MSU professor's research on bacteria's role in precipitation cycle

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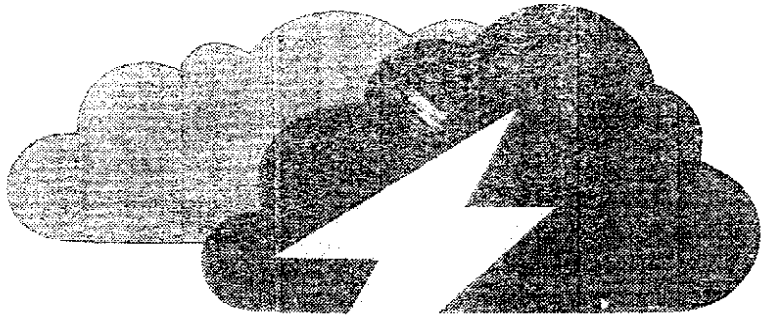

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BOZEMAN - A Montana State University professor and his colleagues have found evidence suggesting that airborne bacteria are globally distributed in the atmosphere and may play a large role in the cycle of precipitation.

The research of David Sands, MSU professor of plant sciences and plant pathology, along with his colleagues Christine Foreman, an MSU professor of land resources and environmental sciences, Brent Christner from Louisiana State University and Cindy Morris, will be published today in the journal "Science."

These research findings could potentially supply knowledge that could help reduce drought from Montana to Africa, Sands said.

Sands, Foreman, Morris, and Christner – who did post-doctorate work at MSU – examined precipitation from locations as close as Montana and as far away as Russia to show that the most active ice nuclei are actually biological in origin. Nuclei are the seeds around which ice is formed. Snow and most rain begins with the formation of ice in clouds. Dust and soot can also serve as ice nuclei. But biological ice nuclei are different from dust and soot nuclei because only these biological nuclei can cause freezing at warmer temperatures.

Biological precipitation, or the "bio-precipitation" cycle, as Sands calls it, basically is this: bacteria form little groups on the surface of plants. Wind then sweeps the bacteria into the atmosphere, and ice crystals form around them. Water clumps on to the crystals, making them bigger and bigger. The ice crystals turn into rain and fall to the ground. When precipitation occurs, then, the bacteria have the opportunity to make it back down to the ground. If even one bacterium lands on a plant, it can multiply and form groups, thus causing the cycle to repeat itself.

"We think if (the bacteria) couldn't cause ice to form, they couldn't get back down to the ground," Sands said. "As long as it rains, the bacteria grow."

The team's work is far-reaching. Sands and his colleagues have found the bacteria all over the world, including Montana, California, the eastern U.S., Australia, South Africa, Morocco, France and Russia.

The team's research also shows that most known ice-nucleating bacteria are associated with plants and some are capable of causing disease.

"Bacteria have probably been around for a million years," Sands said. "They live on the surface of plants, and may occasionally cause plant disease. But their role in rain-making may be more important."

Indeed, the implications of a relationship between rain and bacteria could be enormous, though they are yet to be proven, Sands said.

For example, a reduced amount of bacteria on crops could affect the climate. Because of the bio-precipitation cycle, overgrazing in a dry year could actually decrease rainfall, which could then make the next year even dryer.

"Drought could be less of a problem once we understand all of this," Sands said.

Sands, who earned a doctorate in pathology and bacteriology from the University of California-Berkeley, proposed the concept of bio-precipitation approximately 25 years ago, but few people believed him.

Since that time, he said, better tools have changed the research climate, because new DNA technology allows researchers to distinguish the bacteria, and giant computers allow people to do meteorological studies with satellites.

"It's fun to see something come out after 25 years," Sands said, "particularly when we knew back then it was true."

More studies must be done, though, because questions remain. For example, since the bacteria do not grow above 84 degrees, precipitation could be affected if the world's weather creeps up and reaches a cut-off point, Sands said. The researchers are also examining the bacteria to find out if they vary by region.

At any rate, a diverse group of people should be interested in the research, because bio-precipitation could affect many things.

"I want people to be fascinated by the interconnection of things going on in the environment," Sands said. "It's all interconnected."