Seabird guano releases more ammonia at tropics

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Seabird guano emits more ammonia into the atmosphere in warmer and wetter climates, scientists have found.

A new study, published in *Atmosphere Environment*, shows for the first time how the climate interacts with nitrogen in layers of guano droppings on the ground.

To investigate this, the researchers studied how much ammonia is emitted from seabird excreta around the world. Some ammonia in the atmosphere is produced by bacteria metabolising nitrogen and water in soils and these manures.

Seabird's diets are rich in nitrogen from the marine plant life and fish they eat. This nitrogen is often excreted across a huge area near their

nesting sites. In dry climates the guano at these sites builds up over time and creates a nitrogen-rich material that is often mined for fertiliser.

But over time the nitrogen in the guano breaks down to form ammonia, which is released into the atmosphere.

The international team visited two large colonies of seabirds; one at Ascension Island in the southern Atlantic and another at Michaelmas Island, off the south coast of Australia, to measure both the ammonia emissions and environmental conditions.

'Ammonia emissions were much higher in the warmer climates, as the uric acid changes to form ammonia and is then released into the atmosphere much more quickly,' says Dr Stuart Riddick of King's College London and the NERC Centre for Ecology & Hydrology (CEH), lead researcher of the study.

Despite being similar temperatures at the two sites, the team found that 67 per cent of the nitrogen in the guano on Michaelmas Island was emitted as ammonia, compared to just 32 per cent at Ascension Island.

'Although both Ascension and Michaelmas Islands are a very similar temperature, Michaelmas is much wetter,' Riddick says. 'The more frequent rain events mean ammonia emissions are a lot higher. The bacterial ammonification of uric acid requires water to work, so the emissions were much lower on Ascension.'

If scientists understand how fertiliser interacts with climate, they can build computer models that show how much ammonia is given off in different climates from a range of manure and synthetic fertilizers, which will help improve knowledge of the nitrogen cycle under different environmental conditions.

'If you put fertiliser on a field in central Africa, we need to know if it will react differently, compared with, for example, under UK conditions. This will help us predict the emissions much better and subsequent effects of the ammonia on ecosystems and the atmosphere, which is not well understood at present,' says Riddick.

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