U.S. must unify atmospheric biology research or risk national security, scientists say

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Zotino Tall Tower Observation Facility (ZOTTO) and its surrounding forests in central Siberia. Credit: Photo courtesy of Anastasia Makhnykina, Sukachev Institute of Forest, Krasnoyarsk, Russia.

Global circulating winds can carry bacteria, fungal spores, viruses and pollen over long distances and across national borders, but the United States is ill-prepared to confront future disease outbreaks or food-supply threats caused by airborne organisms, says a new paper published in the Ecological Society of America's journal *Ecological Applications*.

Claire Williams, the paper's primary author and a research professor at American University, has spent decades studying long-range transport of tree pollen. Her early findings led to collaborations with German and Russian scientists who conducted a wide range of research—on forest genetics, atmospheric chemistry and climate change—all under the unifying theme of atmospheric biology.

"The more I learned about pollen aloft, the more I came to understand that pollen is part of a large airborne milieu of what I call 'aerial plankton'—bacteria, fungi, lichen soredia [reproductive structures], insect parts, viruses and more," said Williams.

Zotino Tall Tower Observation Facility (ZOTTO) and its surrounding forests in central Siberia. Photo courtesy of Anastasia Makhnykina, Sukachev Institute of Forest, Krasnoyarsk, Russia.

Now, having seen the highly integrated and well-funded atmospheric biology research underway in Germany and Russia, Williams wants U.S. leaders to understand the value of atmospheric biology to national security—and recognize that the United States is coming up short.

An aerial view from the Aircraft Bioaerosol Collector 2 (ABC-2) science flight in the lower troposphere over the Sierra Nevada mountain range in June 2018. Credit: Photo courtesy of NASA.

The persistent threat of Valley Fever is one example of how well-coordinated research is critical when responding to threats. Valley Fever is caused by the inhalation of *Coccidioides* fungus, which lurks in hot, dry soils of the southern United States. Monitoring and mitigating outbreaks requires an understanding of land use, meteorology and human risk factors. And because fungus spores, bacteria and pollen do not obey borders or boundaries, responding to diseases like Valley Fever can also require international collaboration and diplomacy.

An aerial view from the Aircraft Bioaerosol Collector 2 (ABC-2) science flight in the lower troposphere over the Sierra Nevada mountain range in June 2018. Photo courtesy of NASA.

In the United States, research and monitoring of airborne organisms is

split between an array of federal agencies. The Department of Agriculture monitors airborne pathogens that threaten food supply, the Department of Defense oversees biological warfare agents such as anthrax, the Center for Disease Control studies human-health impacts of airborne pathogens, and additional contributions to atmospheric biology research are spread across the National Institutes of Health, United States Geological Survey, National Aeronautics and Space Administration, National Science Foundation, Department of Energy and National Oceanic and Atmospheric Administration.

While it makes sense for each department or agency to carry out research relevant to its responsibilities and interests, the lack of coordination and information-sharing can effectively cripple the U.S. response to national security threats, such as pandemics, that require cooperation and input from multiple agencies.

"The time has come—after all, pandemics are caused by airborne viruses and a host of airborne pathogens, pests and parasites," said Williams. "If we pieced together the expertise that we do have in a host of U.S. science agencies, we would be better prepared for the next pandemic or disease outbreak."

More information: Claire G. Williams et al, Unifying atmospheric biology research for the U.S. scientific community, *Ecological Applications* (2020). DOI: 10.1002/eap.2275

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