence to increase the impact of our evidence.

Our scientists make all this possible. More than 1,800 specialists carry out our research, analyse our data and model environmental change. Their work guides planning, investment and emergency response. We're committed to investing in their skills and developing pathways for people from all backgrounds to join the science profession and help protect the environment.

Science grows stronger through partnership. Working with communities, industry, government and researchers helps us balance different needs and make better decisions for homes and habitats across the country.

This review reflects what we've achieved in the last year and also looks ahead. Our science will continue to drive progress towards every EA2030 goal and help build a more resilient future for people and nature together.



Our scientists and the role they play in protecting homes and habitats

Science is essential to the Environment Agency's work. It gives us confidence in the decisions that we take. It encompasses research, evidence, data, our science assets and, most importantly, our scientists.

The role our scientists play

The Environment Agency employs over 1,800 scientists. They use their skills to strengthen our regulatory approaches, reduce pollution incidents, restore habitats, build safer communities and ensure we use the best evidence to support sustainable growth that works in balance with land, water and nature. Their role is recognised in the [Environment Agency's Science Strategy](#) and our corporate strategy, [EA2030](#). Our scientists are agile, highly skilled professionals, and include world-class experts. Their science underpins our core activities and helps us anticipate and prepare for challenges ahead.

Some of our scientists are researchers, operating at the cutting edge of science to extend our knowledge and generate new insights into the environment. Others are working in technical roles in our chemical, microbiological and fisheries laboratories. The vast majority are involved in science-based activities, often field based, using their scientific knowledge to solve day-to-day problems.

The demands on our scientists are increasing and the problems we face are becoming more complex. To meet this challenge, we must invest in our science to ensure it is resilient, and that we have the right scientists in the right places with the right expertise to protect homes and habitats.

Developing our scientists and sharing knowledge

The Environment Agency's science profession plays an important role in ensuring our scientists are in the best place to meet these challenges. It brings our scientific community together, recognising the diversity of science that exists across the organisation, sharing knowledge and helping to develop the career paths of our scientists. Over the last 12 months, the science profession has been working with colleagues across the Environment Agency to increase our professionalism in science.

We have advanced the professional development of our scientists through our seminar series, addressing topics as diverse as climate change and extreme weather events to recreational water use in England. We have also strengthened our scientific leadership capability across our operational activities by evaluating existing skills, identifying gaps, and planning for future needs. For example, we introduced the Field Scientist role this year, which has been formally accredited within the [Government Science & Engineering Profession](#).

We have also continued to work on the development of our science disciplines. We now have 3 active disciplines covering research, ecology, and environmental planning and reporting. These cross-cutting groups support the Head of Profession by bridging related specialisms from across the organisation. This helps define the skills and experience our scientists need and sets out the career pathways required to achieve them. Disciplines are essential in ensuring our staff know what development they need and the standards they must adhere to, regardless of where they sit in the Environment Agency.



The annual PhD knowledge exchange event is one of the many opportunities the Environment Agency provides to bring our scientists together.

Bringing our scientists together and giving them the best opportunities to develop is fundamental to our success. We want to be an attractive employer for scientists, and our People Strategy sets out what we want to achieve with our current and future employees. The Environment Agency already has a hugely successful [Environment and Science Graduate Training Scheme](#). This year, we also employed 38 summer interns and 19 industrial placements, many with scientific backgrounds working in areas such as permitting, operational teams and within the Chief Scientist's Group. We also brought together over 200 scientists with members of the Environment Agency board for a day of creating, connecting and appreciating how science supports the strategic priorities of the wider business and Defra. The event highlighted that the Environment Agency already have many of the experts needed to address the complex environmental challenges we face.

“

Science is pivotal to so much of the work that is delivered across the Defra Group, and I am really pleased to see such great working from Environment Agency scientists to support not just the work of their own organisation, but outcomes across the Defra Group.”

**Professor Anjali Goswami,
Chief Scientific Adviser at the Department for
Environment, Food and Rural Affairs (Defra)**

What's next?

In 2026, we will continue to work on improving professionalism in science across our operational teams, and work with our disciplines to develop the standards, capabilities and career pathways for their respective areas of work. We will employ more summer interns and industrial placements to bring new ideas, skills and ways of working into our scientific activities. We will also look to grow our external partnerships, at home and abroad. Working with the international science community to drive innovation and impact is helping to build our reputation as a world-class environmental regulator and practitioner.

We will continue to build and support our community of scientists throughout the year. Operating as one science team and finding better ways to share knowledge and expertise is vital to protect and renew our environment for people and wildlife.

Author:

Rich Walmsley

Chief Scientist's Group



Scientist in the spotlight

Govind Konnanat

“

Working in the Chief Scientist’s Group, I have always felt appreciated for my work and how it would be used to inform decisions about protecting people and the environment.”



Govind Konnanat | Industrial Placement, Chief Scientist’s Group



Exploring the benefits flowing from England's rivers

We have developed a first-of-its-kind tool to help people visualise the services and benefits of nature – ensuring England's rivers remain in a condition for future generations to enjoy.

Introduction

Water environments have long been spaces for recreation, wellbeing, connecting with our communities, and so much more. How can we ensure they are able to keep providing these services in a changing world?

A natural capital approach brings together environmental, economic and social evidence to help people understand the wider value of nature to society and the trade-offs from decisions.

The Environment Agency is building natural capital evidence for integrated water management from source to sea. We're moving beyond traditional environmental measurements to reflect the broader social and economic value of improving England's rich, diverse waters. By doing so, we're connecting nature recovery with climate resilience, public health, and sustainable growth.

Visualising the services from nature

Under Defra's flagship [Natural Capital and Ecosystem Assessment](#) programme, the Environment Agency's natural capital team developed a first-of-its-kind, open and transparent tool called Ecosystem Service Map Explorer (ESME). It uses evidence on the condition of the water environment to model and map ecosystem service capacity – the potential for our waters to provide vital ecosystem services.

These services include the many ways people use and benefit from England's rivers, from water supply to recreation and wellbeing. ESME reveals

where rivers are in a condition to continue serving communities and conversely, where interventions might be needed.

The tool currently covers natural and modified freshwater rivers across England. People can interactively explore their area of interest and view information through maps and charts.



ESME reveals where rivers are in a condition to keep providing services for communities, such as water supply or recreation.

A holistic view of nature's potential

ESME helps decision-makers understand the services and benefits we receive from the environment. This means they can better consider socio-economic trade-offs when making decisions.

The tool supports place-based projects throughout their lifecycle, from planning and engaging stakeholders to carrying out interventions. When developing ESME, we explored which elements of condition are the most influential in determining ecosystem service capacity. This knowledge helps people identify the best ways to improve the condition of rivers and, therefore, the capacity of ecosystem services. People can also use reporting based on ESME to encourage those actions to be taken.

What does this look like in practice? Consider a project set up to restore local river habitats for flood mitigation. The project planning team could use ESME to understand the river's current provision of ecosystem services. This evidence would help them set a strategic vision, define project outcomes, and estimate how ecosystem service provision could change because of their work. They could even use ESME to explore opportunities to improve other ecosystem services at the same time as their primary aim. Looking ahead, ESME has the potential to support funding and business case development, helping the team identify local stakeholders, beneficiaries and additional funding opportunities.

Realising the wider benefits from recreation

Recreation is one of the ecosystem services that ESME maps. Activities like swimming, angling and water sports improve and maintain people's physical and mental wellbeing. Recreation helps people bond with a place, strengthening their sense of belonging or identity. On a larger scale, supporting wellbeing helps reduce healthcare costs. For businesses, improved wellbeing of staff may benefit productivity, and sectors such as hospitality may see increased trade when located near recreational sites.

Provisioning services



water supply

Regulating services



water quality regulation



habitat and population maintenance



water flow regulation

Cultural services



aesthetic and amenity experience



recreation



physical and mental health and wellbeing



education and investigation



spiritual, cultural and religious experiences



intrinsic value of nature

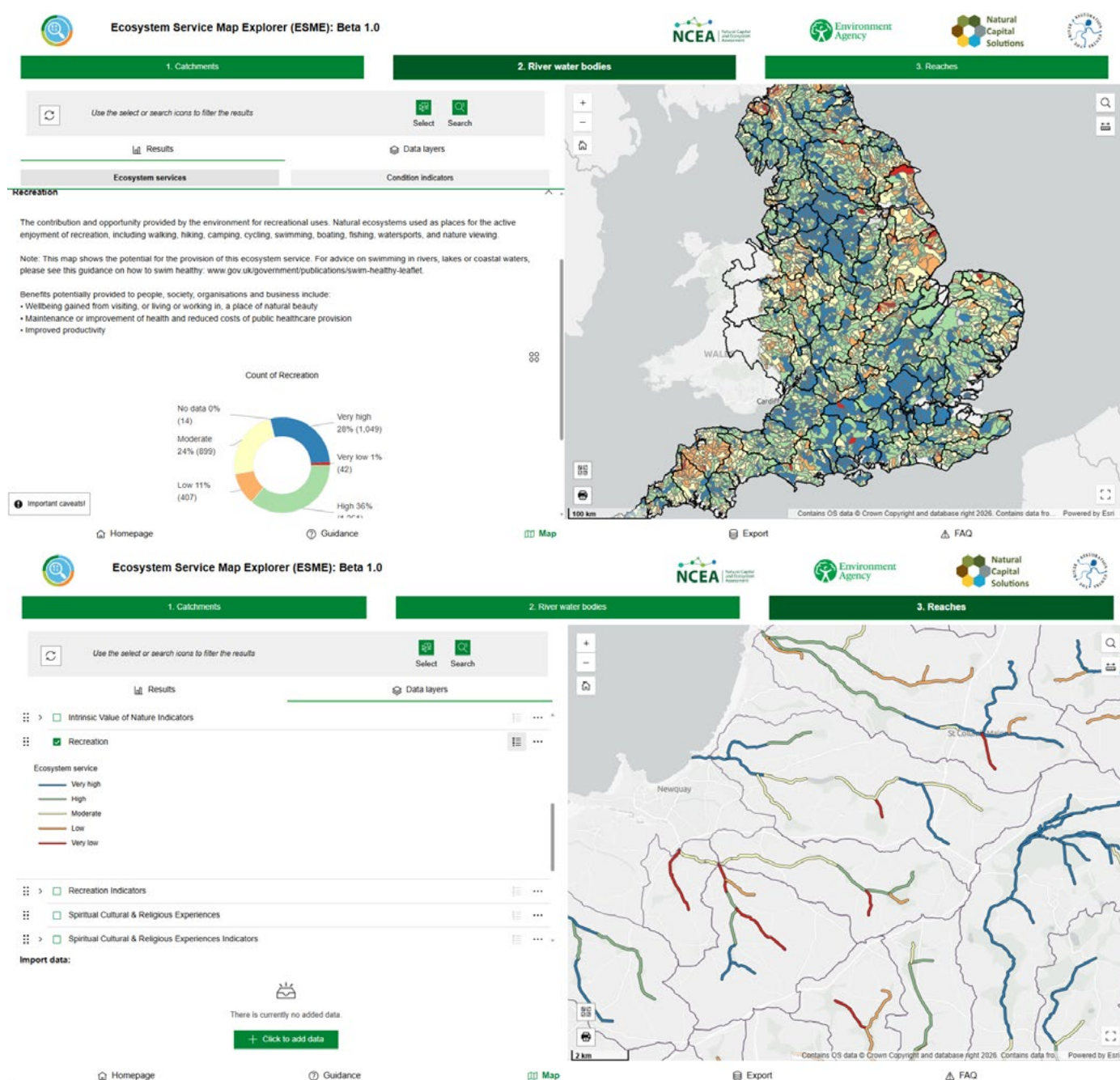
ESME includes 10 provisioning, regulating and cultural ecosystem services.

Understanding the benefits of nature-based recreation is useful in many policy areas such as public health, biodiversity and conservation, water management, land use planning, as well as marine and coastal planning.

ESME considers how the environment contributes to and provides opportunities for recreational uses. The maps show that many rivers in England have high or very high recreation ecosystem service capacity. ESME also highlights the importance of

rivers for recreation, both in ‘destination’ locations such as national parks, but also in and around towns and cities throughout England.

If improving health and wellbeing of residents is a priority for a place, then ESME can be used to understand the capacity of local rivers to provide this service. It can also reveal potential improvements to increase that capacity, such as improving access to the river or prioritising water quality improvements.



Screenshots of ESME in use.

Building resilience to flood and drought

Another ecosystem service included in ESME is water flow regulation. This service considers the features and processes of a river that regulate water flow – including peak flows (flood) and low flows (drought).

The natural environment protects people and nature against storm surges, floods and drought. Habitats, soils and geology combine to slow, retain or divert water flows. People benefit through reduced risk to life, property and public infrastructure like transport networks. Reliable water levels also mean longer periods when rivers and lakes are suitable for recreation. Nature itself benefits because reliable water levels and flows are essential for many habitats and species to flourish.

Public policy areas that benefit from this service include flood risk planning, marine and coastal planning, water security and resource management. Biodiversity and conservation, land use planning and energy security are also likely to benefit.

ESME maps show that in places where water levels are often controlled by artificial structures, such as in the east of England, rivers have a lower capacity for water flow regulation. Many of the rivers with very high capacity occur in upland areas. Chalk streams have the potential for very high capacity, but land use and abstraction practices can limit their full potential.

Using ESME, planners can identify rivers with low capacity for water flow regulation. The tool can help them see how river restoration projects could improve catchment resilience and mitigate the impacts of drought and flood, thereby helping to protect people and places.

What's next?

With ESME, we have developed a reproducible and transparent framework that combines evidence on the condition of the water environment with the ability to model and map ecosystem service capacity. We aim to expand this to all water assets so that a natural capital approach can underpin environmental planning and delivery from source to sea.

The Environment Agency will publicly release the ESME tool and user guidance in 2026. We are working with partners to showcase examples of where ecosystem service mapping has made a positive difference for homes and habitats. Please get in touch if you would like to collaborate with us on this.

For further details on the ESME tool, please contact the [Natural Capital team](#).

Author:

Alice Crouch

Chief Scientist's Group

Resilient water resources in a changing climate

We're working to understand how climate change and drought affect water resources, and how people behave when experiencing water scarcity. Our research will inform future management and planning to secure water supplies and protect the environment.

Introduction

Despite the common perception that we live in a wet country, the UK experiences dry weather and drought. In fact, 2025 was one of the country's hottest and driest years on record.

Droughts are complex events that vary in duration, time of year, location and severity. Climate change is expected to impact water resources and alter

the frequency, severity and duration of droughts. This will significantly impact the environment, agriculture, industry and society.

In this changing world, we need a better understanding of the impacts and risks from drought, particularly droughts that are worse or different to those we have seen before. This knowledge will help secure future water supplies, enable sustainable economic growth and protect the environment.

We have carried out research into the science of drought, the impact of climate change on water resources, the choices people make when it comes to using water, and what actions are needed to secure water supplies and increase resilience to change.



Drought at Bewl Water Reservoir.

Working together to understand drought

Knowing more about what causes droughts and how they develop will help us prepare, respond and recover. However, the complexity of drought presents a significant challenge for research.

The Environment Agency has been instrumental in establishing an [inter-disciplinary community of drought researchers](#) in the UK. Alongside the University of Bristol, we held a workshop with leading experts to improve our collective understanding of drought. Together, we identified 4 themes and priorities for further research: monitoring and data collection, understanding drought processes, water demand and public engagement, and drought management and interventions.

Understanding drought also requires us to consider the role of people within it. This is why we are reviewing the governance and behavioural science of drought, focusing on how drought is managed, and developing behavioural insights to support our response. This work will bring together existing knowledge with insights from water managers to understand how decisions are made during a drought.

Preparing for future change

Understanding future changes in the availability of water resources allows us to identify areas at risk and plan accordingly.

River flows may change with the climate. Changes in the pattern of seasons (wetter winters, hotter and drier summers) or weather conditions (frequencies of extremes, transitions from wet to dry) will alter the volumes of water in different places at different times. Our research has explored different indicators of hydrological change, helping us understand future water availability.

In some places, our understanding of local hydrology is limited, making it difficult to project what will happen in the future. When this uncertainty coincides with high demand for water resources, there may be real risks to supply. Another research project looked at the complex hydrology of a lowland river in the East Anglian Fens – a critical landscape for agricultural production and water supply. We provided new insights into water loss and extreme low flows, including how they may occur more frequently in the future.

Beyond understanding how rivers and flows are changing, we are also exploring what these changes could mean for England's ecosystems. Our research on river water temperature projections revealed where and when English rivers are expected to warm up through to 2080. Meanwhile, our research on [ecological function](#) considers different approaches to assessing ecosystem health as rivers warm. This work supports ongoing research into how drought affects biodiversity in chalk streams and the river microbiome, which will help the Environment Agency protect nature in a changing climate.

Looking ahead

The transition to net zero provides an opportunity to provide innovative, forward-looking solutions to improve and preserve our environment for generations to come. Through interdisciplinary research and engagement with the academic community, Environment Agency scientists have started to identify unintended consequences and provide underpinning evidence that will inform our regulatory and advisory role.

While we've advanced our understanding in many areas, more research is required to support the nation through a sustainable and equitable transition for all parts of society. Our research will continue to support the Environment Agency's regulatory and incident response roles to ensure that we are able to support and facilitate the shift to a net zero future.

New technology: opportunities and trade-offs

We live in a time of rapid technological growth. New technologies offer the opportunity of a cleaner, greener and more efficient future. But many of these technologies consume water to work, affecting the way water is used and managed.

One of these promising, yet water-intensive technologies is AI. The Chief Scientist's Group is hosting a research fellow from The Alan Turing Institute to explore the potential of AI for modelling river flows. The fellow has worked to build in-house capability by installing and developing machine learning code on our computing systems. They have also interviewed people from the Environment Agency, universities and water companies to understand the current state of knowledge and use of AI within hydrology. This pooling and sharing of knowledge will facilitate innovation across the sector, helping us to use AI in a responsible way.

Another change on the horizon is net zero, with low-carbon technologies entering the market. As part of a [collaborative research programme](#) led by the Department for Energy Security and Net Zero, the Environment Agency helped produce [projections of future water resource and demand](#). These projections explore the changes we can expect to see from different energy pathways – from climate change to changes in abstractions and discharges – to help decision-makers spot possible constraints before they occur.

New water sources may be needed to meet the demand required to reach net zero. One solution is desalination, which removes salt from brackish or seawater to provide fresh water. However, a by-product of desalination could contain other chemicals or contaminants. We are researching the impacts of saline discharges on the environment to support the evaluation of risks from new desalination proposals. This evidence will help ensure that solutions for meeting future water demand are safe for people and nature.

What's next?

2026 marks the 50th anniversary of the great 1976 drought. The Environment Agency – in collaboration with the British Hydrological Society, the UK Centre for Ecology and Hydrology and the Universities of Bristol, Birmingham and Newcastle – is developing a programme of drought science events. We will use this milestone as an opportunity to discuss current science and future challenges 50 years on.

The [Climate Adaptation Research and Innovation Framework](#) sets out the UK's research and innovation priorities, with an aim of achieving a plentiful supply of water for everyone. We support this aim through ongoing research into drought and climate change, working with colleagues across academia and industry, with the objective of securing water supplies and protecting the environment, both now and in the future.

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Social Science team, part of the Flood and Coastal Risk Management directorate

Understanding the social impacts of flooding and coastal erosion

Our research shows how flooding and coastal erosion affect the wellbeing of people and communities and their recovery over time. By understanding these social impacts, we can support more resilient places and better prepare for future change.

Introduction

Understanding how flooding and coastal change affect people's lives is vital for strengthening community resilience and ensuring sustainable economic growth. Our research explores how experiences of these events shape resilience over time, helping us understand the social factors that influence wellbeing and recovery.

Two projects illustrate our findings: the first examined the mental health costs of coastal erosion, and the second explored how households and communities recover after floods. Together, they show how understanding these social impacts of flooding and coastal erosion can help us to better prepare for a nation ready for, and resilient to, flooding and coastal change – today, tomorrow, and to the year 2100.



Flood incident response and interaction with the public.

No 'typical' experience: the mental health costs of coastal erosion

Coastal erosion can take a significant emotional toll on the people who live and work in affected areas. Our research explored the links between coastal hazards and stress, trauma, and reduced wellbeing. However, we found that evidence of clinically diagnosed conditions is limited, which makes it difficult to estimate national impacts. Improved data collection and innovative ways of valuing mental health impacts are essential to fully understand the scale of mental health costs.

We worked closely with coastal experts and residents who described their experiences of anxiety-inducing impacts of coastal erosion as a 'creeping threat' – the anxiety of losing homes, communities, heritage and infrastructure. This shows how people and places are impacted by coastal erosion in different ways, from social impacts on wellbeing to physical impacts such as losing homes, communities, heritage and infrastructure.

Coastal areas are places rich in tourism, culture and heritage, and they are widely valued for their 'blue health' benefits and environmental biodiversity. Thriving coasts sustain residents and attract tourism, which is a major economic driver for many coastal communities. By improving how we understand and value the mental health impacts of coastal erosion, our research strengthens the evidence needed to protect these assets. This supports decisions that safeguard wellbeing, community resilience and the sustainable economic growth of coastal places.

“I live in fear of it happening again”: recovering beyond physical damage

Evidence is clear that flood recovery is not a quick return to normal, but a long-term process. It unfolds over months and years, shaped by uncertainty, disruption and the cumulative demands placed on households and communities.

Persistent gaps in governance, communication, mental health support and financial resilience can leave people navigating complex systems with limited guidance. Insurance and grant processes can be difficult to access and uneven in their outcomes, with vulnerable groups experiencing the greatest barriers and longest recovery times.

At the same time, recovery is not defined solely by loss. Many people demonstrate resilience, strong community spirit and a willingness to adapt to future risk. Informal support networks, local leadership and shared experience play a crucial role in helping communities cope and move forward. Together, these findings underline the importance of recovery approaches that are co-ordinated, inclusive and focused on long-term wellbeing as well as physical repair.

What’s next?

Understanding the social impacts of flooding and coastal erosion is essential for building resilience. Despite some data limitations, our research shows that these events cause significant emotional and social challenges. These impacts affect responsibilities for flooding and coastal change across the Environment Agency, risk management authorities, and communities.

We will publish our findings on our [research page](#), continue to explore links between flooding and health, and work with our partners to clarify roles and responsibilities. By combining technical and social perspectives, we can better prepare for flooding and coastal change resilience, enabling sustainable economic growth, now and into the future.

Authors:

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Dr Juliet de Little • Dr Jacqui Cotton

Flood Research team, part of the Flood and Coastal Risk Management directorate



A teenager pushes his bike through deep flood water in a residential area.

Working with nature to protect homes and habitats

Nature-based solutions help manage hazards like floods and droughts, while providing additional benefits for people and wildlife. Our research is addressing uncertainty around what works, helping communities overcome barriers so they can harness nature to its greatest potential.



Vegetated buffer strips help to protect rivers from agricultural pollution.

Introduction

Conservationist Dr Jane Goodall once said: “There is hope in the resilience of nature, her ability to repair the wounds we have inflicted.”

In a changing climate, working with nature is needed now more than ever. Nature-based solutions are actions that protect, restore and support sustainable management of natural assets or natural capital. These interventions provide a range of benefits for homes and habitats, from reducing risks of flood and drought to improving water quality and wellbeing.

We all need to be invested in building resilience to the challenges water presents to all sectors. Whether that be too little or too much, water

extremes can bring economic and social activity to a grinding halt. Developing a deep understanding of what works will help society invest in nature-based solutions and build capacity for sustainable growth in a changing climate.

Valuing the benefits of natural flood management

In 2025, Defra committed to investing at least [£300 million into natural flood management \(NFM\)](#) over the next 10 years. NFM uses nature-based solutions to manage flood and coastal erosion risk. These measures work to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. Examples include woodland planting, leaky barriers, floodplain reconnection, slowing run-off and peatland restoration.

Although many NFM measures are low cost, communities often face challenges in securing funding to design and install these projects. This is because traditional modelling methods used to estimate economic benefits can be expensive and complex.

Our Flood and Coastal Erosion Risk Management Research team developed a new framework for [estimating the economic benefits of NFM projects](#). This method draws directly on the best available evidence and latest scientific understanding. It also allows for future refinement as new data and monitoring evidence become available.

The method offers a consistent, practical and scalable way of estimating flood and wider environmental benefits across a range of NFM interventions. By providing a proportionate approach, it supports early-stage decision-making, screening and prioritisation, particularly when bespoke modelling would be resource intensive or disproportionate.

Modelling how nature-based solutions affect water quality

While there is strong evidence about the benefits of NFM, the outcomes from other nature-based solutions are much less understood. To help fill this gap, researchers in the Chief Scientist's Group reviewed [multiple benefits of nature-based solutions](#). We explored several widely used interventions, the benefits we might expect from them, and how they might perform in a changing climate.

Through this review, we found limited evidence on how efficient nature-based solutions are at reducing nutrient (such as nitrogen and phosphate) and sediment pollution from diffuse sources (such as agriculture), particularly at a catchment scale. We also identified the need to understand how the future efficacy of nature-based solutions might be impacted by climate change.

Building on the review, our ongoing research is using catchment hydrology and nutrient models to explore how some commonly used interventions perform. We are assessing different interventions – such as vegetated buffer strips along river edges and field margin wetlands – in 2 large but contrasting catchments. The modelling will compare the amount of nutrients lost from land into rivers when these interventions are present or absent.

This evidence will help reveal how useful nature-based solutions are in managing nutrient pollution in the present day and over time. It will help us understand how their effectiveness might change with the climate, as warmer and wetter winters could lead to greater movement of pollutants from the land surface and through field drains into rivers. This work will help ensure investments made now remain effective in future.

Building resilience in cities through urban greening

In urban environments, nature-based solutions play an important role in managing water and heat hazards, while supporting nature and human wellbeing. Cities are increasingly turning to nature-based solutions such as green roofs, rain gardens and urban parks to help manage flooding, cool neighbourhoods and improve water quality.

Urban greening is essential for strengthening climate resilience, but interventions must also remain sustainable as the climate continues to change. While there is strong evidence that these interventions can bring about important benefits, far less is known about how they respond to the growing pressures of a changing climate.

Ongoing research in the Chief Scientist's Group is examining how vulnerable urban nature-based solutions are to climate pressures. This includes looking at how different extreme weather events – especially when they happen close together – may affect how well urban nature-based solutions perform and the benefits they provide. One example of this is drought followed by intense rainfall. During a drought, soils dry out and become hard and compacted, reducing their ability to absorb water. When intense rain follows, the soil cannot absorb rainfall fast enough, causing it to pool above ground, and increasing the risk of surface water flooding. This means drought conditions can reduce how effective nature-based solutions are at managing water during heavy rainfall.

We are also identifying stakeholders to help shape future work. Through interviews with Environment Agency teams, we are mapping who is actively involved or who has a strategic interest in urban nature-based solutions to ensure our research can be applied in cities where it will make a difference.



Run-off attenuation ponds in the Evenlode catchment designed to slow the flow of water through the landscape and retain nutrients.

What's next?

The Environment Agency is continuing to explore the benefits and trade-offs of using nature-based solutions under different conditions and in different places.

We're generating new information about how nature-based solutions help with high flood flows, and the role they can play in building resilience to dry periods and droughts. We're also clarifying relationships and responsibilities in urban environments to help build stronger partnerships and co-ordinate more effectively across sectors.

We are using the new evidence on the economics of NFM to support those who are submitting new projects for funding under the flood and coastal erosion risk management investment programme.

By strengthening our evidence base, our research will help cities, towns and communities across the country build resilience – and hope – as they grow.

Authors:

Dr Harriet G Orr • Dr Gina Cavan
Chief Scientist's Group

Dr Jacqui Cotton • Dr Dan Hine

Flood Research team, part of the Flood and Coastal Risk Management directorate

Using monitoring to support sustainable economic growth

Sustainable growth depends on confidence: confidence that new homes can be built, that industries can expand, and that water can be supplied and used safely without damaging the environment we all rely on. Environmental monitoring provides that confidence.



Each year, we track river flows, water quality, wildlife, habitats and groundwater across England. This covers rivers, lakes, estuaries, coastlines and aquifers, all at a local level.

Why monitoring matters

By collecting and analysing high-quality data, we help decision-makers understand where sustainable growth can happen in harmony with the environment and where it cannot. This evidence allows development to move forward without unnecessary delay or risk, supporting thriving communities while protecting nature for the future.

What we monitor – and how it enables sustainable growth

The Environment Agency runs an extensive environmental monitoring programme. Each year, we

track river flows, water quality, wildlife, habitats and groundwater across England, covering rivers, lakes, estuaries, coastlines and aquifers, all at a local level.

This work underpins day-to-day decisions that directly enable sustainable growth. For example, we monitor water quality upstream and downstream of major sewage treatment works. By understanding how much treated water rivers can tolerate before there's a negative impact, we can guide water companies, planners and regulators to make informed decisions about where housing and population growth can be supported without harming local wildlife.

Without this evidence, decisions would have to rely on cautious assumptions. That would significantly limit flexibility for businesses and developers, slow down building housing, and increase pressure for expensive infrastructure upgrades even where they may not be needed. Monitoring allows sustainable growth to happen in the right places, at the right pace, and with confidence.

Using innovation to strengthen our evidence

Alongside our core monitoring work, we are investing in new technologies and scientific approaches that improve the quality, speed and application of environmental data.

We are advancing our use of DNA-based monitoring, working with partners across the UK and internationally. These may make it easier to detect changes in ecosystems early and in more detail. This supports smarter, more targeted regulation, helping businesses understand what is expected of them, while ensuring environmental limits are respected.

“

At the Environment Agency, science and regulation go hand in hand. Good regulation depends on good evidence. It guides our judgement and helps us act with confidence, fairness and proportion. With the right science supporting us, we can see where the real risks lie, where firm action is needed, and when a lighter touch will support the sustainable growth communities want. That balance matters. It protects the environment people care about while giving businesses the clarity they need to thrive.”

Dr Jo Nettleton,
Chief Regulator, Environment Agency

We are also improving how we measure and model rainfall. Working with the University of Leeds, we have developed new ways to combine radar data to improve rainfall estimates in areas without local gauges, such as remote or mountainous regions. Better rainfall data strengthens flood forecasting and water resource planning, and could support more flexible water abstraction during dry periods. This could, for example, allow farmers to irrigate crops when the conditions are right, without increasing environmental risk.

Together, these innovations help create a more responsive system – one that supports growth by making better use of available water and reducing uncertainty in planning and investment decisions.

Working with citizens to broaden our insight

Citizen science is another important part of our monitoring story. We are providing technical leadership to improve the standard of citizen science monitoring in the water environment. This has the potential to extend the reach of our evidence and build shared understanding of the environment.

Members of the public, community groups and NGOs provide valuable local insights that complement our own monitoring. Their observations can identify emerging issues, highlight local impacts, and help us understand how environmental change is felt on the ground. We are compiling a list of examples of where citizen science has led to action that has improved the environment and had a positive impact on communities.

By bringing citizen-led data together with our own high-quality monitoring, we strengthen the evidence base used in decisions about planning, investment and regulation. This helps ensure growth is informed by the fullest possible picture of environmental conditions, while also building public trust in those decisions.



Environment Agency staff engage with local communities to monitor the water environment and the invertebrates living in it.

Looking ahead: building confidence for the future

Monitoring, data and innovative insights sit at the heart of sustainable growth. As pressures on land, water and ecosystems increase, the need for timely, trusted evidence will only grow.

Our focus is on modernising how we collect and use environmental data, making it more connected, responsive and useful for decision-makers. By doing so, we help unlock growth where it is environmentally sustainable, avoid unnecessary constraints, and ensure that development today does not create problems for future generations.

Author:

Owen Lewis

Chief Scientist's Group



Supporting nature's recovery at a landscape scale

Water is essential for human health and wellbeing, biodiversity and the economy. Yet our complex, interconnected water system faces a range of pressures, including those from agricultural activities. Large, long-term Landscape Recovery projects benefit water quality by addressing pollutant sources and pathways across the catchment. By working with the land, these projects help restore rivers, strengthen resilience and support nature's recovery.

Restoring river catchments

Farming covers more than 70% of England's land. How that land is managed directly impacts on water, shaping how it flows across the landscape and the nutrients it carries. That's why the Environment Agency supports agri-environment schemes that reduce the impact of farming on rivers and groundwater. These schemes recognise the vital role of farmers and landowners, rewarding them for taking practical action that improves the environment.

Landscape Recovery is one of these schemes, supporting large-scale, long-term projects that restore nature, enhance biodiversity and provide lasting environmental benefits across England. These projects bring together farmers, landowners, environmental organisations and local communities to shape plans that reflect local landscapes and local needs. Many early projects focus on restoring rivers and floodplains to work more naturally, reducing nutrient pollution, supporting aquatic life, and building stronger resilience to flooding and a changing climate.

Investing sustainably – in every sense

Landscape Recovery uses a blended finance approach, combining government funding with private investment to support nature recovery and the sustainable use of agricultural land. This model helps projects plan with confidence over 20 to 30 years, allowing for a more ambitious approach, while spreading financial risk. This means that farmers and land managers are not relying on a single funding source or carrying the full cost of change upfront. It also opens new income streams through emerging nature markets, enabling businesses to invest alongside farmers and land managers in actions that improve carbon storage, nature recovery, cleaner water and other environmental benefits.

Before projects are offered long-term funding agreements, they must pass through a rigorous assurance process. The Environment Agency works closely with Defra to assess the environmental value and measurable benefits each Landscape Recovery project is expected to deliver. We use established tools and methods to understand likely improvements to water quality and biodiversity, ensuring public and private investment provides real, lasting improvements for nature and the places people depend on.

Measuring water quality benefits

Within the Environment Agency's Agriculture, Risk and Evaluation team, we are using the Farmscoper Tool to understand the potential environmental and financial benefits of Landscape Recovery projects for water quality. Many of the projects are creating areas of grass or woodland between farmland and rivers, which act as 'natural' barriers that intercept pollutants before they reach watercourses. Some projects are reducing the arable crop areas, shifting instead towards pasture for grazing or planting trees. These changes can slow surface run-off and reduce the amount of nutrients and sediment reaching nearby rivers and streams.

We use tools such as Farmscoper to estimate how these interventions are expected to reduce nutrient and sediment loads in the water environment. We then translate these environmental improvements into economic benefits, using pollutant-specific damage costs. These reflect the real value of reducing water pollution across services people rely on, including drinking water quality, fisheries, bathing waters and the impacts of nutrient enrichment.

From planning to implementation: restoring land and water for the long term

After 2 years of development, the first few Landscape Recovery projects have secured funding and are moving into long-term delivery on the ground. Together, these [first 2 projects](#) represent more than £55 million of investment.

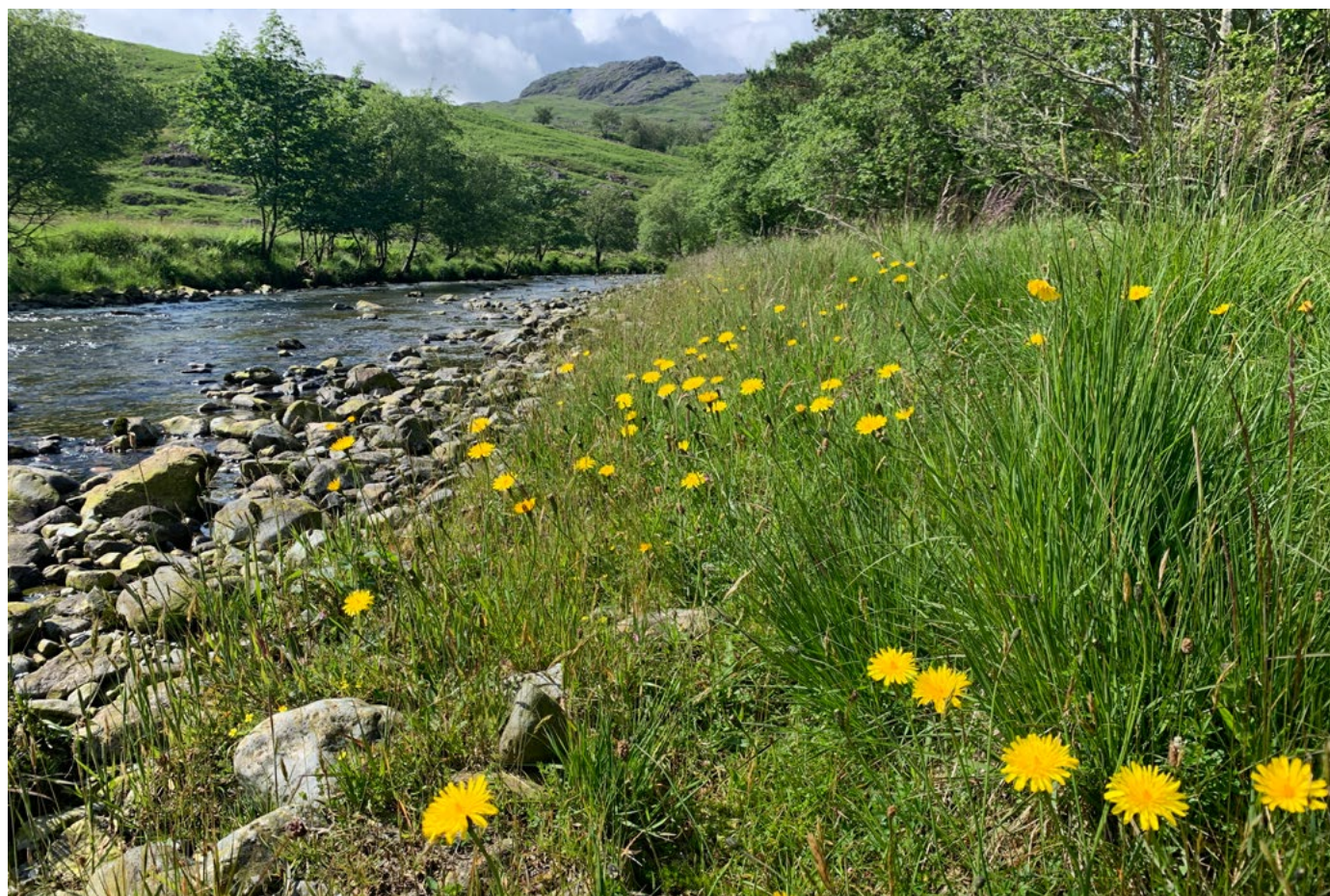
These first projects will restore habitats for local species, reconnect rivers and floodplains, and improve water quality by reducing agricultural run-off and pollutants entering waterways. In doing so, they are helping to shape a future for land use in England that supports both a productive farming sector and a healthier environment.

A second round of projects is now progressing through the development phase, with several beginning to submit their plans. We will shortly begin assessing the potential water quality benefits of these new proposals.

Author:

Dr Caroline Starr

Chief Scientist's Group



Upper Duddon River at Hinning House. (Credit: Upper Duddon Landscape Recovery project)

Healthy air for growing communities

As housing expands and industry evolves, air pollution risks are shifting in ways that aren't always obvious. We're finding smarter ways to predict these changes, so sustainable growth is joined up with healthy air.

Why we're rethinking how we assess air quality

Economic growth brings opportunities but also challenges. As the UK moves towards net zero and builds for a growing population, the way we use land is changing fast. The industries we regulate are getting closer to where people live, making local air quality management more important than ever. Air pollution is the UK's top environmental risk to human health, linked to illness and tens

of thousands of early deaths each year. The Environment Agency plays a vital role in protecting people by regulating industrial emissions.

We recently found that assessments can sometimes overlook very local variations in wind. These are driven by differences in surface temperature, which can carry pollutants in unexpected directions, including towards residential areas. These flows can occur near hills, coastlines, or where urban areas meet the countryside. As land use changes with growth, they may affect more people and become more frequent and intense.

We are working to understand and predict area-specific effects so that land-use, planning and industrial permitting take account of these local pollution flows.



Collaboration matters: by planning land use and regulating industry together, we can manage air pollution as homes and businesses grow closer to each other.
(Image by Dan Andrews at Scribey Sense)

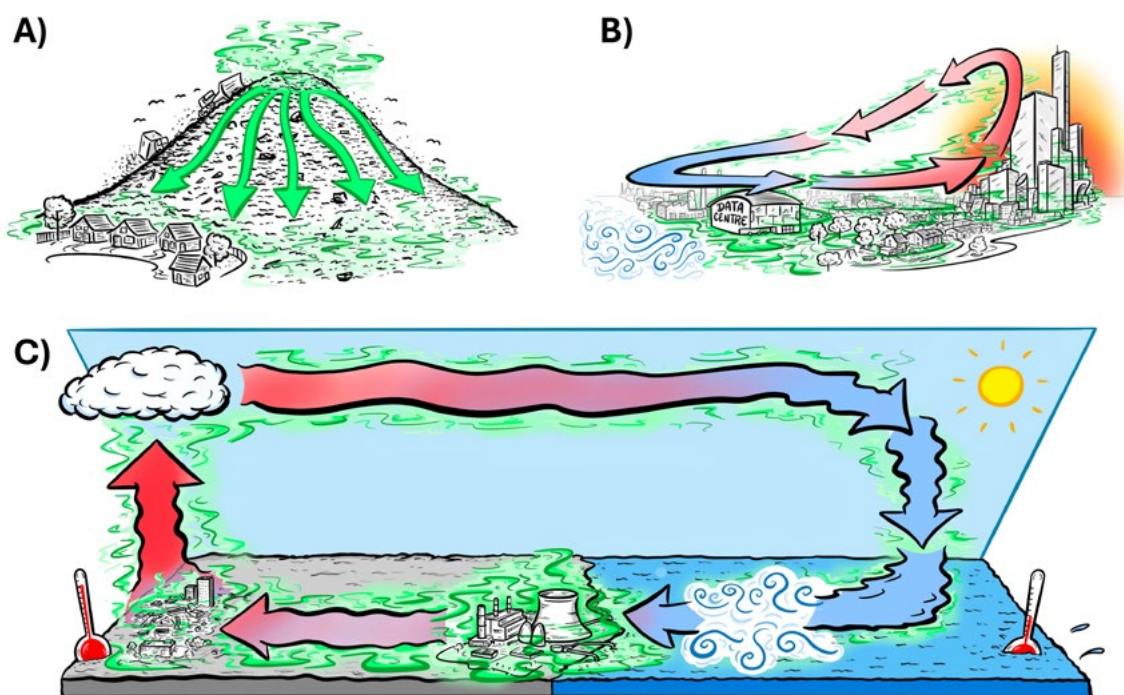
Why local air movements matter for air quality

Typically, air pollution follows the main wind direction. However, local thermal air flows can significantly influence how pollutants travel. Current models and other assessment methods don't always capture these effects, meaning risks could be under or overestimated. For example, sea breezes can sometimes move pollution near the coast, while downslope winds can change the expected flow of pollution. If models ignore these flows, they risk missing real impacts that affect people and their environment.

One of the easiest ways to understand local air movement is to look at information on sloping landscapes and known weather conditions. We use these features as indicators of how often thermal flows might happen and how strong they could be. This can help us predict sea

breezes and downslope winds which can carry air pollution. When suitable indicators aren't available or conditions are more complex, we need alternative approaches. In those cases, we can use sophisticated computer models alongside air quality data. This can give us better information on how air quality moves if we can't rely on indicators alone.

To make sure that our research has the biggest possible impact, we brought regulators and other stakeholders together to discuss implications and to co-design practical tools. Ideas ranged from simple 'traffic light' risk indicators to integrating thermal flow models with maps and complaints data. We agreed that thermal flows must be considered routinely in our air quality assessments. This collaboration bridges the gap between research and regulation so that our research can be used to ensure sustainable growth is accompanied by healthy air.



Types of thermal air flows. A) Cold air sliding downhill. B) Warm city air circulating with cooler rural air. and C) Sea breezes created by temperature differences between land and water.

(Images by Dan Andrews at Scribey Sense)

What's next?

Growth isn't slowing, and neither are we. That's why we plan to apply our screening methods to more sites to better understand the scale of the issue. To help regulators account for local conditions, we plan to develop and pilot a 'hierarchy of assessment methods'.

This framework helps teams choose the right method for any given situation. It starts with quick, low-cost approaches and moves through to detailed, higher-cost methods for assessing thermal flows. Once developed, this will allow regulators to understand the limitations and benefits of available tools, from quick checks to screen out low risk sites to detailed modelling where the stakes are higher. We will future-proof our work by factoring in climate change, evolving land use and new industries.

Accounting for local thermal winds and the local risks they can create isn't something we can do alone. Effective air quality management depends on collaboration and shared responsibility. As new homes are built and industries evolve, we'll continue to work hand-in-hand with planners, local authorities, health experts and communities to make sure our science supports good decisions. By bringing together local knowledge and robust evidence, we can turn growth into an opportunity for healthier air.

Authors:

Dr Philippa Douglas • Prof. Roger Timmis •

Prof. Rob Kinnersley

Chief Scientist's Group



From evidence to action on chemical risks

Chemicals are used in all aspects of our society every day. Despite their many benefits, some chemicals can harm the environment and human health. Environment Agency scientists play a critical role in evaluating and advising on the safe and sustainable use of chemicals. This is vital for a healthy, functioning environment.



Evaluating the safe and sustainable use of chemicals ensures we can keep our environment healthy.

Introduction

Chemicals are essential for modern life. They are used by many industries that drive economic growth, including construction, agriculture and healthcare – bringing major benefits to society and supporting innovation and productivity across the UK.

Their widespread use means some chemicals are routinely found in air, water and soil. Some can harm wildlife and human health if they

reach unsafe levels. Some chemicals stay in the environment for long periods and may build up in food chains. This can create long-term risks by contaminating our food and water.

Our scientists play a critical role in managing the safe and sustainable use of chemicals. We identify chemical hazards and assess risk from exposure over the whole lifecycle of chemical use – from manufacture to disposal. Preventing and reducing environmental emissions and restricting use of the most harmful chemicals are essential to prevent long-term harm to the environment and our health.

Replacing harmful chemicals with safer alternatives

A critical step in effective chemical management is recognising when a substance poses unacceptable long-term risks. Scientists in our Chemical Assessment Unit played a leading role in securing international agreement to restrict a harmful group of chemicals known as medium chain chlorinated paraffins (MCCPs).

This group of chemicals are widely used as an additive in metal-working fluids, and as a flame retardant and plasticiser in various products. Restriction of these harmful chemicals means that they need to be replaced with less hazardous ones. This stimulates the development and marketing of safer alternatives and approaches.

By having international consensus on the hazards of MCCPs and how these are managed, we reduce the risk of goods containing MCCPs being imported into the UK. We also ensure that there is a level playing field for UK companies with their global competitors, so that they can invest in new technologies and alternatives.

Facing the PFAS challenge: preventing and reducing harmful emissions

PFAS – short for per- and polyfluoroalkyl substances – are often called ‘forever chemicals’. Used since the 1950s for their resistance to heat, water and oil, they are found in everything from firefighting foams and pesticides to textiles, electronics, cosmetics, food packaging and many other products. They do not break down easily and can remain in the environment for a very long time.

Because some PFAS are harmful to wildlife and human health, emissions of these chemicals to the environment need to be minimised or prevented. Their extreme stability also makes them difficult and expensive to remove from waste streams and destroy.

Our scientists carried out a [rapid evidence assessment](#) to understand which disposal and clean-up methods work best to destroy PFAS. The findings revealed that the current practice – high-temperature incineration – can destroy PFAS under specific conditions. However, real-world data is limited, and there is a risk of incomplete combustion if optimum conditions are not met. This insight is vital for shaping safe disposal protocols and avoiding unintended emissions.

Equally important, the review identifies promising alternatives that could offer more sustainable, scalable solutions. Our advancements in understanding best practice for PFAS clean-up and remediation can unlock the potential of PFAS-contaminated brownfield sites for reuse and reduce the overall risk of PFAS exposure to the environment.

What’s next?

We work with the Health and Safety Executive, the UK chemicals agency, to identify the most harmful chemicals, and to make sure they are used safely, and risks to the environment are managed effectively. We share our findings with other regulators, to help them to fulfil their regulatory and advisory roles.

Science is at the heart of how we protect people, homes and habitats. Our scientists identify hazards, assess impacts, and develop a greater understanding of chemical exposure risks in the environment. This includes developing new testing methods, including adopting alternatives to animal testing and improving how we monitor chemicals in the environment.

We provide the evidence behind regulation to create the right conditions for businesses to innovate and grow without causing harm to people and the environment.

Authors:

Dr Emma Pemberton • Dr Russell Robertson • Ian Doyle

Chief Scientist’s Group

Scientist in the spotlight

Dr Emma Pemberton

“

Working as a scientist in the Environment Agency is incredibly rewarding. I really enjoy working with others and tackling complex challenges – such as managing risks from PFAS to uncover actionable, scientific insights that help to protect our environment.”



Dr Emma Pemberton | Chief Scientist's Group



Healthy water, healthy people: protecting England's beloved bathing waters

We are drawn to rivers, lakes and the sea for leisure activities, but changes to how we use and manage these places may bring us into contact with harmful environmental hazards. Scientific research can help us to understand these risks and seek solutions.



Using designated bathing waters can give people confidence about the risks they face in entering water for recreation.

Introduction

People in Britain enjoy water environments for swimming, fishing, boating, paddleboarding and more. Many of us have favourite and treasured places to visit, valuing the scenery and benefits that come with spending time in water.

Yet many of these places are under pressure. In some areas, an influx of visitors is changing the environment. In others, pollution from combined sewer overflows and run-off from farmland, urban areas and roads can expose people and nature to harm. Increasing agricultural activity can lead to nutrient pollution and presents challenges to sustainable growth and safe recreational use of our waters.

The Environment Agency is researching the use, potential risks and future change we may see in national and local sites for water recreation. This research ensures we can protect these places and the people who enjoy them.

What do we know so far?

There is growing demand for safe and healthy waters, reflected in the increased number of proposals from water users and community groups to designate inland bathing waters. While designation can prompt further growth of the recreation and tourism sector, this depends on good water quality. Robust scientific evidence is essential to support the revenues and investments that recreation attracts.

In England, the Environment Agency performs seasonal monitoring and classification of more than 450 designated bathing waters. We share this information publicly on the Swimfo website. Our monitoring increases public confidence, helping people select locations where they can safely swim and participate in local tourism activities. Monitoring bathing waters can also drive investment by encouraging water companies and others to make improvements.

At present, many bathing waters in England are in coastal locations. Only 32 designated waters are inland, with 8 in the Lake District. However, anecdotal evidence suggests that more people may be using environmental waters for recreation more often and in more places, but little has been known about where, when and how many people were involved.

Recognising water use and public expectations

To understand current trends in water recreation, the Environment Agency carried out research to produce a national [overview of recreational water use patterns](#). We mapped locations and visitor numbers by drawing on data from diverse organisations, including sporting event listings, community wild swimming databases, and lifeguard units.

In addition, we explored [how human movement data could be used](#) to understand these patterns. We sourced data from organisations involved in using water recreationally for swimming, triathlons, paddling, rowing, sailing and surfing. We collated co-located reports to identify more than 3,300 recreation locations in England.

These studies revealed the ways in which people use wild waters for recreation. Our findings include:

- 3 times more freshwater sites than coastal sites are being used for recreation
- people use lakes and coasts more than rivers
- only 10% of the locations we mapped have a designated monitoring point, however, these locations were generally also the ‘most popular’ locations pinpointed by the highest number of organisations
- the majority of organised swimming events occurred during the designated bathing season from mid-May to September, though other non-documented activities may follow different patterns

This work provides new, systematically collated evidence and a unique overview of the water recreation landscape in England. It bridges an important knowledge gap, moving from anecdotal reports to science-led evidence. The Environment Agency and others can use these national and catchment-level insights to consider the public health context of the water environment.



Hotspots for different water related recreational activities across England.

(Image taken from the Environment Agency ‘Exploring recreational water use in England’ report)

Understanding and managing change in England's iconic lakes

At a local level, Environment Agency researchers are exploring one of the country's most iconic recreational water sites. Windermere is England's largest lake, with 4 designated bathing waters. Part of the Lake District UNESCO World Heritage Site, Windermere is home to around 15,000 residents and sees 7 million visitors a year, contributing £753 million to the local economy.

Windermere is one of the most studied lakes in the world, with scientific monitoring covering nearly a century. This makes it an ideal setting to explore lakes facing similar pressures, their evolution under human influence, and how they may change in future.

The Chief Scientist's Group studied how climate change will alter the lake, its catchment, and how nutrients move across Windermere catchments. Like other lakes, Windemere is affected by blooms of algae (cyanobacteria) due to excess nutrients, which can harm humans, animals and ecosystems. Our research focused on how the abundance of algae might change over time, and how planned and theoretical interventions could help to reduce this.

Organisations involved in the management of Windermere will use these insights to assess the feasibility of future management strategies. A warmer climate will alter the dynamics of all lakes, and while local nutrient regimes need to be understood, the project illustrates how we can weigh up options for nutrient management in lakes across England.

What's next?

Clean, safe bathing water is essential for tourism in places like the Lake District. We are already using some of the data we collected about recreation use of water in the [Environment Agency's Ecosystem Service Map Explorer](#). This forms part of a suite of indicators reflecting England's river capacity for recreation and health and wellbeing ecosystem services.

The Chief Scientist's Group is continuing to research potential harm from climate change and other threats like antimicrobial resistance, as well as ways to reduce nutrient pollution in England's precious waterways.

Environmental protection is a team sport. Working across the Environment Agency and our partners is vital in keeping our bathing waters clean, safe and available for future generations to enjoy.

Authors:

Dr Harriet G Orr • Dr Martin Spurr
Chief Scientist's Group

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2020 Cumbria Tourism Online Visitor Survey – 2020. Cumbria Tourism.

Scientist in the spotlight

Lottie Thomas

“

I've always wanted the science I'm a part of to drive positive environmental and social change, and I'm so lucky to feel that ambition is reflected across the Chief Scientist's Group, including in the research I've contributed to here.”



Lottie Thomas | Industrial Placement, Chief Scientist's Group



Ensuring the net zero transition is equitable and sustainable

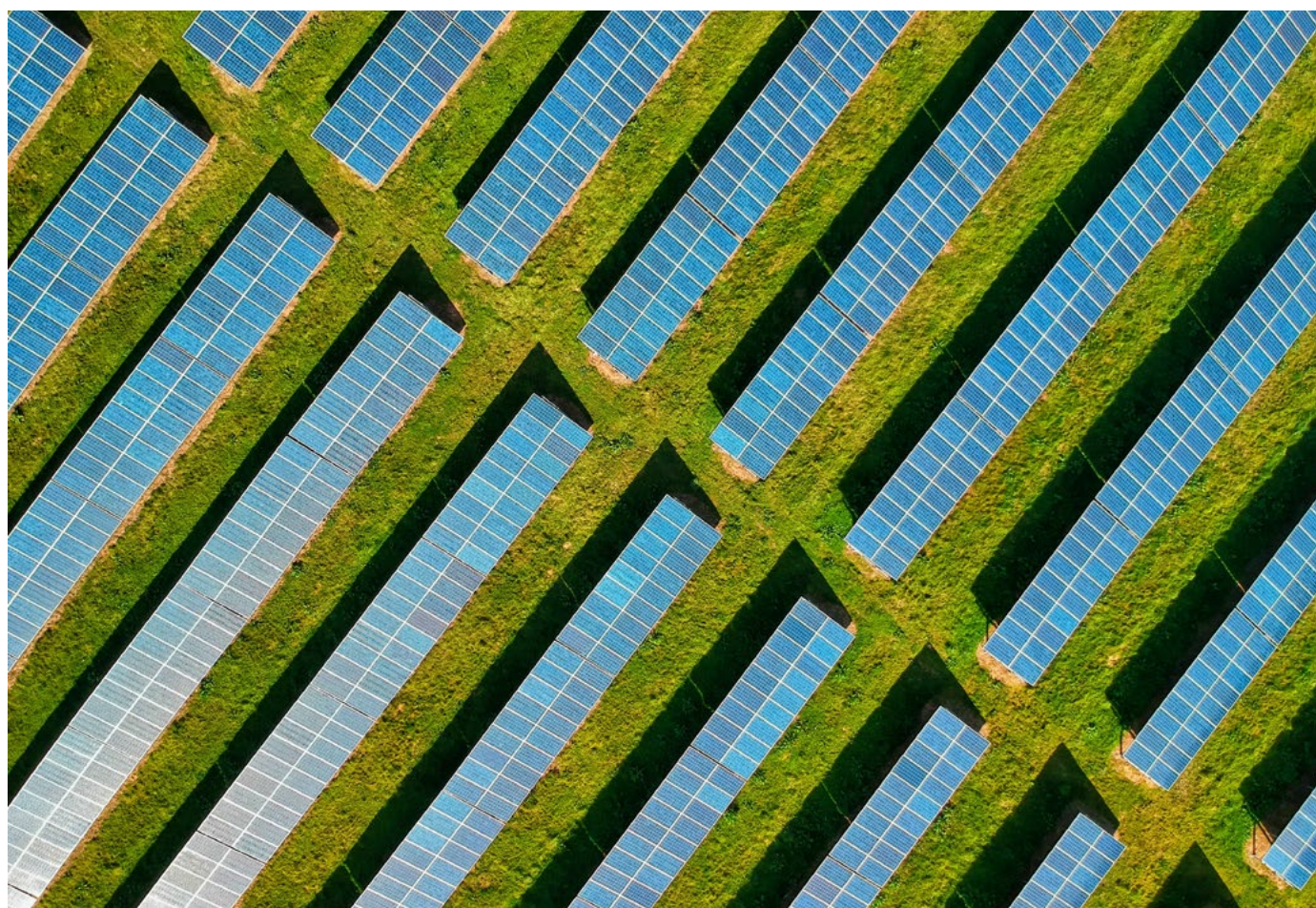
Net zero is shaping people's everyday lives. By using insights from social science, we can ensure the transition benefits society, the economy and the environment.

Introduction

Net zero is about people. It is about how we stay warm, get to work, cook dinner and build a sustainable future for the people and places we love.

According to the Climate Change Committee, changes made at the household level – such as installing a heat pump, switching to an electric car or taking fewer flights – will reduce one-third of UK emissions by 2040. Public support for net zero is, therefore, crucial.

Social science helps us understand how the public perceives low-carbon technologies and how society may be affected by the net zero transition. These insights support decision-making about how we can achieve net zero emissions in a way that maximises benefits for society, the economy and the environment.



The UK has passed legislation to achieve net zero by 2050. This change will provide economic benefits such as new jobs, lower household bills and energy security.

Why do people care about net zero?

In response to the climate emergency, the UK passed legislation to achieve net zero by 2050. This means that the country's total greenhouse gas emissions must equal the emissions removed.

Mitigating climate change will bring a range of benefits for individuals and society. Health benefits include reduced air pollution, improved fitness through active travel, and preventing the physical and mental health effects of extreme weather events. Economic benefits include a boost in growth with new jobs, lower household bills and energy security.

While the public understand their role in unlocking these benefits, they also recognise that achieving net zero will be a collective effort with shared responsibility. People in Britain believe the government should lead these efforts and ensure the path is as fair and as sustainable as possible. They are keen to understand how decisions are made and whether they can rely on policymakers and regulators to protect the environment and people as changes come into effect.



Emphasising the benefits of net zero, such as improved air quality, may encourage more people to make household switches.

Exploring emerging technologies

Social science is woven throughout the Environment Agency's net zero and circular economy research theme. To understand how society may be affected by the net zero transition, one of our research projects reviewed public perceptions of low-carbon technologies.

We focused on 3 technologies: lithium-ion batteries, heat networks that use heat pumps, and a proposed method of greenhouse gas removal called ocean alkalinity enhancement. These technologies are all relevant to the Environment Agency as a regulator and advisor to government, but they differ in their maturity and potential effects on society.

Taking lithium-ion batteries as an example, we surveyed literature across the technology's life cycle. This included experiences of workers in lithium mines, public responses to gigafactories, trends in electric vehicle use and how changes in both battery production and car ownership might facilitate a circular economy in lithium.

We found mixed and nuanced opinions about society's increased reliance on lithium. Although electric vehicle sales have increased in recent years, people have concerns about potential downsides. They are thinking about the environmental and health impacts of the lithium mining industry, as well as economic inequality due to the relatively high cost of electric cars.

The impact on people and places

Another project explored how different pathways to net zero – the specific combinations of decisions, investments and policies – could affect people and the environment over time. This research can help us identify risks, benefits and trade-offs.

Net zero will change places across the country, from agricultural sites to industrial hubs. We characterised 4 illustrative places to show what these changes could look like through to 2050.

While these are not real places, they were designed to represent important characteristics of England's economy, geography and society. The places include rural and urban locations with different demographics, land use and industries. Using evidence on the social and environmental impacts of different net zero pathways, we considered how the people living in these kinds of places may experience change over time.

The evidence suggests that a range of factors will influence public acceptance of net zero initiatives. These include people's understanding of the changes involved and the rationale for them, their trust in decision-makers, and the extent to which the transition aligns with their vision of the places in which they live.



Household changes, such as switching to an electric car, could help to reduce one-third of UK emissions by 2040.

Positive messaging and early engagement matter

Given the scale of change that net zero represents in everyday lives and local and national infrastructure, it is unsurprising that people wonder what this will mean for them, even if they are also hopeful about a lower carbon future. So, what can we learn from public perceptions and behaviours?

One lesson is around how change is communicated. Switching to electric vehicles

can help people reduce their personal carbon emissions, but research shows that appealing to environmental values isn't necessarily the most effective argument for making this change. In fact, messages that emphasise benefits like improved air quality may resonate with more people.

A second important lesson is that people expect to participate in, not just be informed about, decisions on new technologies and installations. By ensuring that changes are rolled out using fair and transparent processes, and demonstrating that public expectations and concerns are being heard, we can enable a smoother transition with more public support.

Finally, we found that what people think about net zero is never simple. It depends on a range of factors, from past experiences with industry to socio-economic conditions and community values. This is why it is important to consider what the pathway to net zero will look like in places with different histories, geographies and demographics rather than assuming a one-size-fits-all response.

What's next?

From a social science perspective, we are now focusing on another crucial net zero technology, carbon capture and storage, and what we can learn from case studies that received varying levels of public support.

We are also engaging with international stakeholders to learn about their approach to regulating net zero technologies. Both projects are intended to inform the Environment Agency's regulatory work.

By learning about how this enormous transition will affect people and the environment, we will be better prepared to make decisions confidently and work together towards the net zero goal.

Author:

Dr Katie Dow

Chief Scientist's Group

Scientist in the spotlight

Dr Katie Dow



This work is important to me because it's a chance to give a voice to members of the public, so their viewpoints are embedded in net zero decision-making."



Dr Katie Dow | Chief Scientist's Group



Forward look

EA2030 highlights our commitment to ‘strengthen the impact of our knowledge and better integrate science into the heart of everything we do’. Our scientists are central to fulfilling this commitment. We will continue to further our understanding of the state of the environment and the threats it faces, and to develop solutions to respond. We will:

1. Strengthen our knowledge

To support the Environment Agency functions, we will carry out research to:

- better understand the role that the environment plays in individual and public health – we will continue to research antimicrobial resistance (AMR) in the environment to support delivery of the [2024 to 2029 AMR National Action Plan](#); risks from bathing and shellfish waters; and sources, pathways and impacts of air pollution and radionucleotides
- generate new understanding and innovative approaches to strengthen our response to threats to ecosystem health, and to support nature recovery – we will focus on understanding the impact of multiple stressors; further developing our DNA and molecular capabilities; measuring and mitigating risks from PFAS and other chemicals; and improving fish population resilience
- increase our knowledge of the potential impacts, risks, trade-offs and co-benefits of low-carbon technologies and activities on the environment and communities to inform proportionate and enabling planning and regulation – we will develop evidence on circular economy practices, perceptions of low-carbon transitions, and nature-based measures, among other things
- develop knowledge of climate impacts and how to prepare for these, reduce vulnerabilities and build resilience to change – we will focus on assessing the resilience of our own water resource assets, preparedness for extreme

events, and the effects of societal expectation on water availability and access

- carry out research and analysis on chemical risks to support legislative delivery, including on endocrine disrupting chemicals, novel bioaccumulation assessment methods, and more cost-effective ways of assessing chemical sorption into soils
- strengthen our response to flood and coastal erosion risk management by continuing to carry out research focused on our published Areas of Research Interest, delivering alongside our partners in Defra, Natural Resources Wales and the Welsh Government

2. Modernise our approach to monitoring

Over the next 12 months, we will improve our approach to monitoring so that decision-makers, the public and our own staff are better equipped than ever before. We will be trialling new monitoring technologies and will continue to upgrade our digital systems. We will be strengthening partnerships with other organisations and with citizen scientists who collect valuable information about the environment and the pressures on it. We will also be expanding the number of air quality monitoring stations across England so that the public and government are better informed about the risks to human health resulting from exposure to air pollution.

3. Develop our community of scientists

We will continue to improve engagement, leadership and professionalism in science across the Environment Agency. We will broaden accessibility to and awareness of science across the organisation so that the work we do continues to be underpinned by robust science. To strengthen our community of scientists, we will launch 3 disciplines to agree standards, build capabilities and define career pathways for our scientists relevant to their expertise and professional context.

4. Assess and evaluate

Through our continued work on the Natural Capital and Ecosystem Assessment programme, we will publish further releases of Analysis Ready Data, systems-based case studies and a new tool to explore ecosystem health and pressures. Our growing evidence base and toolkit will help us better assess natural capital assets and the services and benefits they provide to inform nature recovery. Such efforts alongside our futures thinking will support things like the Environmental Indicator Framework and the Chief Regulator's Report.

To ensure our science continues to provide value for money and is fit for purpose, we will develop and implement an organisational evaluation strategy. We will carry out a range of complex evaluations, including on Catchment Sensitive Farming and similar agriculture support interventions.



Publications and peer-reviewed papers

Research publications from the Chief Scientist's Group and Flood and Coastal Erosion Risk Management Research teams in 2025.

Protecting and enhancing ecosystems

[Using ecological function to assess aquatic ecosystem health: an overview](#) reviewed how the role species play in the environment, their ecological function, could strengthen the Environment Agency's ability to deliver clean and plentiful water and promote sustainable development.

[Molecular data generation and preliminary analysis of river microbial biofilm communities](#) generated a DNA-based data set that captures genetic information from microbial biofilm communities in English rivers. The data set will serve as a foundational source of knowledge and help identify new microbial indicators of ecosystem health.

[State of the water environment indicator B3: supporting evidence](#) supports the B3 state of the water environment indicator for 2025. The water environment is complex and interlinked, with many different aspects playing an important part in the quality and quantity of water ecosystems and habitats.

Environment and human health

[Using human movement data to inform environmental risk management](#) reviews the sources and types of human movement data currently available and explores how they could be used and combined with environmental quality data to understand exposure risks using 2 different case studies.

[Aerial monitoring of environmental radioactivity](#) explored the potential applications of drones for monitoring radioactivity in the environment, now and in the future.

[Exploring recreational water use in England](#) reported on the extent of recreational use of environmental waters in England based on data from 2017 to 2024 provided by 17 organisations, including government, national governing bodies and community sources.

[A quick scoping review of airborne perfluorooctanoic acid \(PFOA\) and other per- and polyfluoroalkyl substances \(PFAS\)](#) provides insights into the sources, transport, concentrations, dispersion, deposition and estimation of airborne perfluorooctanoic acid (PFOA) and other per- and polyfluoroalkyl substances (PFAS) and has identified gaps in knowledge.

[Methodology for the scientific derivation of environmental assessment levels](#) updates the Environment Agency's method for the scientific derivation of environmental assessment levels for air.

[A behavioural approach to communicating bathing water quality](#) aimed to identify potential ways to optimise existing communication channels, and to highlight additional opportunities for disseminating bathing water quality information, drawing on behavioural insights.

Net zero and the circular economy

[The cumulative air quality impacts of net zero technologies](#) used computer models to investigate the potential future impacts on air quality from net zero technologies in the Humber and Teesside industrial areas.

[Environmental impacts of emerging carbon capture technologies for industrial decarbonisation](#)

reviewed evidence on the potential environmental impacts of emerging and novel applications of carbon capture technologies used in industrial decarbonisation.

[Evidence on potential environmental impacts and social implications of selected greenhouse gas removal technologies](#) looked at 5 greenhouse gas removal technologies, assessing their potential environmental and social implications, to improve understanding and identify evidence gaps.

[Public perceptions of net zero technologies: social science research and evidence](#) reviewed evidence about public perceptions and social acceptance of net zero technologies through 3 case studies: lithium-ion batteries, heat networks and ocean alkalinity enhancement.

[The geomechanics of hydrogen storage in salt caverns: environmental considerations](#) explored how the structural integrity of underground salt caverns is affected by using them to store hydrogen.

[Net zero: Environmental and social implications of energy storage technologies](#) examined the potential environmental and social implications of energy storage technologies. The technologies of interest were ammonia storage, hydrogen storage, compressed air energy storage, thermal energy storage, underground pumped hydroelectric storage and battery energy storage systems.

[Net zero: Hydrogen monitoring review](#) assessed the need for, and availability of, methods for monitoring molecular hydrogen in air.

[Net zero technologies: environment impact summaries](#) provides an overview of the potential environmental impacts of different net zero technologies and how the Environment Agency may need to regulate such impacts.

Climate adaptation and resilience

[Catchment processes during drought: a multi-disciplinary workshop](#) focused on understanding catchment processes during drought conditions in the UK. The workshop built upon the [Environment Agency's comprehensive drought review](#) published in 2023.

[Review of stochastic and other approaches in water resources planning](#) reviewed the use of stochastic and other approaches in water resources planning, including their current use and limitations, potential developments and alternative options.

[Multiple benefits of nature-based solutions: an evidence synthesis](#) examined the effects of nature-based solutions on freshwater environments by synthesising evidence from the scientific literature.

[Water temperature projections for England's rivers](#) developed water temperature projections to the year 2080 for English rivers.

[Temperature and dissolved oxygen trends in English estuaries over the past 30 years](#) used Environment Agency monitoring data from English estuaries to determine trends in temperature and dissolved oxygen since 1990.

Chemicals

[Exploration of potential GB-specific modifications to the EUSES model for UK REACH](#) identified modifications that could be made to the European Union System for Evaluation of Substances (EUSES) to make the model more specific to Great Britain (England, Scotland and Wales).

[Rapid evidence assessment of PFAS incineration and alternative remediation methods](#) assessed the effectiveness, feasibility and environmental suitability of current and emerging technologies for treating per- and polyfluoroalkyl substances (PFAS), with a focus on high-temperature incineration.

[Hazard screening and UK risk prioritisation for tyre additives](#) identified chemical additives in tyres that should be prioritised for further assessment. Available hazard and tonnage data and modelling were used to assess and rank substances based on their relative environmental hazard and/or risk.

[Flame retardant scoping review](#) identified flame retardant substances manufactured and used in Great Britain, and assessed their market size, known or suspected dangerous properties (hazards), potential risks and regulatory status.

[The water flea as an alternative to fish for bioaccumulation testing](#) reviewed bioaccumulation studies for chemical substances using the water flea (*Daphnia magna*) to explore the test methods used and consider the implications of these for regulatory assessments.

[A review of the applicability of the screening test for soil adsorption potential, and recommendations for expansion](#) explored the potential for adapting a standardised test method to provide a more accurate measure of how strongly a test substance may interact with (and therefore move through) soils and sediments.

[Estimating the octanol-water partition coefficient for chemical substances](#) assessed the feasibility of expanding the range of chemical substances that can be assessed in a standardised test method for an important physico-chemical property.

Waste crime

[National waste crime survey 2025](#) gathered insights from the waste industry and potential victims of waste crime, providing information on the nature and the scale of waste crime, as well as how the Environment Agency is perceived in tackling it.

Corporate reports

[Chief Scientist's Annual Review 2024](#). The Environment Agency's Chief Scientist's annual review for 2024.

[Environment Agency Chief Regulator's report 2024-25](#) sets out how we regulate a wide range of sectors and issues, at a time of growing environmental pressure and public expectation. This report reflects both the progress made and the challenges that remain.

Flood and coastal erosion risk management

[Estimating the benefits of natural flood management \(NFM\)](#) proposes a new simplified national-scale approach to estimate the economic benefits of NFM projects. It draws directly on the best available evidence and latest scientific understanding and allows for future refinement as new data and monitoring evidence become available.

[Rapid evidence assessment of the use of emulators in flood risk analysis](#) assesses how emulators are used in flood risk activities. It provides a useful starting point should the Environment Agency consider using emulators in future flood risk analyses.

[Improving Probable Maximum Precipitation \(PMP\) and Probable Maximum Flood \(PMF\) estimation for reservoir safety](#) reviewed approaches for estimating PMP and PMF to recommend future research to improve the safety of our highest risk reservoirs.

[Example approaches to transferring or decommissioning flood and coastal erosion risk management \(FCERM\) assets](#) presents practical information on how to transfer or decommission FCERM assets. It's aimed at asset managers in risk management authorities, but the findings will also be of interest to landowners and other stakeholders.

Academic journal articles by Environment Agency staff 2025

Contributing authors from the Environment Agency are marked with **bold** text.

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