Researcher finds life flying high above

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For years, scientists have been tracking pollution that travels across the jet stream from Asia and measuring how much of it winds up in Northwest air. Now new work from University of Washington researchers shows it's not just specks of heavy metals or gases that make the long journey here from China or Russia. Some of the world's smallest life-forms, including bacteria and fungi, do as well.

That phenomenon will help scientists better understand how some life-forms survive what may well be the planet's most extreme environment.

"It's fun finding life in unusual places," said study author and former astrobiologist David Smith, who left the UW in December to take a job with NASA. "Something big is happening here. The biggest gap in the planet (the Pacific Ocean) is not big enough to prevent the regular exchange of biota."

Using a research station high on Oregon's Mount Bachelor, Smith and several other UW researchers for the first time were able to extract enough DNA to trace more than 2,100 different microbial species that had traveled on two separate dust plumes to the Northwest from Asia.

Most of those microorganisms were species typically found at ground level, and arrived dead. Some were marine life commonly associated with hydrothermal vents near Japan. Others were extremely common in soil. None were harmful to humans.

But some were of a type that form spores or protective covering that

might allow them to travel well at high altitudes.

"People shouldn't be paranoid that there are bugs up there," said Noah Fierer, a microbial ecologist at the University of Colorado. "We've known for a long time that they are there. There's nothing bad or scary about it. But we need to do a better job of figuring out how organisms get into the atmosphere and where they are coming from."

Researchers more than a century ago could capture bacteria from the atmosphere on petri dishes. But only in the past five years have scientists really begun to understand the diversity of microbes in the atmosphere and the factors that influence what is found there.

In fact, the upper atmosphere may well be the least understood ecosystem on Earth - if, in fact, it's an ecosystem at all. At 20,000 feet it's exceptionally dry and temperatures can reach 40 degrees below zero. Ultraviolet radiation is extensive.

"It appears, based on our evidence, that almost everything in the atmosphere is dormant," Smith said. "It's persisting and enduring, but it's not 'making a living' - it's not replicating, harvesting nutrients or growing because it's so cold, so dry and so irradiated. Everything just shuts down. Is that an ecosystem? It's an argument about semantics."

Dan Jaffe, a professor at UW-Bothell, has been tracking high-altitude transport of pollution from Asia for years, and has been able to follow atmospheric patterns and see changes over time.

Some pollutants, like ozone, have crept up regularly since 2004 with the explosive industrial growth in China.

"The amount of anthropogenic pollution is increasing very fast, so much of it is being observed here," said Hilkka Timonen, a scientist working

with Jaffe's group. "Climate change is also probably changing the transport patterns of air masses."

But it's not at all clear how much, if any, of what Smith observed is new.

Certain bacteria and fungi likely have always traveled to the Northwest from Asia. Have growth and development on the other side of the globe increased the transport of such bacteria?

Could a global population boom, climate change or other human-sparked changes mean that disease-causing viruses or other harmful microorganisms someday will arrive in the Northwest via the jet stream?

It is far too early to tell.

"We live on a microbial planet; microbial diversity is enormous," Smith said. "There's no comparison: There are more types of microorganisms than there are any other type of life-form. There are thousands and thousands and thousands of unique species. Every day we discover new species, and we understand only a few that are out there."

In the meantime, Smith and other researchers will use this work to help boost science's understanding of life beyond traditional views of the earth, sea and sky.

"NASA's interest in this is in trying to understand life in harsh environments," Jaffe said. "Why did one bug up there survive when others died? What kills one thing and not another? Can we use this as a model to better understand Mars?"