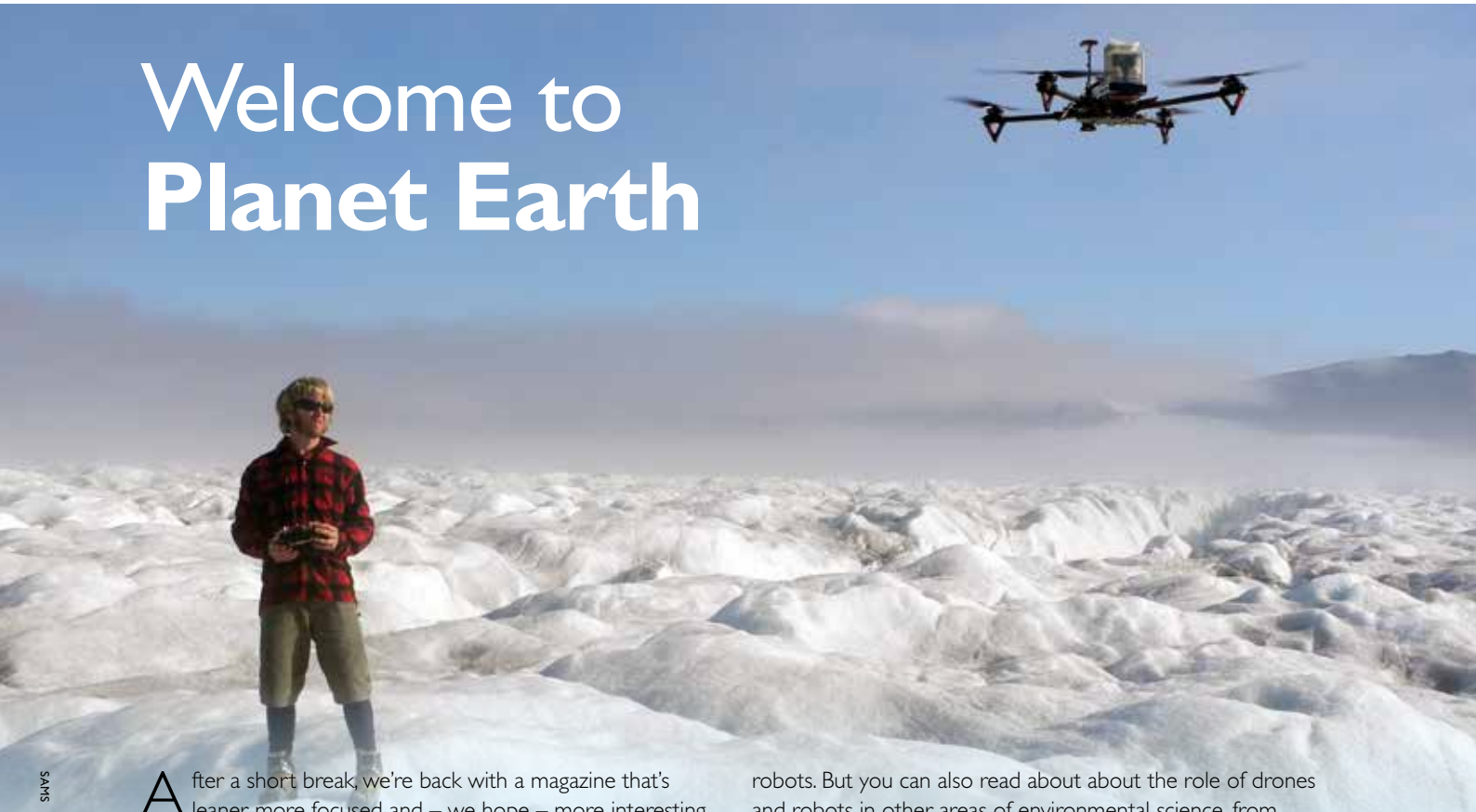
Welcome to **Planet Earth**



SAMS

After a short break, we're back with a magazine that's leaner, more focused and – we hope – more interesting. From now on we'll be paying more attention to the benefits that come from the science NERC supports. And each issue will now focus on a particular theme, rather than being a miscellany of interesting research. For this issue we will focus on drones and robots – one of the fastest-moving areas in environmental science.

Scientists are already using unmanned aerial vehicles (UAVs) for everything from finding orangutan nests in the Indonesian rainforest canopy to hunting for elephant and rhino poachers. That's just the start, though; as drones get cheaper and more powerful, they'll become an indispensable tool in many fields.

The potential of autonomous systems is particularly huge in marine science. Though the oceans cover 70 per cent of the planet's surface, are vital for all life and contribute more than $2.8 trillion a year to the global economy, there's still a huge amount we don't understand about how they work and how they're changing. Amazingly, we've mapped the surface of Mars in greater detail than 90 per cent of the sea floor.

The oceans are vast; research ships are expensive and can only be in one place at a time. Autonomous systems can stay out for months, taking measurements in even the foulest weather, and are much cheaper. They have the potential to take over many data collection tasks so the ships can be devoted to research that takes advantage of the much more advanced instruments they can carry.

In this issue you can learn how our researchers are responding to these challenges with amazing new marine robots. But you can also read about about the role of drones and robots in other areas of environmental science, from modelling landslides in 3D to monitoring atmospheric CO_2 from NASA's Global Hawk.

NERC's investing heavily in the area; for instance, in April we announced we're putting £15m into marine robots over five years - £10m to develop two new members of the Autosub family, and another £5m to create new sensors for use on various submarine and surface platforms. And alongside the Engineering and Physical Sciences Research Council, we've already set up NEXUSS, a Centre for Doctoral Training that aims to produce the next generation of highly-skilled experts in doing science with robots and other autonomous platforms.

Planet Earth's new focus isn't the only thing that's changing round here. We're also relaunching its companion website, which will contain everything that goes in the magazine and more, with news stories and videos about the latest environmental research – please drop by at **www.nerc.ac.uk/planetearth**. And a regular email newsletter will contain the best content from both. To sign up, go to **www.nerc.ac.uk**.

Finally, a correction – on page 17 of the winter 2015 issue, we referred to the Joint Nature Conservancy Council. In fact, the organisation's name is the Joint Nature Conservation Committee. Apologies for the error.

Tom Marshall, editor

New icebreaker named

The UK's new polar research ship will be called the RRS *Sir David Attenborough* when it's launched in 2019, in honour of the veteran broadcaster whose work has inspired generations with a love of the natural world.

The decision came at the end of a hugely successful campaign to ask the public for ideas for the new ship's name. This gained intense media interest from all over the world, attracted some 32,000 suggestions and reached hundreds of millions of people.

'I am truly honoured by this naming decision and hope that everyone who suggested a name will feel just as inspired to follow the ship's progress as it explores our polar regions,' said Sir David. 'I have been privileged to explore the world's deepest oceans alongside amazing teams of researchers, and with this new polar research ship they will be able to go further and discover more than ever before.'

Universities and Science Minister Jo Johnson announced the decision just days before Attenborough's 90th birthday. 'The public provided some truly inspirational and creative names, and while it was a difficult decision I'm delighted that our state-of-the-art polar research ship will be named after one of the nation's most cherished broadcasters and natural scientists,' he said. 'This vessel will carry the Attenborough name for decades to come, as it fulfils its mission to explore the oceans and put Britain at the forefront of efforts to preserve our precious marine environment.'

"I am truly honoured by this naming decision"

At the same time, the Minister announced that the government will invest up to £1m in a new programme aimed at inspiring the scientists, engineers and explorers of the future.

The most popular submission, *Boaty McBoatface*, will live on as the name of one of the advanced marine robots that will be deployed from the ship. The £200m polar research vessel is being built by Cammell Laird on Merseyside, supporting 400 jobs and 60 apprenticeships.

NERC joins forces with M&S on sustainable food

NERC and M&S have announced a new strategic partnership aimed at creating a more sustainable global food system.

The organisations will share knowledge, data and expertise to tackle challenges to food supply chains like population growth, competition for resources and climate change.

'Having access to and contributing to the latest scientific research on food and farming helps us produce high quality, innovative products in the most sustainable ways possible,' said Carmel McQuaid, head of sustainable business at M&S. 'That's what our customers expect from us and a partnership with NERC gives us expertise and facilities that otherwise wouldn't be available to our buyers and suppliers. And access to our buyers and suppliers gives NERC's team information and data that they otherwise wouldn't be able to apply to their research.'

The partnership will focus on improving our understanding of the relationship between land use and the benefits we get from the natural environment, on analysing the risk water shortages pose to the global food supply chain, and on making better use of satellite data for sustainable aquaculture and fisheries.

Bug brother is watching you

A team of insect experts have spent years filming a field of crickets in Spain with more than 140 digital video cameras to find out more about what makes them tick.

Now they're looking for help from the public in dealing with all that footage. If you want to get involved with real science that will shed new light on insect behaviour, here's your chance.

'Our aim is to understand what insects really get up to in the wild, and to use them to understand larger questions about biological variation, ageing and a host of other questions,' says Professor Tom Tregenza of the University of Exeter, the project's leader.

The problem is that they now have far too much footage to go through it all themselves. 'We have thousands of hours of video and we need help analysing it,'

Wildcrickets.org

Tregenza adds.

Visit **http://cricket-tales.exeter.ac.uk** and you can take part in an exciting citizen science project to help the team process the footage. You'll be asked to watch clips of crickets in action and put them into categories – for instance, are they mating, or fighting, or feeding?

To find out more about the overall aims of the project, visit **www.wildcrickets.org.**

Successful disease elimination offers hope for amphibians

We've won a rare victory in the fight against an invasive fungal disease that's cutting a swathe through the world's frogs, toads, newts and salamanders.

New diseases are one of the biggest threats to natural ecosystems worldwide, and we urgently need new ways to control them. Researchers have had some success in clearing the deadly *Batrachochytrium dendrobatidis* (Bd) fungus from captive populations, but this is the first time anyone's managed to do so in the wild.

A study in *Biology Letters* describes how researchers from Imperial College London, the National Museum of Natural History in Spain and the Zoological Society of London tried over five years to eliminate Bd fungus from ponds on the Mediterranean island of Mallorca, where it was introduced by human activities.

Initially the scientists tried taking tadpoles of the Mallorcan midwife toad into the lab and treating them with antifungal chemicals. This worked, but the animals tended to be re-infected once they were reintroduced to the ponds they'd hatched in.

So the researchers decided to try also disinfecting the ponds themselves, using a common laboratory decontaminant chemical, suitably diluted. The results were very encouraging; at four of the five pools treated, the Bd infection has been eliminated and hasn't returned in two years.

Bd has ravaged and even destroyed amphibian populations across five continents; so far it's infected more than 700 species. The new method won't be enough on its own to deal with the threat, as the evidence suggests the fungus is being frequently carried around the globe and so will probably return unless other steps are also taken. Introducing laboratory decontaminant chemicals into the environment isn't something to be done lightly. But as part of wider efforts to control the spread of Bd and other emerging fungal diseases, this method could offer hope for populations that are under severe pressure.

DOI: 10.1098/rsbl.2015.0874

Earthquakes and eruptions in Iceland

Geoscientists at the University of Cambridge are uncovering how volcanic activity in Iceland causes earthquakes – and how these can be used to keep track of where magma might erupt next.

The Cambridge Volcano Seismology group has an extensive network of seismic sensors in central Iceland, forming part of the international FutureVolc project monitoring Icelandic volcanoes.

Robert Green

When unrest started in Bárðarbunga volcano in the summer of 2014, the sheer density of geophysical instruments in the area meant scientists could watch in real time as magma from beneath the volcano moved to the northeast. The 5m-wide channel of molten rock travelled at 7km underground, reaching 48km from the volcano before finally erupting fountains of lava more than 150m high. The eruption lasted six months, as the source of magma underneath Bárðarbunga was gradually exhausted.

The Cambridge researchers recorded more than 30,000 tiny earthquakes produced as the magma forced its way through the Earth's crust. Such small earthquakes would not be felt by a human standing on the surface but provide a very precise way to track the magma's underground advance and reveal the physical processes at play.

The team's results won't just help improve our ability to predict future volcanic eruptions; they could also have applications in areas like understanding seismic activity triggered by fracking.

This work in Iceland forms the subject of an exhibit at the Royal Society's Summer Science Exhibition, taking place from 4-10 July in London – follow @ExplosiveEarth or see **www.esc.cam.ac.uk/ExplosiveEarth** to find out more.

Arctic images

Online atlas explores Africa's groundwater

A newly-launched online reference service provides an overview of precious groundwater resources across Africa.

The Africa Groundwater Atlas has been developed by scientists at NERC's British Geological Survey, in partnership with the International Association of Hydrogeologists' Burdon Groundwater Network for Developing Countries and with more than 50 groundwater experts across Africa.

Many African communities depend heavily on groundwater, so making sure it's safeguarded and exploited in a sustainable way is vital – but historically, the information needed to do this often hasn't been readily available. The atlas is intended to correct that, including valuable data on each country's hydrogeological resources, how they're currently being managed and how they could change in future.

The atlas is still being developed, and more information will be added as it becomes available

It's been produced as part of the Unlocking the Potential of Groundwater for the Poor (UPGro) programme, funded by UK Aid, NERC and the Economic & Social Research Council.

You can find out more about the project, including the accompanying Africa Groundwater Literature Archive, at **www.bgs.ac.uk/africagroundwateratlas.**

New breakthrough in tracing river pollution

Scientists are developing a new way to track the origins of phosphorus pollution in our rivers and understand how it behaves once it gets there.

Too much phosphorus in rivers is a big problem. It's one of the most important plant nutrients and excessive amounts can cause explosive growth of algae, killing fish and disturbing complex aquatic ecosystems. If it reaches lakes and the coastal ocean, it can also stimulate giant algal blooms.

But though we know many of our rivers have far too much phosphorus, we still have a limited understanding of exactly where it's coming from.

Knowing more is vital if Britain is to meet the requirements of the EU Water Framework Directive, which says all rivers must be restored to 'good ecological status' – something we're still a long way from. To do this effectively, we need a detailed grasp of the sources of phosphorus – for example, in one river the pollution might be coming from a sewage works, while in another it might be agricultural fertiliser.

NERC-funded scientists have pioneered a new way of finding out by analysing the the oxygen that's joined with phosphorus to form phosphate ions. Phosphate is one of the main forms of phosphorus in waterways, and among the most readily available to aquatic organisms.

Like many elements, oxygen comes in different forms, known as isotopes. They all have the same number of protons and electrons in each atom – that's what makes them oxygen – but hold different numbers of neutrons.

In this case, the scientists adapted techniques used in other fields in order to look at two oxygen isotopes – ^{16}O and ^{18}O. The ratio between the amounts of these isotopes present in phosphate varies depending on where it came from, forming a chemical signature that points to the source of a river's pollution, and lets researchers track it as it moves through the river ecosystem and is taken up by living things. They tested their approach on the River Beult in Kent, where nutrient pollution comes mainly from sewage plants and farms.

'This gives us a new and very precise way to understand the sources of phosphorus in rivers – whether that's sewage works, leaking water mains or fertiliser – and how it's taken up and cycled in the ecosystem once it gets there,' says Professor Daren Gooddy, an environmental chemist at NERC's British Geological Survey who led the research alongside Dr Ben Surridge of Lancaster University. The technique can also enable researchers to understand how pollution levels in a river vary from season to season or even over the course of a single day.

Phosphate river pollution comes from many sources, including outflow from sewage works, farm runoff and leaking mains water. Each source potentially has its own isotopic fingerprint, letting Gooddy and his colleagues understand the sources of a particular river's pollution problems. There are ways to address each of these sources – for instance, installing phosphate stripping at sewage works, or encouraging farmers to change how they manage their land. But these measures can be expensive, and if we don't understand all the sources in a catchment they may not be as effective as anticipated.

For instance, in some places the main source of phosphorus could be natural, coming from the underlying geology. In these cases the way in which farmland is managed may be less important for phosphorus pollution in rivers, and it would be better to target money elsewhere.

NERC provided the initial grant for the research, alongside parallel industrial funding from Yorkshire Water which was interested in the method's potential to improve understanding of the sources of river pollution. Several other potential users of the new method have since come forward, including the Environment Agency and several water companies. Wessex Water has just started funding a PhD student at the University of Bristol, supervised by Gooddy and Professor Penny Johnes, using this method to try to distinguish between natural phosphate sources and historic ones like legacy fertiliser application.

DOI: 10.1016/j.watres.2015.10.046.

A closer look at citizen science

Citizen science projects, in which researchers enlist volunteers' help gathering or analysing data, have shot to prominence in recent years – in part because they're seen as a more cost-effective alternative to professional scientists gathering observations themselves. But there's still a lot we don't know about how well it works in different situations. It could be that it's sometimes a good idea but that in other situations a more traditional approach would work better.

Two new studies commissioned by the UK Environmental Observation Framework try to address this gap in our knowledge. One analyses the economic costs and benefits of doing citizen science, and includes a tool designed to help users understand these issues more clearly. The other looks at the social dimension of what motivates people to get involved with these projects, either as a participant or as an organiser. Together, they offer organisations considering a citizen science approach new ways to think about whether it's right for them, and if so what they need to do to make it a success. You can find out more at **www.ukeof.org.uk**.

Communicating volcano risk

Researchers have created films aimed at reducing volcanic risk in societies threatened by eruptions.

The researchers on the NERC-ESRC-funded Strengthening Resilience in Volcanic Areas (STREVA) project have been working with communities near six volcanoes in Colombia, Ecuador and the Caribbean – volcanoes that are still active and pose a risk to people living nearby.

One set of films were made around the Colombian volcano of Nevado del Ruiz, which killed around 25,000 people when it erupted in 1985 – among the deadliest volcanic disasters of the twentieth century. Most of the victims lived in the town of Armero, around 50km from the volcano, and were killed by lahars – fast-moving volcanic mudflows that were generated when the eruption melted glaciers on the volcano, burying the town under metres of mud and debris.

The team have spent several years collaborating with local partners: the Servicio Geologico Colombiano, the University of Manizales, Red Cross, the UNGRD (National Unit for Disaster Risk Management) and local community representatives, in an effort to understand more about both the physical dynamics of eruptions and the social dynamics of at-risk communities.

This research informed the films. The team wanted to address the challenge of maintaining the social memory of 1985 by involving local people. They had two goals: to raise awareness of the volcano and the threat it poses, and to find out if the process of making the films, and the final product, empowered people to reduce their risk. To do this, they documented oral histories of the events of 1985, recording survivors' memories and telling the stories of their lives since then.

They've just returned from Colombia, where they held public screenings of the films at schools and community centres in five at-risk areas. More than 700 people attended.

Interviews and focus groups before and after the screenings aimed to assess the films' impact on people's knowledge of the volcano and on how they might act in a crisis. The results are still being analysed, but a lot of the early feedback was positive. 'It's been amazing to see how the films have affected people,' says Dr Anna Hicks, a volcanologist with the STREVA project. 'One of the strengths of the films was that the audience could see people from their own communities – in many cases people they knew well, but who they'd never spoken to about the eruption in 1985. Hearing the stories of people they could identify with made it a far more engaging experience for them.'

While the films' main goal was to increase awareness of the volcano's existence and the kinds of danger it can produce, Hicks says many people who saw them have already started to go further and talk about how they could protect themselves more effectively.

You can watch the films at www.youtube.com/user/STREVAProject. The channel also hosts films made by the STREVA team to support volcanic risk reduction efforts in St Vincent.

Anna Hicks, STREVA project