Carbon expert brings mission-focused, team approach to addressing climate change

Research, Innovation and Impact
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Riley Duren packed his bags in September and moved on from a 30-year career at NASA to join the University of Arizona's interdisciplinary team of climate change experts, tasked with accelerating solutions to climate challenges.

With experience as a founding member of NASA's Carbon Monitoring System and chief engineer for the earth science program at its Jet Propulsion Laboratory, Duren hopes to establish a carbon center on campus to provide actionable data on carbon emissions and expand the University's existing work on climate change. Reporting directly to Elizabeth "Betsy" Cantwell, senior vice president for research and innovation, Duren serves as a research scientist for the Office for Research, Innovation and Impact [1].

"Barriers to climate action include limitations in measurement and mitigation technologies and economics, as well as institutional and cultural challenges," Duren said. The framework of Research, Innovation & Impact, "with its emphasis on building relationships among the University, federal labs like JPL, private-sector companies and government decision-makers, will allow us to assemble the right team to make a real impact."

Aside from working with faculty to establish a carbon center, Duren has set two specific goals for himself: continue to develop methods to provide actionable carbon emissions data to decision-makers and build a public-private partnership to develop an operational satellite constellation for continuous global carbon and ecosystem monitoring. He focuses on carbon because the top two human activity-generated greenhouse gases responsible for global warming - carbon dioxide and methane - are both carbon molecules.

"There are two general kinds of decisions to make about climate change," said Duren, who maintains a continuing joint appointment at JPL, "mitigating greenhouse gas emissions and adapting to a changing world. Both are necessary, but one is proactive and the other is reactive."

One problem, Duren said, is many of the traditional science and engineering disciplines, research institutions and funding agencies are not configured to respond to the rapid pace of climate change. He hopes calls for a new multidisciplinary, mission-focused approach to enable faster, effective climate action will accelerate the search for solutions.

In a paper published in the Nov. 6 issue of Nature [2], Duren and his co-investigators demonstrated just how big an impact actionable data can make on mitigation efforts. Duren's team detailed the results of the California Methane Survey, which detected, geolocated and quantified major methane emissions from oil and gas sector facilities, dairy manure management, landfills and composting facilities, wastewater treatment plants, gas-fired power plants, and liquefied and compressed natural gas facilities. Using airborne remote sensing, the
team was able to pinpoint that 0.2% of facilities in the state are responsible for at least a third of California's methane budget [3], and in some cases reported the data to facility operators who were then able to repair leaking equipment.

"We hope to extend the work done in California by developing the strategies, technologies and methods for monitoring greenhouse gases at all scales ? everything from an oil and gas wellhead to a city to a nation-state. Those efforts already involve pilot programs in the U.S. and around the world and, once scaled up, can help both mitigation and adaptation efforts."

To truly make an impact on both mitigation and human adaptation to climate change, monitoring needs to be operational ? a term of art in the satellite business that means it's always there, it's always on, it's robust to failures, and decision-makers can count on it for reliability. Think GPS or weather satellites.

"To create a satellite program for global, operational carbon and ecosystem monitoring, we're working on a public-private partnership involving a satellite land imaging company and philanthropists seeking to accelerate climate action," Duren said.

The idea is to combine the University's vision and capabilities with advanced NASA remote sensing technology and the "new space" capabilities from satellite companies like Planet Labs to provide data sets for decision-makers. The technology used in this program can provide high-resolution information about Earth's atmosphere and surface, including methane and carbon dioxide emissions, as well as the health of terrestrial and aquatic ecosystems and coral reefs. With global data sets like those Duren envisions, decisions about mitigation, adaptation and conservation can be based on quantitative information in near real time.

"But it's not enough to make better measurements," Duren said. "The bigger impact will likely involve a multidisciplinary approach to interpret the data, educate the public, and advise decision-makers ? a process that brings together natural scientists, engineering and built-system experts like urban planners, as well as social scientists and policymakers."

That's where the carbon center comes in. The biggest roadblocks to addressing climate change aren't limited to technology or economics, Duren said. They're about institutions and cultures. Because the University of Arizona is already a recognized leader in climate adaptation and water resource management, and given its mission as a land-grant university, he said it's the logical place to take the next step and build a home for a comprehensive approach to tackling a challenge as pressing as climate change.

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