

“Baa / ribbit – what a scorcher!”

The incredible case of the dying frogs and the shrinking sheep. Whodunnit – climate change you say?

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As many of you are no doubt aware, the climate is changing, the world is getting hotter, and our cheap holiday flights are just as much to blame as all those polluting industries. The most recent IPCC report tells us these climate changes could lead to the extinction of up to 30% of all plants and animals. An appalling projection, no doubt, but even if the world is not stripped of one third of its biodiversity, several less dramatic changes are certainly in store. Even if they're gradual enough that we don't notice them, over time they will probably have a serious influence on the lives of the remaining species.

Dr Tim Coulson, from Imperial's Division of Biology, says that global warming is leaving an evolutionary signature in the planet's species: “We are probably changing patterns of selection and this could

well result in small-scale evolutionary change”. Some of these changes are described in a paper he published in the journal *Science*, together with researchers from the Universities of Cambridge, Edinburgh and Stanford. They studied a population of Soay sheep in the Outer Hebrides, and found evidence that temperature influences the size of the animals.

In a warmer environment, it seems there is less of an advantage to being a large sheep – it doesn't matter so much if the animal is smaller. After several generations, the result is a general reduction in body size. With this paper, scientists were able to prove that climate change can alter genetic characteristics.

Some animals' behaviour is also modified, explains Dr Coulson. “On the island of Rum, we have seen red deer giving birth to their calves earlier in the year. There are probably many other such changes, but in



Amphibians are at risk from the Chytrid fungus, which affects their skin's ability to absorb water. As climate change raises temperatures, the fungus' spread may threaten many species with extinction

order to pick them up you need detailed individual-based data – and such data are rare.” While all living beings do their best to adapt to the new conditions, in some cases they don't have anywhere to run. Quite literally. “While animals and plants have adapted to past climate shifts by moving to more suitable habitats, their options are now much more limited because of the conversion of so many ecosystems to uses such as cities and intensive agriculture” says Ahmed Djoghlaif, head of the Convention on Biological Diversity, in a column on the BBC website.

But shrinking mammals and altered mating schedules won't be the only consequence of climate change. There's also a fungal disease, deadly to amphibians, which will thrive in the hot weather. According to Dr Matthew Fisher, from Imperial's department of Epidemi-

ology, contamination by the fungus *Batrachochytrium dendrobatidis* (Bd) is nothing less than one of the most potent threats to biodiversity yet discovered.

Last year, researchers from Imperial College and two Madrid Institutions proved that the increase in temperatures is responsible for the virtual extinction of the midwife toad in a mountain region of Spain. They showed that 26 years of increasing temperatures led to the emergence of the chytrid fungus Bd in the area. The disease affects the ability of amphibian skin to absorb water and is causing a huge number of deaths among frogs, toads, salamanders and newts worldwide.

“This is a wake-up call that we are losing biodiversity fast,” said Dr. Fisher. “Climate change appears to be changing patterns of disease and previously resistant species are be-

coming highly infected – even, in a number of cases, becoming extinct.” The Global Amphibian Assessment has warned that a third of the world's amphibian species are in danger of extinction, many because of the chytrid fungus.

We are already changing diseases and evolutionary patterns, and nobody knows exactly what the results will be, but it's likely the effects will be more widespread than we can imagine. “As the Millennium Ecosystem Assessment pointed out in 2005, reduction of biodiversity implies a threat to services as basic as the provision of food, fibre, medicines and fresh water, the pollination of crops and protection from flooding,” warns Ahmed Djoghlaif. It will be a very different world – here's hoping we're one of the species which are able to adapt, to witness what we've unleashed..



A Soay sheep. Baa. Warmer climates mean larger sheep don't enjoy an especial evolutionary advantage, so average sheep size diminishes.