

FORM A
Board of Regents, State of Iowa

**REQUEST TO IMPLEMENT A NEW BACCALAUREATE, MASTERS,
DOCTORAL, OR FIRST PROFESSIONAL DEGREE PROGRAM**
January 28, 2015

Editing color coding:

Yellow: Items to be completed by Provost Office

Gray: Items are draft text to use/edit as appropriate. Please remove highlighting of gray areas once edited.

THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for a Regent university to demonstrate need and demand as well as the university's ability to offer a quality program that is not unnecessarily duplicative of other similar programs offered by colleges and universities in Iowa.

Institution: Iowa State University

CIP Discipline Specialty Title: _____

CIP Discipline Specialty Number (six digits): _____

NOTE: If department has recommendation – please feel free to enter – otherwise, provost office will fill these out

Level: B X M _____ D _____ FP _____

Title of Proposed Program: Climate Science

Degree Abbreviation (e.g., B.S., B.A., M.A., Ph.D.): B.S.

Approximate date to establish degree: Month 08 Year 2022

NOTE: If department has recommendation – please feel free to enter – otherwise, provost office will fill these out based on anticipated meeting date when Board would approve the program.

Contact person: (name, telephone, and e-mail) Kristi Franz, 515 294-7454, kfranz@iastate.edu

College that will administer new program: Liberal Arts and Sciences

Please provide the following information (use additional pages as needed). Do not use acronyms without defining them.

1. Describe the proposed new degree program, including the following:
 - a. A brief description of the program. If this is currently being offered as a track, provide justification for a standalone 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 has never been more 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. 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 B.S. 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 fifteen 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. The specific requirements of the curriculum are available in Appendix A.

b. A statement of academic objectives;

Graduates of the Climate Science degree 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 timescales, 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 distil application-relevant knowledge.
5. Demonstrate proficiency in data analysis and problem-solving of relevant climate science issues/problems systems/problems.
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.

Core Course	Academic Objectives Met
GEOL 100 (or GEOL 101) and 100L (How Earth Works/Environmental Geology, 4 credits)	1, 2, 4, 9
MTEOR 140 (Climate and Society, 3 credits)	1, 2, 3, 4, 8, 9
MTEOR 206 (Introduction to Weather and Climate, 3 credits)	1, 2, 4, 9
CRP 293 (Environmental Planning, 3 credits) or Soc 220 (Globalization and Sustainability, 3 credits)	3, 6, 7, 8, 9
ECON 380 (Energy, Environmental and Resource Economics, 3 credits)	3, 6, 8
GEOL 324 (Energy in the Environment, 3 credits)	1, 2, 4, 8, 9
GJLMC 347 (Science Communication, 3 credits)	3, 4, 7, 10
MTEOR 360X (Ocean/Atmosphere Interactions, 3 credits)	1, 2, 4, 5, 9
MTEOR 404 (Global Change, 3 credits)	1, 2, 3, 4, 6, 9, 10
GEOL 415 (Paleoclimatology, 3 credits)	1, 2, 3, 4, 5, 9
CAPSTONE CHOICE (3-4 credits)	2, 4, 5, 8, 9, 10

Assessment: 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.

c. What the need for the program is and how the need for the program was determined.

Climate change and its associated impacts are global in scale and socially complex. It is also well established that the impacts of climate change disproportionately impact poor nations and minoritized people. Thus, climate change is perhaps one of the most important, and challenging, problems facing humanity in the 21st century. In order to adapt to and mitigate the impacts of climate change, we need to train and educate the next generation of students in the fundamentals of climate science. Specifically, we need qualified individuals to tackle climate-related problems that span national borders and include the cooperation of international community. Solving and managing climate-related challenges requires an ability to consider the complexity of socio-economic systems, understand the limitations of available natural resources, and work with diverse groups to transform energy and other human-made systems toward sustainable sources. Furthermore, we need individuals to be proficient in climate data analysis while at the same time adept at communicating with scientific, public, and policy facing audiences. Finally, it will take a well-trained and adaptable workforce to lessen the impacts and burden of climate change in the coming years to decades. Iowa State is uniquely poised to develop an effective Program in Climate Science.

The types of jobs that a climate science major would qualify for would fall under the title of "green jobs". The Bureau of Labor Statistics (<https://www.bls.gov/green/home.htm>) defines green jobs as either:

- Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources.
- Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

These jobs are in line with what the UN recognizes is needed to address the climate change crisis (<https://www.un.org/sustainabledevelopment/news/communications-material/>; Sustainable Development Goals #13):

- (1) limiting the global temperature rise by transforming the systems that sustain our societies, and
- (2) building resilience in communities by anticipating and adapting to the impending change.

By designing the climate science major with pathways and flexible electives, students can build on the core curriculum into areas that will give them the skills they need to contribute to building a more sustainable society through avenues of government, academia, or business. Sustainability experts, for example, help advise companies on how to lower their carbon footprint or perform environmental impact assessments. They help governments assure that growth plans and investments will be environmentally sound for years to come. The Bureau of Labor Statistics projects job growth rate of 11-12% for atmospheric scientist and environmental scientists, two

closely related occupations.

Increasingly, cities across the country, including Ames, are developing Climate Action Plans. Such plans require the hiring of expert consultants, as well as personnel on staff to evaluate proposed plans. Conversations with recruiters from the US military show that intelligence agencies are interested in people who are holistic thinkers and can think about problems from multiple avenues. The financial industry has long been interested in climatological predictions for futures trading. A perspectives paper published in Nature Climate Change (Fiedler et al., 2021) supports the idea that society requires professionals trained in climate analytics who understand the needs of business and how businesses can respond appropriately to climate-related financial risks. The insurance industry has long been interested in the impact of climate change on their actuarial tables.

- d. The relationship of the proposed new program to the institutional mission and how the program fits into the institution's and college's strategic plan;

The mission and vision of Iowa State University as stated on the webpage for the Office of the President is to "create, share, and apply knowledge to make Iowa and the world a better place." Climate change is a major threat facing communities around the world. Iowa State can play a key role in addressing these issues by helping students become problem-solvers trained to critically evaluate and synthesize multidisciplinary data as it relates to climate change and climate change-related decision-making. Students will build the skills needed to work and to innovate with diverse teams to address climate change issues facing society today and into the future. Graduates of the climate science program will be motivated and equipped to aid and improve responses to climate variability and extremes to the betterment of individual lives and livelihoods regionally, nationally and globally.

The mission of LAS mirrors the mission of the university in its goal to educate students, conduct research and produce scholarship with international significance and which benefits Iowa, the nation, and the world. At the core of the climate science program will be an interdisciplinary set of courses spanning physical sciences, statistics, communication, sustainability, and planning; a curriculum designed to "prepare LAS majors for success" in an increasingly complex and connected world. The climate science program relies on bringing together existing strengths at ISU in novel ways and its interdisciplinary focus makes it unique nationwide. The program will support LAS's goal to "lead the nation and the world in integrating scientific, technological, cultural, and historical perspectives in order to arrive at the most sustainable solutions, of the greatest benefit to our societies and the planet" (<https://las.iastate.edu/mission/>).

- e. The relationship of the proposed new program to other existing programs at the institution; describe how the proposed program will enhance other programs at the university. Will the proposed program duplicate existing programs at the university?

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 expertise in 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 us 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, we are developing coherent, cross-disciplinary tracks, which are not viewed as duplicative, but rather as enhancing opportunities and training for students in the collaborating programs.

- f. The relationship of the proposed new program to existing programs at other colleges and universities in Iowa, including how the proposed program is different or has a different emphasis than the existing programs.

As of this writing, there are no such programs at the Regent's 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 the University of Iowa and the University of Northern Iowa (UNI) offer Environmental Science degrees. The University of Northern Iowa 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 the University of Iowa offers four tracks: Biosciences, Chemical Sciences, Geosciences, and Hydrosiences. None of these tracks overlap with the proposed Climate Science degree.

We will work with Iowa's Regent's 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. We will work with advisers at community colleges to plan a curriculum that will allow students to successfully transition and complete the Climate Science major.

- g. Special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program.

As noted in 1.e., 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.

- h. Are the university's personnel, facilities, and equipment adequate to establish and maintain a high-quality program?

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 (see items 12 and 13).

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. Additional administrative support may be needed in the future.

- i. How does student demand for the proposed program justify its development?

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 of student groups across campus with an interest in environmental issues such as climate change. A search of the term "sustainability" on the ISU student organization webpage returned 13 student clubs that included Engineers without Borders, the Entrepreneur Club, and the Council on the Built Environment. 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.

A search of the internet reveals a small number of universities with climate science programs or

the option to choose a climate science focus. The degree at Grand Valley State shows minimal resemblance to our planned degree. Their curriculum is focused in geography, GIS, and land use and urban planning.

The UNL degree, the closest related program in terms of location, is housed within their College of Agricultural and Natural Resources. The core curriculum is based in agronomy and ecology, with specific degree requirements in meteorology, climatology, and climate change. Our proposed program differs in that our core courses span the earth sciences, including topics of deep time. We also present an interdisciplinary curriculum that includes pathways in science communication, agriculture and community planning.

The climate science program at UCLA is three years old. It requires all the courses required of their Atmospheric Sciences majors, thus it is an advanced atmospheric sciences degree that shows little similarity to what we propose here. Professor Alex Hall at UCLA indicated that the program was too new to do a proper statistical analysis of the impact of the major on their department, but noted they have seen students already within the department switching to the Climate Science major as well as new students coming to their department as a result of the degree.

Utah State University has Climate Science degrees at the undergraduate and graduate levels. Similar to the UCLA program, this appears to be a variant of their meteorology program with a focus on the physical aspects of the climate system and an emphasis on climate prediction. There is no apparent incorporation of paleoclimate in the curriculum, and it lacks the interdisciplinary options that the proposed degree will have.

The Climate Science option at Oregon State is most similar to what we propose in that it is set within an earth science program with complementary courses in adaptation, mitigation, policy and economics. The director, Professor Karen Shell, reported that they are graduating about 10 students per year, but are in the process of converting the Climate Science option into a major. She thinks that students are not “finding” the option under the Earth Sciences major. We will ensure that interested students understand how to navigate/find the new degree option.

2. Describe the state and/or national workforce need and/or demand for graduates of the proposed program currently and in the foreseeable future (provide documentation about the current sources of data used to estimate need and demand).

As is clear from the above discussion, climate science is an emerging major, making estimates of market demand challenging. The proposed Climate Science 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-climate-change-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. A February 2021 commentary in Nature Climate Change also points to the growing need for climate analytics to address business risk. (<https://www.nature.com/articles/s41558-020-00984-6.pdf>) 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.

3. List all other public and private institutions of higher education in Iowa currently operating programs similar to the proposed new degree program. (For comparison purposes, use a broad definitional framework, e.g., such identification should not be limited to programs with the same title, the same degree designation, having the same curriculum emphasis, or purporting to meet exactly the same needs as the proposed program.)

See response to 1f above.

If the same or similar program exists at another public or private institution of higher education in Iowa, respond to the following questions:

- a. Could the other institution reasonably accommodate the need for the new program through expansion? Describe collaboration efforts with other institutions.

No similar program exists. The curriculum integrates across two programs with GEAT, across departments and colleges at ISU. ISU is uniquely poised to bring together a variety of existing coursework to create a novel degree program.

- b. With what representatives of these programs has there been consultation in developing the program proposal? Provide a summary of the response of each institution consulted.

NA

- c. Has the possibility of an inter-institutional program or other cooperative effort been explored? What are the results of this study? (Consider not only the possibility of a formally established inter-institutional program, but also how special resources at other institutions might be used on a cooperative basis in implementing the proposed program solely at the requesting institution.)

While faculty at ISU and UI have long-standing collaborations in the areas of climate change, climate impacts, water sustainability, and natural hazards research, we have not explored the possibility of an inter-institutional program. ISU has all the necessary expertise and capacity to administer this program. Further, undergraduate students generally want to attend a particular institution and as a result, we do not believe there is anything to be gained from an inter-institutional program. However, if a student in the Climate Science program takes or has taken a class at either the University of Iowa or the University of Northern Iowa that is a direct substitute for one of the classes required for our program, we will allow that substitution if it meets our university and college policies for such substitutions.

- d. Do other colleges in Iowa offer programs similar to the proposed program at comparable quality and cost?

See response to 1f above.

- e. Are letters of support included with the program proposal?

Letters of support are included from the Deans of the appropriate colleges at the University of Iowa and the University of Northern Iowa. Additional support letters are provided from within Iowa State University.

4. Estimate the number of majors and non-majors students that are projected to be enrolled in the program during the first seven years of the program.

- a. **Undergraduate.** Given student demand for recently added classes, such as 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 major. We also expect growth in enrollments in some of the key core courses.

Undergraduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors	25	50	80	100	120	140	150
Non-Majors							

- b. Graduate

This is an undergraduate program.

- c. What are the anticipated sources of these students?

We anticipate this new major will draw new students to ISU from within the state and bordering states as similar programs do not exist regionally. The Meteorology program, for example, has long drawn students from neighboring states. We also anticipate some students will transition to this major from open option or through a major change. Meteorology at ISU loses a sizable number of freshman and sophomores who struggle with the advanced calculus and physics requirements, which is common for Meteorology programs across the country. We believe climate science will be an attractive major for these meteorology students as it will allow them to maintain a similar path of study and utilize science and math credits already earned. As a result, we believe the climate science degree will assist LAS and the university retain students who might have otherwise left for programs elsewhere.

5. If there are plans to offer the program away from the campus, briefly describe these plans, including potential sites and possible methods of delivery instruction. Will off-campus delivery require additional **HLC accreditation**?

There are no current plans to offer this degree off campus.

6. Has the proposed program been reviewed and approved by the appropriate campus committees and authorities?

The program has been approved by the appropriate College and Faculty Senate Curriculum Committees, the Faculty Senate, the Provost and the President.

7. List date the program proposal was submitted to the Iowa Coordinating Council for Post High School Education (ICCPHSE) and results of listserv review.

Note: will be completed by the Provost Office.

8. Will the proposed program apply for programmatic accreditation? When?

At the time of this writing, accreditation bodies for Climate Science programs have not emerged.

9. Will articulation agreements be developed for the proposed program? With whom?

As a part of the normal University collaborations with Iowa Community Colleges, the program faculty and staff will work with all Iowa Community colleges to develop appropriate transfer plans or articulation agreements.

10. Will there be opportunities for student internships?

Immediate opportunities for experiential learning are available through undergraduate research projects conducted in collaboration with GEAT faculty; such projects can be conducted for credit or for pay from faculty grants and foundation funds. We will encourage interested students to apply for a LAS Dean's High Impact Award for Undergraduate Research to support their research activities. We also will actively foster opportunities for internships with local and regional entities, such as City of Ames, Story County Conservation, National Weather Service, Prairie Rivers of Iowa, and the Women Food and Agricultural Network. We will tap into the Department's alumni base as several faculty on the planning committee have former students employed in the climate sector. We will assist students in identifying other relevant opportunities such as NSF-supported Research Experiences for Undergraduates (REUs).

11. Describe the faculty, facilities, and equipment that will be required for the proposed program.

See response to 1h above.

12. From where will the financial resources for the proposed program come (list all that apply, e.g., department reallocation, college reallocation, grants, new to the university)?

Iowa State University utilizes a decentralized financial management model for the development of its annual operating budgets. The Resource Management Model (RMM), is a responsibility-centered and incentive-driven approach to financial planning and management. The model supports departments and colleges in making budgetary decisions that enhance student success (e.g., retention), innovate by meeting market demands from students and employers for degree programs of the future, and discontinue legacy curricula which are either not aligned with industry/employer needs or for which student demand is low. Through the RMM, 25% of net tuition revenue is allocated to academic colleges based on a student's choice of major, and 75% is allocated to academic colleges based on teaching (as measured by student credit hours). Through the infrastructure of Iowa State's budget model, then, financial resources follow students and are allocated based on majors and teaching that is conducted. Tuition revenue will include both base tuition and applicable differential rates. The proposed degree program will be funded through this existing, proven financial model, and is expected to be fully self-sustaining over time. In addition to the budget model as described, financial resources may also come from internal reallocations made within the college during the program's startup phase. The level of reallocation will depend, in part, on the numbers of new students attracted to the proposed program, and the number of existing students who choose the proposed program over another program, based on

standard and differential tuition rates. The proposed program will not be dependent on grants, contracts, gifts, central university resources, or reallocations between academic colleges.

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 (<https://link.las.iastate.edu/2021/05/03/timing-is-everything/>; <https://www.foundation.iastate.edu/s/1463/giving/interior-min.aspx?sid=1463&qid=1&pgid=2853>). 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.

13. Estimate the total costs/total new costs (incremental increases in expenditures) that will be necessary for the next seven years as a result of the new program. Be as specific as possible.

The department has the necessary faculty in-place to begin offering the program. Through the donation mentioned above, 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.

14. Describe the marketing plan developed to communicate the new program and recruit students.

The Office of Admissions will incorporate this new program into the overall marketing strategy for undergraduate student recruitment. The program will be included in print materials, websites, and other marketing strategies to attract students from within the state, from across the country and globally. The program will also be included in the appropriate college and departmental recruiting materials, websites, and outreach programs. Outreach opportunities at K-12 schools within Iowa will be sought.

15. Describe the program evaluation plan to determine if the program is meeting the intended objectives, if the expected student enrollment has occurred, funding for the program, and any other components that affect the effective operation of the program.

This program will be incorporated into the university's normal academic review process. That review process assesses whether the program is achieving its mission, providing high quality academic experiences, and fulfilling the enrollment and success metrics identified for the program. In addition to the academic program review, as a part of the college budgeting process the program will be monitored annually for achievement of enrollment goals.

16. Include any additional information that justifies the development of this program.

Appendix A: Proposed climate science curriculum.

Proposed Core Curriculum – 34-35 credits

GEOL 100 (or GEOL 101) and 100L (How Earth Works/Environmental Geology, 4 credits)
MTEOR 140 (Climate and Society, 3 credits)
AGRON/MTEOR 206 (Introduction to Weather and Climate, 3 credits)
CRP 293 (Environmental Planning, 3 credits) or Soc 220 (Globalization and Sustainability, 3 credits)
GEOL 324 (Energy in the Environment, 3 credits)
JLMC 347 (Science Communication, 3 credits)
ECON 380 (Energy, Environmental and Resource Economics, 3 credits)
MTEOR 360X (Ocean/Atmosphere Interactions, 3 credits)
MTEOR 404 (Global Change, 3 credits)
GEOL 415 (Paleoclimatology, 3 credits)
CAPSTONE CHOICE (3-4 credits)

Supporting courses – 24 credits

ECON 101, (3 credits)
CHEM 163 and 163L, CHEM 167 and 167L, CHEM 178 and 178L, or CHEM 201 and 201L, (5 credits)
MATH 160 or Math 165 (required if selecting the Advanced Climate Science pathway), (4 credits)
STAT 305 (Engineering Statistics, 3 credits) or STAT 104 (Intro to Statistics, 3 credits)
PHYS 131 and 131L or PHYS 231 and 231L, (5 credits)
PHYS 132 or Phys 232, (4 credits)

Pathway requirement – 15 credits

Students must take a minimum 15 credits of coursework from one specialized pathway. Pathways will consist of predefined courses. New pathways will be considered and approved by the Climate Science curriculum committee. The following example pathways are provided below: Advanced Climate Science; Sustainability, Design and Planning; Data Visualization; Policy and Human Behavior; Climate, Food, Agriculture and Biodiversity Pathway, and Science Communication.

- **Advanced Climate Science (students wishing to take this pathway should take Math 166 plus 12 credits from below)**

AGRON 405 (Environmental Biophysics, 3 credits)
AGRON 406 (World Climates, 3 credits)
GEOL 402 (Watershed Hydrology, 3 credits)
GEOL 411 (Hydrogeology, 4 credits)
GEOL 452 (GIS for Geoscientists I, or other advanced GIS course such as GEOL 488, 3 credits)
GEOL 468 (Applied Geostatistics for Geoscientists, 3 credits)
GEOL 474 (Glacial and Quaternary Geology, 3 credits)
GEOL 479 (Surficial Processes, 3 credits)
GEOL 483 (Environmental Biogeochemistry, 3 credits)
GEOL 489 (Survey of Remote Sensing Technologies, 3 credits)
MTEOR 227 or GEOL 559 (or other computer programming course, 3 credits)
MTEOR 301 (General Meteorology, 4 credits)
MTEOR 341 (Atmospheric Physics, 3 credits)
MTEOR 408X (Numerical Modeling, 3 credits)
MTEOR 452 (Climate Modeling, 3 credits)

- **Data Visualization**

ARCH 439 (Computational Design Theory, 3 credits)
ARTIS 212 (Studio Fundamentals: Computers, 3 credits)
ARTIS 308 (Computer Modeling, Rendering & Virtual Photography, 3 credits)
ARTIS 408 (Principles of 3D Animation, 3 credits)
ARTIS 470X (Data, Code and Form, 3 credits)
ARTIS 473 (Video Art, 3 credits)
ARTIS 475 (Interactive Art, 3 credits)
LA 211 (Digital Design and Methods for Landscape Architecture, 3 credits)
LA 454 (Fundamentals of Remote Sensing, 3 credits)
LA 459 Digital Design and Methods for Landscape Architecture (3 credits)
STAT/ENGL 332 (Visual Communication of Quantitative Data, 3 credits)
CRP 251 (Fundamentals of GIS, 3 credits)
CRP 351 (Intermediate GIS, 3 credits)
CRP 449 (Geodesign, 3 credits)
CRP 456 (GIS Programming and Automation, 3 credits)
GEOL 452 (GIS for Geoscientists, 3 credits)
GEOL 488 (GIS for Geoscientists II, 3 credits)

- **Design and Planning for Sustainability**

ARCH 451 (Whole Building Energy Performance Modeling, 3 credits)
ARCH 558 (Sustainability and Green Architecture, 3 credits)
CRP 251 (Fundamentals of GIS, 3 credits)
CRP 291 (World Cities & Globalization, 3 credits)
CRP 293 (Environmental Planning, 3 credits)
CRP 301 (Urban Analytical Methods, 4 credits)
CRP 351 (Intermediate GIS, 3 credits)
CRP 383 (Theory of Planning Process, 3 credits)
CRP 445 (Transportation Policy & Planning, 3 credits)
CRP 449 (Geodesign, 3 credits)
CRP 455 (Smart and Sustainable Cities, 3 credits)
CRP 457 (Geogames for Civic Engagement, 3 credits)
CRP 460 (Social Justice and Planning, 3 credits)
CRP 484 (Sustainable communities, 3 credits)
CRP 492 (Planning Law, Administration and Implementation, 3 credits)
GEOL 452 (GIS for Geoscientists I, 3 credits)
GEOL 488 (GIS for Geoscientists II, 3 credits)
LA 270 (Foundations in Natural Resource Policy and History, 3 credits)

- **Policy and Human Behavior (students wishing to take this pathway should take POL S 383 plus 12 credits from below)**

HIST 362 (Global Environmental History, 3 credits)
HIST 363 (United States Environmental History, 3 credits)
PHIL 230 (Moral Theory and Practice, 3 credits)

PHIL 330: (Ethical Theory, 3 credits)
PHIL 334 (Environmental Ethics, 3 credits)
POL S 335 (Science, Technology and Public Policy, 3 credits)
POL S 344 (Public Policy, 3 credits)
POL S 443x (Energy Policy, 3 credits)
POL S 480 (Ethics and Public Policy, 3 credits)
PSYCH 318: (Thinking and Decision Making, 3 credits)
SOC 220 (Globalization and Sustainability, 3 credits)
SOC 382 (Environmental Sociology, 3 credits)
SOC 331 (Social Class and Inequality, 3 credits)
SOC 348 (Global Poverty, Resources and Sustainable Development, 3 credits)

- **Climate, Food, Agriculture and Biodiversity**

AECL231 (Principals of Wildlife and Fisheries Conservation; 3 cr)
AECL471 (Conservation Biology; 3 cr)
AGRON 180 Global Ag in a Changing World instead of MTEOR 140
AGRON 181 (Intro to Crop Sci, 3 cr)
AGRON 182 (Intro to Soil Science; 3 cr)
AGRON 316 (Crop Structure-function relationship; 3 cr)
AGRON 317 (Principles of Weed Science; 3 cr)
AGRON 334 (Forest Crop Management; 3 cr)
AGRON 342 (World Food Issues; 3 cr)
AGRON 405 (Environmental Biophysics; 3 cr)
AGRON 406 (World Climates; 3 Cr)
BIOL201 (Biodiversity; 2 cr)
BIOL355 (Plants and People; 3 cr)
BIOL366 (Plant Systematics; 3 cr)
BIOL370 (GIS for Ecology and Environmental Science; 3 cr) OR NREM 446 (Integrating GPS and GIS for Natural Resource Management; 3 cr.)
ENT 370 (Introduction to Entomology; 3 cr.) OR AECL366 (Natural History of Iowa Vertebrates; 3 cr.) OR BIOL354 (Animal Behavior; 3 cr)
ENT 374 (Insects and Our Health; 3cr)
ENT 471 (Insect Ecology; 3 cr)
GLOBE 304 (Socio-Economic Global Resource Systems; 3 cr.)
HORT 342 (Landscape Plant Installation, Establishment, and Management
HORT/NREM 475 (Urban Forestry; 3 cr.)
NREM 301 (Natural Resource Ecology and Soils; 3 cr.)
NREM 311 (Field Ecology in Montana; 3 cr.) OR AECL321 (Ecology; 3cr.)
NREM 390 (Fire Ecology and Management)
NREM452 (Ecosystem Management 3 cr)

- **Science Communication**

BPMI 323 (Scientific Illustration Principles and Techniques, 3 credits)
BPMI 326 (Illustration and Illustration Software, 3 credits)
BPMI 327 (Illustration as Communication, 3 credits)
ENGL 332 (Visual Communication of Quantitative Data, 3 credits)
ENGL 355 (Literature and Environment (GE), 3 credits)
ENGL 477 (Seminar in Technical Communication, 3 credits)
JLMC/PR/ADVRT 200-levelIX (Media Controversies in Science and Technology)

JLMC 401 (Mass communication theory, 3 credits)
JLMC 474 (Communication Technology and Social Change, 3 credits)
JLMC 476 (World communication systems, 3 credits)
PHIL 206 (Introduction to Logic and Scientific Reasoning, 3 credits)
PR 305 (Publicity Methods, 3 credits)
PR 220 (Principles of public relations, 3 credits)
PR 323X (Strategic Communication in Agriculture and the Environment, 3 credits)
SP CM 322 (Argumentation, Debate, and Critical Thinking, 3 credits)
SP CM 327 (Persuasion and Social Influence, 3 credits)

March 4, 2022

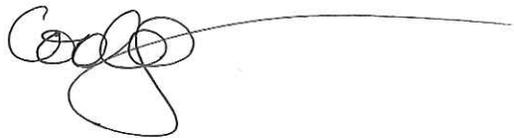
To Whom it May Concern

I am writing in support of the proposed BS degree in Climate Science at Iowa State University, in the Department of Geology and Atmospheric Sciences. The proposed degree is quite unique in the state, and would meet a need for those looking at global climate causes, analysis, and impacts. In the College of Humanities, Arts and Sciences at the University of Northern Iowa, we offer degree programs in Biology and Environment Science, both BA and BS, with the emphasis on localized issues with air, water, and land quality and ecosystems. However, the proposed ISU degree has, in addition, a solid foundation in atmospheric science and geology, which is necessary to understand the global impact of climate change, as well the long-term geologic record of such changes. The various degree pathways also distinguish the proposed program, and will likely appeal to students looking for a way to implement their scientific understanding in a variety of non-technical ways. In short, we support the creation of this valuable new program.

Best regards,



Jennifer Cooley
Associate Dean





College of Liberal Arts and Sciences

Academic Programs and Student Development

University of Iowa

120 Schaeffer Hall

Iowa City, Iowa 52242-1409

Phone: 319-335-2633 | Fax: 319-335-3192

Email: clasps@uiowa.edu | Web: clas.uiowa.edu/students

12 March 2022

Dear Associate Dean Slagell,

Thank you for sharing the proposal for the new major BS in Climate Science to be offered by the College of Liberal Arts and Sciences at Iowa State University (ISU). I shared the proposal with other stakeholders on our campus.

The proposal for this new major lays out an innovative and thoughtful pathway for students to gain the foundation for an interdisciplinary study of climate science.

Although there is thematic and synergistic overlap with undergraduate degrees offered in the College of Liberal Arts and Sciences here at the University of Iowa, specifically the BS in Geoscience and the BS in Environmental Sciences, and curricular overlap with the Sustainability Sciences BS, the emphasis of the proposed Climate Science BS at ISU is very focused around climate and atmosphere.

The proposed study of Climate Science at Iowa State University appears to build on strength across your departments and will be important and relevant for undergraduate students. We wish you the best as you begin a pathway to this new program of study for your students.

Sincerely,

Cornelia C. Lang (she/her/hers)
Associate Dean for Undergraduate Education
Professor of Physics & Astronomy
College of Liberal Arts and Sciences

March 1, 2022

Dear Professor Franz,

The College of Liberal Arts and Sciences enthusiastically supports this innovative proposal for a new major in Climate Science. Students completing this curriculum will have the opportunity to not only understand the science undergirding climate systems, but also to examine the impact on human systems and communities. The interdisciplinary nature of this degree program is visible in the core and supporting coursework as well as in the six potential pathways: advanced climate science; data visualization; design and planning for sustainability; climate, food, agriculture and biodiversity; policy and human behavior; and science communication. Conversations around the college and university and among our alumni demonstrate great enthusiasm for this initiative. We know that today's students care deeply about environmental and climate issues and want to protect our planet and the plants and animals with whom we share it. This program will help them make a positive difference.

The faculty in the Geology and Atmospheric Sciences Department have deep expertise in climate science and a strong tradition of collaboration and interdisciplinary work and will provide an excellent home for the new major. Thank you for your leadership of this effort. As our climate changes, businesses and communities will rely on the expertise fostered through this Iowa State University program.

Sincerely,



Beate Schmittmann
Dean, College of Liberal Arts and Sciences

IOWA STATE UNIVERSITY

College of Design
Office of the Dean
715 Bissell Road
Ames, Iowa 50011-1066
515 294-7428
FAX 515 294-9755
E-mail isucod@iastate.edu
<http://www.design.iastate.edu>

March 22, 2022

Dear Dr. Franz,

Please consider this an enthusiastic support for the B.S. degree in Climate Science. We have worked with our faculty from multiple departments in the College of Design and identified courses that would be complimentary to the degree program, primarily in the three tracks: Sustainability, Design and Planning, Data Visualization, and Science Communication.

We believe this degree will provide students a foundation on climate science while creating opportunities to explore connections through well-thought tracks. The program will also enhance the collaboration across various units on campus, strengthening crossdisciplinarity and academic excellence.

Sincerely,



Seda McKilligan, Ph.D.
Associate Dean for Academic Programs
College of Design

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

College of Agriculture and Life
Sciences
Academic Innovation
20 Curtiss Hall
513 Farmhouse Lane
Ames, IA 50011-1054 515
294-2555

April 7, 2022

Dear Dr. Franz,

The College of Agriculture and Life Sciences supports the proposal for a new B.S. degree in Climate Science. Climate change is one of the most important ‘grand challenges’ confronting humanity. ISU has many faculty with expertise in understanding the causes of climate change, its impacts on humans and managed and natural plant and animal systems, and what solutions we as a society can develop to mitigate these impacts. Therefore, the proposed Climate Science B.S. degree is both timely and important.

Faculty in the College of Agriculture and Life Sciences who teach, research and do extension and outreach in this area developed the “Climate, Food, Agriculture, and Biodiversity” pathway for the Climate Science degree. We look forward to collaborating further in the future.

Sincerely,

A handwritten signature in blue ink, appearing to read 'C. Bain', is positioned below the word 'Sincerely,'.

Carmen Bain, Ph.D.
Associate Dean of Academic Innovation
College of Agriculture and Life Sciences

IOWA STATE UNIVERSITY

Department of Community and
Regional Planning

College of Design

Ames, Iowa 50011-3091

515 294-2557

FAX 515 294-1440

<http://www.design.iastate.edu>

September 24, 2021

Professor Kristie J. Franz
Chair, Dept. Geological and Atmospheric Sciences
Smith Family Foundation Chair in Geology
Iowa State University

Dear Professor Franz:

The Community and Regional Planning Department is pleased to support the proposed Climate Science major.

There are potential synergies between the proposed program and our Bachelors of Community and Regional Planning program. We encourage our students to develop a good understanding of the impacts of climate change in today's ever-changing world to diversify their education and employment opportunities. The proposed major enable our students to explore and expand their expertise in climate science, including mitigation and resilience strategies.

We look forward to having our students take courses in the proposed major and explore opportunities to create a path for a double major.

If you have any questions or need further information about our courses, please feel free to contact me.

Sincerely,



Francis Owusu, Ph.D.

Professor and Chair

Department of Community & Regional Planning

Iowa State University

College of Design

Phone: (515) 294-7769

E-mail: fowusu@iastate.edu

30 September 2021

To: Kristie Franz
Chair, Geology and Atmospheric Sciences

From: Lynn G. Clark 
Interim Chair, Ecology, Evolution, and Organismal Biology

Re: Proposal for the new Climate Science major

I have read the information regarding the new Climate Science major to be offered by the Department of Geology and Atmospheric Sciences, and support this proposal. There is strong justification for formally training undergraduates in this area, given the already evident impacts of climate change, and the need will only grow.

October 7, 2021

Subject: New BS Degree in Climate Science

To Whom It May Concern

The Department of Civil, Construction, and Environmental Engineering supports the proposed degree program in climate science. The program offers a good opportunity for students at ISU. It is important area for our society and students.

The program compliments our programs in Civil Engineering and Environmental Engineering. We are planning to dual-list the course C E 574 Integrated Assessment Modeling and Science--Policy Integration for Global Environmental Change at the undergraduate level, and that course would be a good candidate for the Advanced Climate Science pathway area in the proposed curriculum.



David H. Sanders, PhD, F. ACI, F. ASCE, F. SEI
Greenwood Department Chair and Professor
Department of Civil, Construction, and Environmental Engineering

2 December 2021

Professor Kristie J. Franz
Professor and Chair
Department of Geological and Atmospheric Sciences
Iowa State University

Dear. Dr. Franz,

I write to add the support of the Department of Economics for the proposed Climate Science major curriculum that has been developed by your department. The major will serve an important need by providing students an opportunity to integrate knowledge and methods from the natural and social sciences to better understand this pressing societal challenge.

I appreciate that you have been in communication with representatives of the Economics Department as this proposal was developed, and we are pleased that you have chosen to include two Economics courses – ECON 101 and ECON 380 – among the courses required for this major. We offer both of these courses regularly and are committed to continuing to do so in the future to support students in the proposed new major.

I wish you the best success.

Sincerely,



Joshua L. Rosenbloom
Professor and Chair

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

6 December 2021

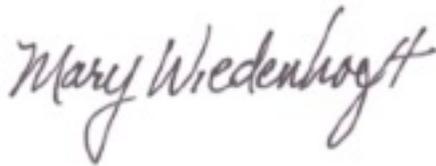
Department of Agronomy
Crop, Soil, & Environmental Sciences
716 Farm House Lane
Ames IA 50011-1010
Phone: 515-294-3274
Email: mwiedenh@iastate.edu

Dr. Kristie Franz:

The Agronomy Curriculum Committee reviewed the new Climate Science major that is being proposed by GE AT. We support your efforts. The committee members did suggest that GE AT add AGRON 180 to their list of courses for the major as Agron180 is a climate science class and meets the international prospective requirement. We discussed the inclusion of climate change effects on agriculture. Because ISU is an agricultural institution, students studying climate change will benefit from understanding the effects of climate on crop production. We discussed the idea of an agricultural pathway as an option for students wanting to focus on relevant agricultural issues. Committee members also suggested that GE AT consider including AGRON 182, AGRON 282 and AGRON 405.

I am happy to talk to you more about this.

Sincerely,



Mary Wiedenhoef, Ph.D.
Morrill Professor
Professor of Agronomy
Associate Chair for Academics, Agronomy
Chair, Agronomy Curriculum Committee

IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

College of Liberal Arts and Sciences

Department of Political Science
503 Ross Hall, 527 Farm House Lane
Ames, Iowa 50011-1054
515-294-7256
FAX 515-294-1003

Kristie J. Franz, Ph.D.
Professor, Department of Geological and Atmospheric Sciences
Chair, Department of Geological and Atmospheric Sciences
Smith Family Foundation Chair in Geology
Iowa State University
253 Science I
Ames, IA 50011

Dear Kristie,

This memo is written in enthusiastic support of the proposal by the Department of Geological and Atmospheric Sciences for a new major in Climate Science. I am delighted to learn of the plans for the major and am very happy to partner in this important endeavor.

We look forward to establishing a pathway for Political Science. A number of the courses we currently offer or may plan for the future should provide an excellent fit with the goals of the new major, and several of our faculty are well positioned to contribute to its success. We are working now to provide further details about our courses.

Many thanks for this initiative.

Sincerely,

Mack C. Shelley, II

University Professor and Chair, Department of Political Science
Iowa State University

Academic Program Approval Voting Record

This document is to be appended as the last page of the proposal for any new or revised academic program to record the successive votes of approval as the proposal moves through its required review and approval steps. Consult Faculty Handbook Section 10.8 or the Faculty Senate Curriculum Committee website for information regarding Committee review and voting requirements for each action.

Curricular Action: (check appropriate boxes below)

1. New Program Name Change Discontinuation Concurrent Degree for:
2. Undergraduate Major Graduate Major Undergraduate Minor Graduate Minor
 Undergraduate Certificate Graduate Certificate Other: _____
3. Name of Proposed Change: BS Climate Science _____
4. Name of Contact Person: Kristie Franz e-mail address: kfranz@iastate.edu
5. Primary College: Liberal Arts and Sciences Secondary College: _____
6. Involved Department(s): Geological and Atmospheric Sciences

Voting record for this curricular action:

Voting Body	Votes			Date of Vote
	For	Against	Abstain	
Dept. or Program Committee				
--GEAT Department	20	0	1	9/27/21-9/30/21
LAS College Curriculum Committee	8	0	0	11/12/2021
College Approval Vote:				
--Faculty Representative Assembly	21	0	0	11/30/2021
Graduate Council	N/A	N/A	N/A	
Faculty Senate Curriculum Committee				
Faculty Senate Academic Affairs Council	10	0	1	3/31/2022
Faculty Senate				