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Q&A

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5th anniversary focus: author Peter Fretwell on penguins and climate change

Peter Fretwell is a senior scientist in the Mapping and Geographic Information Centre, at the British Antarctic Survey.

Peter has pioneered the use of satellite imagery to study polar wildlife such as penguins, walrus, whales, and seabirds; and has authored books on penguins and Antarctic environments.

Peter Fretwell. Credit: British Antarctic Survey

Why did you choose to be a scientist?

I have always loved the curiosity-based science and the feeling you get when finding new things and publishing new research. It is that discovery aspect that really drives me and keeps me interested. Being the first person to see something or work something out really inspires my research. But it took me a while to find my path. I sort of fell into science rather late in my career. It wasn't until my mid-thirties that I published my first paper and not until I was 49 before I got my PhD. I started working at British Antarctic Survey twenty-four years ago, my first post was Temporary Assistant Map Curator, but it was a foot in the door and got me into a great science organisation with inspiring people and a long history of discovery. Since then, I have worked my way up through a number of posts until now I am a senior scientist with my own internal research group. But it is still that sense of wonder and excitement that you get from a new discovery that inspires me.

What scientific development are you currently most excited about?

I am a remote sensing scientist by trade, so for me the most exciting thing in the pipeline are the new Earth observation satellites that are being launched. Over the last decade or two, these satellite platforms have been getting more powerful with better resolution, faster return rates, and more capable sensors.

There are plans to launch 10 cm resolution optical commercial satellites and sub metre thermal satellites and we have recently had a number of high-resolution Synthetic Aperture Radar (SAR) platforms launched. These open up huge new research areas. Mix those new satellites with the increasing ability of AI to automate analysis and our ability to incorporate "big data" and the Earth observation field will be an obvious growth area in coming years. The Polar Regions, which I work on, are changing at an unprecedented rate, so the need for remote sensing is urgent. In many cases, the environment and ecology are changing without us even noticing it.

What direction do you think your research field should go in?

Environmental remote sensing has traditionally looked at things on a coarse spatial scale – habitat mapping, vegetation and land-use are classic examples. That is mainly because in the past, the spatial resolution of the satellite sensors has been fairly coarse. But with a move to higher spatial resolution, we can actually monitor individual animals rather than estimate them by mapping their habitat. With the number of new satellite-platforms, the huge amount of data gives massive scope for a revolution in Earth Observation. To do that effectively we need automation and that means AI and Machine Learning. That automation is one of my group's focus areas. The AI landscape is fast moving and keeping up with it means collaborating with experts in the field. Those interdisciplinary collaborations between AI experts, remote sensors and ecologists will be key to taking the science forwards.

What do the next 5 years look like for Earth and Environmental science?

It's the twin challenge of incorporating massive technological improvements, but with an ever-increasing need. The three challenges of Climate Change, Habitat Destruction and Pollution are pushing more species towards extinction, and we know that with climate change it is going to get a lot worse before it gets better. We need to be able to detect, monitor and communicate the effects that the changing planet is having on our ecosystems and species to inform the public and policy makers to make the changes needed.

On the other hand, there are the funding and political challenges that we have seen recently that make the future suddenly look so unsure. With cuts to environmental science budgets in many nations and political upheavals, keeping our eye the environmental needs and opportunities, rather than fire-fighting those problems will be key to the next five years.

Tell us about the journey you've been on since publishing with *Communications Earth & Environment*.

Our paper[1] on the catastrophic breeding failure of emperor penguins had massive impact – from the metrics I have read, of all 370,000 papers published in the last two years, that paper was ranked 36th highest impact. That is all research globally in all academic journals in the 99.9% of impact. It has certainly opened doors and got lots of people talking about climate change and penguins. For me, the paper has helped with several funding bids and engagements, and I have published another paper in the journal earlier this year.

Has geographical location influenced your experience in science?

I'm employed by the British Antarctic Survey, that means that most of my research is Polar. It's not always Antarctica; I often work on species in the Arctic and have published papers on walrus and beluga whales and done fieldwork in Svalbard, although it's fair to say that most of my research is in the Southern Ocean and Antarctic region. Being in Cambridge is also a great benefit.

Our institute is a government research institute, but having Cambridge University on our doorstep makes a difference. We have had many collaborative projects especially with the Cambridge Maths and Image Analysis Departments, who have a depth of knowledge and experience in AI. On a larger scale being in the UK helps too, the research scene is always vibrant and collaborative and there is a genuine buzz about environmental science.

Do you think your field needs changes to bring more inclusion? If yes, what could they be?

Yes, there are certainly things that we can do to help bridge the inclusion gaps. Over the last couple of decades, we have seen great leaps forward in gender inclusion in our field in the UK, but we still need to address other types of social inclusion that are obvious. Environmental science is still very white, middle class, and does not always reflect the general population. From what I can see, it seems to be a cultural thing rather than a specific recruitment bias- we just are not attracting a diverse range of recruits from other social and cultural backgrounds. Maybe other cultures do not see environmental science in the same way or are driven by other motives than what science and the environment can give them. So, balancing the inclusion will be problematic and take time. There have been several good initiatives to help, and we must keep trying to open those doors and make our science attractive to the whole range of groups and cultures.

Have you had any setbacks in your career - how did you handle them and what did you learn from them?

One thing I have learned is that you need to have a thick skin to be a scientist. Publishing papers, writing research grants, planning challenging fieldwork; all of them can lead to knock backs. Sometimes reviews of your papers can seem quite personal and be hard to take. I've had reviews that say that a particular paper should never be published. And big grants, that you'd put months' worth of effort that were cancelled at the last minute, when you thought that you had them in the bag. But what experience tells you is that there is always another paper, always another grant opportunity or project. It's hard not to get emotionally involved with your research, but sometimes you have to just take the hit and move on. That is really tricky when you are an early career scientist, when each paper means more.

One particular challenge I had was when I was doing my Master's degree. I have a field site in Scotland on a cattle farm where I was supposed to collect all my field data. I'd only been there for two days when Mad Cow disease hit Scotland. In a panicked phone call my supervisor instructed me to get out immediately or I would be quarantined. When I got back to the university I was stuck several months into my year's course with no data and a cancelled project. Some people advised me to wait it out, but the quarantine lasted for a year. Luckily, I was able to change my research from a field project to a modelling study, based on existing data. On the way, I learn new analytical skills like GIS which stood me in good stead for my future career. Without that change I would never have ended up where I am now.

This interview was conducted by the editors of Communications Earth & Environment.

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Reference

1. Fretwell, P. T., Boutet, A. & Ratcliffe, N. Record low 2022 Antarctic sea ice led to catastrophic breeding failure of emperor penguins. *Commun. Earth Environ.* **4**, 273 (2023).