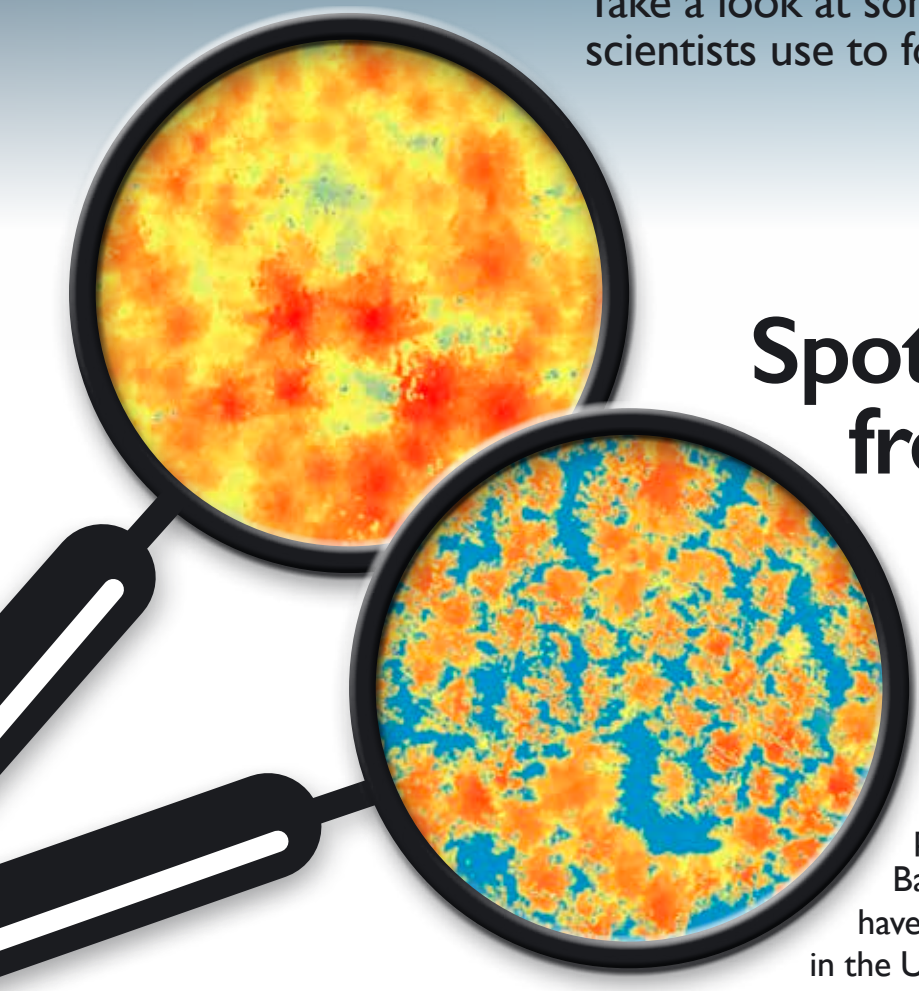
Biodiversity detectives!

Take a look at some of the amazing techniques scientists use to follow nature's clues.



Spotting sick trees from the sky

Lidar, short for 'light detection and ranging', generates precise 3D maps of the Earth's surface using pulses of laser light. Professor Heiko Balzter at NERC's National Centre for Earth Observation (NCEO) and postgraduate NERC researcher Chloe Barnes at the University of Leicester have been using it to spot individual trees in the UK affected by a destructive disease. Janet Fillingham at NCEO found out more.

Above: Lidar images showing a healthy section of forest (top) and an infected area (bottom). Shorter areas are shown in blue suggesting where tree tops have died back.

Find out more about this and other Earth observation science at www.nceo.ac.uk and follow NCEO on Twitter @NCEOscience.

To create these superbly detailed maps of the heights of tree canopies, the team worked with an aerial mapping company called Bluesky.

They were looking for an invasive disease, *Phytophthora ramorum*, sometimes called larch disease, that causes extensive damage to a number of different trees, including larch, oak and rhododendron, often killing them. The disease was first discovered in the UK back in 2002 and has now spread to sites spanning from Cornwall to Scotland, causing destruction to larch trees in much-loved areas including Epping Forest and the Forest of Dean.

One of the symptoms is that branches at the top of a tree die back, making it shorter. That change in height means scientists have been able to use Lidar to spot it from the air.

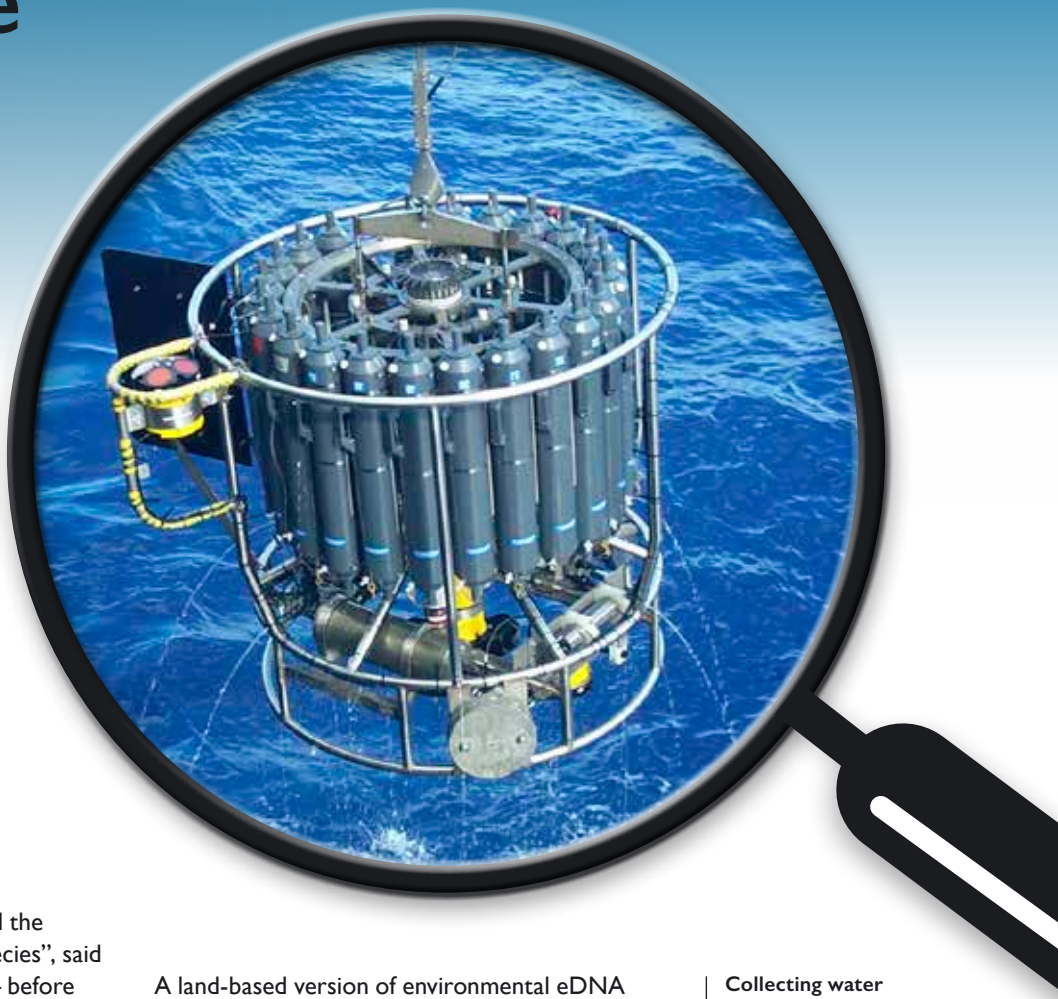
The origins of the disease are not known precisely but it's likely that it has been accidentally introduced to the UK from somewhere in Asia via the European continent. Heiko said it's important to find better ways of detecting infected trees so they can be dealt with more quickly, stopping the disease spreading: "Invasive tree diseases pose a huge threat to Britain's forests. Infections can wipe entire tree species from our landscapes within a few years."

Drier summers and wetter winters caused by climate change make trees less able to cope with disease, increasing the risk of their spread across the UK.

Chloe, who led this work, said: "Current trends suggest that UK forests and woodlands are subject to a greater threat from exotic diseases than ever before. Lidar provides information on canopy height, tree density and crown dimensions, which we have proved can be used to inform forest inventories."

What's the ocean's DNA?

A new technique could revolutionise how we assess and monitor our seas. It's been used on land and now scientists are finding out whether it will work at sea. Science writer Kelvin Boot dives in with Professor Willie Wilson, Director of the Sir Alister Hardy Foundation for Ocean Science.



Collecting water samples for processing and analysis.

Environmental DNA (eDNA) "can reveal the habitats of the Earth's most reclusive species", said Willie. And that's extremely important – before governments can start putting in conservation measures to protect rare and endangered species, scientists have to gather evidence about the habitats they rely on, the areas they move through and, most importantly, whether or not they actually live there.

eDNA successes

- **Scientists are probing forest elephant dung in Ghana to get population estimates of these enormous, but retiring, creatures.**
- **Poo samples are being used to see whether the long-beaked echidna still exists in Western Australia, hundreds of years after it was thought to have become extinct.**
- **A rare salamander, the olm – known locally as a 'baby dragon' – has been located in underground cave systems in Slovenia and Croatia, without a single one being spotted.**

A land-based version of environmental eDNA has been shown to work and we can now see where an animal has been from just the smallest samples of cells. On land we can collect cells from samples of poo, slivers of shedded skin and other 'remains'. But whole cells are difficult to find in the ocean and new research off the coast of Plymouth, led by Willie, is looking for DNA that's shaken loose from its cells and is floating free.

Unlike the cells around DNA, which tend to degrade quickly, sink or get eaten, DNA breaks down at a consistent rate, so it should be relatively straightforward to tell how old it is. By knowing its identity and age, and details of local currents, we can conduct detailed analysis of what there is, how long ago it was there and whether it's local or just passing through.

"Less than a pint of water can contain traces of many thousands of species," said Willie. We're trying to find how reliably we can use the footprints marine life leaves behind when taken from the unforgiving waters of the ocean," said Willie. "If the technique works here, it should work anywhere in the world. We could use it as a tool for a huge range of things such as detecting potential diseases in fisheries, for conservation and assessing the risk of toxic algal blooms."

The MARINe-DNA project brings together scientists from: The Sir Alister Hardy Foundation for Ocean Science, Plymouth Marine Laboratory, The Marine Biological Association, The National Oceanography Centre and the University of Exeter.