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Animals 'predict' earthquakes – new study

Scientists capture significant changes in behaviour as seismic activity increases

Scientists have, for the first time, been able to capture and document how the behaviour of wild animals changes prior to an earthquake – a development which may help with short-term seismic forecasting.

The study, led by Dr Rachel Grant of Anglia Ruskin University and co-authored by Professor Friedemann Freund of NASA and Professor Jean-Pierre Raulin of the Centre of Radio Astronomy and Astrophysics Mackenzie (CRAAM) in Brazil, is published by the journal *Physics and Chemistry of the Earth*.

Previously, scientists had relied on anecdotal evidence of changes in wild animal behaviour. In the new study, the scientists used data gathered from a series of motion-triggered cameras located in the Yanachaga National Park in Peru.

The research found that significant changes in animal behaviour began 23 days before the magnitude 7.0 Contamana earthquake struck the region in 2011.

On a typical day the cameras would record between 5-15 animal sightings. However, within the 23-day period in the run-up to the earthquake, they recorded five or fewer sightings. And for five of the seven days immediately before the earthquake, no animal movements were recorded at all, which was incredibly unusual for this mountainous rainforest region.

At the same time, by recording the reflection of very low frequency (VLF) radio waves above the area surrounding the epicentre, the scientists detected disturbances in the ionosphere, which started two weeks before the earthquake. A particularly large fluctuation was recorded eight days prior to the quake, coinciding with the second significant decrease in animal activity observed in the pre-earthquake period.

Prominent among the most likely causes for the unusual animal response are positive airborne ions, which are known to be generated in large numbers at the earth's surface when rocks deep below are subjected to increasing stresses during the build-up to an earthquake.

Positive ions in the air lead to disagreeable side effects in animals and humans, such as "serotonin syndrome". This is caused by an increase in the serotonin levels in the bloodstream, and can lead to symptoms such as restlessness, agitation, hyperactivity and confusion.

Therefore the injection of positive airborne ions into the earth's atmosphere prior to major seismic activity can be expected to have a profound effect on mammals and birds, in particular those living on the ground and in burrows. At the same time, if this process occurs on a massive scale and over a wide area, the ionosphere can be affected.

Dr Rachel Grant, Lecturer in Animal and Environmental Biology at Anglia Ruskin University, said: "As far as we know, this is the first time that motion triggered cameras have documented this phenomenon prior to an earthquake.

"The results are particularly interesting as we also found evidence of disturbances in the ionosphere in the area where the earthquake struck. We believe that both of these anomalies arise from a single cause: seismic activity causing stress build-up in the earth's crust, leading – among other things – to massive air ionisation.

"We hope our work will stimulate further research into this area, which has the potential to help with short-term seismic risk forecasting."

Professor Friedemann Freund, of NASA's Ames Research Centre in California, added: "The camera traps were located on a ridge at an altitude of 900m. If air ionisation occurred, it is likely that it was particularly strong along such a ridge. Hence, the animals would have escaped to the valley below, where they were exposed to fewer positive airborne ions.

"With their acute ability to sense their environment, animals can help us understand subtle changes that occur before major earthquakes. These changes, that we are now able to measure, express themselves in many different ways at the earth's surface and above."

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Notes to Editors

Anglia Ruskin University

- Anglia Ruskin is a modern, global university with 35,000 students from 177 countries studying with us across four continents.
- 12 of our research areas across our five faculties were classed as world-leading by the Research Excellence Framework (REF) 2014.
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- We have three main campuses, in Cambridge, Chelmsford and Peterborough.
- Anglia Ruskin University is the *Times Higher Education's* Entrepreneurial University of the Year.

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