National Centre for Universities and Business

Nature's Nexus

SHOWCASING COLLABORATION:

'Nature's Nexus' showcases the varied and impactful university and business partnerships that address the urgent challenges of conservation, restoration, and the sustainable use of nature.

Summer 2024

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Introduction

Joe Marshall
Chief Executive, National Centre for Universities and Business

Ensuring the resilience of our planet through conservation, restoration and the sustainable use of nature is one of the United Nation's key Environment Programme Topics.

Nature is fundamental to the planet's functionality and health, and also to human existence and wellbeing.

Currently, three-quarters of land and two-thirds of oceans are affected by human activities, leading to the degradation of nature's many benefits to people.

What's more, human needs are not being met in a sustainable manner. In 2020, between 720 and 811 million people experienced hunger and in 2021, 2.3 billion people lived in water-stressed areas. By 2030, resource demands, including water and food, will increase, while nature loss is anticipated to continue accelerating.

UK universities and businesses around the world are rising to this challenge. Together they are working to secure a more resilient future for our planet and communities.

Collaborative efforts are being made to develop sustainable solutions to the escalating nature crisis. This includes protecting and restoring ecosystems and biodiversity, transitioning to sustainable food systems and using fungi to support the green economy and global net zero ambitions, as well as using our natural work to help to fight cancer.

There is an increasing acknowledgment that we are confronting twin global crises – a Nature Crisis and a Climate Emergency. In this booklet, we lay out how universities and businesses are joining forces to fight the Nature Crisis.

Renewing UK biodiversity to revive nature and communities

The "renewing biodiversity through a people-in-nature approach" (RENEW) project, led by the University of Exeter, aims to address the UK's severe biodiversity loss by engaging landowners, businesses, and communities in restoring natural habitats.

The initiative will focus on creating sustainable solutions through community involvement and cross-sector business collaboration. This project aligns with the Global Biodiversity Framework's goal, set out at COP15 in 2022, to reverse biodiversity decline by 2030, addressing environmental and climate crises. By fostering inclusive participation and integrating biodiversity renewal into business practices, RENEW aims to create a substantial impact on the UK's ecological health and resilience.

University of Exeter

National Trust

RENEW

Researchers at the University of Exeter are investigating and tackling biodiversity loss in the UK through partnerships and community action.

The RENEW project will work with landowners, businesses, and communities to restore woodlands, wetlands and farmland across England, Northern Ireland, Scotland and Wales.

The project will put people at the centre of action on biodiversity renewal and build expertise across different sectors and communities to address the environment and climate crisis.

The collaboration between the University of Exeter and the National Trust has received funding through a grant from the Natural Environment Research Council (NERC).

Project lead, Professor Kevin Gaston at the University of Exeter and founding Director of the Environment and Sustainability Institute in Cornwall said: "We're delighted to receive such a significant investment from the Natural Environment Research Council which will give nature in the UK a critical boost.

"Currently, the UK is one of the world's most nature-depleted countries, with 40% of monitored species having declined in abundance in recent decades. We rely on the biodiversity of the planet's ecosystem to provide oxygen, pollination of plants, food and much more, making this a crucial time to act.

"We will bring together wide-ranging research and partnership expertise

with environmental and community intelligence to create the sustainable solutions required. The UK Government has committed to reversing UK biodiversity decline by 2030 through a legally binding target on species abundance and the RENEW project will play a major part in reaching that goal."

RENEW will be focusing on several challenges including:

- How community support for biodiversity renewal can be harnessed
- How people who are disengaged, disadvantaged, or disconnected from nature can benefit from inclusion in solutions development
- How renewal activities can be designed and delivered by diverse sets of land-managers and interest groups
- How biodiversity renewal can most effectively be embedded into finance and business activities

Professor Rosie Hails, Director of Science and Nature at the National Trust and co-lead of the project said: "This is a tremendous opportunity to trial solutions to renew biodiversity at a landscape scale by co-designing approaches with communities and land managers. The next five to ten years are critical for making the step change needed to tackle the nature crisis and to alter the current trajectory of biodiversity loss."

The £10 million from NERC forms a quarter of their £40 million investment to find resolutions to environmental issues caused by climate change.

Professor Sir Duncan Wingham, Executive Chair of NERC, said: "As COP26 has shown, it's imperative that we invest in world-leading science to find solutions now to climate change and recovery of our natural environment. This investment by NERC will enable an ambitious step change in how the best science from across different disciplines can come together to address major environmental challenges facing the UK and support the transition to a Net Zero and nature-positive future.

Find out more about the collaborative work of RENEW, access project case studies, blog posts from RENEW researchers and recent news from the University of Exeter and National Trust, and partnering businesses, by visiting https://renewbiodiversity.org.uk/

Using AI to help Ghanaian farmers monitor crops in real time

A collaboration between Aston University researchers and Tropical Growers in Ghana aims to develop agriculture processes, through AI-powered real-time crop monitoring systems. By incorporating hydroponics with advanced monitoring technologies, the team is aiming to address Ghana's significant reliance on imported fruits and vegetables, enhancing local food production.

The collaboration not only aims to improve crop yield and quality by optimising growing conditions but also offers a scalable and marketable solution for other farmers. Together Aston University and Tropical Growers are aiming to promote sustainable agricultural practices, to reduce water usage, and bolster food security in a region facing extreme climate challenges. The work contributes to wider global efforts in sustainable development and climate resilience.

Aston University BIRMINGHAM UK

Tropical growers

Aston University researchers are using AI to help increase the number and range of different crops grown in Ghana by developing real time monitoring systems.

Due to its climate, Ghana has to import around £1,147 million of fruit and vegetables annually. The University has entered a knowledge transfer partnership (KTP) with Tropical Growers, a company which cultivates plants in a nutrient solution, without soil, also known as 'hydroponics'.

As well as reducing the amount of water needed, the technique allows production of a greater range of crops than Ghana's traditional 'open field' farming, such as salad and fruit.

A KTP is a three-way collaboration between a business, an academic partner and a highly qualified researcher, known as a KTP associate. The UK-wide programme helps businesses to improve their competitiveness and productivity through the better use of knowledge, technology and skills. Aston University is a sector leading KTP provider, with 80% of its completed projects being graded as very good or outstanding by Innovate UK, the national body.

Tropical Growers currently needs to develop a digital platform for plant health monitoring so it can make sure its plants are cultivated in the best possible environment. It needs a system integrated with an evaporative cooling system, so that plants can withstand Ghana's extreme summer temperatures. It also needs it to function via an AI framework to allow automatic, continuous micro-adjustments to the plants' nutrition, temperature and humidity.

The Aston University team will create a system of devices, including cameras, humidity monitors and tiny weather-stations, which will monitor and control

the environment inside a Tropical Grower's greenhouse.

The network will collect and analyse data, including real-time images of the crops, and will ultimately communicate with the evaporative cooling system, which itself will be powered by solar energy. A phone app will be developed to estimate crops' water and nutrient requirements, as well as for predicting the yield.

Aston University's Dr Muhammad Imran, a senior lecturer in mechanical, biomedical and design who specialises in research into innovative thermal energy systems and recently devised a novel solar-powered pre-cooling food storage system for smallholder farmer clusters in Nigeria, said: "We aim to develop a 'plug and play' monitoring system. Our goal is to design software and algorithms and integrate various components so that the system is incredibly user-friendly for farmers. It should also be adaptable, allowing farmers to easily adjust its scale according to their needs. Our aim is not only to assist this company but also to provide them with technology that they can market to other farmers."

Being able to reduce temperatures by just a few degrees will make a considerable difference to crop health and to the varieties that can be grown. For example, celery and strawberries are in demand from customers but have always been impossible to grow in the heat until now. Tropical Growers will also be better able to predict its crop yields, which will lead to greater efficiency and certainty of supply for customers.

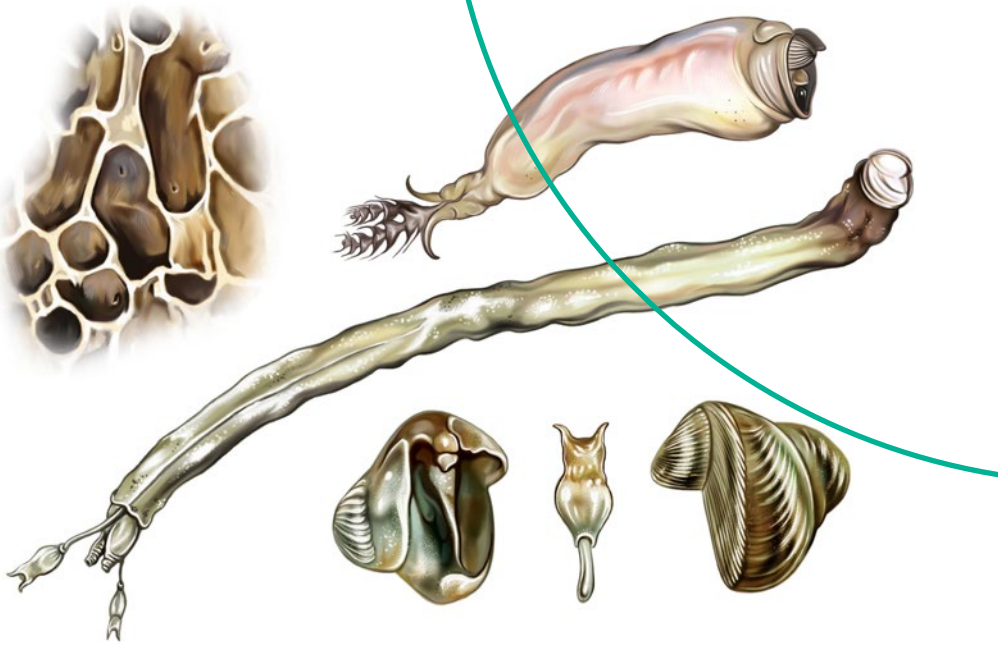
Prince Akwanda, chief technical officer for Tropical Growers, said: "The complexity of this project is in making the different systems communicate with each other, and we need that expertise in creating a single environment. It's not possible for people to watch plants 24 hours a day, so we believe this KTP project is a dream come true for us, as it will not only lead to better, healthier crops, but help us predict our supply."

The monitoring system itself will be developed as a product package that can be sold to other farmers interested in hydroponic farms, creating a new income stream for Tropical Growers. The company is keen for Ghanaian farmers to realise the benefits of hydroponic cultivation to help reduce the huge amount of fruit and vegetables that have to be imported each year.

Innovative aquaculture system turns waste wood into nutritious seafood

The University of Cambridge, The Fishmongers' Company and other partners have developed a new aquaculture system to farm 'Naked Clams' from waste wood.

The project helps to deliver sustainable food production in the UK and to address the need for alternative, environmentally-friendly protein sources, turning marine pests into a valuable resource. Together they are aiming to contribute to sustainable development and environmental conservation, and they could help end the reliance on traditional meat and fish while offering a sustainable solution to global food security challenges.



Researchers hoping to rebrand a marine pest as a nutritious food have developed the world's first system of farming shipworms, which they have renamed 'Naked Clams'.

The Fishmongers' Company Incorporated 1272

University of Cambridge

University of Plymouth

These long, white saltwater clams are the world's fastest-growing bivalve and can reach 30cm long in just six months. They do this by burrowing into waste wood and converting it into highly-nutritious protein.

The researchers found that the levels of Vitamin B12 in the Naked Clams were higher than in most other bivalves – and almost twice the amount found in blue mussels.

And with the addition of an algae-based feed to the system, the Naked Clams can be fortified with omega-3 polyunsaturated fatty acids - nutrients essential for human health.

Shipworms have traditionally been viewed as a pest because they bore through any wood immersed in seawater, including ships, piers and docks.

The researchers developed a fully-enclosed aquaculture system that can be completely controlled, eliminating the water quality and food safety concerns often associated with mussel and oyster farming.

And the modular design means it can be used in urban settings, far from the sea.

"Naked Clams taste like oysters, they're highly nutritious and they can be produced with a really low impact on the environment," said Dr David Willer, Henslow Research Fellow at the University of Cambridge's Department of Zoology and first author of the report.

He added: "Naked Clam aquaculture has never been attempted before. We're growing them using wood that would otherwise go to landfill or be recycled, to produce food that's high in protein and essential nutrients like Vitamin B12."

Scientifically named Teredinids, these creatures have no shell, but are classed as bivalve shellfish and related to oysters and mussels.

Because the Naked Clams don't put energy into growing shells, they grow much faster than mussels and oysters which can take two years to reach a harvestable size.

Wild shipworms are eaten in the Philippines - either raw, or battered and fried like calamari. But for British consumers, the researchers think Naked Clams will be more popular as a 'white meat' substitute in processed foods like fish fingers and fishcakes.

"We urgently need alternative food sources that provide the micronutrient-rich profile of meat and fish but without the environmental cost, and our system offers a sustainable solution," said Dr Reuben Shipway at the University of Plymouth's School of Biological & Marine Sciences, senior author of the report.

He added: "Switching from eating beef burgers to Naked Clam nuggets may well become a fantastic way to reduce your carbon footprint."

The research is a collaboration between the Universities of Cambridge and Plymouth, and has attracted funding from sources including The Fishmongers' Company, British Ecological Society, Cambridge Philosophical Society, Seale-Hayne Trust, and BBSRC

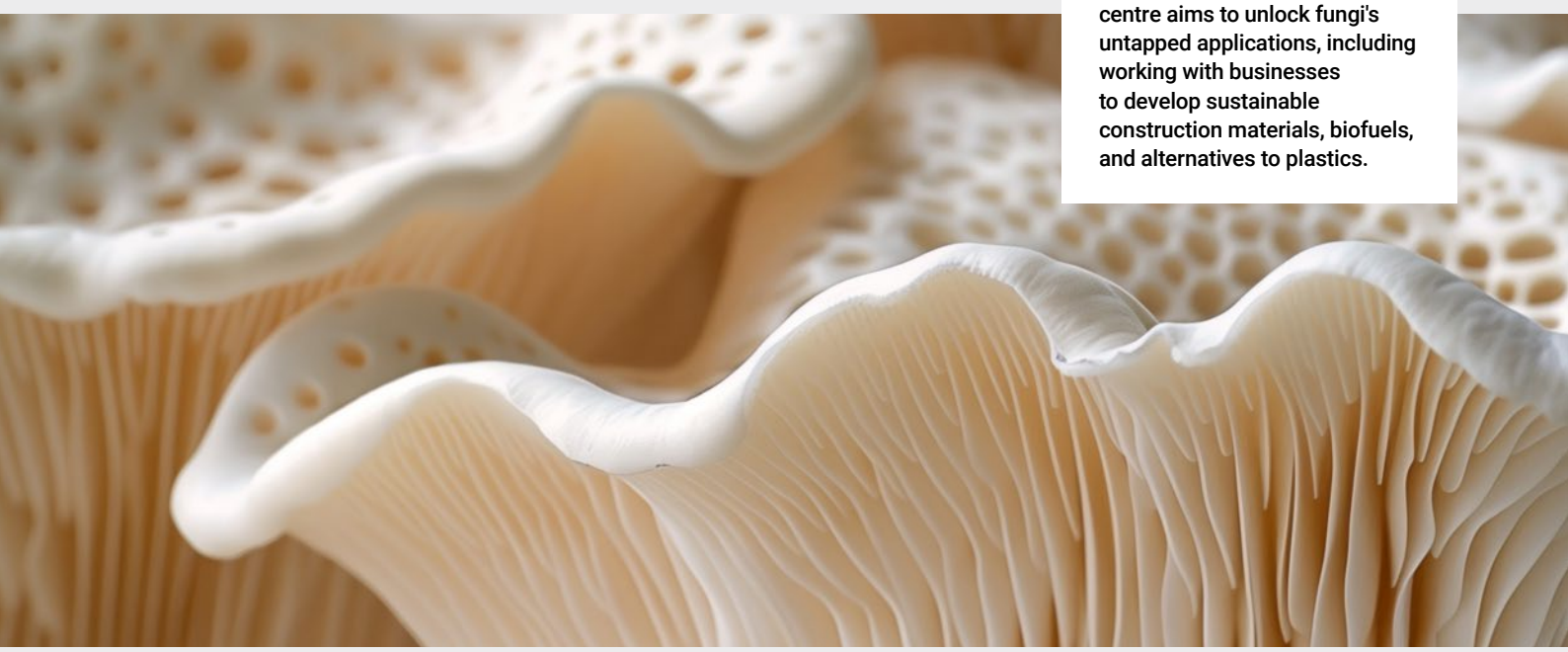
The team is now trialling different types of waste wood and algal feed in their system to optimise the growth, taste and nutritional profile of the Naked Clams – and is working with Cambridge Enterprise to scale-up and commercialise the system.

Read more about this work here: https://bit.ly/CambridgeShipWorms

Exploring how the ‘untapped kingdom’ of fungi can change our world

Fungi are a diverse group of organisms covering a wide range of life forms, from single celled to very complex multicellular organisms. Fungi play a crucial role in numerous ecological, industrial, and medical contexts, making them essential to life on earth.

The establishment of the Magan Centre of Applied Mycology at Cranfield University shows the potential of fungi in advancing the green economy and global net zero goals. With over 35 years of research expertise, the centre aims to unlock fungi's untapped applications, including working with businesses to develop sustainable construction materials, biofuels, and alternatives to plastics.

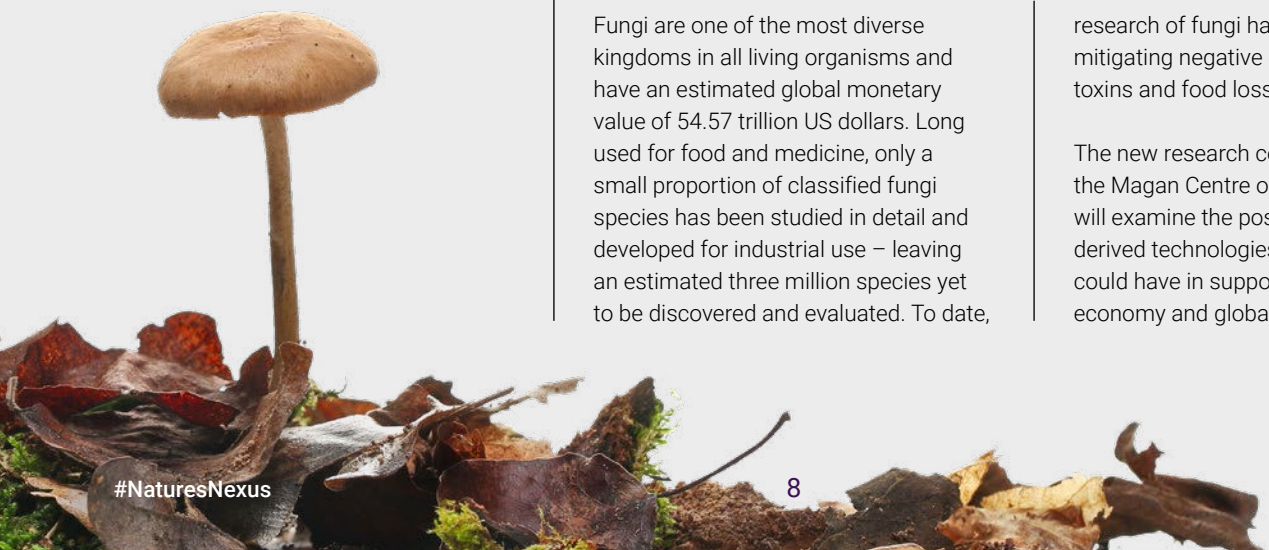


Cranfield University

A new research centre focused on harnessing the positive powers of fungi is being established at Cranfield University with a £7.2 million injection of funding from Research England.

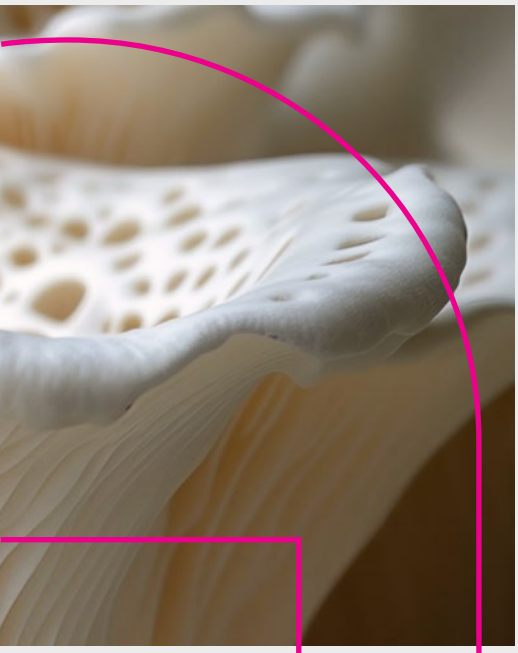
Fungi are one of the most diverse kingdoms in all living organisms and have an estimated global monetary value of 54.57 trillion US dollars. Long used for food and medicine, only a small proportion of classified fungi species has been studied in detail and developed for industrial use – leaving an estimated three million species yet to be discovered and evaluated. To date, research of fungi has largely focused on mitigating negative effects like disease, toxins and food loss.

The new research centre at Cranfield, the Magan Centre of Applied Mycology, will examine the positive role fungi-derived technologies and applications could have in supporting the green economy and global net zero ambitions.



Businesses will play a crucial role as stakeholders and will be part of the advisory board at the Centre. This prominent role is vital as the primary objective of the research is to deliver fungal-based solutions that businesses can quickly implement, accelerating progress towards net zero targets.

The project team anticipates significant potential in several expansion areas. For instance, construction materials made with fungi have demonstrated excellent sound and fire insulation properties. They aim to collaborate closely with car and plane manufacturers to design lightweight materials for various applications, including alternatives to plastics. Additionally, the centre will explore the production of biofuels and industrially relevant chemicals from waste materials, which could help industrial partners become more sustainable by reusing waste streams.



'Untapped Kingdom' with transformative potential

With over 35 years of research expertise in fungi, particularly in food storage and safety, Cranfield will extend its work into other areas where fungi could have a profound impact. This will involve interdisciplinary research into applications such as renewable energy, biofuels, construction materials, packaging, robotic parts and fuel cells.

"Fungi is an untapped kingdom with the potential to transform our world," said Professor Angel Medina-Vaya, Director of Environment and Agrifood at Cranfield University and Principal Investigator of the project.

"It's not exaggerating to say that fungi can have a truly pivotal role in helping us reach global net zero ambitions. Imagine creating self-healing electrical components, fuelling an aircraft with fungi-derived biofuel, or building a house with fungal insulation. All of these and more are possible – and this new and unique research centre will pioneer many of these new applications and technologies."

Global collaborations will create centre of excellence

Cranfield will be collaborating with organisations around the world that hold large collections of fungi to advance the research, including the Royal Botanic Gardens Kew in the UK, the Westerdijk Fungal Biodiversity Institute in the Netherlands, the Forestry and the Agricultural Biotechnology Institute in South Africa.

The new funding is boosted by a contribution from the University to create a £10 million centre of excellence. It will support five academic posts, five post doctorate roles and several technical staff, as well as upgrading Cranfield's lab facilities.

Professor Leon A. Terry, Pro-Vice-Chancellor for Research and Innovation at Cranfield University welcomed the new investment: "The interdisciplinary nature of this new research centre along with Cranfield's world-renowned and long-standing expertise in mycology makes this a really exciting prospect. We look forward to working with partners and industry to develop some of the most novel and innovative technologies in this space."

Dr Steven Hill, Director of Research at Research England, said: "We have invested in research units in universities right across England. This will diversify the regional spread of research disciplines to support the sustained enhancement of research capacity across England, and enhance the skills base, build and diversify talent and bring disciplines together to develop new skillsets and "future leaders" in areas of research excellence where there is untapped potential.

"Our investment will also help to reinforce the contribution of HEPs to their region through strategic local partnerships, focusing on sharing resources and infrastructure and generating local impact, backed by robust institutional leadership. We're excited to see how these units develop over the next five years."

Cranfield is the only Higher Education Provider to have been part of two different and successful Expanding Excellence in England awards in this funding round from Research England. Cranfield academics are also set to collaborate on a new £13.5 million Future Biodetection Technologies Research Hub, led by the University of Hertfordshire, in collaboration with Cranfield, Leeds and Manchester universities.

Collaborative initiative aims for net-zero meat production in the Lake District

Livestock production contributes about 11%–17% of global greenhouse gas emissions. A collaboration between Lancaster University and a meat wholesaler - Lake District Farmers – is exploring how to move towards net-zero meat production through regenerative farming practices. Lake District Famers (LDF) works closely in partnership with the farmers that supply them across Cumbria to develop high quality products for their clients across the UK. Sustainability is of high priority to LDF and many of its suppliers and customers, and this partnership seeks to address the urgent need for agriculture to contribute to global efforts to combat climate change, promote ecological health, and resilience in farming communities.

Together the team is involved with soil assessment, lab testing, and carbon modelling to create sustainable agricultural methods that reduce carbon emissions and enhance biodiversity. By sharing research outcomes and developing a financial framework for sustainability, the project seeks to support the Lake District Farmers to support their customers on a low carbon transition.

A collaboration between Lancaster University and Lake District Farmers is exploring how soils and land management can play a role in the move towards net-zero meat production

Scientists from Lancaster Environment Centre (LEC) and environmental accounting experts at The Pentland Centre for Sustainability in Business have been working with the Lake District Farmers (LDF) organisation on a Knowledge Transfer Partnership (KTP) project. A film has also been made to highlight the ongoing work.

Research towards the project includes soil assessment and lab testing on three case study farms that supply LDF and are transitioning to regenerative farming practises.

The research data will be put through a soil carbon modelling system and then given to the Pentland Centre which will design a financial framework.

The results can then be shared throughout LDF's supply network and beyond.

LDF was founded in 2009 to facilitate a quality driven and sustainable supply chain for family run fell farms in The Lake District.

Professor John Quinton and Professor Jess Davies from LEC and Professor Jan Bebbington from the Pentland Centre are providing academic support for the project.

Dr Laura Giles has been appointed as the KTP Associate and will be working on a full-time basis for 24 months with LDF.

Phil Scott, Head of Purpose and Sustainability at LDF, said: "Our hope is that with our research, we will be able to support and enable farmers, particularly in the upland areas of the UK, to transition to more sustainable models that focus on reducing carbon emissions, enhance biodiversity and provide nutrient dense food."

Professor Jan Bebbington, Director of the Pentland Centre for Sustainability in Business, said: "I am very happy to be collaborating with both soil scientists and a practice partner to create better accounts of how ecological impact can be articulated in a form that will be meaningful to a business. The KTP partnership outcomes will be valuable to individual businesses as well as informing accounting advisors about how to deal with wider impacts."

Professor Jess Davies, Director of the Centre for Global Eco-innovation at LEC added: "We are excited to be working with Lake District Farmers and their

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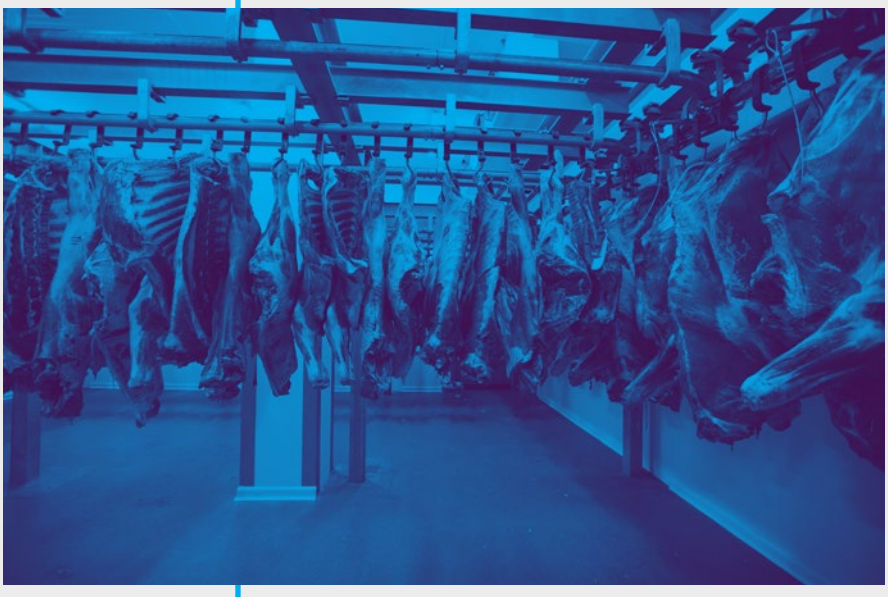
For more information see here:
https://bit.ly/lancasterfarmers

farmers in this Knowledge Transfer Partnership. We work with many innovative businesses on their net zero journey through the Centre for Global Eco-innovation, where we first came into contact with Phil and the team.

"It's brilliant to have the support of this KTP to take the next steps on that journey together – developing the science around understanding soil carbon in farms where new regenerative practices are being trialled and collaboratively exploring how to integrate that into the business.

"These sorts of collaborations are critical if we are to get to net zero."



Helping Yorkshire's wildlife recover

Wild Ingleborough is a multi-partner, landscape-scale conservation project creating a wilder future.

The Wild Ingleborough project is a collaborative, landscape-scale conservation initiative in the Yorkshire Dales, aiming to restore 1,200 hectares of land to combat climate change and biodiversity loss. With support from multiple partners, including businesses, landowners, Natural England, Yorkshire Wildlife Trust, and the University of Leeds, the project focuses on reforestation, reducing grazing pressure, and creating habitat links to facilitate wildlife movement.

This collaboration addresses severe biodiversity decline in the region, where only a small fraction of native woodlands and wildflower meadows remain. By engaging local farmers and communities, Wild Ingleborough seeks to enhance ecological resilience, reduce flooding, and ensure long-term environmental sustainability.

UNIVERSITY OF LEEDS

The project builds on decades of work by Natural England and Yorkshire Wildlife Trust. It aims to restore 1,200 hectares of land to combat the impacts of the climate crisis and help nature thrive in this part of the Yorkshire Dales.

The project team are made up of environmental scientists, with a research focus on the climate and forests, from the School of Earth and Environment at the University of Leeds and other organisations, including those that own or manage land. The project includes a large, diverse team working with Natural England, Yorkshire Wildlife Trust, WWF, the Woodland Trust and The United Bank of Carbon.

Biodiversity in the Yorkshire Dales

Only 4% of the Yorkshire Dales are covered by woodland, and only 2% of this is made up of native trees. More than 97% of wildflower rich meadows in the UK have disappeared, with drastic consequences for insects, bees and other wildlife.

Water voles, once common across the UK, are now almost completely absent from the Dales. The curlew – a bird recognised by its haunting and evocative call – is declining rapidly. The bird's eye primrose, also known as the Yorkshire Primrose, has disappeared from much of Yorkshire's hills. One of our most loved animals, the red squirrel, hangs on in the tiny fragments of woodland.

The causes of biodiversity loss

As with many other parts of the UK, much of the Yorkshire Dales has been given over to agriculture. As Cat Scott, Environmental Scientist at the University of Leeds explains, that can cause problems.

"Even though there has been a national nature reserve on Ingleborough for some time, parts of it have been quite heavily grazed by sheep in particular. Too many sheep can cause loss of native vegetation," she said.

"One of the big things the Wild Ingleborough project is aiming to do is relieve some of the grazing pressure on the land. This isn't always about removing grazing altogether, but a switch from sheep to cattle can allow trees and other vegetation to recolonise naturally."

Over time, fragmented pockets of habitat surrounded by intensively farmed land make it harder for wildlife to move around. Wild Ingleborough aims to change that, creating links between these pockets that increase nature's movement and repopulate species.
Working with the community

For the project, there's a need to work with farmers in a collaborative way, as Dominick Spracklen, Environmental Scientist at the University of Leeds explained.

"Farmers had been asked to drain their land, make it more productive and manage it more intensely. That means when it rains hard, water runs off the land really quickly and we flood our towns and cities. It also means we have to pay a lot of money to water companies to clean water.

"Instead, we could manage the land in a slightly different way that soaks up more of that water and allows it to run off more slowly. It might be that it creates more marshy, nature-rich bits of the landscape that slow that flow of water, which could have overall economic benefits thanks to reduced flooding. Finding ways to reward farmers to manage the land in this way is one of the challenges."

The project team have worked with farmers and community members and showed them how managing the landscape in a different way can provide different benefits.

Wildlife returns

So far, 60,000 new trees have been planted, with more planned in the future.

It's not a case of blanket forestation – it's connecting little pockets of native woodland together.

Trees are growing naturally across the site, and the difference being made to the type of grazing is being tracked. There's also evidence of wildflowers recovering, which attracts butterflies back to areas they've not been seen in years.

Some things happen quickly, but the big picture could take years to become apparent. With time and commitment, Wild Ingleborough could help wildlife across the Yorkshire Dales, and help preserve our future.

Get involved and find out more on the Wild Ingleborough website.

According to the National Cancer Institute In 2022, there were almost 20 million new cases and 9.7 million cancer-related deaths worldwide. By 2040, the number of new cancer cases per year is expected to rise to 29.9 million and the number of cancer-related deaths to 15.3 million.

Many common medicines are produced using fungi, and it has been used in traditional Chinese medicine for hundreds of years to treat cancers and other inflammatory diseases.

An industry-academic partnership between the University of Oxford and biopharmaceutical company NuCana has found an anti-cancer drug, derived from a Himalayan fungus, is 40 times better at killing cancer cells than its parent compound, cordycepin.

Anti-cancer drug derived from fungus

Oxford University researchers have worked in collaboration with industry leaders NuCana to evaluate a novel anti-cancer medicine. A study in Clinical Cancer Research has shown that the new drug NUC-7738, developed by NuCana, has greater potency for killing cancer cells in vitro than its parent compound cordycepin,

NUCANA

UNIVERSITY OF OXFORD

THE UNIVERSITY of EDINBURGH

Newcastle University

University of St Andrews

Cordycepin is a naturally-occurring nucleoside analogue found in the Himalayan fungus Cordyceps sinensis and due to its potential therapeutic properties has been used in traditional Chinese medicine for hundreds of years to treat cancers, inflammatory diseases, and viral infections. However, it is broken down quickly in the bloodstream by an enzyme, so only a minimal amount of cancer-destroying drug is delivered to tumours. Therefore, despite its potential, cordycepin has not been successfully developed as an anti-cancer medicine in the clinic.

In order to improve its potency and clinically assess its applications as a cancer drug, biopharmaceutical company NuCana has used their novel ProTide technology to convert cordycepin into an anti-cancer therapy called NUC-7738. Using ProTide chemistry, a small protective chemical cap was attached to cordycepin to prevent it from being degraded in the bloodstream. The cap also allows NUC-7738 to enter cancer cells more easily and is metabolised away once NUC-7738 has reached the patient's cancer cells, releasing a pre-activated form of the drug.

This technology has already been successfully used in the FDA approved antiviral drugs Sofosbuvir and Remdesivir to treat different viral infections such as Hepatitis C and COVID-19.

The results of the study published in Clinical Cancer Research suggest that by overcoming enzymatic digestion and directly delivering a pre-activated form of the drug to cancer cells, NUC-7738 is more toxic to a range of cancer cells than cordycepin.

Oxford researchers and their collaborators in Edinburgh, Glasgow, Manchester, Newcastle and St Andrews (translational science work) have been evaluating NUC-7738 in a Phase 1/2 clinical trial. The trial is testing the drug in patients with advanced solid tumours that were resistant to conventional treatment. Early results from the trial have shown that NUC-7738 is well tolerated by patients and shows encouraging signs of anti-cancer activity, particularly in patients with melanoma (skin cancer).

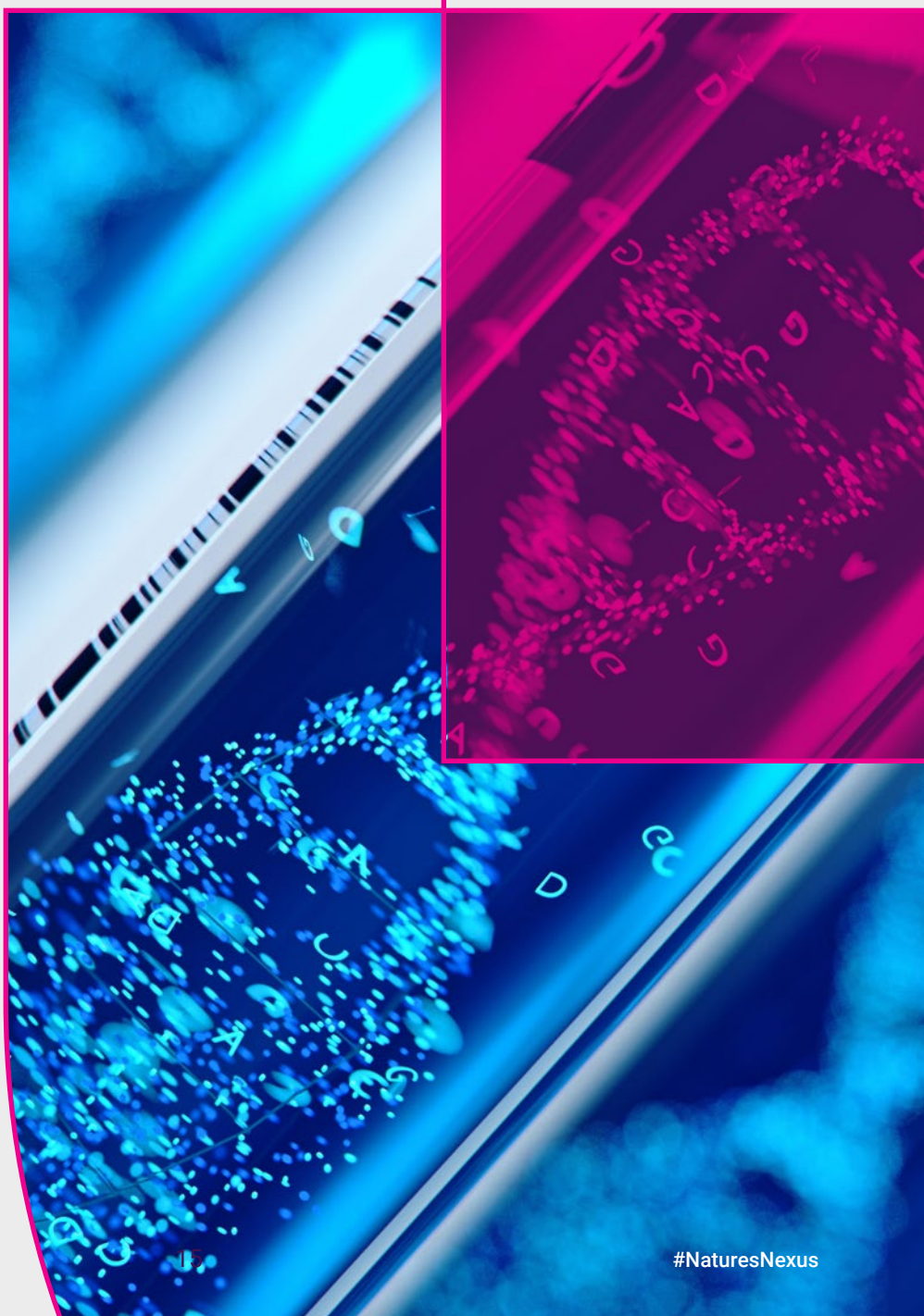
Further clinical trials of this drug are now being planned in partnership with NuCana, to add to a growing number of ProTide technology drugs that are being developed to treat cancer.

About this study

The study is led in Oxford by Professor Sarah Blagden. NuCana is a clinical-stage biopharmaceutical company focused on significantly improving treatment outcomes for cancer patients by applying ProTide technology to transform some of the most widely prescribed chemotherapy agents, nucleoside analogues, into more effective and safer medicines.

While these conventional agents remain part of the standard of care for the treatment of many solid and haematological tumours, their efficacy is limited by cancer cell resistance mechanisms and they are often poorly tolerated.

Utilising their proprietary technology, NuCana are developing new medicines, ProTides, designed to overcome key cancer resistance mechanisms and generate much higher concentrations of anti-cancer metabolites in cancer cells.



Boosting the health impacts of nature in cities

NCUB members Queen's University Belfast, the University of Liverpool and the University of Edinburgh are jointly involved in the GroundsWell project, a five-year initiative involving researchers, businesses, communities, and policymakers across the UK, focusing on the health benefits of nature in cities.

The project aims to address health inequalities by improving access to and quality of urban nature spots, with a specific emphasis on socio-economic disparities.

The project underscores the critical role of urban natural spaces in mitigating climate change impacts and promoting health equity, particularly for vulnerable populations. By engaging local stakeholders, the project seeks to implement sustainable solutions that enhance both human and environmental well-being.

GroundsWell is a five-year research project with a consortium consisting of researchers, communities and policymakers across the UK, led out of three hubs: Belfast, Edinburgh, and Liverpool.

The project aims to better understand and evidence the role of Urban Green and Blue Space (UGBS) within wider social, economic, environmental, cultural, and health systems, as well as identifying and implementing actions to maximise health benefits from UGBS. Health inequalities are at the core of GroundsWell as there are stark inequalities in access to, and use of, high quality UGBS across socio-economic status, gender, ethnicity, (dis) ability, and age.

The Belfast team is led by Queen's University Belfast and their work involves meaningful collaborations across the region. Queen's researchers are exploring a number of themes related to UGBS in Belfast, including but not limited to: inclusion and accessibility to green and blue spaces, violence against women and girls in public spaces, and the link between public and planetary health.

One long standing collaboration with the researchers in Queen's is with the Connswater Community Greenway, in East Belfast. The region underwent significant regeneration, which was completed in 2017, resulting in a 9km linear park through the east of the city. It is home to 16km of foot and cycle paths, 26 new or improved bridges and crossing, and serves 23 local schools and colleges. Furthermore, it is a hub for education and tourism, and provides a wildlife corridor from Belfast Lough to the Castlereagh Hills.

One recent collaboration saw GroundsWell, Connswater Community Greenway and landscape architects, The Paul Hogarth Company, take a look at the greenway through the lens of nature conservation, climate resilience, adaptation and self-sustainability.

Two of the most important issues of our time are the climate and nature crises, and we are in a critical moment in time for humans and non-human species. The impacts of climate change are being felt across the world, and we know that the most vulnerable among us face the worst impacts (for example older adults, young children, and those living in areas of high deprivation) which can create or exacerbate existing health inequalities.

Our food and health systems the world over are endangered, and the symbiosis of our health and the health of our planet has never been clearer. One key component of addressing climate change and public health is addressing

the quality and sustainability of our nature – our green and blue spaces.

Through consultation with local residents, stakeholders and experts, the team produced a set of findings and recommendations for "future-proofing" the greenway in a report which can be accessed online. Proposals include reducing emissions, expanding the greenway network, enriching wildlife habitats and examining sources of renewable energy.

Inspired by the public, the report also features ideas for immediate action, such as getting more people using the greenway, as well as simple energy saving measures. As opportunities arise it is hoped that the proposals of this report can be actioned in the short to medium term by many stakeholders, contributing to the urgent need for climate and nature action across the city and beyond.

EastSide Greenways Manager Jacqueline O'Hagan said, "The Greenway is being regarded as an example of a nature-based solution in the context of Climate Change. This consultation process has allowed us to explore and include the contribution of our stakeholders in identifying a series of recommendations for future work on the Greenway within the area of Climate and Nature. We are excited for what is to follow from this report which is only the first step."

The study demonstrates that, as the world faces the daunting challenges posed by the climate and nature crises, our natural spaces have a significant role to play. GroundsWell researchers will continue to investigate the link between health and our UGBS in the face of the climate and nature crises, including engaging in meaningful collaboration with our communities.

Cutting-edge technology used in fight against peatland degradation

Teesside University is collaborating with Climate Solutions Exchange Ltd (CSX) to use artificial intelligence (AI) technology to monitor and restore peatlands. Ecosystems like peatlands can absorb and store large amounts of carbon dioxide – they are known as "carbon sinks," making them ideal for helping to tackle climate change.

However, much of the UK's peatlands are significantly degraded.

The project aims to enhance peatland condition assessments and facilitate access to carbon offset funding, promoting large-scale restoration. By using AI, the project aims to cost-effectively identify and restore damaged peatlands, water quality and biodiversity.

Teesside University has embarked on an innovative research collaboration with a North Yorkshire business to utilise cutting-edge artificial intelligence (AI) technology to monitor the degradation of peatland.

Academics at Teesside University will work with Northallerton-based Climate Solutions Exchange Ltd (CSX) on a Knowledge Transfer Partnership (KTP) to develop an artificial intelligence system to improve peatland condition monitoring and assessment.

The project will support the fight against the climate emergency by enabling peatland owners to scale peatland restoration, and better access peatland carbon offset funding markets to increase the delivery of major carbon benefits.

Peatlands store vast quantities of carbon, 'locking in' an estimated 3.2 billion tonnes in the UK alone.

However, 80% of peatlands in the UK have been damaged by human

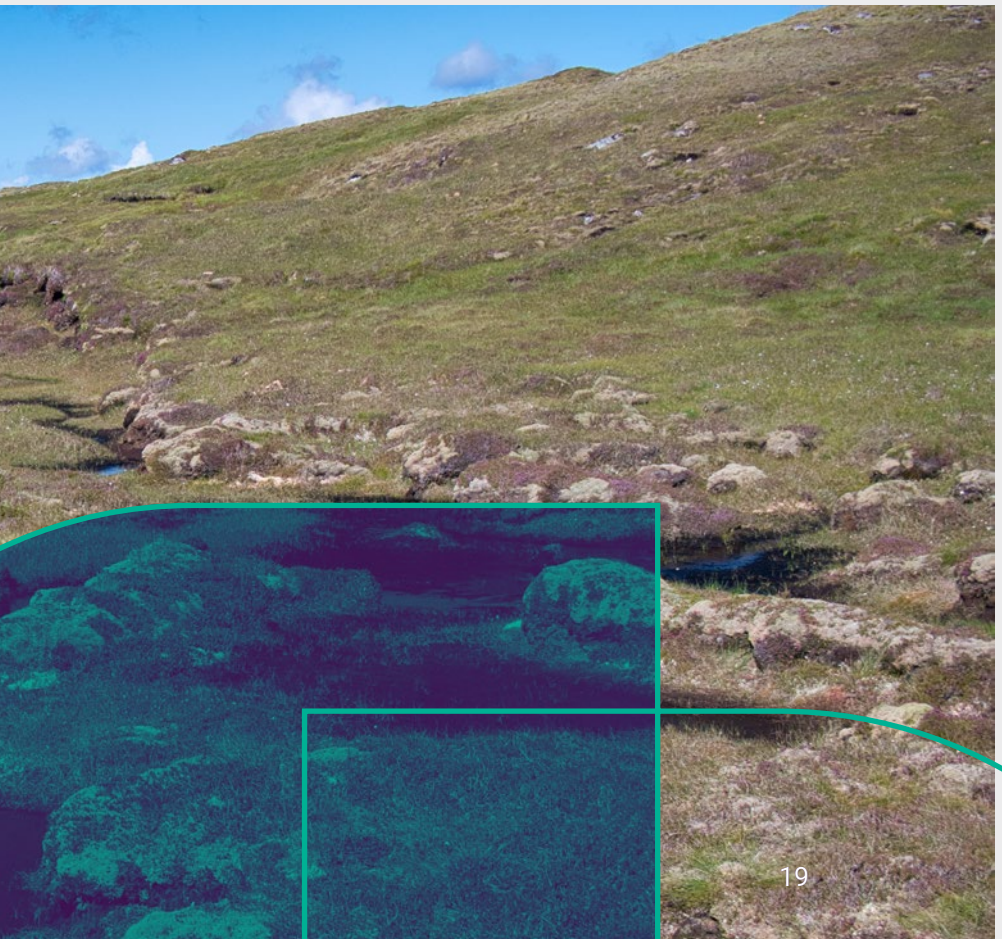
intervention; primarily through drainage to allow for the grazing of animals or growing of crops and trees.

Drainage leads to decomposition of plant material and soil shrinkage which releases carbon into the air contributing to CO2 emissions in the atmosphere. Worldwide, CO2 emissions from drained peatlands are estimated annually at 1.3 gigatonnes.

Peat formations are a significant element of the higher ground surrounding Teesside, with the source of the River Tees in Upper Teesdale being surrounded by extensive peat bogs.

Teesside University academics Dr Annalisa Occhipinti, Associate Professor, and Dr Alessandro Di Stefano, Senior Lecturer in Computer Science, will utilise their expertise in machine learning, AI, and predictive modelling to develop an AI model to identify, measure and predict peatland conditions and identify peatlands requiring intervention.

"Working with Teesside University we will create the link utilising modern technology and artificial intelligence to enable the effective protection and restoration of these vital habitats." Andy Howard, CSX CEO



The project is being supported by Professor Claudio Angione, Professor of Artificial Intelligence and Dr Gillian Taylor, Associate Professor in Analytical Chemistry.

Using the developed AI model, landowners can then cost effectively identify areas of peatland degradation and take restorative action to protect the peatland. This will have significant environmental impacts on CO2 emissions, as well as improving water quality and biodiversity by increasing habitat stability for wildlife.

Andy Howard, CSX CEO, said: "Being able to secure the KTP financial support … enables us to demonstrate how further collaborations along the River Tees can put the region at the forefront of combatting the climate emergency. We have around us a critical carbon store and potential sink in peatlands. Working with Teesside University we will create the link utilising modern technology and artificial intelligence to enable the effective protection and restoration of these vital habitats."

Dr Occhipinti added: "Delivering research which responds directly to the climate emergency is central to Teesside University's research strategy and so we are delighted to be working alongside CSX on this highly innovative project.Peatlands are a key feature of this region's landscape, and this project will be highly impactful in helping preserve them for future generations to enjoy, while utilising their carbon storage potential in the fight against global climate change."

Knowledge Transfer Partnerships (KTPs) aim to help businesses to improve their competitiveness and productivity through the better use of knowledge, technology and skills within the UK knowledge base. This KTP project was co-funded by UKRI through Innovate UK.

Restoring and protecting the health of our blue planet

According to the Rivers Trust "no single stretch of river in England or Northern Ireland is in good overall health". Our coastal waters are in a similarly compromised condition. Many of our most precious and rare ecosystems are under threat.

Working alongside a range of organisations and businesses, including ASOS, Barbour and Montane, researchers at Loughborough University are addressing this critical issue, examining the management and conservation of our waterways while exploring the impact of human activity on their well-being.

Camasunary beach – Isle of Skye

The team are part of IMPACT+ – an interdisciplinary UKRI-funded Network led by Northumbria University – that is challenging how environmental impact is measured across the fashion and textile industries. The primary aim of IMPACT+ – working with partners including ASOS, Barbour and Montane – is to improve the way that environmental impact data is collated, analysed and assessed throughout the lifecycle, from fibre sourcing to disposal and beyond. The research team's expertise – spanning design, environmental science and forensic science – will inform future innovation of materials and processes in the fashion industry, utilising and led by evidence-based scientific data.

The Loughborough researcher involved, Dr Tom Stanton, has worked in this field for almost a decade, recently completing a study of beach litter pollution on the Isle of Skye. Working alongside community groups and local landowners, with particular support from Skye Beach Cleans, his team characterised beach litter around the island – including one site, Camasunary beach, where 1,000 pieces of litter were found in just one square metre.

As well as developing new techniques for mapping polluted beaches, he will share his findings with industry and legislative policymakers with a view to updating the environmental laws which govern the upkeep of British coastlines.

Dr Worne investigating the algal community and water quality of Rutland Water Nature Reserve

Meanwhile, Dr Kate Mathers is exploring the 83% biodiversity decline (1970-2014) in freshwater ecosystems. One of the primary causes is the loss of habitat linked to excessive deposition of fine sediment – particles measuring less than 2mm. Changes to land use – such as intensive farming – alongside excessive rainfall, flooding and surface runoff have significantly increased fine sediment in rivers. This makes them unsuitable for flora and fauna to thrive, affecting all parts of the habitat's food chain.

Dr Mathers' work is investigating the populations of river invertebrates like snails, insects and crustaceans – keystone organisms in the food web. Invertebrate species have varying levels of tolerance to environmental stressors. By understanding their occurrence at different sites, she will quantify the implications of fine sediment for different ecosystems.

Undertaken in partnership with the Environment Agency, this work will help us to understand whether different river systems react differently to fine sediment – and, therefore, how management can be tailored and, importantly, when and how sites should be monitored.

Another element of the programme uses datasets from leading scientists and biomonitoring programmes around the world – including New South Wales (Australia), Environment Southland (New Zealand) and Rothamsted Research (UK). This will provide a much-needed global perspective, enabling new knowledge to be shared internationally and, crucially, solutions to be found.

Ultimately, her research will lead to an exciting step-change in knowledge, provide a framework to determine where and when rivers are most vulnerable to fine sediment pressures and deliver evidence to support mitigation strategies. Her research has important global ramifications for stakeholders and how they allocate resources to efficiently monitor, manage and conserve river ecosystems.

Another Loughborough researcher working in this area is Dr Savannah Worne. In collaboration with the Leicestershire and Rutland Wildlife Trust and Anglian Water, she is investigating the ecological health and water quality of standing water bodies – like lakes, ponds and reservoirs.

Working at Rutland Water, Dr Worne is studying the impacts of treated sewage effluent on the lagoons in the nature reserve as well as the organisms that live within them. She is particularly interested in the interaction between nutrient pollution and the formation of harmful algal blooms. Her research is assessing the ecosystem's health while identifying its vulnerability to climate change and urban development.

The study's findings will inform site management practices, as part of the implementation of a long-term water quality monitoring scheme. The work is being shared with relevant stakeholders – including the Environment Agency and Natural England – in the hope that it will contribute to updates to national guidance around the monitoring and improvement of freshwater quality at internationally protected sites.

Kate, Savannah and Tom are part of a growing community of researchers and organisations striving to restore and protect the health of our freshwater and marine ecosystems – while sustaining economic activities and preserving valuable habitats for future generations of humans and wildlife

Fine sedimentation threatens macroinvertebrates such as aquatic mayfly

Conclusion

Nature's Nexus showcases the varied and impactful partnerships between universities and businesses that are addressing the urgent challenges of conservation, restoration, and the sustainable use of nature.

As our planet faces the increasing pressures of nature loss and environmental degradation, these collaborations highlight the critical role of research and innovation in forging sustainable solutions. The ten case studies featured here exemplify the commitment of NCUB members to harnessing the power of nature for the benefit of society.

At a time when three-quarters of our land and two-thirds of our oceans are impacted by human activities, and millions of people face hunger and water stress, the importance of these efforts cannot be overstated. The diverse initiatives presented in this booklet—from using AI to aid Ghanaian farmers to exploring the potential of fungi in the green economy—demonstrate the creativity, expertise, and dedication of UK universities and businesses.

As we navigate the twin global crises of Nature and Climate, this booklet underscores the necessity of continued collaboration. The innovations and solutions developed through these partnerships are paving the way for a more sustainable and resilient future. By protecting and restoring ecosystems, transitioning to sustainable food systems, and leveraging cutting-edge technology, we can ensure that nature's benefits are preserved for future generations.

Through these impactful projects, universities and businesses are not only addressing immediate environmental challenges but also shaping a better, more sustainable world for all.

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Get in touch:
For more information please contact NCUB at:
info@ncub.co.uk
www.ncub.co.uk
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