Graduate Council Curriculum Report

The Graduate Council Curriculum Report (GCCR), which includes all graduate curricular proposals approved through the Graduate Council curricular review process, is published 12 times each calendar year.

Questions/comments regarding the GCCR or its contents may be directed to the Director of Graduate Education Administration.

March 7, 2018

Graduate Degree Programs

ADD

Climate Science – add new dual-title program for the Ph.D. degree (College of Earth and Mineral Sciences), page 7

CHANGE

Landscape Architecture – add IUG with B.L.A. and M.S. in Landscape Architecture (College of Arts and Architecture), page 48

Landscape Architecture – change degree requirements, drop two options in Community and Urban Design and Watershed Stewardship (College of Arts and Architecture), page 65

Meteorology – change name to Meteorology and Atmospheric Science, adopt dual-title in Climate Science for the Ph.D. degree, change degree requirements (College of Earth and Mineral Sciences), page 83

Graduate Courses

ADD

APLNG 571
Usage-Based Approaches to Second Language Learning and Teaching
USAGE-BASED SLA (3)
This course provides a broad exploration of usage-based approaches to second language learning and teaching. It considers the roles played by cognition, usage, and communication in shaping how we acquire, process, and use language and builds an awareness of language as a complex adaptive system that emerges gradually through usage. Building on these insights, participants will explore and critique foundations to contemporary research about the cognitive processes underlying language structure, language learning, and language teaching.
RECOMMENDED PREPERATION: It is recommended that students have taken coursework in linguistics and/or (second) language acquisition (at PSU or elsewhere)
PROPOSED START: SU2018
**IST 543**  
Foundations of Software Security  
SOFTWARE SECURITY (3)  
This course teaches the principles and practice of software security. The course gives an overview of the foundations of computation models and languages. It then builds on this foundation by teaching students how to address software security issues using fundamental techniques such as type systems and program analysis. The course also covers the practical side of software security, such as memory safety issues including buffer overflow, code injection, and code reuse attacks, as well as some of the latest security problems. Through this course, the students will gain a concrete understanding of principles and practices of software security and be prepared for research on software security related problems.  
PROPOSED START: SU2018

**IST 820**  
Cybersecurity Analytics  
CYBERSEC ANALYTICS (3)  
IST 820 provides theoretical and applied foundations of fundamentals of network security, data sources, data collection techniques and tools, cybersecurity analytics infrastructure, machine learning and data mining, network forensics, anomaly and malware detection, security data visualization, and security dashboard design and implementation.  
PREREQUISITES: IST 554, IST 815  
PROPOSED START: SU2018

**LGWR 530**  
Chinese Labor Relations in Comparative Perspective  
CHINESE LABOR REL (3)  
Since it opened its economy to private investment in 1978, China’s planned economy has been turned into a market-driven economy. Relying heavily on export-oriented industries, China serves as a “spatial fix” for Western capital, which eagerly searches for new sites of investment and business opportunities. As a result, China has become a gigantic manufacturing hub and the second largest economy in the world. The massive inflow of foreign investment, the pro-business developmental strategies of the Chinese state, and weak legal enforcement of workers’ rights have rendered workers victims of economic reform. This course will examine labor relations in post-socialist China. It will cover topics such as the development of China’s economic reform, the employment and working conditions of workers, trade unions and the collective bargaining system, the state’s role in employment relations, the labor law system, and the role of civil society and non-governmental organizations in the country’s labor relations.  
In addition to China, this course will focus on Vietnam (another post-communist country in Asia), and Hong Kong, Taiwan, and South Korea (three of the four Asian Tigers). It will investigate how these countries are similar to or different from China in terms of socio-economic development and labor relations. Moreover, the course examines labor relations in China and other countries by drawing upon analytical and theoretical concepts on subjects such as the state, the legal system, the economic system, class relations, and civil society.  
PROPOSED START: SU2018
OLD

BUSAD 528
Mergers and Acquisitions
MERGERS AND ACQ (3)
Survey of drivers of success in M&A and develop knowledge and skills in the design and evaluation of M&A transactions.
PREREQUISITES: ACCTG 512, BUSAD 526
APPROVED START: FA2011

NEW

BUSAD 828
Mergers and Acquisitions
MERGERS AND ACQUIS (3)
The mission of this course is to survey the drivers of success in mergers and acquisitions (M&A) and develop students' skills in the design and evaluation of these transactions. The course will combine a survey of mergers and acquisitions, an investment banking product-training class for associates, and a case study. We will focus on the type of merger most class participants will potentially be involved with - the acquisition of a modest-sized private company by a larger private company, or by a mid-size public company. At the same time, due to the availability of date, much of the case material relates to larger public-to-public transactions. We will use these cases to illustrate major points applicable across a range of transactions.
M&A combines a range of disciplines - finance, accounting, corporate strategy, and marketing - that translate an idea into a concrete transaction. We will survey a number of analytic tools and then use those tools to develop the students' own pitch book exercise.
PREREQUISITES: ACCTG 512

OLD

BUSAD 530
Ethical Issues in Information Technology
BIO/HEALHT IND (3)
Organization, financing, policy, trends, problems and issues in the biotechnology, pharmaceutical, and health industries. Overview of cost, quality, access issues.
APPROVED START: FA2002

NEW

BUSAD 830
Biotechnology and Health Industry Overview
BIOTECH/HEALHT IND (3)
The course explores current issues and trends in the biotechnology, pharmaceutical, medical device, and health care industries. The classic cost, quality, and access paradigm is applied from the perspective of multiple stakeholders. Organization of care, financing, policy, regulatory, and ethical problems and issues are emphasized.
OLD
BUSAD 534
Ethical Dimensions of Management in the Biotechnology and Health Industry
ETH MGMT BIOT HLTH (3)
Ethical managerial decision-making in biotechnology, pharmaceuticals, and health including ethical implications of technological/scientific advances, medical interventions, and business decisions.
PREREQUISITES: BUSAD 530
APPROVED START: SU2002

NEW
BUSAD 834
Ethical Dimensions of Management in the Biotechnology and Health Industry
ETH MGMT BIOT HLTH (3)
This course provides an overview of various ethical decision-making frameworks, which are then applied to critically examine issues within the biotechnology and health industries. Ethical decision-making frameworks include utilitarian principles, rights and justice theories, virtue ethics, feminist ethics, and various medical ethics models. Applications to cases involving genetic testing, stem cell research, euthanasia, organ retrieval and transplantation, and pharmaceutical development are among those to be explored.
PREREQUISITES: None

OLD
BUSAD 576
Ethical Issues in Information Technology
ETH ISS INFOR TECH (3)
Exploration of ethical issues affected by IT: privacy, free speech, computer crime, intellectual property, IT professionalism, and software product liability.
PREREQUISITES: MGMT 501
APPROVED START: SP2012

NEW
BUSAD 876
Ethical Issues in Information Technology
ETH ISS INFOR TECH (3)
Computers are the technological foundation of the information age. Well over half of workers in the U.S. and around the globe make their living by collecting, storing, and manipulating data. Technology has improved our lives, but has also created some unpleasant situations that raise serious ethical questions. The course explores important ethical issues that are affected by information technology, such as privacy, free speech, computer crime, intellectual property, IT professionalism, and software product liability.
PREREQUISITES: BUSAD 537

OLD
FIN 513
Speculative Markets
SPECULATIVE MKTS (3)
Analysis of derivative securities covering options, forwards, futures, OTC derivatives; topics include valuation, trading, hedging. Involves computer analysis.
PREREQUISITES: BA 531
NEW

FIN 813
Speculative Markets
SPECULATIVE MKTS (3)
This course covers the valuation and uses of derivative securities. The topics include the pricing and valuation of forward contracts, futures, swaps, and options. In addition, common hedging strategies will be discussed using the financial derivatives as basic building blocks to manage financial risk exposures to equity prices, interest rates, foreign exchange rates, and commodity prices. The topics in this course are quantitative and challenging because of the conceptual complexity of financial derivatives and the precision and degree of details required in pricing and valuation of derivative instruments.
PREREQUISITES: FIN 508

OLD

LEAD 562
Ethical Issues in Information Technology
STRAT LEADERSHIP (3)
Executive-level leadership of larger systems and organizations. Impact of developing human, intellectual, social, structural, financial and reputational capital as strategic tools.
PREREQUISITES: LEAD 555, LEAD 556
APPROVED START: SU2004

NEW

LEAD 862
Strategic Leadership
STRATEG LEADERSHIP (3)
LEAD 562 explores and analyzes the requirements for effective strategic leadership in organizations operating in today's technology-driven environments. Students will be given an overview of the various elements of the strategic leadership system, including organizational context/environment, leader's life stream of biographic and demographic elements influencing leadership, and followers' perceptions the leader's behavior. Emphasis in this course is placed on learning from "real world" senior managers/administrators to enhance the practicality and usefulness of the material covered in the course. As the course progresses, new knowledge and skills are integrated into a more sophisticated framework for understanding strategic leadership.
PREREQUISITES: LEAD 501, LEAD 555, LEAD 556

OLD

PHS 501
Principles of Public Health
PUBLIC HEALTH (3)
This course is designed to provide students with a foundation in public health principles.
APPROVED START: SU2012

NEW

PHS 809
Principles of Public Health
PUBLIC HEALTH (3)
This course provides students with a foundation in public health principles and practice. Students will examine public health models and frameworks, determinants of health, indicators of health, and the etiology of disease. Students will learn about public health milestones and innovations, measures of health and well-being, issues surrounding health disparities, ethical issues in public health practice and research, and the role of state and county health departments in disease control and prevention. Students will examine today’s priority health concerns using a public health framework.

**DROPS**

**CSA 595**  
Internship  
INTERNSHIP (1-9/Repeatable Max: 9)  
Supervised off-campus, nongroup instruction, including field experiences, practicums, or internships. Written and oral critique of activity required.  
PROPOSED DROP: SU2018
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

The Program Proposal Procedures provide guidance for the development of a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this Graduate Council proposal form, contact the Office of the Dean of the Graduate School.

College/School: College of Earth and Mineral Sciences
Department or Instructional Area: Meteorology and Atmospheric Science

New Graduate Program, Option, or Minor: Add
Designation of new graduate program: Climate Science
Classification of Instructional Programs (CIP) Code: 40.0499
Designation of new graduate option:
Designation of new graduate minor:

Indicate effective semester:
First semester following approval
Second semester following approval

Existing Graduate Program Option, or Minor: Change
Drop
Current designation of graduate program: IUG/MS/PhD in Meteorology
Current designation of graduate option:
Current designation of graduate minor:

New designation of existing graduate program (if changing): IUG/MS/PhD in Meteorology and Atmospheric Science
New designation of existing graduate option (if changing):
New designation of existing graduate minor (if changing):

Brief description of the change (if not noted above): Please see attached
Indicate effective semester:
First semester following approval
Second semester following approval

Submitted by Graduate Program Head
David J. Stensrud
Printed name
Signature Date: 1/28/2017

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:

David Babb
Printed name
Signature Date: 12/5/2017

Approved by College/School Dean/Chancellor (or Designee):

John Hellmann
Printed name
Signature Date: 12/14/2017
<table>
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<td>C. Andrew Cole</td>
<td>[Signature]</td>
<td>3/4/2018</td>
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<td>Recommended by Chair, Graduate Council Committee on Programs and Courses:</td>
<td>Kathleen Heid</td>
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<td>3/6/2018</td>
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<td>Noted by Dean of the Graduate School:</td>
<td>Regina Vasilatos-Younken</td>
<td>[Signature]</td>
<td>3/6/2018</td>
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<td>On Behalf of Regina Vasilatos-Younken</td>
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A Proposal to Graduate Council to Establish a  
Dual-Title Doctoral Program in Climate Science

Submitted by  
Department of Meteorology and Atmospheric Science

Contact:  
Michael E. Mann  
Distinguished Professor of Atmospheric Science  
Department of Meteorology and Atmospheric Science, and Department of Geosciences  
514 Walker Building  
814-863-4075  
mann@psu.edu  

Director, Earth Systems Science Center
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1) Objectives and Justification for the Climate Science Program

A. Program Need

Climate Science is a field devoted to the study of the Earth’s climate in the past, present and future. The effects of human (anthropogenic) and natural forcing, and their interactions, on climate and society is of great interest as the Earth enters the Anthropocene where human activity has become a dominant influence on our global environment. The need for this dual title program is seen daily as stories on climate and climate science appear in the news. International organizations, such as the Intergovernmental Panel on Climate Change, were formed in the past few decades to assess the state of the science on climate and now play important roles in the global climate conversation. Government agencies, companies, non-profit organizations and citizens are asking for increasingly more specific information on how the climate will evolve and the potential impacts of these changes. These groups and individuals are looking to climate scientists to provide this guidance.

The techniques used to study climate have expanded dramatically from simple energy balance approaches to sophisticated global climate models, from the analysis of instrumental climate records to the development of proxy climate records including ice cores, tree rings, corals, speleothems, sub-fossil pollen, ocean and lake sediments spanning many thousands of years. There is an increasing use of Geographical Information Systems (GIS) and sophisticated statistical methods that are used to inter-compare data sets, uncover the relationships between variables and assess the statistical significance of interrelationships. New observational systems to measure concentrations of greenhouse gases and emissions from human activity are becoming common and more affordable. Global climate models are being run at finer and finer scales and are beginning to provide information on regional climate and climate change that can be applied to planning and climate impacts. Physical process parameterization schemes within these models are becoming increasingly faithful as they are verified against special observational data sets, including line-by-line solar and infrared radiation spectra. Assessments of climate risk are becoming more robust, backed by detailed scientific and statistical analysis. A better understanding has been developed of the relationship between climate change and extreme
weather events. Many of these approaches to climate science have origins in diverse specific disciplines, emphasizing the need for a dual-title program to span departments and allow the students to gain knowledge not easily available from a single perspective. This approach will give our PhD students a richer and more diverse education and training than any department could offer alone.

In a survey of 106 departments of meteorology and/or atmospheric science in 2015, only three department names included the word “climate”. This suggests that the proposed dual-title program in Climate Science would provide our graduate students a unique advantage as career opportunities in Climate Science continue to grow. There is an increasing demand for scientists with strong training and expertise in Climate Science to serve the need for climate information and analysis, and application to society.

The proposed Climate Science dual title doctoral degree program will:

- Provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society.
- Develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science.
- Supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

B. Professional Associations and Journals

A number of professional associations and journals are used to advance the field of Climate Science. These include


Springer’s journals *Climate Dynamics* and the international weekly journal of science *Nature*.

The **International Glaciology Society** and its *Annals of Glaciology*, and *International Journal of Glaciology*.

Elsevier’s journal *Quaternary Science Reviews*.

The **American Association for the Advancement of Science** and its journal *Science*.

The **International Union for Quaternary Science** and the **American Quaternary Association**.

The **Quaternary Research Association** and its *Journal of Quaternary Science*.

The United States **National Academy of Sciences** and its *Proceedings of the National Academy of Sciences*.

The **Royal Society of London** and its *Proceedings of the Royal Society of London*.

The **Royal Meteorological Society** and its *International Journal of Climatology*.

The **American Association of Geographers** and its *Annals of the Association of Geographers*.
C. Graduate Student Recruitment and Research

The proposed dual-title Ph.D. program in Climate Science is intended to expand graduate student recruitment. Many graduate student applicants are interested in climate and climate change, and climate impacts on society, and want to pursue a Ph.D. in this field, but can be challenged to find the department that best fits their interests. This is owing to the many departments at Penn State that have faculty members involved in Climate Science. The proposed dual-title program will thus provide an important connective tissue between departments, allowing graduate student applicants to see how they can develop research projects that span departments and capture the increasingly interdisciplinary nature of Climate Science.

The Climate Science dual-title Ph.D. program will provide critical skills and cross-disciplinary knowledge that will enhance the students’ education, training and research and thereby enhance their ability to compete for academic and non-academic positions after graduation. The skills will be developed through participation in the Climate Dynamics Seminar and a course in climate dynamics and observations, with three other courses to be chosen from the four remaining course areas: numerical and statistical methods, atmosphere and ocean dynamics, biogeochemistry and isotopes, and human dimensions of climate change. The Climate Dynamics Seminar will be particularly helpful in developing student and faculty interactions that span all aspects of Climate Science, as students will be required to take this course twice and thus will have ample opportunity to learn from each other and network with faculty members and students from other departments who adopt the dual title program.

The graduate student research also will be enhanced by the participation of a Graduate Faculty member from the Climate Science program, who is not a member of the student’s home graduate program, on the doctoral committee (in accordance with the Graduate Council requirement). This alternative perspective is designed to broaden the student’s knowledge and skills and provide experience in communicating with audiences from different academic disciplines.
D. Climate Science Dual-Title Graduate Program

The Climate Science dual-title degree program is to be administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. A Climate Science program committee will be composed of representatives from each participating graduate program. This Climate Science program committee maintains program definition, defines the nature of the candidacy examination and assigns the examining committee, identifies and reviews courses for their applicability to the program, and recommends policies and procedures for the program's operation to the dean of the Graduate School and to the deans of the participating colleges. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Climate Science, while maintaining a close association with major program areas of application.

Graduate students with research and educational interests in climate science may apply to the Climate Science Dual-Title Degree Program. Candidates must submit transcripts of their undergraduate and graduate course work, a written personal statement indicating the career goals they hope to serve by attaining a Climate Science dual title, and a statement of support from their dissertation adviser. A strong preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines. Doctoral students should seek entry into the Climate Science Dual-Title Degree upon arriving for their graduate studies, but will be evaluated for acceptance provided they have not yet taken their candidacy exam.

E. Description of Required Climate Science Coursework

The minimum academic requirements for the dual-title Ph.D. degree in Climate Science begin with the course work and other requirements of the primary program. Students must also take a total of at least 3 credits of approved 400-, 500-, or 800-level courses in each of two specific areas: 1) Climate dynamics seminar and 2) Climate dynamics and observations, as well as 3 credits of approved 400-, 500-, or 800-level courses in each of three of the four remaining areas: 3) Physical climate system, 4) Biogeochemistry of the climate system, 5) Numerical methods
and data analysis, and 6) Human dimensions of climate change, for a total of 15 credits. Students are not eligible to take a 400-level course in any one of the areas if the course is offered by their primary graduate program. All students must take at least one 500-level course, and at least one course must be from outside of their core disciplinary expertise. Finally, all of the courses offered in Climate Dynamics and Observations will include sufficient material in radiative transfer and the greenhouse effect to ensure that the students clearly understand the underlying physics of climate and climate change. A list of the approved courses that will satisfy each of the area requirements is maintained by the graduate program office. Students or faculty may request that the Climate Science Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses.

Students enrolled in the dual-title degree program should expect to spend one additional semester in order to obtain the dual-title degree, as some of the required course work should also serve their major graduate degree program. Advisers will work with the students to select the courses in order that the requirements are met in a timely manner. Funding for graduate student support will come from the home graduate program.

The approved courses for the Climate Science dual-title program are:

1) **Climate Dynamics Seminar (3 credits total required)**

   METEO 575 (1 or 2 credits)

   This course is key to building the student cohort each year. It will involve reading and discussing papers of current interest that span the disciplines involved in the dual-title program. Students will take the course twice, once for 1 credit (reading and discussion only) and once for 2 credits (with requirements for writing papers). Faculty members involved in the dual-title program are expected to participate in the seminar regularly.

2) **Climate dynamics and observations (3 credits required)**
GEOG 412 - Climatic Change and Variability (3)
GEOG 417 – Satellite climatology (3)
METEO 470—Climate dynamics (3)
METEO 570 – Climate system dynamics (3)

These courses are critical for developing a foundational understanding of climate science and include sufficient material in radiative transfer and the greenhouse effect to ensure that the students clearly understand the underlying physics of climate and climate change.

3) Physical climate system (3 credits, this is one of four remaining categories)

GEOSC 405 (SOILS 405) - Hydropedology (3)
METEO 421—Atmospheric dynamics (4)
METEO 422—Advanced atmospheric dynamics (3)
METEO 436 – Radiation and Climate
METEO 451—Introduction to physical oceanography (3)
METEO 521—Dynamical meteorology (3)
METEO 535 – Radiative transfer (3)
METEO 551 – Physical oceanography (3)
C E 561 – Surface hydrology (3)
METEO 563 – Bioclimatology (3)

These courses delve deeper into the physical processes that govern the climate system.

4) Biogeochemistry of the climate system (3 credits, this is one of four remaining categories)

GEOSC 410—Marine biogeochemistry (3)
GEOSC 419—The organic geochemistry of natural waters and sediments (3)
C E 475 – Water Quality Chemistry (4)
GEOSC 502—Evolution of the biosphere (4)
METEO 532 – Chemistry of the Atmosphere (3)
METEO 561 – Global Carbon Cycle (3)
These courses explore the relationships between climate and the chemical reactions in the atmosphere, oceans, land, and living organisms that create the composition of the natural environment.

5) **Numerical methods and data analysis (3 credits, one of four remaining categories)**
   
   GEOSC 450—Risk analysis in the Earth Sciences (3)
   C E 461 – Water-resource Engineering (3)
   GEOG 464—Advanced Spatial Analysis (3)
   METEO 473—Application of computers to Meteorology (3)
   METEO 515 – Practical statistics for atmospheric sciences (3)
   METEO 523—Modeling the climate system (3)
   METEO 527 – Data assimilation (3)
   C E 555 – Groundwater Hydrology: Modeling and Analysis (3)
   FOR 565—GIS Based Socio-Ecological Landscape Analysis (3)

   These courses provide advanced training in the quantitative techniques used to predict climate and/or interpret observations of the climate system.

6) **Human dimensions of climate change (3 credits, one of four remaining categories)**
   
   ANTH 432 – Environmental Archaeology (3)
   GEOG 438 – Human dimensions of global warming (3)
   GEOG 510 – Seminar in Physical Geography (3)

   These courses explore how climate change impacts society and the natural environment.

F. **Accreditation**

No accrediting body or board exists for Climate Science programs and no licensing procedure is relevant.
G. Departments Affected

The primary and most immediate impact would be to the Department of Meteorology and Atmospheric Science as the administrative home of the dual-title Climate Science Ph.D. degree program. The Department of Meteorology and Atmospheric Science commits to providing the core Climate Dynamics Seminar (METEO 575) as well as the other METEO courses in the approved list of courses. The graduate program in Meteorology is submitting the initial proposal to adopt the dual-title. Two other departments (Geosciences and Geography) intend to propose adoption of the dual-title program within the next year. Letters of support for this dual-title program from these two departments are included in this proposal as part of the consultation.

This dual-title Climate Science graduate program does not duplicate any other program at Penn State.

H. Consultation

The following units have been consulted and are supportive of the dual-title Climate Science Ph.D. program:

Department of Agricultural Economics, Sociology, and Education, College of Agricultural Sciences
Department of Anthropology, College of the Liberal Arts
Department of Biology, Eberly College of Science
Department of Chemistry, Eberly College of Science
Department of Civil and Environmental Engineering, College of Engineering
College of Information Sciences and Technology
Department of Ecosystem Science and Management, College of Agricultural Sciences
Department of Electrical Engineering, College of Engineering
Department of Energy and Mineral Engineering, College of Earth and Mineral Sciences
Department of Geosciences, College of Earth and Mineral Sciences
Department of Geography, College of Earth and Mineral Sciences
Department of Materials Science and Engineering, College of Earth and Mineral Sciences
Department of Mathematics, Eberly College of Science
Department of Philosophy, College of the Liberal Arts
Department of Physics, Eberly College of Science
Department of Psychology, College of the Liberal Arts
Department of Statistics, Eberly College of Science
Institute for CyberScience
School of Law
Penn State Earth and Environmental Systems Institute
Rock Ethics Institute

Please see attached letters and emails in Appendix A.

2) Proposed Bulletin Listing

Climate Science (CLSCI)

Distinguished Professor Michael Mann, Program Coordinator
514 Walker Bldg.
814-863-4075

Degree Conferred

Students electing this degree program through participating programs earn a degree with a dual title in the Ph.D., i.e., Ph.D. in (graduate program name) and Climate Science.

The following graduate programs offer dual degrees in Climate Science: Ph. D. in Meteorology and Atmospheric Science and Climate Science.
The Graduate Faculty

- **Richard B. Alley**, Ph.D. (UNIVERSITY OF WISCONSIN-MADISON), Evan Pugh Professor of Geosciences
- **Sridhar Anandakrishnan**, Ph.D. (UNIVERSITY OF WISCONSIN-MADISON), Professor of Geosciences
- **Le Bao**, Ph.D. (UNIVERSITY OF WASHINGTON), Associate Professor of Statistics
- **Timothy Bralower**, Ph.D. (UNIVERSITY OF CALIFORNIA SAN DIEGO), Professor of Geosciences
- **Douglas Bird**, Ph.D. (UNIVERSITY OF CALIFORNIA DAVIS), Associate Professor of Anthropology
- **Rebecca Bliege Bird**, Ph.D. (UNIVERSITY OF CALIFORNIA DAVIS), Professor of Anthropology
- **Andrew M. Carleton**, Ph.D. (UNIVERSITY OF COLORADO), Professor of Geography
- **Guido Cervone**, Ph.D. (GEORGE MASON UNIVERSITY), Associate Professor of Geography and Geoinformatics
- **Robert Crane**, Ph.D. (UNIVERSITY OF COLORADO), Professor of Geography
- **Kenneth J. Davis**, Ph.D. (UNIVERSITY OF COLORADO), Professor of Atmospheric and Climate Science
- **Jenni L. Evans**, Ph.D. (MONASH UNIVERSITY), Professor of Meteorology
- **Matthew S. Fantle**, Ph.D. (UNIVERSITY OF CALIFORNIA BERKELEY), Associate Professor of Geosciences
- **Karen Fisher-Vanden**, Ph.D. (HARVARD UNIVERSITY), Professor of Environmental and Resource Economics
- **Chris Forest**, Ph.D. (MASSACHUSETTS INSTITUTE OF TECHNOLOGY), Associate Professor of Climate Dynamics in Meteorology
- **Katherine H. Freeman**, Ph.D. (INDIANA UNIVERSITY BLOOMINGTON), Evan Pugh Professor of Geosciences
- **Melissa Gervais**, Ph.D. (MCGILL UNIVERSITY), Assistant Professor of Meteorology and Atmospheric Science
• Murali Haran, Ph.D. (UNIVERSITY OF MINNESOTA MINNEAPOLIS), Professor of Statistics
• Jose Fuentes, Ph.D. (UNIVERSITY OF GUELPH), Professor of Meteorology
• Gregory S. Jenkins, Ph.D. (UNIVERSITY OF MICHIGAN ANN ARBOR), Professor of Meteorology
• James F. Kasting, Ph.D. (UNIVERSITY OF MICHIGAN ANN ARBOR), Evan Pugh Professor of Geosciences
• Margot Kaye, Ph.D. (COLORADO STATE UNIVERSITY), Associate Professor of Forest Ecology
• Douglas J. Kennett, Ph.D. (UNIVERSITY OF CALIFORNIA SANTA BARBARA), Professor of Anthropology
• Klaus Keller, Ph.D. (PRINCETON UNIVERSITY), Associate Professor of Geosciences
• Lee R. Kump, Ph.D. (UNIVERSITY OF SOUTH FLORIDA), Dean of the College of Earth and Mineral Sciences and Professor of Geosciences
• Thomas Lauvaux, Ph.D. (VERSAILLES SAINT-QUENTIN-EN-YVELINES UNIVERSITY), Senior Research Associate and Associate Professor of Meteorology
• Jia Li, Ph.D. (STANFORD UNIVERSITY), Professor of Statistics and Computer Science and Engineering
• Li Li, Ph. D. (PRINCETON UNIVERSITY), Associate Professor of Civil and Environmental Engineering
• Kenneth Mankoff, Ph.D. (UNIVERSITY OF CALIFORNIA SANTA CRUZ), Research Associate, Department of Geosciences
• Michael E. Mann, Ph.D. (YALE UNIVERSITY), Distinguished Professor of Meteorology and Professor of Geosciences
• Alfonso Mejia, Ph.D. (UNIVERSITY OF MARYLAND COLLEGE PARK), Assistant Professor of Civil and Environmental Engineering
• Douglas Miller, Ph.D. (THE PENNSYLVANIA STATE UNIVERSITY), Professor of Geography
• Raymond Najjar, Ph.D. (PRINCETON UNIVERSITY), Professor of Meteorology
• **Byron Parizek**, Ph.D. (PENNYSYLVANIA STATE UNIVERSITY), Associate Professor of Mathematics and Geosciences
• **David Pollard**, Ph.D. (CALIFORNIA INSTITUTE OF TECHNOLOGY), Senior Scientist, Earth and Environmental Systems Institute
• **Benjamin Shaby**, Ph.D. (CORNELL UNIVERSITY), Assistant Professor of Statistics
• **Chaopeng Shen**, Ph.D. (MICHIGAN STATE UNIVERSITY), Assistant Professor of Civil Engineering
• **James Shortle**, Ph.D. (IOWA STATE UNIVERSITY), Professor of Agricultural Economics
• **Erica A.H. Smithwick**, Ph.D. (OREGON STATE UNIVERSITY), Associate Professor of Geography
• **Janet Swim**, Ph.D. (UNIVERSITY OF MINNESOTA MINNEAPOLIS), Professor of Psychology
• **Alan H. Taylor**, Ph.D. (UNIVERSITY OF COLORADO), Professor of Geography
• **Ted Toadvine**, Ph.D. (UNIVERSITY OF MEMPHIS), Professor of Philosophy
• **Nancy Tuana**, Ph.D. (UNIVERSITY OF CALIFORNIA BERKELEY), Professor of Philosophy, Women’s Studies, and Science, Technology, and Society
• **David W. Titley**, Ph.D. (NAVAL POSTGRADUATE SCHOOL), Professor of Practice and Director, Center for Solutions to Weather and Climate Risk
• **Fuqing Zhang**, Ph.D. (NORTH CAROLINA STATE UNIVERSITY), Professor of Meteorology and Statistics

The Program

The Climate Science dual-title degree program is administered by the Department of Meteorology and Atmospheric Science for the participating graduate programs. A program committee with representatives from each participating department maintains program definition, defines the nature of the candidacy examination and assigns the examining committee, identifies courses appropriate to the program, and recommends policy and procedures for the program's operation to the dean of the Graduate School and to the deans of the participating colleges. The
dual-title degree program is offered through participating programs in the College of Earth and Mineral Sciences and, where appropriate, other graduate programs in the University. The program enables students from several graduate programs to gain the perspectives, techniques, and methodologies of Climate Science, while maintaining a close association with major program areas of application. Climate Science is a field devoted to the study of Earth’s climate in the past, present, and future. A particular focus is understanding the effects of human activities (anthropogenic impacts) and natural forcing on climate.

Admission Requirements

Students must be admitted to their primary graduate program and The Graduate School before they can apply for admission to the dual-title degree program. Students must be admitted into the dual-title degree program in Climate Science prior to obtaining candidacy in their primary graduate program.

Graduate students with research and educational interests in climate science may apply to the Climate Science Dual-Title Degree Program. Students must submit transcripts of their undergraduate and graduate course work, a written personal statement indicating the career goals they hope to serve by attaining a Climate Science dual title, and a statement of support from their dissertation adviser. A strong preparation in the basic sciences is expected, with evidence of an interest in multiple disciplines.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the primary graduate program in which they are enrolled. In addition, they must satisfy the degree requirements for the dual-title in Climate Science, listed below.

The minimum course requirements for the dual-title in Climate Science are as follows: students must take a total of at least 3 credits of approved 400-, 500-, or 800-level courses in each of two specific areas: 1) Climate dynamics seminar and 2) Climate dynamics and observations, as well as 3 credits of approved 400-, 500-, or 800-level courses in each of three of the four remaining areas: 3) Physical climate system, 4) Biogeochemistry of the climate system, and 5) Numerical
methods and data analysis, and 6) Human dimensions of climate change, for a total of 15 credits. Students are not eligible to take a 400-level course in any one of the areas if the course is offered by their primary graduate program. All students must take at least one 500-level course, and at least one course must be from outside of their core disciplinary expertise. Finally, all of the courses offered in Climate Dynamics and Observations will include sufficient material in radiative transfer and the greenhouse effect to ensure that the students clearly understand the underlying physics of climate and climate change. A list of the approved courses that will satisfy each of the area requirements is maintained by the graduate program office. Students or faculty may request that the Climate Science Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses.

The candidacy examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Climate Science program. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. There will be a single candidacy examination, containing elements of both the primary graduate degree program and Climate Science. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for doctoral committees, the doctoral committee of a Climate Science dual-title doctoral degree student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. If the chair of the doctoral committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their doctoral committee and reflects their original research and education in both their primary graduate program and Climate Science. Upon completion of the
doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

**Student Aid**

Graduate assistantships and other forms of student aid may be available through the student’s primary graduate program; these are described in the Student Aid section of the Graduate Bulletin. Students on graduate assistantships must adhere to the course load limits set forth in the Graduate Bulletin.

**Courses**

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

**Appendix A: Letters and Emails of Support from Consultations**
August 11, 2017

Dr. David Stensrud
Department of Meteorology
Penn State Campus

Dear David:

The Department of Geosciences is excited about the proposed dual degree PhD program in Climate Science. We expect that it will help us recruit students and provide additional linkages between our department and yours.

Once approved, the Department of Geosciences will adopt the dual degree program and thus I lend my strong approval to your proposal.

Best wishes,

Timothy J. Bralower
Interim Head, Department of Geosciences
October 9, 2017

Dear Dr. David Stensrud

I am writing to offer the full support of the Department of Geography for the dual-title PhD program in Climate Science proposed by the Department of Meteorology and Atmospheric Science. To participate more fully, we hope to hire an additional faculty member in climate science and have additional Geography courses to include in the program in future years. We also expect that Geography PhD students studying physical geography and environment & society topics will value seeking this additional credential while studying at Penn State. We will encourage them to join the dual-degree program.

Sincerely

[Signature]

Dr. Cynthia A. Brewer
Professor of Geography
Head of Department
cbrewer@psu.edu
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: Douglas Kennett <djk23@psu.edu>
Date: 9/13/17, 6:49 PM
To: david.stensrud@psu.edu

Dear David, I'm happy to support this dual degree program.

cheers,

Doug

On Mon, Aug 7, 2017 at 11:35 AM, David Stensrud <djs78@psu.edu> wrote:
Dear Douglas,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Anthropology to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support. You and several of your faculty members have agreed to be members of the dual-title graduate faculty.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud

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David J. Stensrud
Professor and Head, Department of Meteorology and Atmospheric Science
503 Walker Building
The Pennsylvania State University
University Park, PA 16802 david.stensrud@psu.edu

"I would rather be right than consistent."
- Winston S. Churchill
Dear David,

Thank you for bringing this to my attention. Looks like a very nice graduate program. Definitely a strong group of faculty. It is unlikely to impact Biology directly, as it does not require any Bio courses of these students and no Biology faculty are directly involved.

Please let me know if you need anything else from me.

Best, Tracy

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
Tracy Langkilde
Professor and Head
Department of Biology

208 Mueller Lab
The Pennsylvania State University
University Park, PA 16802, USA

LangkildeLab.com
+1 814 863 4530 – phone
+1 814 865 9131 – fax

On Wed, Aug 16, 2017 at 8:03 AM, David Stensrud <djs78@psu.edu> wrote:

Dear Tracy,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Biology to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support.

Please let me know if you have any questions or concerns.
Hi David. It sounds like this will not have a major impact on the Chemistry graduate program, but we definitely do support the project as a good idea for Meteorology and Atmospheric Science.

Best regards,
Tom

On Aug 16, 2017, at 8:08 AM, David Stensrud <djs78@psu.edu> wrote:

Dear Thomas,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Chemistry to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud

David J. Stensrud
Professor and Head, Department of Meteorology and Atmospheric Science
503 Walker Building
The Pennsylvania State University
University Park, PA 16802 david.stensrud@psu.edu
Re: Consultation Request: Dual-Title Doctoral Program in Climate Science

Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: Mike Messina <mgm20@psu.edu>
Date: 8/16/17, 8:43 AM
To: david.stensrud@psu.edu
CC: MARGOT W KAYE <mwk12@psu.edu>, MARC MCDILL <mem14@psu.edu>, Jack Watson <jew21@psu.edu>

Dave:

I can't think of a good reason why my department would oppose the creation of the dual-title Ph.D. in Climate Science, so we concur.

You mentioned Margot Kaye in your note, but another ESM faculty member, Marc McDill, has been teaching a General Natural Science elective described as:

FOR 201 (GN) Global Change and Ecosystems (3) This course will provide students with an understanding of the climate system, ecosystems, and feedbacks between the two.
Effective: Summer 2013
Prerequisite: 3 credits of science

I am including Marc on this note as an FYI.

Thanks, and good luck.

MGM

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Michael G. Messina, Head and Professor
Department of Ecosystem Science and Management
Penn State University
121 Forest Resources Building
University Park, PA 16802
Phone: 814-863-7093
FAX: 814-865-3725
mgm20@psu.edu

From: "David Stensrud" <djs78@psu.edu>
To: "Mike Messina" <mgm20@psu.edu>
Sent: Wednesday, August 16, 2017 8:25:03 AM
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Mike,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Ecosystem Science and Management to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support. Margot Kaye has agreed to be a member of the dual-title graduate faculty and I am excited about the possibility to build stronger connections between our departments.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: Susan Brantley <sxb7@psu.edu>
Date: 8/20/17, 1:41 PM
To: david.stensrud@psu.edu

Dave: I am fully supportive of this and would be able to help the program if it is instituted. Sue

On 8/16/2017 9:16 AM, David Stensrud wrote:

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Dear Sue,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Earth and Environmental Systems Institute to ask if this proposed dual-title Climate Science program would have any impact on your institute or programs and to ask for your support. Several of your EESI Associates have agreed to be members of the dual-title graduate faculty and Mike Mann will be the first Program Director for the Dual-title program once approved.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud

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David J. Stensrud
Department of Meteorology and Atmospheric Science
503 Walker Building
The Pennsylvania State University
University Park, PA 16802 david.stensrud@psu.edu

"I would rather be right than consistent."
- Winston S. Churchill
Subject: RE: Consultation Request: Dual–Title Doctoral Program in Climate Science
From: Kultegin Aydin <aydin@engr.psu.edu>
Date: 8/16/17, 3:53 PM
To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>

Dear Dave,

I support your department’s proposal for the dual-title doctoral program in Climate Science. It is well prepared and should lead to a successful program.

Best regards,

Kultegin

Kultegin Aydin
Professor and Head
Department of Electrical Engineering
School of Electrical Engineering and Computer Science
The Pennsylvania State University
129 EE East, University Park, PA 16802
Phone: (814) 863-2788

From: David Stensrud [mailto:djs78@psu.edu]
Sent: Wednesday, August 16, 2017 8:30 AM
To: KULTEGIN AYDIN <AQX@PSU.EDU>
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Kultegin,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Electrical Engineering to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support.

Please let me know if you have any questions or concerns.
Dave,

I fully support this new graduate program. I can see some interesting opportunities for ICS co-hired faculty to participate as advisors or mentors.

Cheers,

Jenni.

Jenni L. Evans
Director, Institute for CyberScience
Professor of Meteorology and Atmospheric Science

Dear Jenni,

As you know, the Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Institute for CyberScience to ask if this proposed dual-title Climate Science program would have any impact on your institute or programs and to ask for your support. You and several ICS Co-Hires, Associates, and Affiliates have agreed to be members of the dual-title graduate faculty.
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: Sanjay Srinivasan <sanjays@psu.edu>
Date: 8/5/17, 3:00 PM
To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>

Hello Dave:

The proposal for the new program was circulated among the members of our EME Graduate Education Committee. All feedback received was positive and supportive. We do not see any negative impact on our department or graduate program and we hereby confirm our support of it. I wish you success on this venture.

Hope your weekend is restful.

Best regards,

Sanjay

Sanjay Srinivasan
Professor and Head
John and Willie Leone Family Chair
Department of Mineral and Energy Engineering
The Pennsylvania State University
206 Hosler Building
University Park, PA 16802

email: sanjays@psu.edu
Phone: 814 863 9470

From: David Stensrud <djs78@psu.edu>
Reply-To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>
Date: Monday, July 31, 2017 at 1:22 PM
To: Sanjay Srinivasan <sanjays@psu.edu>
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Sanjay,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private
Subject: Re: Consultation Request: Dual–Title Doctoral Program in Climate Science
From: Andrew Sears <asears@ist.psu.edu>
Date: 8/16/17, 1:39 PM
To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>, "aus67@psu.edu" <aus67@psu.edu>
CC: Andrew Sears <asears@ist.psu.edu>

Dave,

Based on my initial consultations, I do not believe there would be any concerns from IST. I have some inquiries that are still out, and I will follow up with you directly if any concerns do arise.

Andrew

---
Andrew Sears
Dean and Professor
College of Information Sciences and Technology
The Pennsylvania State University
332 Information Sciences and Technology Building
University Park, PA 16802
+1 814 865 3528
andrew.sears@psu.edu

From: David Stensrud <djs78@psu.edu>
Reply-To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>
Date: Wednesday, August 16, 2017 at 8:19 AM
To: "aus67@psu.edu" <aus67@psu.edu>
Subject: Consultation Request: Dual–Title Doctoral Program in Climate Science

Dear Dean Sears,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the College of Information Sciences and Technology to ask if this proposed dual-title Climate Science program would have any impact on your college or programs and to ask for your support.
Thanks. I’m not going to raise any objection to the program over this, but I want to push back a little in our conversation. As someone in the climate law and policy space, I found it immensely useful to have taken climate science with a climate scientist (which few people in this space have done, and which I think is a problem for the dialogue). Similarly, I think it would help climate scientists to have more rigorous grounding in the law and policy context in which they operate (which the sound bites of our media represents just as poorly as the science). One of the great strengths at PSU is that we have knowledge across disciplines relevant to major problems, and making the approach more interdisciplinary I think adds value and helps us better take advantage of those strengths.

Hari M. Osofsky
Dean | Penn State Law and the School of International Affairs
Distinguished Professor of Law | Professor of International Affairs | Professor of Geography
The Pennsylvania State University | University Park

814-863-1521 | hmo8@psu.edu
252 Lewis Katz Building | University Park, PA 16802
Twitter: @hariosofsksy

From: David Stensrud <djs78@psu.edu>
Reply-To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>
Date: Wednesday, August 23, 2017 at 9:41 AM
To: Hari Osofsky <hmo8@psu.edu>, "david.stensrud@psu.edu" <david.stensrud@psu.edu>
Cc: Scott Gartner <gartner@psu.edu>, David Titley <dwt12@psu.edu>
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Hari,

Thanks for your support of the climate science dual-title! Your question is a good one.

What most dual title programs have done is to include in each area of focus a few classes at the senior (400) level that have few or no prerequisites. That way the dual title students can take those courses and know that if they work hard they can do well, even if the material is outside of their main area of study (e.g., meteorology students taking an environmental archaeology course that looks at climate change). This is the approach we took when designing the climate science proposal and unfortunately we did not find any 400
level courses related to law or policy that appeared to fit based upon the course descriptions. My recollection is that all the courses were at the graduate level.

I am admittedly reluctant to recommend course options at the graduate level that are far outside of a student's area of expertise, as graduate courses tend to build upon a defined set of core courses (it may be that Dave Titley's new course would work well, but we are not allowed to include classes with the 597 designation in the approved course list). That being said, students can request approval of elective designations for any course, meaning that a student could take a course on climate law and policy as part of the dual title by first asking for approval. This course would fit in the "human dimensions of climate change" course area and it would be an easy case to make. If we find that a law and policy course is taken every few years as part of the dual title, then we could modify the course listing accordingly at that time. I suspect the dual-title faculty will want to revisit the course list every few years to make sure it still makes sense and adapt to the needs of the students.

Does this sound like a workable approach? Happy to discuss.

Best!

Dave

On 8/22/17 4:12 PM, Osofsky, Hari wrote:

Dave,

Thanks for checking in. I know you've also been in touch with Scott and Dave, so I'm looping them in. I think this looks great. The only question I have is whether it could be enhanced by adding a climate change law and policy course to help provide that context.

Best,

Hari

Hari M. Osofsky
Dean, Penn State Law and School of International Affairs
Distinguished Professor of Law, Professor of International Affairs, and Professor of Geography
252 Lewis Katz Building
University Park, PA 16802
Email: hmo8@psu.edu.
Tel: 814-863-1521
Fax: 814-863-7274
Twitter: @hariosofsky

PennState Law PennState School of International Affairs
UNIVERSITY PARK, PA
From: David Stensrud <djs78@psu.edu>
Reply-To: "david.stensrud@psu.edu" <david.stensrud@psu.edu>
Date: Wednesday, August 16, 2017 at 9:05 AM
To: Hari Osofsky <hmo8@psu.edu>
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Dean Osofsky,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the School of Law to ask if this proposed dual-title Climate Science program would have any impact on your School or programs and to ask for your support.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud

David J. Stensrud
Professor and Head, Department of Meteorology and Atmospheric Science
503 Walker Building
The Pennsylvania State University
University Park, PA 16802  david.stensrud@psu.edu

"I would rather be right than consistent."
- Winston S. Churchill
David J. Stensrud  
Department of Meteorology and Atmospheric Science  
503 Walker Building  
The Pennsylvania State University  
University Park, PA  16802  david.stensrud@psu.edu

"I would rather be right than consistent."
- Winston S. Churchill
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: YUXI ZHENG <yuz2@psu.edu>
Date: 8/16/17, 9:23 AM
To: david.stensrud@david.stensrud@psu.edu

Dave,

It looks good to me. You may want to add John Harlim onto your list of graduate faculty.

Thanks,
Yuxi

________________________________________________________________________

Yuxi Zheng
Professor and Head
Francis R. Pentz and Helen M. Pentz Professor of Science
Department of Mathematics
The Pennsylvania State University
University Park, PA 16802
1(814)865-7527; yuz2@psu.edu
________________________________________________________________________

________________________________________________________________________

From: "David Stensrud" <djs78@psu.edu>
To: zheng@psu.edu
Sent: Wednesday, August 16, 2017 8:35:29 AM
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Yuxi,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Mathematics to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support.

Please let me know if you have any questions or concerns.
Re: Consultation Request: Dual-Title Doctoral Program in Climate Science

Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: SUSAN B SINNOTT <sbs5563@psu.edu>
Date: 7/31/17, 2:43 PM
To: david stensrud <david.stensrud@psu.edu>

Dear David,

I do not anticipate that there would be any impact on MatSE from this new Dual-Title Doctoral Program. I support your Department's pursuit of this new Program.

All the best,
Susan

P.S. I am having a great summer and it is flying by. I hope yours is going well!

Susan B. Sinnott, PhD
Department Head and Professor, Materials Science & Engineering
Editor in Chief, Computational Materials Science
The Pennsylvania State University
221A Steidle Building
University Park, PA 16802
Phone: 814-863-3117
Email: sbs5563@psu.edu
http://www.matse.psu.edu

From: "David Stensrud" <djs78@psu.edu>
To: "SUSAN B SINNOTT" <sbs5563@psu.edu>
Sent: Monday, July 31, 2017 1:20:18 PM
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Susan,

As you know, the Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and your department to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support. Please let me know if you have any questions or concerns.

I hope your summer has been a good one!
Dear David,

The proposal looks great to me and especially in light of Nancy and Ted's involvement I can only see a positive impact on my department. So I'm happy to give my support.

All best,
Amy

From: "David Stensrud" <djs78@psu.edu>
To: "AMY R ALLEN" <ara17@psu.edu>
Sent: Wednesday, August 16, 2017 8:38:39 AM
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Amy,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Philosophy to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support. Both Ted Toadvine and Nancy Tuana have agreed to be members of the dual-title graduate faculty and I am excited about the possibility to strengthen the ties between our departments.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud
Subject: Re: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: NITIN SAMARTH <nsamarth@psu.edu>
Date: 9/11/17, 10:24 AM
To: david.stensrud@psu.edu

Dear Dave:

My apologies for the slow reply. While it would not have any direct impact on the physics department, I find this proposal very timely and compelling. I am sure it will have a positive impact on Penn State in general and, by extension, it will also have a positive impact on the world by training future generations of scientists in an area of critical need. I fully support it.

Nitin

***********************************************************************
Nitin Samarth
George A. and Margaret M. Downsbrough Department Head,
Department of Physics
104 Davey Lab
Penn State University
University Park PA 16802
nsamarth@psu.edu
(814)863-0136

On 8/16/17 8:40 AM, David Stensrud wrote:

Dear Nitin,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Physics to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support.
Subject: RE: Consultation Request: Dual-Title Doctoral Program in Climate Science
From: MELVIN MICHAEL MARK <m5m@psu.edu>
Date: 8/16/17, 11:10 AM
To: <david.stensrud@psu.edu>

Dear Dave, I have reviewed the proposal for a dual-title Ph.D. program in Climate Science. On behalf of the Department of Psychology, I am happy to offer my endorsement of this valuable addition to graduate training at Penn State.

Please let me know if you need additional information or need this endorsement in a form other than an email.

Best,

mel

Melvin M. Mark,
Professor and Head of Psychology

---

From: David Stensrud [mailto:djs78@psu.edu]
Sent: Wednesday, August 16, 2017 8:44 AM
To: m5m@psu.edu
Subject: Consultation Request: Dual-Title Doctoral Program in Climate Science

Dear Mel,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual-title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Department of Psychology to ask if this proposed dual-title Climate Science program would have any impact on your department or programs and to ask for your support. Janet Swim has agreed to be a member of the dual-title graduate faculty and I am excited about the possibilities to strengthen ties between our departments.

Please let me know if you have any questions or concerns.
Subject: Re: Consultation Request: Dual–Title Doctoral Program in Climate Science
From: Ted Toadvine <tat30@psu.edu>
Date: 8/22/17, 10:15 AM
To: david.stensrud@psu.edu

Dear Dave,

Thank you for this update. The Rock Ethics Institute is fully supportive of the proposed dual–title doctoral program in Climate Science. The program will undoubtedly create new opportunities for collaboration among faculty and graduate students, and we see it contributing to the work on climate ethics that we have supported for many years. If there is anything more that we can do in support, please do let me know.

I am also personally delighted to be included among your faculty for the new program.

Best wishes,
Ted

On 8/16/2017 9:23 AM, David Stensrud wrote:

Dear Ted,

The Department of Meteorology and Atmospheric Science is in the process of finalizing a proposal (attached) for a dual–title doctoral program in Climate Science. The proposed Climate Science dual title doctoral degree program will 1) provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society, 2) develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, and 3) supply highly–trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

As an important part of the proposal process, I am consulting with you and the Rock Ethics Institute to ask if this proposed dual–title Climate Science program would have any impact on your institute or programs and to ask for your support. You and several of your faculty members have agreed to be members of the dual–title graduate faculty and I am excited about the possibilities to strengthen ties between our faculty members.

Please let me know if you have any questions or concerns.

Best regards,

Dave Stensrud
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

The Program Proposal Procedures provide guidance for the development of a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this Graduate Council proposal form, contact the Office of the Dean of the Graduate School.

College/School: **ARTS & ARCHITECTURE**
Department or Instructional Area: **LANDSCAPE ARCHITECTURE**

New Graduate Program, Option, or Minor: **Add**
Designation of new graduate program: **MS LANDSCAPE ARCHITECTURE**
Classification of Instructional Programs (CIP) Code: 
Designation of new graduate option: 
Designation of new graduate minor: 

Indicate effective semester: **First semester following approval**
Second semester following approval

Existing Graduate Program Option, or Minor: | Change | Drop |
--- | --- | --- |
Current designation of graduate program: 
Current designation of graduate option: 
Current designation of graduate minor: 
New designation of existing graduate program (if changing): 
New designation of existing graduate option (if changing): 
New designation of existing graduate minor (if changing): 

Brief description of the change (if not noted above): 
Indicate effective semester: 
First semester following approval
Second semester following approval

Submitted by Graduate Program Head

MALLIKA Bose
Printed name
Mallika Bose
Signature
Date: April 14/2017

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:

CHARLES ANDREW COLE
Printed name
Charles Cole
Signature
Date: 1/31/17

Approved by College/School Dean/Chancellor (or Designee):

BARBARA KORNZ
Printed name
Barbara Kornz
Signature
Date: 4/18/17
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<thead>
<tr>
<th>Task</th>
<th>Name</th>
<th>Signature</th>
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<tr>
<td>Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:</td>
<td></td>
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<tr>
<td>On Behalf of C. Andrew Cole</td>
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<td>Recommended by Chair, Graduate Council Committee on Programs and Courses:</td>
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<td>On Behalf of M. Kathleen Heid</td>
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<td>Noted by Dean of the Graduate School:</td>
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<tr>
<td>On Behalf of Regina Vasilatos-Younken</td>
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<td>Printed name</td>
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<td>Date: 3/6/2018</td>
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PROGRAM CHANGE PROPOSAL FOR LANDSCAPE ARCHITECTURE

TO CREATE AN INTEGRATED UNDERGRADUATE-GRADUATE (IUG) DEGREE PROGRAM

BLA IN LANDSCAPE ARCHITECTURE/MS IN LANDSCAPE ARCHITECTURE

SUBMITTED BY
THE DEPARTMENT OF LANDSCAPE ARCHITECTURE

January 27, 2017
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I. Proposed Integrated Degree Program and Complete Program Statement

A. Brief Description of the Program

The proposed integrated undergraduate-graduate (IUG) degree program (B.L.A. in Landscape Architecture/M.S. in Landscape Architecture) will provide an opportunity for strong students in Penn State’s Landscape Architecture BLA to complete a master’s degree with 6 total years of study (the B.L.A. is a 4.5-year program).

The IUG will allow students to use upper level Landscape Architecture courses to complete elective requirements in the M.S. degree program in Landscape Architecture while using M.S. courses to complete some of their B.L.A. requirements. Students in their fifth year will take some M.S. courses and in their sixth and final year a mix of B.L.A. and M.S. courses. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count toward the graduate degree.

B. Justification Statement for Action Being Taken

Increasingly, Landscape Architects are facing complex design issues that require an ability to conduct research as well as to understand research results generated by other allied disciplines. To that end, an IUG combining the B.L.A. (a professional design degree) with the M.S. (a research degree) would provide the most comprehensive training available for landscape architecture students. These graduates would be better trained for careers in a variety of consulting settings, as well as all levels of government and non-profit agencies. Furthermore, if the student wished to pursue a Ph.D., they would be well prepared to do so.

C. Time of Admission to the Program

The number of openings in the integrated B.L.A. /M.S. program will be limited. Admission will be selective based on specific criteria set by the Department of Landscape Architecture (see below). Because the B.L.A. is a 4.5-year program, students will be admitted to the IUG program no earlier than the beginning of the seventh semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study.

D. Admission Requirements

Admission requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin.

1. Must be enrolled in the Landscape Architecture B.L.A. program.
2. Must apply to, and be accepted into, The Graduate School and the M.S. program in Landscape Architecture. Students must complete the Graduate School application.
3. All applicants will submit GRE scores, three letters of recommendation, and a personal statement addressing their reasons for pursuing a graduate degree in Landscape Architecture and discussing their plans and goals.

4. An applicant will be expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.

5. A plan of study must be included identifying undergraduate credits to be applied to the M.S. degree elective requirements. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an Adviser as the student advances through the program.

**Plan of Study**

In consultation with both the Undergraduate Academic Advisor in the Stuckeman School and the Graduate Coordinator in Landscape Architecture, the applicant should prepare a plan of study that covers the entire time period of the IUG program. The plan should be reviewed periodically with both the Undergraduate Academic Advisor in the Stuckeman School and the Professor-in-Charge of the graduate program in Landscape Architecture.

**E. Degree Requirements**

**M.S. Requirements for the Integrated B.L.A./M.S.**

The IUG program requires no new course approvals. The M.S. portion of the integrated B.L.A./M.S. requires the completion of a minimum of 40 graduate credits, at least 18 of which are at the 500-level or higher. The B.L.A./M.S. students will be required to complete a Master’s thesis.

<table>
<thead>
<tr>
<th>M.S. Degree</th>
<th>Integrated B.L.A./M.S. Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>LArch 501 (3)</td>
<td>LArch 414* (5)</td>
</tr>
<tr>
<td>LArch 502 (3)</td>
<td>LArch 501* (3)</td>
</tr>
<tr>
<td>LArch 510 X 4 (12)</td>
<td>LArch 502 (3)</td>
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<tr>
<td>LArch 590 X 4 (4)</td>
<td>LArch 510 X 3 (9)</td>
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<tr>
<td>Quantitative (3)</td>
<td>LArch 590 (1)</td>
</tr>
<tr>
<td>Elective (9) [At 500-level or higher]</td>
<td>Quantitative (3)</td>
</tr>
<tr>
<td>LArch 600 (6)</td>
<td>Elective* (10) [At 500-level or higher]</td>
</tr>
<tr>
<td>Total Degree Credits (40)</td>
<td>Total Degree Credits (40)</td>
</tr>
</tbody>
</table>
The list of courses that will double count (marked as *) includes LArch 414, LArch 501 and one of the graduate electives, for a total of 11 credits (maximum allowed is 12). A list of possible elective courses that could be double-counted is as follows:

- ANTH 559
- ECLGY 510
- FORS 565
- GEOG 550
- GEODZ 511
- HDNRE 574
- HDNRE 575
- RSOC 555

The program will accept 5 credits of LARCH 414 from students in the IUG program, in lieu of 3 credits of LARCH 510 and 3 credits of LARCH 590. Students in the IUG program must also take an additional 1 credit elective to meet the 40 credit minimum required for the degree.

G. Sample Program of Study

A typical sequence of coursework for a Landscape Architect student in the IUG program would appear as follows:
<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 325: First-year seminar</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 240: Imaging &amp; Plants I</td>
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</tr>
<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 256: History of Landscape Architecture</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Gen Ed (Eng 130) (GWS)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td>Arch 215: Design II</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 235: Design implementation I</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
<td>3</td>
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<tr>
<td></td>
<td>Gen Ed</td>
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</table>

**Total for 1st year:** 12 credits

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<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 235: Design implementation II</td>
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</tr>
<tr>
<td></td>
<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
<td>3</td>
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<td></td>
<td>Gen Ed</td>
<td>3</td>
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</table>

**Total for 2nd year:** 13 credits

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<th>Course</th>
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</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design III</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 235: Design implementation III</td>
<td>3</td>
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<td>Arch 245: Imaging &amp; Plants II</td>
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<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
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<td></td>
<td>Gen Ed</td>
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**Total for 3rd year:** 13 credits

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<th>Semester</th>
<th>Course</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design IV</td>
<td>3</td>
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<tr>
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<td>Arch 235: Design implementation IV</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
<td>3</td>
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<td></td>
<td>Gen Ed</td>
<td>3</td>
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**Total for 4th year:** 13 credits

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<th>Semester</th>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design V</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 235: Design implementation V</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
<td>3</td>
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<td></td>
<td>Gen Ed</td>
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**Total for 5th year:** 13 credits

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<th>Semester</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design VI</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 235: Design implementation VI</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
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<tr>
<td></td>
<td>Arch 255: Skills: Info. &amp; digital graphics</td>
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<td></td>
<td>Gen Ed</td>
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**Total for 6th year:** 13 credits

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<tr>
<td><strong>Fall</strong></td>
<td>Arch 215: Design VII</td>
<td>3</td>
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<td>Arch 235: Design implementation VII</td>
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**Total for 7th year:** 13 credits

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<td></td>
<td>Arch 235: Design implementation VIII</td>
<td>3</td>
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<td>Arch 245: Imaging &amp; Plants II</td>
<td>3</td>
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<td>Arch 255: Skills: Info. &amp; digital graphics</td>
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**Total for 8th year:** 14 credits

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**Total for 9th year:** 13 credits

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**Total for 10th year:** 13 credits

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<td>Arch 235: Design implementation XI</td>
<td>3</td>
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**Total for 11th year:** 13 credits

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**Total for 12th year:** 13 credits

**Total of 11 double-masted credits (afforded 12)**
H. Academic Advising

Advising is an important component of the integrated B.L.A./M.S. degree program. Upon acceptance into the program, each student will be assigned a Graduate Faculty adviser whose academic specialty and/or area of research are as closely matched with the student’s interests as possible. In consultation with the Graduate Faculty adviser, and the Undergraduate Academic Adviser, the student will develop an individualized plan of study.

Program Overview

The Department of Landscape Architecture offers a number of academically outstanding students enrolled in the fourth year of the Bachelor of Landscape Architecture degree program the opportunity to enroll in an integrated B.L.A.-M.S. in Landscape Architecture program. The program permits the student to integrate the fifth year of study for the professional B.L.A. degree with the program of study for the M.S. in Landscape Architecture degree into a continuous program culminating in the award of both degrees. The ability to coordinate as well as concurrently pursue the two degrees enables the student to achieve greater depth and comprehensiveness than if the degrees are pursued sequentially, and to earn the two degrees in a shorter period of time.

Note: The Integrated B.L.A. – M.S. in Landscape Architecture is only available to fourth-year undergraduate students in Penn State’s B.L.A. program.

Details/Sample Schedule (Graduate portion)

1ST YEAR FALL
LArch 414 – Design VI
LArch 590 – Colloquium
Gen Ed
LArch 501 – Depth seminar

1ST YEAR SPRING
LArch 510 – seminar
Gen Ed
Graduate elective
Graduate elective

2ND YEAR FALL
LArch 510 – seminar
Elective – qualitative/quantitative analysis
Graduate elective – seminar

2ND YEAR SPRING
LArch 510 – seminar
LArch 600 – thesis

Applicants to the integrated program must be enrolled in the fourth year of the B.L.A. program at Penn State. Admission is competitive, and applicants must meet the requirements as outlined in
the Graduate Degree Bulletin. The best-qualified students will be accepted up to the number of spaces available for new students. Acceptance to the program prior to the completion of all required course work is provisional, contingent upon meeting the above requirements.

Note- If this proposal is accepted, the above language (beginning with Program Overview), will be incorporated into the Graduate Student Handbook (see attached or the link below):

http://stuckeman.psu.edu/sites/default/files/arch-arch håndbook_2015_v1_web_2.pdf

II. Proposed Graduate Programs Bulletin Listing
Landscape Architecture (LARCH)

ELIZA PENNYPACKER, Professor, *Department Head*
121 Stuckeman Family Building
814-865-9511

**Degrees Conferred:**

- Master of Landscape Architecture (M.L.A.)
- M.S. in Landscape Architecture
- Integrated B.L.A./M.S. in Landscape Architecture
- Dual-title M.S. in Landscape Architecture and Human Dimensions of Natural Resources and the Environment (HDNRE)

**The Graduate Faculty**

- **Peter Aeschbacher**, M. Arch. (UNIVERSITY OF CALIFORNIA, LOS ANGELES), Associate Professor of Landscape Architecture
- **Mallika Bose**, Ph.D. (UNIVERSITY OF WISCONSIN-MADISON), Associate Professor of Landscape Architecture
- **Charles Andrew Cole**, Ph.D. (SOUTHERN ILLINOIS UNIVERSITY - CARBONDALE), Associate Professor of Landscape Architecture and Ecology
- **José Duarte**, Ph.D. (MASSACHUSETTS INSTITUTE OF TECHNOLOGY), Stuckeman Chair in Design Innovation
- **Stuart Echols**, Ph.D. (VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY), Associate Professor of Landscape Architecture
- **Kelleann Foster**, M.L.A. (UNIVERSITY OF MASSACHUSETTS - AMHERST), Professor of Landscape Architecture
- **David Goldberg**, M.L.A. (PENNSYLVANIA STATE UNIVERSITY), Practitioner Instructor
- **Larry Gorenflo**, Ph.D. (UNIVERSITY OF CALIFORNIA - SANTA BARBARA), Professor of Landscape Architecture and Geography
- **Wu Hong**, Ph.D. (UNIVERSITY OF OREGON), Assistant Professor Stuckeman Career Development Professorship in Design
- **Timothy P. Johnson**, M.L.A. (OHIO STATE UNIVERSITY), Associate Professor of Landscape Architecture
- **Neil P. Korostoff**, M.L.A. (UNIVERSITY OF PENNSYLVANIA), Associate Professor of Landscape Architecture
- **Marc Miller**, M.L.A. (CORNELL UNIVERSITY), Assistant professor of Landscape Architecture
- **Timothy Murtha**, Ph.D. (PENNSYLVANIA STATE UNIVERSITY), Associate Professor of Landscape Architecture
- **Frans Padt**, Ph.D. (Radboud University Nijmegen), Senior Lecturer
- **Eliza Pennypacker**, M.L.A. (UNIVERSITY OF VIRGINIA), Professor of Landscape Architecture
- **Bonj Szczygiel**, M.L.A. (PENNSYLVANIA STATE UNIVERSITY), Associate Professor of Landscape Architecture
• Kenneth R. Tamminga, M.P.L. (QUEENS UNIVERSITY AT KINGSTON), Professor of Landscape Architecture

The Programs

Landscape Architecture is the art of design, planning, or management of the land and of the natural and built elements upon it. As an academic discipline, it embodies creative, cultural, philosophical, and scientific knowledge bases. As a professional endeavor, the practice of landscape architecture includes site design, urban design, master planning, community planning, regional planning, resource conservation, and environmental and social stewardship.

Master of Landscape Architecture (M.L.A.)

The M.L.A. program is an accredited professional degree program focused on preparation to practice Landscape Architecture for students who hold a bachelor's degree in another field. The Master of Landscape Architecture program prepares students to enter the profession of Landscape Architecture. It provides individuals who do not already have a practice-oriented design degree with a professionally accredited education in landscape architecture. The program prepares graduates for entry into professional offices or further study in Landscape Architecture or related disciplines.

M.S. in Landscape Architecture

The M.S. in Landscape Architecture program is a research-focused degree program designed to offer students graduate-level research inquiry into Landscape Architecture for students who hold a bachelor's degree.

Admission Requirements

Requirements listed here are in addition to general Graduate School requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission.

To be admitted to the program, applicants must meet the following requirements:

- For admission to the M.L.A. program, applicants must have completed a bachelor's degree from any discipline prior to entry into the M.L.A. program.
- For admission to the M.S. in Landscape Architecture, applicants must have completed a bachelor's degree in Landscape Architecture or a closely related discipline (e.g., architecture, geography, ecology, and anthropology).

All applications for admission must include:

1. Evidence of creativity (portfolio or other), evidence of analytical ability (research paper or other), and an essay explaining why the individual seeks to study landscape architecture at Penn State
2. Official transcripts from all post-secondary institutions attended.
3. GRE scores
4. 3 letters of recommendation

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination, are required for admission.

Students with a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. Consult the English Proficiency section of the Graduate Bulletin Application and Admission Procedures page for more information.

Masters of Landscape Architecture Degree Requirements

The M.L.A. curriculum develops creative insight and the knowledge, skills, and abilities essential to professional practice, fulfilling the education requirement needed in all states to be eligible to take the Landscape Architecture licensing examination. Students in the M.L.A. degree program must also develop research understanding characteristic of graduate education, undertaking a research-based design project as a final cumulative experience to demonstrate their understanding and application of appropriate and professional research and design expertise.

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

The M.L.A. curriculum requires completion of 57 credits of graduate work at the 400, 500, or 800 level, including a minimum of 47 credits at the 500 or 800 level, with at least 6 credits at the 500 level. In addition, to fulfill the requirements of professional accreditation, students must undertake 15 credits of prerequisite courses that do not count towards the M.L.A degree requirements.

Requirements for Professional Accreditation (Prerequisites):

**LANDSCAPE ARCHITECTURE (LARCH)**
060. History of Design on the Land (3)
145. Ecology and Plants I (3)
276. Human Dimensions of Design: History & Theory (3)
365. Contemporary Trends in Landscape Architecture (3)
386. Professional Practice (3)

Core Requirements for the M.L.A.:

**LANDSCAPE ARCHITECTURE (LARCH)**
414. Design and Theory V: Depth Studio (10)
815. Grad Design I (6)
816. Grad Design II (6)
817. Grad Design III (6)
835. Design Implementation I – Grading (3)
The final culminating experience for the M.L.A. will be a capstone project completed while enrolled in LARCH 551(1), LARCH 552(4), and LARCH 553(2).

M.S. in Landscape Architecture Degree Requirements

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

The core curriculum is a two-year, research-focused program requiring a minimum of 40 credits including a minimum of 18 credits at the 500 or 600 level. Students are required to take graduate level coursework, including 12 credits of Graduate Seminar, 4 credits of Graduate Colloquium, 3 credits in Research Writing in Landscape Architecture, 3 credits in Intellectual History and Theory of Landscape Architecture, 3 credits in quantitative/qualitative analysis at the 500 level (which must be approved in advance by the student’s adviser and/or the graduate program professor-in-charge), and at least 6 credits in thesis research (600 and 610). The thesis must be accepted by the adviser(s) and/or committee members, the head of the graduate program, and the Graduate school, and the student must pass a thesis defense.

Core graduate requirements:

A 500-level course in quantitative/qualitative analysis (3 credit minimum)
501. Research Writing in Landscape Architecture (3)
502. Intellectual History and Theory of Landscape Architecture (3)
510. Graduate Seminar (12)
590. Graduate Colloquium (4)
600. Thesis Research (6)

The remaining elective credits may be chosen from a list of approved electives maintained by the program office. The student and the student's adviser, subject to the approval of the departmental Graduate Program Committee, determine specific course requirements.

Integrated B.L.A./M.S. in Landscape Architecture

The integrated undergraduate-graduate (IUG) degree program (B.L.A. in Landscape Architecture/M.S. in Landscape Architecture) provides an opportunity for strong students in Penn State’s Landscape Architecture B.L.A. program to complete a master’s degree with 6 total years of study (the B.L.A. is a 5-year program).
The number of openings in the integrated B.L.A./M.S. program is limited. Admission is selective based on specific criteria set by the Department of Landscape Architecture (see below). Because the typical B.L.A. is a 5-year program, students shall be admitted no earlier than the beginning of the seventh semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study.

**Admission Requirements**

a. Must be enrolled in the Landscape Architecture B.L.A. program.
b. Must apply to, and be accepted into, The Graduate School and the M.S. program in Landscape Architecture. Students must complete the [Graduate School application](#).
c. All applicants will submit GRE scores, three letters of recommendation, and a personal statement addressing their reasons for pursuing a graduate degree in Landscape Architecture and discussing their plans and goals.
d. An applicant will be expected to have a minimum overall GPA of 3.5 (on a 4.0 scale) in undergraduate coursework and a minimum GPA of 3.5 in all coursework completed for the major.
e. A plan of study must be included identifying undergraduate credits to be applied to the M.S. degree elective requirements.

**Plan of Study**

In consultation with both the Undergraduate Academic Advisor in the Stuckeman School and the Graduate Coordinator in Landscape Architecture, the applicant should prepare a plan of study that covers the entire time period of the IUG program. The plan should be reviewed periodically with both the Undergraduate Academic Advisor in the Stuckeman School and the Graduate Coordinator in Landscape Architecture.

**Degree Requirements**

Students must fulfill all requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the B.S. in Landscape Architecture are listed in the [Undergraduate Bulletin](#). Degree requirements for the M.S. degree are listed in the M.S. in Landscape Architecture Degree Requirements section above. The program will accept 5 credits of LARCH 414 from students in the IUG program, in lieu of 3 credits of LARCH 510 and 3 credits of LARCH 590. Students in the IUG program must also take an additional 1 credit elective to meet the 40 credit minimum required for the degree.

Up to 11 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are: LARCH 414 (5 credits), LARCH 501 (3 credits) and one elective from the following list: ANTH 559 (3 credits), ECLGY 510 (2 credits), FOR 565 (3 credits), GEODZ 511 (3 credits), GEOG 550 (3 credits), HDNRE 574 (3 credits), HDNRE 575 (3 credits), RSOC 555 (3 credits).
Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count towards the graduate degree. If students accepted into the IUG program are unable to complete the M.A. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

**Dual-Title M.S. Degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment (HDNRE)**

Graduate students with research and educational interests in landscape architecture or a closely related discipline (e.g., architecture, geography, ecology, anthropology, etc.) may apply to the dual-title M.S. degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment Program. The goal of the dual-title M.S. degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment is to enable graduate students from Landscape Architecture to acquire the knowledge and skills of their major area of specialization in Landscape Architecture, while at the same time gaining the perspective and methods of Human Dimensions of Natural Resources and the Environment.

**Admission Requirements**

Students must apply and be admitted to the graduate program in Landscape Architecture and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the HDNRE dual-title program. Refer to the Admission Requirements section of the [HDNRE Bulletin page](#).

**Degree Requirements**

To qualify for this dual-title degree, students must satisfy the requirements of the Landscape Architecture Master of Science degree program, listed above under “M.S. in Landscape Architecture Degree Requirements.” In addition, they must satisfy the HDNRE program requirements for the dual-title master’s degree. Refer to the Master’s Degree Requirements section of the [HDNRE Bulletin page](#). Some courses may satisfy both the graduate primary program requirements and those of the HDNRE program. Final course selection is determined by the student after consulting, in advance, with their Landscape Architecture and HDNRE advisers.

For the dual-title M.S. degree in Landscape Architecture and HDNRE, the thesis must reflect the student’s education and interest in both Landscape Architecture and HDNRE. All members of the student’s committee must be members of the Graduate Faculty. The master’s committee must include at least one Graduate Faculty member from HDNRE. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role.

**Student Aid**

Graduate assistantships available to students in this program and other forms of student aid are described in the [Student Aid section](#) of the Graduate Bulletin. Students on graduate assistantships must adhere to the course load limits set forth in the [Graduate Bulletin](#).

**Courses**
Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Letters of Consultation: As this is entirely internal, the department did not feel that any external consultation was necessary.
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

The Program Proposal Procedures provide guidance for the development of a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this Graduate Council proposal form, contact the Office of the Dean of the Graduate School.

College/School: Arts & Architecture/Stuckeman School of Architecture and Landscape Architecture
Department or Instructional Area: Department of Landscape Architecture

New Graduate Program, Option, or Minor: Add
Designation of new graduate program: __________
Classification of Instructional Programs (CIP) Code: __________
Designation of new graduate option: __________
Designation of new graduate minor: __________

Indicate effective semester:
First semester following approval
Second semester following approval

Existing Graduate Program Option, or Minor: Change
Drop
Current designation of graduate program: Master of Landscape Architecture
Current designation of graduate option: __________
Current designation of graduate minor: __________

New designation of existing graduate program (if changing): __________
New designation of existing graduate option (if changing): __________
New designation of existing graduate minor (if changing): __________

Brief description of the change (if not noted above): Minor curricular updates including course number changes

Indicate effective semester:
First semester following approval
Effective no earlier than Fall 2018
Second semester following approval

Submitted by Graduate Program Head
Stuart Echols
Printed name
Signature
Date: 9/22/2017

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:
Charles Andrew Cole
Printed name
Signature
Date: 9/22/2017

Approved by College/School Dean/Chancellor (or Designee):
Associate Dean Scott Wing
Printed name
Signature
Date: 9/25/17
Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:

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Recommended by Chair, Graduate Council Committee on Programs and Courses:

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Noted by Dean of the Graduate School:

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PROGRAM CHANGE PROPOSAL FOR
MASTER OF LANDSCAPE ARCHITECTURE
(M.L.A.)

SUBMITTED BY
THE DEPARTMENT OF LANDSCAPE ARCHITECTURE

Submitted per all requirements set forth by the Graduate
School of Penn State as published September 17, 2017
(http://gradschool.psu.edu/faculty-and-
staff/faculty/developing-graduate-program-
proposals/#required)

Revised November 28, 2017
M.L.A. Program Change Proposal

Contents

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   A. Justification for Proposed Changes.............................................................3
   B. Change Logs
      (1) Comparison of the Proposed Changes to the Existing Program Requirements.5
      (2) Complete Copy of the Existing Graduate Bulletin Description..................7
   C. Consultation from Departments Affected..................................................14
   D. SARI Requirement Statement.....................................................................14

II. Appendices

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   Appendix 2: Graduate School Definitions of 500 vs 800 Level Courses............16
I. Proposed M.L.A. Program Change

A. Justification for Proposed Changes

Summary

These two changes are simple and straightforward. First, we have proposed number changes through the CRCS that will better align with the Graduate School’s 500-level and 800-level distinctions as recently articulated in an update (August 2017). These number changes are also important because our department employs a course numbering system that make sequencing clear for accreditation and scheduling purposes. These course number changes will also result in a change to our Recommended Academic Plan for the M.L.A.

Second, we propose a change in the way M.L.A. students achieve their Final Culminating Experience (FCE) that is required of Penn State’s Graduate School for degree conferral and the Landscape Architecture Accreditation Board (LAAB) for professional accreditation that would permit a graduate to pursue registration as a licensed landscape architect. We are proposing to split the current FCE studio credit course into three distinct courses for the same total number of credits.

(1) Number Changes. The existing approved M.L.A. program is highly regarded by external ranking (consistently ranked in the Top 10 for M.L.A. programs nationwide by Design Intelligence, the established source for landscape architecture program rankings). It is also fully accredited by LAAB through the spring semester of 2019. It will be reviewed again for LAAB reaccreditation in spring of 2019.

The M.L.A. program shares resources and is collocated with the top-ranked and also fully accredited Bachelor of Landscape Architecture program (#2 nationwide for the past three years, and #1 in 2014). The B.L.A. program undertook a full curriculum change in the Fall of 2016, with full approvals granted in January 2017, ratified by the Board of Trustees in May 2017, and implemented this semester, Fall 2017.

Because the programs share some resources and are collocated, the M.L.A. program is being affected by the evolution of the B.L.A. program, particularly with course number changes.

Also, because the Penn State Graduate School recently clarified the use of 500-level vs 800-level courses, we wanted to take the opportunity to clarify which of our graduate courses should be an 800-level course and which should remain a 500-level course.

Presently, the graduate design studio courses and design implementation courses are 500-level courses. We believe they should be 800-level courses per the Graduate School definition:

“An 800-level graduate course foregrounds the application of theory and research to professional practice in a field of study. It is grounded in use of theories and research findings for the professional practice of that discipline. The student must demonstrate analytical thinking and application of knowledge to professional-practitioner issues or problems. The ultimate goal

M.L.A.
of an 800-level course is to contribute to the student’s ability to generate creative approaches for improved professional practice.”

(Penn State Graduate School, August 2017)

(2) The Final Culminating Experience. Another curricular proposed change is modifying our final culminating experience, required by both the Penn State Graduate School and the LAAB for accreditation. Presently, our final culminating experience is achieved through one (7) credit graduate studio course, LARCH 550. We would like to add the opportunity to achieve this final culminating experience by dividing the requisite work into three courses:

LARCH 551 (1) Final Culminating Experience: Proposal
LARCH 552 (4) Final Culminating Experience: Production
LARCH 553 (2) Final Culminating Experience: Presentation & Documentation

We believe this evolution of the approved final culminating experience enables individual graduate students and their advisers the opportunity to pursue tailored education focused on advancing the discipline of landscape architecture (that would also enhance the practice of the profession). An M.L.A. student pursuing an accredited first-professional degree program in landscape architecture may come from a design or a non-design background, and this diversity provides a wider range of potential to affect meaningful change on the discipline, on the profession, and on the shared educational experience of their studio-mates. It also requires some flexibility regarding when and how the final culminating experience is achieved. We believe that the separated credit offerings would enable the students to engage in and more fully develop the final culminating experience over one to three semesters (with the coordination of their adviser).

The Final Culminating Experience (FCE) courses would remain at the 500-level per the Graduate School’s updated definition:

“A 500-level graduate course research in the frontiers of knowledge in a field of study. It is grounded in the current research literature, theoretical frameworks, analysis of evidence, and methodologies appropriate to that discipline. The student must engage in synthesis of knowledge and analytical work. The ultimate goal of a 500-level course is to contribute to the student’s ability to expand the frontiers of knowledge, and therefore produce creative scholarly products.”

(Penn State Graduate School, August 2017)

We believe that both of these proposed changes will strengthen this excellent program and provide clarity to applicants, accepted students, the Graduate School, and our accreditors. Thank you for your time and consideration of our proposal.

NOTE—With this proposal, we intend to drop the two existing M.S. options, (1) Community and Urban Design and (2) Watershed Stewardship. The Bulletin has been updated accordingly.
### B. Change Logs

#### a. Comparison of the Proposed Changes to the Existing Program Requirements

<table>
<thead>
<tr>
<th>Course Type</th>
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<td>3</td>
<td>276</td>
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<td>3</td>
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<td>817</td>
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<td><strong>Implementation Sequence – GRAD</strong></td>
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<td>836 – Implementation II: Materials</td>
<td>331 - Implementation II: Materials</td>
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<td>837</td>
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<td>3</td>
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<td>552 – Final Culminating Experience: Production</td>
<td>550 - Master's Capstone Project Studio</td>
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<td>2</td>
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<td>553 – Final Culminating Experience: Presentation &amp; Documentation</td>
<td>550 - Master's Capstone Project Studio</td>
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<td>590</td>
<td>590 – Graduate Colloquium</td>
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Table 2 | Side-by-Side Comparison of Proposed New Recommended Academic Plan (Orange) and Existing Academic Plan (Green)

<table>
<thead>
<tr>
<th>Accredited MLA</th>
<th>Current MLA Program Curriculum</th>
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<tr>
<td><strong>Semester One (Fall)</strong></td>
<td><strong>Semester One (Fall)</strong></td>
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<tr>
<td>3 835 – Implementation I: Grading</td>
<td>3 241 - Ecological Principles</td>
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<td>3 502 – Intellectual History &amp; Theory</td>
<td>3 251 - Visualization</td>
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<td>5 515 - Design/Theory I: Studio</td>
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<td>1 145 – Ecology &amp; Plants I</td>
<td>1 590 - Graduate Colloquium</td>
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<td></td>
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<tr>
<td><strong>Semester Two (Spring)</strong></td>
<td><strong>Semester Two (Spring)</strong></td>
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<tr>
<td>3 836 – Implementation II: Materials</td>
<td>3 60 - Landscape Architecture History</td>
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<td>3 60 – LA History online</td>
<td>3 231 - Implementation I: Grading</td>
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<td>6 816 – Grad Studio II</td>
<td>1 272 - Field Trip (Post-semester)</td>
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<td>3 501 – Research &amp; Writing in LARCH</td>
<td>3 361W - Historic Issues</td>
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<td>1 590 - Graduate Colloquium</td>
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<td><strong>Semester Three (Fall)</strong></td>
<td><strong>Semester Three (Fall)</strong></td>
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<td>3 837 – Implementation III: Planting Methods</td>
<td>3 331 - Implementation II: Materials</td>
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<tr>
<td>3 Elective</td>
<td>3 341 - Plants, People, Place</td>
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<td>6 817 – Grad Studio III</td>
<td>3 502 - Intellectual History</td>
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<td>1 590 – Graduate Colloquium</td>
<td>5 530 - Design/Theory III: Systems/Regions</td>
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<td></td>
<td>1 590 - Graduate Colloquium</td>
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<td><strong>Semester Four (Spring)</strong></td>
<td><strong>Semester Four (Spring)</strong></td>
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<td>3 838 – Implementation IV: Stormwater</td>
<td>3 332 - Implementation III: Plants</td>
</tr>
<tr>
<td>3 Elective</td>
<td>3 510 - Graduate Seminar</td>
</tr>
<tr>
<td>3 276 – Human Dimensions of Design: H&amp;T</td>
<td>5 540 - Design/Theory IV: Community Design</td>
</tr>
<tr>
<td>1 851 – FCE Proposal</td>
<td>1 590 - Graduate Colloquium</td>
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<td><strong>Semester Five (Fall)</strong></td>
<td><strong>Semester Five (Fall)</strong></td>
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<td>5 414 – Design V: Depth Studio</td>
<td>3 382 - Professional Practice</td>
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<td>3 510 – Graduate Seminar</td>
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<td>4 852 – FCE Production</td>
<td>3 431 - Implementation IV: Stormwater</td>
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<td></td>
<td>1 590 - Graduate Colloquium</td>
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<tr>
<td></td>
<td>3 (---) - Elective</td>
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<tr>
<td><strong>Semester Six (Spring)</strong></td>
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<td>3 510 – Graduate Seminar</td>
<td>3 510 - Graduate Seminar</td>
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<td>2 853 – FCE Presentation &amp; Documentation</td>
<td>6 550 - Master’s Capstone Project Studio</td>
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<td>3 500 – Level Elective</td>
<td>1 590 - Graduate Colloquium</td>
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<tr>
<td>3 386 – Professional Practice</td>
<td>3 (---) - Elective</td>
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*NOTE: Some of the existing courses in green (right) are under CRCS review for course number/name update. The proposed changes are included in the orange plan (left).*
Complete Copy of the Existing Graduate Bulletin Description

The following is the Graduate Bulletin Description for the department of landscape architecture which includes the approved and Landscape Architecture Accreditation Board (LAAB) accredited Master of Landscape Architecture (M.L.A.) program at the Pennsylvania State University:

Landscape Architecture (LARCH)

ELIZA PENNYPACKER, Professor, Department Head
121 Stuckeman Family Building
814-865-9511

Degrees Conferred:

- Master of Landscape Architecture (M.L.A.)
- M.S. in Landscape Architecture
- Integrated B.L.A./M.S. in Landscape Architecture
- Dual-title M.S. in Landscape Architecture and Human Dimensions of Natural Resources and the Environment (HDNRE)

The Graduate Faculty

- Peter Aeschbacher, M. Arch. (UNIVERSITY OF CALIFORNIA, LOS ANGELES), Associate Professor of Landscape Architecture
- Mallika Bose, Ph.D. (UNIVERSITY OF WISCONSIN-MADISON), Associate Professor of Landscape Architecture
- Charles Andrew Cole, Ph.D. (SOUTHERN ILLINOIS UNIVERSITY - CARBONDALE), Associate Professor of Landscape Architecture
- José Duarte, Ph.D. (MASSACHUSETTS INSTITUTE OF TECHNOLOGY), Stuckeman Chair in Design Innovation
- Stuart Echols, Ph.D. (VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY), Associate Professor of Landscape Architecture
- Kelleann Foster, M.L.A. (UNIVERSITY OF MASSACHUSETTS - AMHERST), Professor of Landscape Architecture
- David Goldberg, M.L.A. (PENNSYLVANIA STATE UNIVERSITY), Practitioner Instructor
- Larry Gorenflo, Ph.D. (UNIVERSITY OF CALIFORNIA - SANTA BARBARA), Professor of Landscape Architecture and Geography
- Wu Hong, Ph.D. (UNIVERSITY OF OREGON), Assistant Professor Stuckeman Career Development Professorship in Design
- Timothy P. Johnson, M.L.A. (OHIO STATE UNIVERSITY), Associate Professor of Landscape Architecture
- Neil P. Korostoff, M.L.A. (UNIVERSITY OF PENNSYLVANIA), Associate Professor of Landscape Architecture
- Marc Miller, M.L.A. (CORNELL UNIVERSITY), Assistant professor of Landscape Architecture
- Timothy Murtha, Ph.D. (PENNSYLVANIA STATE UNIVERSITY), Associate Professor of Landscape Architecture

M.L.A.
The Programs

Landscape Architecture is the art of design, planning, or management of the land and of the natural and built elements upon it. As an academic discipline, it embodies creative, cultural, philosophical, and scientific knowledge bases. As a professional endeavor, the practice of landscape architecture includes site design, urban design, master planning, community planning, regional planning, resource conservation, and environmental and social stewardship.

Master of Landscape Architecture (M.L.A.)

The M.L.A. program is an accredited professional degree program focused on preparation to practice Landscape Architecture for students who hold a bachelor's degree in another field. The Master of Landscape Architecture program prepares students to enter the profession of Landscape Architecture. It provides individuals who do not already have a practice-oriented design degree with a professionally accredited education in landscape architecture. The program prepares graduates for entry into professional offices or further study in Landscape Architecture or related disciplines.

M.S. in Landscape Architecture

The M.S. in Landscape Architecture program is a research-focused degree program designed to offer students graduate-level research inquiry into Landscape Architecture for students who hold a bachelor's degree.

Admission Requirements

Requirements listed here are in addition to general Graduate School requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission.

To be admitted to the program, applicants must meet the following requirements:

- For admission to the M.L.A. program, applicants must have completed a bachelor's degree from any discipline prior to entry into the M.L.A. program.
- For admission to the M.S. in Landscape Architecture, applicants must have completed a bachelor's degree in Landscape Architecture or a closely related discipline (e.g., architecture, geography, ecology, and anthropology).

All applications for admission must include:
1. Evidence of creativity (portfolio or other), evidence of analytical ability (research paper or other), and an essay explaining why the individual seeks to study landscape architecture at Penn State
2. Official transcripts from all post-secondary institutions attended.
3. GRE scores
4. 3 letters of recommendation

Scores from the Graduate Record Examinations (GRE), or from a comparable substitute examination, are required for admission.

Students with a 3.00 junior/senior average (on a 4.00 scale) will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces available for new students. Exceptions to the minimum 3.00 grade-point average may be made for students with special backgrounds, abilities, and interests, at the discretion of the program.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. Consult the English Proficiency section of the Graduate Bulletin Application and Admission Procedures page for more information.

Masters of Landscape Architecture Degree Requirements

The M.L.A. curriculum develops creative insight and the knowledge, skills, and abilities essential to professional practice, fulfilling the education requirement needed in all states to be eligible to take the Landscape Architecture licensing examination. Students in the M.L.A. degree program must also develop research understanding characteristic of graduate education, undertaking a research-based design project as a final cumulative experience to demonstrate their understanding and application of appropriate and professional research and design expertise.

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

The M.L.A. curriculum requires completion of 57 credits of graduate work at the 400, 500, or 800 level, including a minimum of 47 credits at the 500 or 800 level, with at least 6 credits at the 500 level. In addition, to fulfill the requirements of professional accreditation, students must undertake 15 credits of prerequisite courses that do not count towards the M.L.A degree requirements.

Requirements for Professional Accreditation (Prerequisites):

LANDSCAPE ARCHITECTURE (LARCH)
060. History of Design on the Land (3)
145. Ecology and Plants I (3)
276. Human Dimensions of Design: History & Theory (3)
365. Contemporary Trends in Landscape Architecture (3)
386. Professional Practice (3)

Core Requirements for the M.L.A.:
LANDSCAPE ARCHITECTURE (LARCH)

414. Design and Theory V: Depth Studio (10)
815. Grad Design I (6)
816. Grad Design II (6)
817. Grad Design III (6)
835. Design Implementation I – Grading (3)
836. Design Implementation II – Materials (3)
837. Design Implementation III – Plants (3)
838. Design Implementation IV – Stormwater (3)
501. Research Writing in Landscape Architecture (3)
502. Intellectual History and Theory of Landscape Architecture (3)
510. Graduate Seminar in Landscape Architecture (3)
551. Final Culminating Experience: Proposal (1)
552. Final Culminating Experience: Production (4)
553. Final Culminating Experience: Presentation & Documentation (2)
590. Colloquium (1)

The final culminating experience for the M.L.A. is a capstone project completed while enrolled in LARCH 551(1), LARCH 552(4), and LARCH 553(2).

M.S. in Landscape Architecture Degree Requirements

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

The core curriculum is a two-year, research-focused program requiring a minimum of 40 credits including a minimum of 18 credits at the 500 or 600 level. Students are required to take graduate level coursework, including 12 credits of Graduate Seminar, 4 credits of Graduate Colloquium, 3 credits in Research Writing in Landscape Architecture, 3 credits in Intellectual History and Theory of Landscape Architecture, 3 credits in quantitative/qualitative analysis at the 500 level (which must be approved in advance by the student’s adviser and/or the graduate program professor-in-charge), and at least 6 credits in thesis research (600 and 610). The thesis must be accepted by the adviser(s) and/or committee members, the head of the graduate program, and the Graduate school, and the student must pass a thesis defense.

Core graduate requirements:

A 500-level course in quantitative/qualitative analysis (3 credit minimum)
501. Research Writing in Landscape Architecture (3)
502. Intellectual History and Theory of Landscape Architecture (3)
510. Graduate Seminar (12)
590. Graduate Colloquium (4)
600. Thesis Research (6)

The remaining elective credits may be chosen from a list of approved electives maintained by the program office. The student and the student’s adviser, subject to the approval of the departmental Graduate Program Committee, determine specific course requirements.
Dual-Title M.S. Degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment (HDNRE)

Graduate students with research and educational interests in landscape architecture or a closely related discipline (e.g., architecture, geography, ecology, anthropology, etc.) may apply to the dual-title M.S. degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment Program. The goal of the dual-title M.S. degree in Landscape Architecture and Human Dimensions of Natural Resources and the Environment is to enable graduate students from Landscape Architecture to acquire the knowledge and skills of their major area of specialization in Landscape Architecture, while at the same time gaining the perspective and methods of Human Dimensions of Natural Resources and the Environment.

Admission Requirements
Students must apply and be admitted to the graduate program in Landscape Architecture and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the HDNRE dual-title program. Refer to the Admission Requirements section of the HDNRE Bulletin page.

Degree Requirements
To qualify for this dual-title degree, students must satisfy the requirements of the Landscape Architecture Master of Science degree program, listed above under “M.S. in Landscape Architecture Degree Requirements.” In addition, they must satisfy the HDNRE program requirements for the dual-title master’s degree. Refer to the Master’s Degree Requirements section of the HDNRE Bulletin page. Some courses may satisfy both the graduate primary program requirements and those of the HDNRE program. Final course selection is determined by the student after consulting, in advance, with their Landscape Architecture and HDNRE advisers.

For the dual-title M.S. degree in Landscape Architecture and HDNRE, the thesis must reflect the student’s education and interest in both Landscape Architecture and HDNRE. All members of the student’s committee must be members of the Graduate Faculty. The master’s committee must include at least one Graduate Faculty member from HDNRE. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role.

Student Aid
Graduate assistantships available to students in this program and other forms of student aid are described in the Student Aid section of the Graduate Bulletin. Students on graduate assistantships must adhere to the course load limits set forth in the Graduate Bulletin.

Courses
Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.
C. Consultation from Departments Affected

Because all of the proposed course changes and curricular plan changes are for courses taught exclusively by the department of landscape architecture for students of the M.L.A. program, there are no other affected departments.

Further, this program and all approved/proposed required courses are only offered at Penn State, University Park campus.

Because we are dropping the options, we did seek the requisite consultation related to the Watershed Stewardship option:

I acknowledge the intention of LA to drop the Watershed Stewardship Option.

jack

**************************
Dr. Jack Watson
Professor of Soil Physics and Biogeochemistry
ESM Director of Graduate Studies
Ecosystem Science and Management Dept.
409 ASI Building
University Park, PA 16802
jackwatson@psu.edu
814-863-6714
**************************

D. Consultation with the Office of Research Protections Regarding SARI Requirements (if necessary)

Consultation with the ORP is not necessary to this program as the SARI @ PSU plan for the department of landscape architecture will not be changing.
M.L.A. Program Change Proposal

Appendix 1 | Graduate School Instructions for Program Change Proposal

http://gradschool.psu.edu/faculty-and-staff/faculty/progprop/

Changes in programs*, options**, and minors*** (including program name changes)

a. A justification for proposed changes, such as updating instruction, together with an indication of expected enrollments and any effects on existing programs.

b. A revised version of the affected area showing both the old program requirements and the new program requirements (so that the reviewers can determine what specifically is being changed). The proposal should include a side-by-side comparison of admission requirements, number of credits required, specific courses to be taken, etc. A copy of the existing Graduate Bulletin description, with all changes marked (with track changes, for example), also must be included.

c. Original written responses from departments affected, either by potential overlapping content or audience or by potential opportunities for collaboration (received during consultation phase).

d. Written evidence of consultation with the Office for Research Protections regarding SARI requirements, as necessary, depending on the nature of the proposed change(s). For example, addition of a new degree would require such consultation, but changes to existing degree requirements may not, unless the changes affect previously approved SARI requirements for the program.
Graduate education includes the development of skills related to critical analysis and creative thinking. These skills are, in part, developed via participation in classes. The high level of understanding and analysis expected of graduate students means all graduate courses should build on advanced undergraduate and/or graduate courses, should be based in current knowledge of research in the field, and should include significant and regular instructor-initiated interaction between students and the instructor(s). Students with a focus on research degrees include classes with content providing the necessary background for expanding the frontiers of knowledge, while those in professional preparation degrees include classes related to the application of theory or research findings to address needs in professional practice. The program of study of students with either focus, may incorporate classes from the other focus (for professional degrees at least six credits must have a research focus). These designations, research and professional, reflect approaches to graduate education which are equal in merit but with different intended educational outcomes.

Features of Research Education typically include:

- Deep scholarly investigation of a significant problem, question, or issue in the field of study, which could include original primary research.
- Understanding of theoretical frameworks, research methodologies, and testing or analysis of evidence appropriate to the field.
- Analytical thinking and creative skills are typically combined with specific analytical techniques to expanding the frontiers of knowledge in the field.

Features of Professional Practitioner Education typically include:

- Deep knowledge in a field of study applied to a domain of professional practice.
- Understanding of research literature to support application of knowledge to practice.
- Analytical thinking and creative skills are typically combined with application of theory or research findings to address needs in professional practice.

While student work in research-oriented and professional-oriented courses should reflect these different needs, it may be appropriate for 500-level courses particularly in applied fields to include both research-oriented and professional-oriented features and both types of students. All graduate students are expected to conduct themselves in accordance with their field’s professional practices and ethics, including applicable rules, regulations, and laws.

Distinctions between 500-level (research-oriented) and 800-level (practitioner-oriented) courses tend to be the following:

- A 500-level graduate course foregrounds research in the frontiers of knowledge in a field of study. It is grounded in the current research literature, theoretical frameworks, analysis of evidence, and methodologies appropriate to that discipline. The student must engage in synthesis of knowledge and analytical work. The ultimate goal of a 500-level course is to contribute to the student’s ability to expand the frontiers of knowledge, and therefore produce creative scholarly products.
M.L.A. Program Change Proposal

- An 800-level graduate course foregrounds the application of theory and research to professional practice in a field of study. It is grounded in use of theories and research findings for the professional practice of that discipline. The student must demonstrate analytical thinking and application of knowledge to professional-practitioner issues or problems. The ultimate goal of an 800-level course is to contribute to the student’s ability to generate creative approaches for improved professional practice.

In classes in which research and practice are intertwined the designation of 500 or 800 level is determined by that domain reflecting the majority of the content.
M.L.A.--Additional Specific Requirements

The Master of Landscape Architecture program prepares students to enter the profession of Landscape Architecture. It provides individuals who do not already have a practice-oriented design degree with a professionally accredited education in landscape architecture. The program prepares graduates for entry into professional offices or further study in Landscape Architecture or related disciplines. Landscape Architecture is the art of design, planning, or management of the land and of the natural and built elements upon it. As an academic discipline, it embodies creative, cultural, philosophical, and scientific knowledge bases.

As a professional endeavor, the practice of landscape architecture includes site design, urban design, master planning, community planning, regional planning, resource conservation, and environmental and social stewardship.

The M.L.A. curriculum develops creative insight and the knowledge, skills, and abilities essential to professional practice, fulfilling the education requirement needed in all states to be eligible to take the Landscape Architecture licensing examination. Students in the M.L.A. degree program must also develop research understanding characteristic of graduate education, undertaking a research-based design project as a final cumulative experience to demonstrate their understanding and application of appropriate and professional research and design expertise.

The M.L.A. curriculum requires completion of 57 credits of graduate work at the 400, 500, or 800 level, including a minimum of 47 credits at the 500 or 800 level, with at least 6 credits at the 500 level.

The final culminating experience for the M.L.A. is a capstone project completed while enrolled in LARCH 551(1), LARCH 552(4), and LARCH 553(2).
Graduate Council
Program, Option, or Minor Proposal Form

Submit 1 original, signed Graduate Council proposal form and 2 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Office of the Dean of the Graduate School, 211 Kern Building, University Park. For more information about the process, see the Overview of the Graduate Council Curricular Review Process.

The Program Proposal Procedures provide guidance for the development of a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this Graduate Council proposal form, contact the Office of the Dean of the Graduate School.

College/School: College of Earth and Mineral Sciences
Department or Instructional Area: Meteorology and Atmospheric Science

New Graduate Program, Option, or Minor: Add
Designation of new graduate program: Climate Science
Classification of Instructional Programs (CIP) Code: 40.0499
Designation of new graduate option: 
Designation of new graduate minor: 

Indicate effective semester:
First semester following approval
Second semester following approval

Existing Graduate Program Option, or Minor: Change
Drop

Current designation of graduate program: IUG/MS/PhD in Meteorology
Current designation of graduate option: 
Current designation of graduate minor: 

New designation of existing graduate program (if changing): IUG/MS/PhD in Meteorology and Atmospheric Science
New designation of existing graduate option (if changing): 
New designation of existing graduate minor (if changing): 

Brief description of the change (if not noted above): Please see attached

Indicate effective semester:
First semester following approval
Second semester following approval

Submitted by Graduate Program Head

Printed name: David J. Stensrud
Signature: [signature]
Date: 11/28/2017

Noted by College/School Representative to Graduate Council Subcommittee on New and Revised Programs and Courses:

Printed name: David Babb
Signature: [signature]
Date: 12/5/2017

Approved by College/School Dean/Chancellor (or Designee):

Printed name: John Hellmann
Signature: [signature]
Date: 12/14/2017
Recommended by Chair, Graduate Council Subcommittee on New and Revised Programs and Courses:

<table>
<thead>
<tr>
<th>On Behalf of C. Andrew Cole</th>
<th>[Signature]</th>
<th>Date: 3/6/2018</th>
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Recommended by Chair, Graduate Council Committee on Programs and Courses:

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<tr>
<th>On Behalf of M. Kathleen Heid</th>
<th>[Signature]</th>
<th>Date: 3/6/2018</th>
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Noted by Dean of the Graduate School:

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<th>On Behalf of Regina Vasilatos-Younken</th>
<th>[Signature]</th>
<th>Date: 3/6/2018</th>
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A Proposal to Graduate Council to Change the Graduate Program in Meteorology and Adopt a Dual-Title Doctoral Program in Climate Science

Submitted by
Department of Meteorology and Atmospheric Science

Contact:
David J. Stensrud
Head, Department of Meteorology and Atmospheric Science
504 Walker Building
814-863-7714
djs78@psu.edu

Kenneth Davis
Professor of Atmospheric and Climate Science
Chair, Graduate Academic Program Committee
Department of Meteorology and Atmospheric Science
512 Walker Building
814-863-8601
kjd10@psu.edu

Johannes Verlinde
Professor of Atmospheric Science
Associate Head, Graduate Program in Meteorology
Department of Meteorology and Atmospheric Science
605A Walker Building
814-863-9711
jxv7@psu.edu
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1. Justification for Changes to the Graduate Program in Meteorology

The name of our department was recently changed from Department of Meteorology to Department of Meteorology and Atmospheric Science. This change was motivated by a desire to correctly align with faculty research and teaching expertise that has evolved over the past decades as the science has advanced. With the expansion of the breadth of research activities and the greater focus on interdisciplinary research, our faculty desired to allow greater flexibility in our core curriculum to prepare our students adequately for their research activities. This proposal documents the new core curriculum as approved by the faculty and updates the program description to be consistent with this new core curriculum. The graduate programs affected are the IUG program, the MS program, and the PhD program. The changes are outlined in section 3, with the proposed updated graduate school bulletin in section 4.

Our department spearheaded the effort for the formation of a new dual-title doctoral degree in Climate Science as overviewed in the next section. This program change proposal accompanies the proposal for the Climate Science degree, and includes the description of the dual-title degree.

2. Justification for Adopting the Dual-Title Climate Science Program

The graduate program in Meteorology and Atmospheric Science proposes to adopt the dual-title Ph.D. degree program in Climate Science.

Climate Science is a field devoted to the study of the Earth’s climate in the past, present and future. The effects of human (anthropogenic) and natural forcing, and their interactions, on climate and society is of increasing interest and importance as the Earth enters the Anthropocene – the epoch in which human activity has become the dominant influence on our global environment. The need for this dual title climate science program is seen daily as stories on climate and climate science appear in the news. Past predictions on how climate change would alter the character of weather events are being verified. International organizations, such as the Intergovernmental Panel on Climate Change, were formed in the past few decades to assess the state of the science on climate and now play important roles in the global climate conversation.
Current and future impacts of climate change on the environment are being sought after by government agencies, companies, non-profit organizations, and citizens. These groups and individuals are looking to climate scientists to provide this guidance.

The proposed dual-title Ph.D. program in Climate Science is intended to serve these needs for experts in climate science, while also expanding graduate student recruitment at Penn State. In a survey of 106 departments of meteorology and/or atmospheric science in 2015, only three department names included the word “climate”. This suggests that the proposed dual-title program in Climate Science would provide our graduate students a unique advantage as career opportunities in Climate Science continue to grow. Indeed, many graduate student applicants are interested in climate and climate change, and climate impacts on society, and want to pursue a Ph.D. in this field, but can be challenged to find the department that best fits their interests. This is owing to the many departments at Penn State that have faculty members involved in Climate Science. The proposed dual-title program will thus provide an important link between departments, allowing graduate student applicants to see how they can develop research projects that span departments and capture the increasingly interdisciplinary nature of Climate Science.

The Climate Science dual-title doctoral program will provide critical skills and cross-disciplinary knowledge that will enhance the students’ education, training, and research, and thereby enhance their ability to compete for academic and non-academic positions after graduation.

The techniques used to study climate have expanded dramatically over the past several decades from simple energy balance approaches to sophisticated global climate models, from the analysis of instrumental climate records to the development of proxy climate records including ice cores, tree rings, corals, speleothems, sub-fossil pollen, ocean and lake sediments spanning many thousands of years. There is an increasing use of Geographical Information Systems (GIS) and sophisticated statistical methods that are used to inter-compare data sets, uncover the relationships between variables and assess the statistical significance of interrelationships. New observational systems to measure concentrations of greenhouse gases and emissions from human activity are becoming common and more affordable. Global climate models are being run at finer and finer scales and are beginning to provide information on regional climate and climate change that can be applied to planning and climate impacts. Physical process parameterization
schemes within these models are becoming increasingly faithful as they are verified against special observational data sets, including line-by-line solar and infrared radiation spectra. Assessments of climate risk are becoming more robust, backed by detailed scientific and statistical analysis. A better understanding has been developed of the relationship between climate change and extreme weather events. Many of these approaches to climate science have origins in diverse specific disciplines, emphasizing the need for a dual-title program to span departments and allow the students to gain knowledge not easily available from a single perspective. This approach will give our PhD students a richer and more diverse education and training than any department could offer alone.

The proposed Climate Science dual title doctoral degree program will provide a rich curriculum in climate dynamics and observations, numerical and statistical methods, the physical climate system, biogeochemistry, and human dimensions of climate change to ensure that all of our Climate Science students have a broad and deep understanding of the science and its application to society. It also will develop a cohort of PhD students across departments, leading to enhanced appreciation for and understanding of the various facets of Climate Science, while also helping to generate stronger connections among our talented faculty. Last, the Climate Science program will provide highly-trained PhDs to the academic, government and private sectors to meet the growing need for climate information and climate impacts.

3. Comparison of Changes to the Graduate Program

a. Integrated Undergraduate/Graduate Program

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<th>Current Meteorology Bulletin</th>
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<tr>
<td>IUG</td>
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<tr>
<td>The total degree requirements are as follows: The new program will fulfill the present rigorous requirements of the existing M.S. Program. In particular, all IUG students must defend their theses or papers, as do all M.S. students, in a</td>
<td>The total degree requirements are as follows: The new IUG program will fulfill the present rigorous requirements of the existing M.S. Program. In particular, all IUG students must defend their theses or papers, as do all M.S.</td>
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students, in a public presentation toward the end of their graduate program.

The total degree requirements are as follows:

B.S. Degree Portion:

TOTAL B.S. REQUIREMENTS: 121 credits (12 double-counted with the M.S. Requirements)

General Education: 45 credits, 24 of which are included in the REQUIREMENTS FOR THE MAJOR

Requirements for the Major (All Options): 75 credits

Prescribed Courses: 56 credits
Additional Courses: 19 credits

Requirements for the General Option: 18-19 credits

M.S. Degree Portion:

TOTAL M.S. REQUIREMENTS: 34 credits (12 double-counted with the B.S. Requirements)

Prescribed Courses: METEO 520, 521, 531, 533, 580, 590, 591 (16 credits)

Additional Courses: 18 credits

6 credits of 500-level course work
6 credits of 400- or 500-level course work
6 credits of METEO 600 (thesis option) or 6 credits of 400- or 500-level course work (paper option)

6 credits in Dynamic Meteorology from the following list: METEO 520 (3), 521 (3), 554 (3), 551 (3), and 570 (3)
6 credits in Physical Meteorology from the following list: METEO 532 (3), 533 (3), 535 (3), 556 (3), and 570 (3)
### b. Master of Science Program

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<th>Current Meteorology Bulletin</th>
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<td><strong>MS</strong></td>
<td><strong>MS</strong></td>
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<tr>
<td>The M.S. degree is offered with thesis or research paper options, both requiring 34 credits.</td>
<td>The M.S. degree is offered with thesis or research paper options, both requiring 34–35 credits.</td>
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<td>For both options, a core curriculum is required that is composed of METEO 520 (3 credits), 521 (3 credits), 531 (3 credits), 533 (3 credits), 580 (1 credit), 590 (1 credit/semester; minimum or 2 credits) and 591 (1 credit) that is supplemented by 6 elective credits from 500-level Meteorology courses, for a total of 22 credits.</td>
<td>For the thesis option, a core curriculum is required that is composed of four distinct courses, two each from two prescribed lists for dynamic meteorology and physical meteorology, METEO 520 (3 credits), 521 (3 credits), 531 (3 credits), 533 (3 credits), 880 (1 credit), 590 (1 credit/semester; minimum or 2 credits) and 591 (1 credit) that is supplemented by 6 elective credits from 500-level Meteorology and Atmospheric Science courses or related disciplines, for a total of 22–23 credits. For the paper option, students must take 596 (2) instead of 880 (2).</td>
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<td>All students must take a minimum of 12 additional elective credits for a total of 30 credits, which are distributed as follows. Students in the M.S. thesis option must select 6 additional credits from 400- and 500-level course work in Meteorology or related disciplines, and 6 quality-graded credits of METEO 600 (quality-graded credits count toward the grade-point average). Students in the M.S. paper option must select 6 of the additional credits from 400- and 500-level course work in Meteorology,</td>
<td>The dynamic meteorology list consists of METEO 520 - Atmospheric Fluid Dynamics (3), 521 - Atmospheric Dynamics (3), 554 - Atmospheric Turbulence (3), 551 - Physical Oceanography (3), and 570 - Climate</td>
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together with 6 additional credits from 400- and 500-level course work in Meteorology or related disciplines if not used as electives above. METEO 600 credits cannot be used to fulfill any portion of these additional paper-option credits.

All M.S. students defend their thesis or paper in a public presentation that is evaluated by, and must be approved by, the students' committee. A minimum of three signatures is required for a M.S. thesis, including the thesis adviser and the department head or program chair.

**M.S. Minor**

For a minor in Meteorology, an M.S. student must select 6 credits of 500-level Meteorology courses in a course plan approved by the department.

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<th>Dynamics (3), and the list for physical meteorology consists of</th>
<th>METEO 532 - Chemistry of the Atmosphere (3), 533 - Cloud Physics (3), 535 - Radiative Transfer (3), 556 - Atmospheric Boundary Layer (3), and 570 - Climate Dynamics (3).</th>
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All students must take a minimum of 12 additional elective credits for a total of 30 credits, which are distributed as follows. Students in the M.S. thesis option must select 6 additional credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines, and 6 quality-graded credits of METEO 600 (quality-graded credits count toward the grade-point average). Students in the M.S. paper option must select 6 of the additional credits from 400- and 500-level course work in Meteorology and Atmospheric Science, together with 6 additional credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines if not used as electives above. METEO 600 credits cannot be used to fulfill any portion of these additional paper-option credits. Students complete the scholarly paper while registered for 2 credits of METEO 596 in their final semester.

All M.S. students defend their thesis or paper in a public presentation that is evaluated by, and must be approved by, the students' committee. A minimum of three signatures is required for a M.S. thesis, including the thesis adviser and the department head or program chair.

**Master’s Minor**

For a master’s minor in Meteorology and Atmospheric Science, a student must select 6 credits of Meteorology and Atmospheric
Science courses, 3 of which have to be at the 500-level, in a course plan approved by the Meteorology and Atmospheric Science graduate program.

c. Doctor of Philosophy Program

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<td><strong>Ph.D.</strong></td>
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<td>Studies for the Ph.D. degree are designed to accommodate the interests and capabilities of the candidate, and they are overseen by a doctoral committee, which also administers comprehensive and final oral examinations. Before being admitted to Ph.D. candidacy, a student must have the academic support of a faculty member and the student must pass the Ph.D. candidacy examination that is typically offered once each year. The exam must be taken within one year of being admitted to the program. If a student does not pass the exam on their first attempt, then a second attempt is allowed at the time the student completes a M.S. degree in our graduate program.</td>
<td>Studies for the Ph.D. degree are designed to accommodate the interests and capabilities of the candidate, and they are overseen by a doctoral committee, which also administers comprehensive and final oral examinations. Before being admitted to Ph.D. candidacy, a student must have the academic support of a faculty member and the student must pass the Ph.D. candidacy examination that is typically offered once each year. The exam must be taken within one year—three semesters (excluding summer sessions) of entry into the doctoral program. If a student does not pass the exam on their first attempt, then a second attempt may be allowed at the discretion of the graduate faculty members of the department, time the student completes a M.S. degree in our graduate program.</td>
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<tr>
<td>A student must take METEO 591 (1 credit) the first semester it is available upon matriculating in the program. METEO 580 (1 credit) must be taken prior to the department's competency exam in written and spoken technical English. METEO 580 and METEO 591 will be waived as required classes if a student has taken them or equivalent courses before matriculating in the Ph.D. program. A minimum of 6 elective credits from METEO 500-level (other than METEO 501, 520, 521, 531,</td>
<td>A student must take METEO 591 (1 credit) the first semester it is available upon matriculating in the program. METEO 580 (1 credit) must be taken prior to the department's competency exam in written and spoken technical English. METEO 580 and METEO 591 will be waived as required classes if a student has taken them or equivalent courses before matriculating in</td>
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DISCIPLINE 400- or 500-level courses must be taken that do not count toward any other degree requirement and finished by the semester in which the comprehensive exam is passed. One credit of METEO 590 is required each semester until the comprehensive exam is passed. A student must pass the department's competency exam in written and spoken technical English before being admitted to the comprehensive exam. There are no minimal credit requirements for quality-graded METEO 600 (research credits whose grades count toward the grade-point average); students may earn up to 12 quality-graded METEO 600 credits. The student is expected to master the material in the M.S. core courses (METEO 520, 521, 531, and 533), but need not take those courses for credit.

The Ph.D. program. A minimum of 6 elective credits from METEO 500-level (other than METEO 501, 520, 521, 531, 533, 580, 590, 591) or RELATED DISCIPLINE related discipline 400- or 500-level courses must be taken that do not count toward any other degree requirement and finished by the semester in which the comprehensive exam is passed. One credit of METEO 590 is required each semester until the comprehensive exam is passed. A student must pass the department's competency exam in written and spoken technical English before being admitted to the comprehensive exam. There are no minimal quality-graded credit (research credits whose grades count toward the grade-point average) requirements for quality-graded METEO 600 (research credits whose grades count toward the grade-point average); students may earn up to a maximum of 12 quality-graded METEO 600 credits. The student must declare a core curriculum consisting of two courses from each of the two prescribed lists for dynamic meteorology and physical meteorology. The dynamic meteorology list consists of METEO 520 - Atmospheric Fluid Dynamics (3), 521 - Atmospheric Dynamics (3), 554 - Atmospheric Turbulence (3), 551 - Physical Oceanography (3), and 570 - Climate Dynamics (3), and the list for physical meteorology consists of METEO 532 - Chemistry of the Atmosphere (3), 533 - Cloud Physics (3), 535 - Radiative Transfer (3), 556 - Atmospheric Boundary Layer (3), and 570 - Climate Dynamics (3). The student will be tested for mastery of the selected core in the candidacy exam. He is expected to master the material in the M.S. core courses (METEO 520, 521, 531, and
4. Description of Required Climate Science Course Work

The minimum course work requirements for the dual-title Ph.D. degree in Climate Science are as follows:

- Course work and other requirements of the Meteorology and Atmospheric Science graduate program
- METEO 575 (1 credit, reading and discussion only)
- METEO 575 (2 credits, reading, discussion, and writing papers)
- One course in the physical climate system focus area. This course can be GEOG 412, GEOG 417, or METEO 570. These courses are critical for developing a foundational understanding of climate science and include sufficient material in radiative transfer and the greenhouse effect to ensure that the students clearly understand the underlying physics of climate and climate change. A student cannot take a 400-level course offered by their primary graduate program.
• Three or more elective credits from three different focus areas within Climate Science from a list of courses maintained by the Climate Science Committee. The focus areas are (1) physical climate system, (2) biogeochemistry of the climate system, (3) numerical methods and data analysis, and (4) human dimensions of climate change. A student cannot take a 400-level course offered by their primary graduate program. The courses in each focus area are as follows:

  o (1) Physical climate system: GEOSC 405, METEO 521, METEO 535, METEO 551, C E 561, or METEO 563. These courses delve deeper into the physical processes that govern the climate system.

  o (2) Biogeochemistry of the climate system: GEOSC 410, GEOSC 419, C E 475, GEOSC 502, METEO 532, or METEO 561. These courses explore the relationships between climate and the chemical reactions in the atmosphere, oceans, land, and living organisms that create the composition of the natural environment.

  o (3) Numerical methods and data analysis: GEOSC 450, C E 461, GEOG 464, METEO 515, METEO 523, METEO 527, C E 555, or FOR 565. These courses provide advanced training in the quantitative techniques used to predict climate and/or interpret observations of the climate system.

  o (4) Human dimensions of climate change: ANTH 432, GEOG 438, or GEOG 510. These courses explore how climate change impacts society and the natural environment.

Students or faculty may request that the Climate Science Committee consider approval of elective designations for any course, including temporary approvals for experimental or variable-title courses. A comparison of the course requirements for Ph.D. students in Meteorology and Atmospheric Science and Ph.D. students in Meteorology and Atmospheric Science & Climate Science is shown below.
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<th>Course requirements</th>
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<td>METEO 580 (2 credits)</td>
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<td>METEO 591 (1 credit)</td>
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<tr>
<td>A minimum of 6 elective credits from METEO 500-level or related discipline 400- or 500-level courses</td>
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<tr>
<td>The student must declare a core curriculum consisting of two courses from each of the two prescribed lists for dynamic meteorology and physical meteorology. The dynamic meteorology list consists of METEO 520 - Atmospheric Fluid Dynamics (3), 521 - Atmospheric Dynamics (3), 554 - Atmospheric Turbulence (3), 551 - Physical Oceanography (3), and 570 - Climate Dynamics (3), and the list for physical meteorology consists of METEO 532 - Chemistry of the Atmosphere (3), 533 - Cloud Physics (3), 535 - Radiative Transfer (3), 556 - Atmospheric Boundary Layer (3), and 570 - Climate Dynamics (3). The student will be tested for mastery of the selected core in the candidacy exam.</td>
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<tr>
<td>METEO 590 (1 credit each semester until the comprehensive exam is passed)</td>
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<td>METEO 600 (up to 12 credits)</td>
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<td>METEO 880 (2 credits)</td>
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<td>METEO 591 (1 credit)</td>
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<tr>
<td>A minimum of 6 elective credits from METEO 500-level or related discipline 400- or 500-level courses</td>
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<tr>
<td>The student must declare a core curriculum consisting of two courses from each of the two prescribed lists for dynamic meteorology and physical meteorology. The dynamic meteorology list consists of METEO 520 - Atmospheric Fluid Dynamics (3), 521 - Atmospheric Dynamics (3), 554 - Atmospheric Turbulence (3), 551 - Physical Oceanography (3), and 570 - Climate Dynamics (3), and the list for physical meteorology consists of METEO 532 - Chemistry of the Atmosphere (3), 533 - Cloud Physics (3), 535 - Radiative Transfer (3), 556 - Atmospheric Boundary Layer (3), and 570 - Climate Dynamics (3). The student will be tested for mastery of the selected core in the candidacy exam.</td>
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<td>The 12 credits of core curriculum courses, METEO 880, and METEO 591 may be waived as required courses at the discretion of the program if the student has already taken them or equivalent courses, and the total required credits will be reduced accordingly.</td>
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<tr>
<td>METEO 590 (1 credit each semester until the comprehensive exam is passed)</td>
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<td>METEO 600 (up to 12 credits)</td>
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Additional courses needed for the dual-title in Climate Science. These courses are in addition to the courses required for the degree in Meteorology and Atmospheric Science, such that courses cannot be double counted.

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<tr>
<td>METEO 575 (1 credit)</td>
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<tr>
<td>METEO 575 (2 credits)</td>
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<tr>
<td>One additional course from GEOG 412, GEOG 417, or METEO 570.</td>
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One additional course from each of three of the following four areas of study:

Physical climate system: GEOSC 405, METEO 521, METEO 535, METEO 551, CE 561, or METEO 563.

Biogeochemistry of the climate system: GEOSC 410, GEOSC 419, CE 475, GEOSC 502, METEO 532, or METEO 561.

Numerical methods and data analysis: GEOSC 450, CE 461, GEOG 464, METEO 515, METEO 523, METEO 527, CE 555, or FOR 565

Human dimensions of climate change: ANTH 432, GEOG 438, or GEOG 510

The SARI requirements are fulfilled by taking METEO 591.

5. Proposed Graduate Program Bulletin Listing

Meteorology and Atmospheric Science (METEO)

Program Home Page

DAVID J. STENSRUD, Head of the Department
503 Walker Building
814-863-7714
grad-admissions@meteo.psu.edu

Degrees Conferred:

- Ph.D., M.S.
- Integrated B.S./M.S. Program in Meteorology and Atmospheric Science
- Dual-Title Graduate Degree (Ph.D.) in Astrobiology

Dual-Title Graduate Degree (Ph.D.) in Climate Science

The Graduate Faculty

The graduate program embraces topics that span atmospheric processes from those of the planetary boundary layer to those of the upper atmosphere, that encompass phenomena from weather to climate with molecular to planetary dimensions, and that range from practical to
theoretical significance. The program develops and integrates approaches based on observational, computational, and analytical techniques, and seeks to advance both fundamental understanding and predictive skill.

The major interests of the faculty and graduate students include (1) mesoscale- and synoptic-scale weather systems; (2) climate and earth system dynamics; (3) atmospheric physics including radiative transfer and cloud physics; (3) atmospheric chemistry, air quality and the earth’s biogeochemical cycles; (4) atmospheric turbulence, boundary layers, land-atmosphere interactions, ocean-atmosphere interactions, and ocean-ice-atmosphere interactions; (5) geophysical fluid dynamics, (6) physical oceanography, and (7) climate and weather risk. Methodological approaches include numerical modeling, data assimilation, atmospheric remote sensing, field observations, atmospheric data analysis, and laboratory studies. Center on (1) analysis, modeling, and prediction of the evolution of synoptic-scale, or mesoscale weather systems, particularly those of significant impact on human activities; (2) observation and theoretical study of processes related to transmission of radiation through the atmosphere, including remote sensing through use of electromagnetic or acoustic systems; (3) laboratory, and theoretical study of trace gases, particulates, and clouds and their consequences for air quality and climate; and (4) observation and theoretical study of atmospheric physics on a variety of scales, including phenomena of weather and climate, boundary layer physics, turbulence, convective systems, and severe storms; (5) weather risk.

The department encourages interdisciplinary studies and is expanding its programs in biometeorology, climate dynamics, atmospheric pollution prediction, atmospheric carbon cycling, forecast reliability and verification, mathematical study of fluid dynamical systems, and integrated atmosphere-ocean studies. The department is affiliated with the Earth and Environmental Sciences Institute, which conducts studies in Earth system science, including climate, large-scale dynamics, oceanography, and regional assessments.

**Admission Requirements**
Requirements listed here are in addition to requirements stated in the GENERAL INFORMATION section of the Graduate Bulletin. Applicants apply for admission to the program via the Graduate School application for admission.

The Meteorology and Atmospheric Science program is open to all students with a baccalaureate degree and a strong interest in the atmospheric sciences. A degree in meteorology, science (including, but not limited to, meteorology or atmospheric science), mathematics, or engineering provides a particularly good background, although the department has had some students with arts and humanities degrees (such as Art History) who have done well. The minimum course requirements for admission are mathematics at least through differential equations and at least one year of calculus-based physics. Scores from the Graduate Record Examinations (GRE) are required for the evaluation of all applicants.

For admission to the program, the departmental admission committee considers courses taken, grade-point average, three letters of recommendation, GRE scores, professional experience, and English proficiency. Rather than setting rigid standards in each category, the committee examines the overall record as a whole. The best-qualified applicants are accepted up to the number of spaces that are available for new students.

Generally, additional mathematics and physics beyond the minimum requirements listed above, as well as courses in statistics, chemistry, and computer programming, will strengthen the student's application. Courses in meteorology and atmospheric science are not required for admission. Most students admitted to the graduate program have undergraduate grade-point averages GPA's of 3.50 or higher. Three recommendations are solicited from persons familiar with the student's academic competence, and the student is required to write a letter summarizing interests and goals. A verbal and quantitative combined GRE score of 1200 315 or greater is typical for the department's students.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. Consult the English Proficiency section of the Graduate Bulletin Application and Admission Procedures page for more information.
Note: All international students required to take the English proficiency test must take the American English Oral Communicative Proficiency Test (AEOCPT) upon first enrollment. If the student does not meet the minimum score requirements on the AEOCPT, the student must complete additional course work in English in order to be eligible to receive a teaching assistantship.

Master of Science (M.S.) Degree Requirements

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.”

The M.S. degree is offered with thesis or research paper options, both requiring 34 credits.

A minimum of 35 credits at the 400, 500, 600, or 800 level is required, with at least 29 credits at the 500, 600 and 800 level combined. The required core curriculum consists of 23 credits, including 12 credits in four distinct courses, two each from two prescribed lists for dynamic meteorology and physical meteorology. The dynamic meteorology list consists of METEO 520 (3 credits), METEO 521 (3 credits), METEO 554 (3 credits), METEO 551 (3 credits), and METEO 570 (3 credits). The physical meteorology list consists of METEO 532 (3 credits), METEO 533 (3 credits), METEO 535 (3 credits), METEO 556 (3 credits), and METEO 570 (3 credits). In addition, students must complete at least 2 two credits of METEO 880 or METEO 596, at least 2 credits of METEO 590, 1 credit of METEO 591, and 6 elective credits from 500-level Meteorology and Atmospheric Science courses or 500-level courses in related disciplines from a list of approved electives maintained by the program office.

Students can choose to complete either a thesis or a scholarly paper as the culminating experience for the degree. Students who choose the thesis track must select METEO 880 and 6 additional elective credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines from a list of approved electives maintained by the program office. In addition, students must complete 6 quality-graded credits in thesis research (600 or 610) in conjunction with completing the thesis (quality-graded credits count toward the
grade-point average). The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

Students in the scholarly paper track must select 2 credits of METEO 596, 6 additional elective credits from 400- and 500-level course work in Meteorology and Atmospheric Science, and 6 additional credits from 400- and 500-level course work in Meteorology and Atmospheric Science or related disciplines from a list of approved electives maintained by the program office. Students in the scholarly paper track cannot count METEO 600 credits towards degree requirements. Students will complete the scholarly paper while registered for 2 credits of METEO 596 in their final semester. M.S. students in the scholarly paper track must defend their scholarly paper in a public presentation that is evaluated by, and must be approved by, the students' committee.

Master’s Minor

Requirements listed here are in addition to requirements stated in the Graduate Minors section of the Graduate Bulletin.

For a master’s minor in Meteorology and Atmospheric Science, a student must select 6 credits of Meteorology and Atmospheric Science courses, 3 of which have to be at the 500-level, in a course plan approved by the Meteorology and Atmospheric Science graduate program.

Doctor of Philosophy (Ph.D.) Degree Requirements

Requirements listed here are in addition to requirements stated in the DEGREE REQUIREMENTS section of the Graduate Bulletin.

Studies for the Ph.D. degree are designed to accommodate the interests and capabilities of the candidate, and they are overseen by a doctoral committee, which also administers comprehensive and final oral examinations. Before being admitted to Ph.D. candidacy, a student must have the
The academic support of a faculty member and the student must pass the Ph.D. candidacy examination that is typically offered once each year. The exam must be taken within one year three semesters (excluding summer sessions) of entry into the doctoral program. If a student does not pass the exam on their first attempt, then a second attempt may be allowed at the discretion of the graduate faculty members of the department. The student must complete an M.S. degree in our graduate program.

In addition, Ph.D. degree requirements include successful completion of the following: approved graduate course work, English Competence requirements, a comprehensive examination, and a final oral examination (the dissertation defense). The student must pass the English competency exam before scheduling the comprehensive exam. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the doctoral committee, the head of the graduate program, and the Graduate School. For the Ph.D. program, a minimum of 21 credits is required, including a core curriculum of 12 credits in four distinct courses, two each from two prescribed lists for dynamic meteorology and physical meteorology. The dynamic meteorology list consists of METEO 520 (3 credits), METEO 521 (3 credits), METEO 554 (3 credits), METEO 551 (3 credits), and METEO 570 (3 credits). The physical meteorology list consists of METEO 532 (3 credits), METEO 533 (3 credits), METEO 535 (3 credits), METEO 556 (3 credits), and METEO 570 (3 credits). The student will be tested for mastery of the selected core in the candidacy exam.

In addition, a student must take METEO 591 (1 credit) the first semester it is available upon matriculating in the program. METEO 880 (2 credits) must be taken prior to the department's competency exam in written and spoken technical English. The 12 credits of core curriculum courses, METEO 880, and METEO 591 may be waived as required courses at the discretion of the program if the student has already taken them or equivalent courses, and the total required credits will be reduced accordingly. A minimum of 6 elective credits from METEO 500-level (other than METEO 501, 520, 521, 531, 533, 880, 590, 591) or RELATED DISCIPLINE related discipline 400- or 500-level courses must be taken that do not count toward any other degree requirement and finished by the semester in which the comprehensive exam is passed. In addition to the 21 minimum required credits, one credit of METEO 590 is required each semester until the comprehensive exam is passed. A student must pass the department's competency exam in written and spoken technical English before being admitted to the comprehensive
exam. There are no minimum quality-graded credit (research credits whose grades count toward the grade-point average) requirements for quality-graded METEO 600 (research credits whose grades count toward the grade-point average); students may earn up to a maximum of 12 quality-graded METEO 600 credits. It is expected to master the material in the M.S. core courses (METEO 520, 521, 531, and 533), but need not take those courses for credit. Doctoral Minor

Requirements listed here are in addition to requirements stated in the Graduate Minors section of the Graduate Bulletin.

For a minor in Meteorology and Atmospheric Science, doctoral students should select 15 credits of Meteorology and Atmospheric Science courses, 9 credits of which have to be 500-level, in a course plan approved by the department.

**Dual-Title Ph.D. in Climate Science (CLSCI)**

Students interested in the field of Climate Science may wish to obtain a Dual-Title Doctoral Degree in Climate Science and Meteorology and Atmospheric Science. The pursuit of this dual title entails additional course work beyond the degree requirements set forth here (see the Graduate Bulletin, Climate Science, for further details concerning these course and other program requirements), as well as the participation of at least one Climate Science program faculty member on the dissertation committee. The Climate Science representative, who assists with the selection of courses, may be the adviser and have an appointment in Meteorology and Atmospheric Science. The Ph.D. candidacy exam for dual-title students will be administered by Meteorology and Atmospheric Science but with a component of it from the Climate Science representative, that assesses their potential in the field of Climate Science. The field of Climate Science will also be integrated into the comprehensive examination. A Ph.D. dissertation that contributes fundamentally to the field of Climate Science is required. A public oral presentation of the dissertation is required.

**Admissions Requirements**

Students must apply and be admitted to the graduate program in Meteorology and Atmospheric Science and The Graduate School before they can apply for admission to the dual-title degree
program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Climate Science dual-title program. Refer to the Admission Requirements section of the Climate Science Bulletin page. Doctoral students must be admitted into the dual-title degree program in Climate Science prior to taking the candidacy examination in their primary graduate program.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Meteorology and Atmospheric Science, listed above. In addition, students must complete the degree requirements for the dual-title in Climate Science, listed on the Climate Science Bulletin page.

The candidacy examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Meteorology and Atmospheric Science and must include at least one Graduate Faculty member from the Climate Science program. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. There will be a single candidacy examination, containing elements of both Meteorology and Atmospheric Science and Climate Science. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for doctoral committees, the doctoral committee of a Meteorology and Atmospheric Science and Climate Science dual-title Ph.D. student must include at least one member of the Climate Science Graduate Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. If the chair of the doctoral committee is not also a member of the Graduate Faculty in Climate Science, the member of the committee representing Climate Science must be appointed as co-chair. The Climate Science representative on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their doctoral committee and reflects their original research and
education in Meteorology and Atmospheric Science and Climate Science. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

**Dual-Title Ph.D. in Astrobiology (ABIOL)**

Students interested in the emerging field of Astrobiology may wish to obtain a Dual-Title Graduate Degree in Astrobiology and Meteorology and Atmospheric Science. The pursuit of this dual title entails additional course work beyond the degree requirements set forth here (see the Graduate Bulletin, **Astrobiology**, for further details concerning these course and other program requirements), as well as the participation of at least one Astrobiology program faculty member on the dissertation committee. The Astrobiology representative, who assists with the selection of courses, may be the adviser and have an appointment in Meteorology and Atmospheric Science. The Ph.D. candidacy exam for dual-title students will be administered by Meteorology and Atmospheric Science but with a component of it from the Astrobiology representative, or others related to this dual-title graduate degree, that assesses their potential in the field of Astrobiology. The field of Astrobiology will also be integrated into the comprehensive examination. A Ph.D. dissertation that contributes fundamentally to the field of Astrobiology is required. A public oral presentation of the dissertation is required.

**Admissions Requirements**

Students must apply and be admitted to the graduate program in Meteorology and Atmospheric Science and The Graduate School before they can apply for admission to the dual-title degree program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Astrobiology dual-title program. Refer to the Admission Requirements section of the **Astrobiology Bulletin page**. Doctoral students must be admitted into the dual-title degree program in Astrobiology prior to taking the candidacy examination in their primary graduate program.

**Degree Requirements**
To qualify for the dual-title degree, students must satisfy the degree requirements for the Ph.D. in Meteorology and Atmospheric Science, listed above. In addition, students must complete the degree requirements for the dual-title in Astrobiology, listed on the Astrobiology Bulletin page.

The candidacy examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Meteorology and Atmospheric Science and must include at least one Graduate Faculty member from the Astrobiology program. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. There will be a single candidacy examination, containing elements of both Meteorology and Atmospheric Science and Astrobiology. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the candidacy examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for doctoral committees, the doctoral committee of a Meteorology and Atmospheric Science and Astrobiology dual-title Ph.D. student must include at least one member of the Astrobiology Graduate Faculty. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. If the chair of the doctoral committee is not also a member of the Graduate Faculty in Astrobiology, the member of the committee representing Astrobiology must be appointed as co-chair. The Astrobiology representative on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their doctoral committee and reflects their original research and education in Meteorology and Atmospheric Science and Astrobiology. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the doctoral committee, the head of the graduate program, and the Graduate School.

Ph.D. Minor

For a minor in Meteorology, Ph.D. students should select 15 credits of 500-level Meteorology courses in a course plan approved by the department.
Integrated B.S./M.S. Program in Meteorology and Atmospheric Science

The Department of Meteorology and Atmospheric Science offers an integrated B.S./M.S. program, also called the Integrated Undergraduate-Graduate (IUG) program, that is designed to allow academically superior students to obtain both the B.S. and the M.S. degree in Meteorology and Atmospheric Science in five years of study. In order to complete the program in five years, students interested in the IUG program in Meteorology and Atmospheric Science must apply for admission to the Graduate School and the IUG program no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree.

During the first three years, the student will follow the course scheduling of one of the options in the B.S. degree, normally the Atmospheric Sciences or the General Option (see the Undergraduate Bulletin). Students who intend to enter the IUG program are encouraged to take upper level classes during their first three years whenever appropriate. However, students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. By the end of the junior year, students normally apply for admission to both the IUG Program and to the Graduate School. Acceptance decisions will be made prior to the beginning of the senior year and M.S. advising committees appointed for successful applicants. During the senior year, IUG students follow the scheduling of the selected B.S. Meteorology and Atmospheric Science Option, with an emphasis on completing 500-level course work as appropriate. During the senior year, IUG students will start work on their theses or papers that are designed to meet the requirements of the M.S. degree in Meteorology and Atmospheric Science. During the fifth year, IUG students take courses fulfilling the departmental M.S. degree requirements and complete their M.S. theses or papers. Typical scheduling plans for students pursuing the General or Atmospheric Sciences Options are given on the departmental website. If a plan similar to one of these plans is followed, then the student will have completed all requirements for the B.S. in Meteorology and Atmospheric Science by the end of the fourth year. If, for some reason, a student cannot continue in the integrated program, then this student will be able to receive the undergraduate degree upon completion of all of the B.S. requirements.

IUG Program Admission Requirements
Students must apply to the program via the Graduate School application for admission, and must meet all the admission requirements of the Graduate School and the Meteorology and Atmospheric Science graduate program for the Master of Science degree, listed above. In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study in person to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Students who wish to complete the IUG program in Meteorology and Atmospheric Science must be admitted to the program no earlier than the beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Admission to the program will be at the discretion of the Associate Head of the Department of Meteorology and Atmospheric Science graduate program, who will determine the necessary criteria for all applicants. These criteria include the setting of the minimum required scores on the GRE and minimum cumulative GPA for consideration, the receipt of recommendation letters from three faculty and a letter of support from the department head, and the identification of an adviser who is willing to oversee the student's research project. Evidence of significant research potential must be provided in the application.

**IUG Program Degree Requirements**

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Information Systems are listed in the Undergraduate Bulletin. Degree requirements for the Master of Science in Meteorology and Atmospheric Science degree are listed above. All IUG students must defend their theses or papers, as do all M.S. students, in a public presentation toward the end of their graduate program.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500
or 800 level. Credits associated with the culminating experience for the graduate degree cannot be double-counted. The courses that are eligible to double count for both degrees are: METEO 520, METEO 521, METEO 532, METEO 533, METEO 535, METEO 554, METEO 551, METEO 556, and METEO 570.

**Other Relevant Information**

The program differentiates between instruction and research topics appropriate for M.S. students seeking positions of advanced responsibility in government or industry, those appropriate for M.S. students anticipating further study, and those appropriate for Ph.D. candidates who will work in advanced research laboratories or academic institutions.

**Student Aid**

Graduate assistantships available to students in this program and other forms of student aid are described in the **STUDENT AID** section of the Graduate Bulletin. Most graduate students are supported with teaching or research assistantships. Students on graduate assistantships must adhere to the **course load limits set forth in the Graduate Bulletin**.

**Courses**

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

**METEOROLOGY (METEO) course list**  
**Meteorology and Atmospheric Science (METEO) course list**

**6. Consultation for Graduate Program Changes**
The following units which may be impacted by the proposed changes in the Meteorology and Atmospheric Science program have been consulted and are supportive of the changes:

Department of Geosciences, College of Earth and Mineral Sciences

Department of Geography, College of Earth and Mineral Sciences

The following request was sent to the Directors of the Graduate Programs in both departments:

Our department changed names from Meteorology to Meteorology and Atmospheric Science. Accompanied with that, we changed our core requirements (relaxed what Meteo classes we accept in the core), and we are also adding the dual-title graduate degree in Climate Science. Both Geosc and Geol are part of the dual-title degree.

In any case, we have to submit program change proposals for the three graduate degrees we offer, Ph.D., M.S. and IUG. I have attached copies of these proposals. We are required by the Grad School to consult with other programs that may be impacted by these changes. Geosc and Geol are probably the closest two. Would you be willing to look over the proposals (in reality, if you look at section 3 of any of the proposals you will all the relevant content), and send comments back via e-mail?

I believe what the Graduate School want from you is your opinion as to whether there are conflicts/overlaps between what we propose and your programs. Best I understand, your response may be as simple as an e-mail stating that you see no conflicts/overlaps and that you are OK with this proposal. But of course, if you do have real concerns we would very much like to hear about those at your earliest convenience so we can address those.

If you glance at the proposal and think there are no concerns, we would greatly appreciate a quick response. That will allow us to go forward with the submission of the dual-title proposal (the Grad School asked for the program change and the dual-title proposals to come in together). We would like to have the dual-title on the books by the fall.

Geosciences:

We received the following request from Geosciences:

Can you send along the description of the Climate Science dual title proposal (or at least the brief summary that will go in the Graduate Bulletin)? The documents you sent are helpful but don’t outline the details or requirements of the dual title program.

I don’t envision any issues from Geosciences, but would like to circulate the description to a few key faculty here for some feedback.

After complying, Geosciences indicated they had no objections:

As expected, I think there are no comments from Geosciences - looks good to folks here.
Geography:

We received the following comments from Geography:

Overall, we feel these are good changes and look forward to continuing collaborations in the future.

One of the faculty here had a quick comment/question that perhaps you could incorporate in the proposal if appropriate? It is here:
My only question was one of clarification. In the PhD Degree Requirements (and also for the M.S. Requirements), there is mention of Meteo Atmos Sci students being able to take 400- or 500-level courses in "related disciplines". The possible "related disciplines" are not specified or examples given either of departments/programs or courses, although presumably courses such as our G410/G412W, G417, and G510 would be included? That was my only question and minor suggestion-- they may want to spell out some of the related disciplines they have in mind in the revised text (Geography? Geosciences? Electrical Engineering? Forestry?).

We responded to the comment/question:

Our students must appeal to our graduate academic program committee to get courses approved.

We are striving for a good measure of flexibility because the science is progressively becoming more interdisciplinary. My experience is that the committee carefully consider the student's plan of study and approves what makes sense. Yes, Geography courses would in all likelihood be acceptable, as would be the other three disciplines depending on the student's plan of study. We are hesitant to specify disciplines because that will almost certainly invite the reviewers to ask why their disciplines are not listed.

After this communication, Geography accepted the proposal with no objections:

Thanks for this. I appreciate the need for flexibility and am sure you will support geography offerings as appropriate. Please send as is- this was more of an inquiry than a requested revision.
8. Consultation for Dual-Title Doctoral Program in Climate Science

The following units have been consulted and are supportive of the dual-title Climate Science Ph.D. program:

- Department of Agricultural Economics, Sociology, and Education, College of Agricultural Sciences
- Department of Anthropology, College of the Liberal Arts
- Department of Biology, Eberly College of Science
- Department of Chemistry, Eberly College of Science
- Department of Civil and Environmental Engineering, College of Engineering
- College of Information Sciences and Technology
- Department of Ecosystem Science and Management, College of Agricultural Sciences
- Department of Electrical Engineering, College of Engineering
- Department of Energy and Mineral Engineering, College of Earth and Mineral Sciences
- Department of Geosciences, College of Earth and Mineral Sciences
- Department of Geography, College of Earth and Mineral Sciences
- Department of Materials Science and Engineering, College of Earth and Mineral Sciences
- Department of Mathematics, Eberly College of Science
- Department of Philosophy, College of the Liberal Arts
- Department of Physics, Eberly College of Science
- Department of Psychology, College of the Liberal Arts
- Department of Statistics, Eberly College of Science
- Institute for CyberScience
- School of Law
- Penn State Earth and Environmental Systems Institute
- Rock Ethics Institute

The responses to the consultation are included in the proposal to establish a dual-title doctoral degree program in climate science.