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AI-CLIMATE institute aims to curb emissions, boost economy

By Tom Fleischman, Cornell Chronicle

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Cornell is one of six universities receiving a total of $20 million over five years from the National Science Foundation and the U.S. Department of Agriculture's National Institute of Food and Agriculture to form an institute aiming to create more climate-smart practices that will curb U.S. greenhouse gas emissions, while boosting the economy in the agriculture and forestry industries.

The AI Institute for Climate-Land Interactions, Mitigation, Adaptation, Tradeoffs and Economy (AI-CLIMATE) – to be led by the University of Minnesota, with Shashi Shekhar, professor of computer science and engineering, serving as principal investigator (PI) – is one of seven new **NSF- and USDA-NIFA-funded AI Institutes** (https://new.nsf.gov/funding/opportunities/national-artificial-intelligence-research) announced May 4. The institute is part of a larger federal initiative, totaling nearly $500 million, to bolster collaborative AI research across the country.

Of the $20 million in grants over five years, Cornell will be receiving $6 million – with $3.5 million going to the College of Agriculture and Life Sciences (CALS) and $2.5 million going to the Cornell Ann S. Bowers College of Computing and Information Science (Cornell Bowers CIS).

In addition to Cornell and Minnesota, AI-CLIMATE institutions include Colorado State University, Delaware State University, North Carolina State University and Purdue University.

AI-CLIMATE'S co-PIs from Cornell will be **Johannes Lehmann** (https://cals.cornell.edu/johannes-lehmann), the Liberty Hyde Bailey Professor in the School of Integrative Plant Science (CALS) and co-director of the institute (with Shekhar and forestry expert Keith Paustian of Colorado State); and **Carla P. Gomes** (http://www.cs.cornell.edu/gomes/), the Ronald and Antonia Nielsen Professor of Computing and Information Science (Cornell Bowers CIS).

A total of 15 Cornell researchers are inaugural members of AI-CLIMATE; the hope is to expand the institute, with Cornell researchers joining planned efforts and initiating new ones.

A public introduction and invitation (https://events.cornell.edu/event/cida_seminar-_ai-climate_institute_at_cornell_advancing_climate-smart_agriculture_through_artificial_intelligence) to the institute is scheduled for May 8, noon to 1 p.m., in G01 Biotechnology Building. Lehmann, Gomes and Shekhar will invite the

Cornell community to help shape the institute and its plans for the next five years and beyond. The seminar will also be available on Zoom; **registration is required** (https://cornell.zoom.us/meeting/register/tJIsd-2urTIiHdPB762wJRBsPZMeioAMnHVR#/registration).

Lehmann, whose research focuses on **soil biogeochemistry** (https://news.cornell.edu/stories/2020/12/scientists-map-soils-potential-combat-climate-change) and soil fertility management, said the institute should serve as a hub for discovery by a wide range of researchers.

"Computer scientists and engineers should talk with soil scientists and earth scientists and plant scientists," he said. "And we should talk with farmers and industry and policymakers. That's a tall order, because we all speak different languages, so I think the most exciting task will be to develop a common understanding, a common language, common goals, and align our ways of working."

Lehmann, a recent electee into **the National Academy of Sciences** (https://news.cornell.edu/stories/2023/05/four-cornell-elected-national-academy-sciences), hopes the institute will spawn a new way of thinking about and researching climate issues – "a community of practice that goes beyond academia … and that will do business differently for having been part of this institute."

Gomes, **who pioneered the field of computational sustainability** (https://news.cornell.edu/stories/2021/03/computational-sustainability-trailblazer-honored) and co-directs the **Cornell AI for Science Institute** (https://science.ai.cornell.edu/), said AI can be an integral part of solving the climate crisis.

"AI can help scale up solutions to tackle the tremendous challenges associated with climate-smart ag and forestry practices," she said. "For example, AI can help by optimizing carbon sequestration, aiding in adaptation measures and identifying effective mitigation strategies."

She noted that AI could help develop multi-objective decision-making approaches, that will consider viable tradeoffs – **her work on the Amazon River basin** (https://news.cornell.edu/stories/2022/02/ai-enables-strategic-hydropower-planning-across-amazon-basin) with biologist **Alex Flecker** (https://ecologyandevolution.cornell.edu/alexander-s-flecker) is an example of this approach – and strategies that can maximize economic value while minimizing negative environmental impacts.

The institute will be integrated into a wide array of cutting-edge climate work happening across Cornell.

"AI-CLIMATE is a powerful example of Cornell's universitywide mobilization to support climate solutions," said Ben Furnas, executive director of **The 2030 Project: A Cornell Climate Initiative** (https://climate.cornell.edu/), housed at the **Cornell Atkinson Center for Sustainability** (https://www.atkinson.cornell.edu/). "These new resources and partnerships will help us develop the farms and food systems of the future in this decisive decade for climate action."

Also playing a pivotal role in this institute will be the Cornell Institute for Digital Agriculture (**CIDA** (https://digitalagriculture.cornell.edu/)). Director **Diane Bailey** (https://cals.cornell.edu/diane-bailey), the Geri Gay Professor of Communication (CALS), noted that CIDA's mission is to advance equitable, sustainable and efficient agriculture and food systems through multidisciplinary research.

"Everything about this new institute, on the agriculture side of it, resonates with the interests of our researchers who are affiliated with CIDA," Bailey said.

Bailey said one of CIDA's goals related to AI-CLIMATE is to foster a community of researchers, from Cornell and elsewhere, whose shared interests in sustainable agriculture and forestry could lead to new projects and research avenues.

“We want to spread a really wide umbrella,” she said. “We want others to come in to see the kinds of things that we have planned, to talk to us about extensions of that work, variations of that work, ideas that are perhaps tangential but related.”

Using new AI techniques like **deep reasoning networks（DRNets）** (https://news.cornell.edu/stories/2021/09/drnets-can-solve-sudoku-speed-scientific-discovery) and knowledge-guided machine learning, researchers at the AI-CLIMATE institute are improving accuracy and lowering the cost of accounting for carbon and greenhouse gases in farms and forests, ultimately making the process more accessible for more people.

″Foundational research in AI and machine learning has never been more critical to the design, development and deployment of AI-powered systems that deliver transformative solutions across our society,″ said Margaret Martonosi, NSF assistant director for computer and information science and engineering. “These recent awards, as well as our AI Institutes ecosystem as a whole, represent our active efforts in addressing national AI priorities that accelerate our nation’s AI capability, decision-making and leadership.”

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