

Contact: Rachel Boon

**REQUEST FOR NEW PROGRAM AT IOWA STATE UNIVERSITY: BACHELOR OF SCIENCE  
IN CLIMATE SCIENCE**

**Action Requested:** Consider approval of the request by Iowa State University for a Bachelor of Science in Climate Science in the College of Liberal Arts and Sciences.

The Council of Provosts and the Board office support approval of this program.

**Description of proposed program.** Climate change is currently impacting global environmental and ecological systems, agricultural systems and food security, human health, water availability, human migrations and economic systems. Furthermore, future climate change is projected to increase and worsen these impacts. Considering the financial costs associated with extreme events such as flooding, droughts and heat waves or wide-spread crop failures, the need to provide a well-trained, adaptable workforce to address these challenges is urgent.

To meet the need identified above, faculty from the Department of Geological and Atmospheric Sciences (GEAT) at Iowa State University propose climate science as a new major within the College of Liberal Arts and Sciences (LAS). The program is designed to meet the needs of an ever changing world that is under considerable pressure from climate change. All students who complete the bachelor of science in climate science will have a solid foundation on how the climate system works, will be knowledgeable about climate impacts on society and relevant sustainability and mitigation options, and will be competent with data analysis and science communication.

Students will complete a core climate science curriculum (35-36 credits), a set of designated supplemental courses in natural science, math, statistics and social sciences (24 credits), and 15 credits of additional coursework in at least one of six defined pathways: advanced climate science; data visualization, design and planning for sustainability; climate, food, agriculture and biodiversity, policy and human behavior; and science communication. While this set of pathways have been identified, the goal of the pathway requirement is to give students a specialization in an area of climate science that most interests them and aligns with their future career goals. Climate science is an emerging area of study and the faculty steering committee for the major will review and approve additional pathways.

**Academic objectives.** Graduates with the climate science major will have the skills and knowledge to:

1. Understand scientific principles and their application to scientific inquiry and to societal concerns relating to climate change science.
2. Demonstrate a broad understanding of the climate system, how it works on multiple time scales, and the utility of tools, such as models, and their strengths and limitations in the context of climate change science.
3. Demonstrate a broad understanding of climate science issues and policies.
4. Think critically about the range of climate information, data, and literature coming from a variety of sources and distill application-relevant knowledge.
5. Demonstrate proficiency in data analysis and problem-solving of relevant climate science issues/problems and systems.
6. Understand societal concerns related to climate change to develop and/or promote practical and applied research within the climate change research community.
7. Work with diverse teams whose members have a range of professional and disciplinary skills relevant to climate issues.

8. Work to identify climate-related needs and develop strategies to address these needs.
9. Use systems-thinking approaches to better understand/solve climate change issues.
10. Effectively communicate in oral, written and visual formats.

In addition to regular assessments of individual courses, the program will engage in program level assessment through evaluation of students' performance in the capstone experience, specifically, how well they convey their understanding of the objectives above. The program's efficacy will also be evaluated through exit interviews and placement rate data. Periodic (approximately every three years) surveys will be sent to alumni to collect information about the types of employment or other climate-related activities they participate in after graduation. Student internships and other professional development experiences will also be tracked. Findings from these assessments will be used to improve the program curriculum and inform recruitment efforts.

Relationship to existing programs at the institution. The climate science program will not duplicate any current degree program at ISU; rather, the advantage of the proposed program is that it utilizes the strength of existing programs within GEAT, LAS and other colleges, specifically the College of Design. Faculty within GEAT have core expertise in paleoclimate, the physics of climate, earth systems modeling, climate change, environmental geology and geospatial data visualization. Faculty across the ISU campus work on climate-related issues including sustainability, climate impacts assessment, mitigation and climate impacts on indigenous and vulnerable populations. GEAT faculty are often leading efforts related to multidisciplinary climate research in collaboration with faculty at ISU and other Iowa Regents institutions.

The program is distinct from both meteorology and geology in several ways. A significant strength of the proposed climate science program is that it leverages the interdisciplinarity at the intersection of the geology and meteorology programs. Thus, the core curriculum consists of a set of geology and meteorology courses focused on the climate system. Because of its different focus, the core curriculum will not meet the requirements of either the geology or meteorology programs. In addition, to allow students to develop a broader, multidisciplinary perspective, it will require a smaller, but still rigorous, set of complementary math, physics and chemistry courses, giving students opportunity to pursue fundamentals in related disciplines, such as communication, visualization and multidisciplinary analysis.

The climate science program also shares some similarities to ISU's environmental science program in its math and physics requirements. While the environmental science program has a focus on biological and chemistry coursework, this is not a key feature of the climate science degree. The environmental sciences outcomes focus on developing a student's ability to integrate chemical, biological and physical aspects of modern environmental systems, while the climate science program focuses student outcomes primarily on understanding the physical climate system. However, both programs take a systems interaction approach, where the climate science program will cover atmospheric and climatic interactions with land surface systems (including human systems) across space and time. The climate science program is also unique from environmental science in that it offers students opportunity to select a specialized pathway that includes non-STEM options.

Existing course offerings have allowed ISU to build a curriculum consisting of courses already available, while creating a possibility of adding new pathways beyond the core as opportunities arise. In collaboration with other academic units, ISU is developing coherent, cross-disciplinary tracks, which are not viewed as duplicative, but rather as enhancing opportunities and training for students in the collaborating programs.

Relationship to existing programs at other colleges and universities. There are no such programs at the Regent universities in Iowa. The most closely related offering at University of Iowa (UI) is a BS in Sustainability Science, which also has an interdisciplinary design. The UI major focuses on social and urban systems, agriculture, and the interaction of humans with the environment. While it includes topics of climate change, the natural systems coursework is focused on ecology rather than physical earth system processes. Both UI and the University of Northern Iowa (UNI) offer environmental science degrees. UNI offers a major in environmental science and minors in environmental science, air quality, geology and earth science. Similar to the program at ISU, the UNI Environmental Science program differs from the proposed climate science degree in its greater focus on biology, ecology, and chemistry. The BS in Environmental Science from UI has four tracks: biosciences, chemical sciences, geosciences and hydrosciences. None of these tracks overlap with the proposed climate science degree.

The department will work with Iowa's Regent universities and community colleges to identify opportunities at other institutions for climate science majors, such as online or summer offerings that can be transferred to ISU. Through its meteorology program, the department has experience working with community colleges to prepare students for transferring to Iowa State University.

Resources to establish a high-quality program. Core strengths in GEAT and supportive expertise across campus allow us to build a curriculum largely with existing resources. This degree will leverage existing resources to build a cost-effective, cutting-edge program that is unique within the Midwest region. The new data science minor and certificate and the proposed science communication certificate all present opportunities for students to earn additional skills and credentialing in areas that are complementary to the climate science major. Students will benefit from state-of-the-art science conducted through external funding in climate science research in GEAT and other units. Faculty at ISU have long participated in the Intergovernmental Panel on Climate Change, with their efforts highlighted by their inclusion in the 2007 Nobel Peace Prize; panels of the National Academies of Science and Engineering focused on climate change; and U.S. National Climate Assessments. The Iowa Environmental Mesonet at ISU is nationally known as a critical source of weather and climate data. ISU is making considerable efforts toward building environmentally sustainable operations, and this major provides further opportunity for the university to demonstrate climate action. Finally, ISU is one of few R-1 universities in the Midwest with a meteorology program, which makes it possible to provide the core course offerings.

Current facilities and equipment are adequate to establish and maintain a high-quality program. Courses in the program are staffed with existing faculty, and no new courses are immediately planned. A recently hired assistant teaching professor will support the proposed climate science program through teaching, advising, recruiting, and outreach specifically for the major. The position will initially be funded through an endowed foundation fund specifically aimed at supporting climate science education at ISU.

As the major is utilizing courses already in existence, no new support for field or laboratory supplies are needed at this time. Existing computer labs are suitable for instruction at this time. As enrollment grows, it is possible that additional laboratory teaching space may be needed. The major will reside within GEAT, which has an assigned 0.70 FTE secretarial support.

Student demand. GEAT created an Interdisciplinary Studies in Climate Science track in January 2021. This program has not been available long enough to be useful in evaluating student interest. However, there are a variety student groups across campus with an interest in environmental issues such as climate change.

The curriculum of the interdisciplinary studies in climate science track, which is a model for the proposed major, was discussed with the officers of the Climate Reality Campus Corps student club. Feedback from these students was overwhelmingly positive, example quotes include: "I'm thrilled to hear that there will be a Climate Science major!" and "I added Meteorology as a second major because I wanted to study the climate, and this major did not exist at the time that I came in." Related programs were found at Grand Valley State University (B. SC. In Geography: Climate Change Mitigation, Adaptation and Resiliency Planning), The University of Nebraska-Lincoln (B.S. in Applied Climate Science), UCLA (B.S. in Climate Science), and Oregon State University (B.S. in Earth Science with Climate Science option). UC Berkeley offers a minor in Climate Science.

Workforce need/demand. Since climate science is an emerging major, making estimates of market demand challenging. The proposed major will prepare students to go on to contribute to areas of applied science, seasonal forecasting, environmental policy, environmental justice, economics and education. Traditional pathways for climate scientists include the National Laboratories and National Oceanic and Atmospheric Administration (NOAA), which includes the National Weather Service and the National Climatic Data Center.

Opportunities also exist with science advocacy and policy groups (e.g., Union of Concerned Scientists) and private industry (AIR WorldWide, Decartes Labs). A conversation in February 2020 with military recruiters revealed strong interest in people trained in this area, in part because they would need to be broad, systems-oriented thinkers and because there are national security concerns tied to climate change. Students will also be prepared for further career development through graduate school or training in K-12 education.

A November 13, 2019 article in US News and World Report (<https://www.usnews.com/education/best-colleges/articles/2019-11-13/how-to-study-climatechange-in-college>) states that "Employers look for students that not only understand that climate change is an issue but understand something about how the climate is changing, and how technologies could be applied in order to mitigate the change that is happening, and prevent further change from occurring". The article goes on to list example opportunities such as in business and finance, where graduates can help companies prepare for, and mitigate effects of, climate change in supply chains. A search of "climate science" on Indeed.com resulted in 5,893 full-time postings. Postings were from NGOs, consulting, technology, legal and investment firms, and cities. Job titles ranged from climate risk specialist, data analyst, sustainability analyst, scientist, energy analyst, climate coordinator, and carbon and climate program manager. The major is designed to allow students to specialize in one or more complementary topics, which will increase their competitiveness in their targeted job area.

Funding and Cost. While no new resources are needed for the proposed program, GEAT has received a generous donation specifically to advance climate science education and outreach at ISU. Dr. John Graether, a retired ophthalmic surgeon from Marshalltown, has donated \$2.2M establishing The Graether Family Fund for Climate Science Advancement which will assist GEAT in its efforts to create this major. Initially these funds are being used to support an assistant teaching professor who will teach core courses in the program, develop internship opportunities for majors, and assist the department chair in directing and marketing the program. This gift provides initial financial support and stability for the program and is an expression of outside interest.

Through the Graether donation the department has resources to cover the salary of the assistant teaching professor who has been hired on a 3-year contract starting fall 2021. This individual brings experience in geoscience education and climate literacy, as well as experience in program

assessments. In addition, the endowment can support program marketing, student scholarships and other student-centered opportunities. Based on the budget model, tuition revenue associated with student credit hour production will provide additional support to cover the cost of teaching classes for this program and any marginal costs for equipment or marketing as the program grows. This program will not require investments in fixed expenses such as facility renovations.

Projected student enrollment. Given student demand for recently added classes, such a MTEOR 140: Climate and Society, where enrollment has grown from 48 in the first offering of the course in Fall 2019 to 100 in Fall 2021, and the ongoing robust enrollment of over 250 students each year in MTEOR/AGRON 206: Introduction to Weather and Climate, we anticipate good enrollment in this major as both a first and second majors, We also expect growth in enrollments in some of the key core courses.

	Y1	Y 2	Y3	Y4	Y5
Undergraduate	25	50	80	100	120

Accreditation. There are no programmatic accreditations for climate science programs. No additional HLC accreditation approval is required.

Date of implementation. August 2022

Letter of Support



IOWA STATE UNIVERSITY



June 9, 2022

To the Board of Regents:

The Council of Provosts discussed Iowa State University proposal for a Bachelor of Science in Climate Science and reviewed associated documentation. There is sufficient evidence for the need and value for this program. The plan indicates due diligence and the Council of Provosts appreciates the collaboration between the deans and departments involved. Based on the evidence and documentation, this program is likely to benefit the state of Iowa.

The Council of Provosts is supportive of the program and wishes Iowa State University the best in its implementation.

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