Twin Cities Campus

Land and Atmospheric Science Ph.D.

Soil, Water, & Climate

College of Food, Agricultural and Natural Resource Sciences

Link to a list of faculty for this program.

Contact Information:
Department of Soil, Water, and Climate, 439 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-5251; fax: 612-625-2208)
Email: laas@umn.edu
Website: http://www.laas.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Spring 2021
- Length of program in credits: 50
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

Land and atmospheric science (LAAS) is a science-based interdisciplinary program focused on the fundamentals of Earth system processes related to land and atmosphere and their coupled interactions. Students have the option to develop a program based on one of the more traditional areas in atmospheric science or soil science or to design their own interdisciplinary course of study bridging the two disciplines. The Land and atmospheric science graduate program has no formal tracks or emphasis areas, but instead allows students to design a curriculum that addresses their interests within the scope of the program. This multidisciplinary program encompasses aspects of chemistry, physics, biology, atmospheric sciences, and geology.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.20.

Applicants to the LAAS PhD program are expected to have an MS degree or equivalent in a related field of science.

Required prerequisites

Basic Sciences

Students are expected to have taken a minimum of four of the following courses (or their equivalent):
MATH 1271 - Calculus I [MATH] (4.0 cr)
or MATH 1142 - Short Calculus [MATH] (4.0 cr)
or MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
PHYS 1101W - Introductory College Physics I [PHYS, WI] (4.0 cr)
PHYS 1102W - Introductory College Physics II [PHYS, WI] (4.0 cr)
or ESPM 3131 - Environmental Physics (3.0 cr)
or BIOL 1009 - General Biology [BIOL] (4.0 cr)
or CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
or STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)

Environmental Sciences

Students are expected to have taken a minimum of two of the following (or similar) courses:
Take 2 - 6 course(s) from the following:
•ESPM 1011 - Issues in the Environment [ENV] (3.0 cr)
•ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
•SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)
•ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
•ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)

or MICB 3301 - Biology of Microorganisms (5.0 cr)
•EEB 3407 - Ecology (3.0 cr)

Other requirements to be completed before admission:
Students with a BS degree and outstanding scholarship can request direct admission to the LAAS PhD program. Each request will be considered on a case-by-case basis by the Graduate Advisory Committee. Evidence of outstanding scholarship may include: peer-reviewed publications, a pre-doctoral fellowship, a National Science Foundation PhD Fellowship, high GPA/GRE scores, or strong previous research experience. Current MS candidates who exhibit outstanding scholarship may request transfer to a PhD degree program after completion of their first two semesters of coursework.

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations(TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

16 credits are required in the major.
10 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

Core Courses

All doctoral students must complete the 10-credit core curriculum.
Take exactly 5 course(s) totaling exactly 10 credit(s) from the following:
•LAAS 5050 - Integrated Topics in Land & Atmospheric Science (3.0 cr)
•LAAS 8128 - Land and Atmospheric Science Seminar (1.5 cr)
•SOIL 8123 - Research Ethics in the Plant and Environmental Sciences (0.5 cr)
•LAAS 5051 - Thesis Proposal Writing for Land & Atmospheric Science (2.0 cr)
•GRAD 8101 - Teaching in Higher Education (3.0 cr)

LAAS and Related Courses

Choose courses relevant to particular area of research with consent of advisor. Take at least 6 credits from the following list to complete the 16-credit minimum for the major, and at least 10 credits for the supporting program minimum.
Take 16 or more credit(s) from the following:
•LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
•LAAS 5416 - Precision Agriculture and Nutrient Management (3.0 cr)
•LAAS 5425 - Atmospheric Processes I: Thermodynamics and Dynamics of the Atmosphere (3.0 cr)
•LAAS 5426 - Atmospheric Processes II: Radiation, Composition, and Climate (3.0 cr)
•LAAS 5480 - Special Topics in Land and Atmospheric Science (1.0 - 4.0 cr)
•LAAS 5515 - Soil Formation: Earth Surface Processes and Biogeochemistry (3.0 cr)
•LAAS 5621 - Environmental Genomics and Microbiomes (3.0 cr)
•LAAS 8195 - Research Problems in Soils (1.0 - 5.0 cr)
•AGRO 5121 - Applied Experimental Design (4.0 cr)

- ESPM 5061 - Water Quality and Natural Resources (3.0 cr)
- BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
- AGRO 5321 - Ecology of Agricultural Systems (3.0 cr)
- BBE 5608 - Environmental and Industrial Microbiology (3.0 cr)
- CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
- CEGE 4562 - Environmental Remediation Technologies (3.0 cr)
- CEGE 5180 - Special Topics (1.0 - 4.0 cr)
- CEGE 5511 - Urban Hydrology and Water Quality (4.0 cr)
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
- CEGE 5542 - Experimental Methods in Environmental Engineering (3.0 cr)
- CEGE 5543 - Introductory Environmental Fluid Mechanics (4.0 cr)
- CEGE 5551 - Environmental Microbiology (3.0 cr)
- CEGE 8501 - Environmental Fluid Mechanics I (4.0 cr)
- CEGE 8502 - Environmental Fluid Mechanics II (4.0 cr)
- CEGE 8503 - Environmental Mass Transport (4.0 cr)
- CEGE 8506 - Stochastic Hydrology (4.0 cr)
- CEGE 8541 *{Inactive}*(3.0 cr)
- CEGE 8521 - The Atmospheric Boundary Layer (4.0 cr)
- CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
- CEGE 8551 - Environmental Microbiology: Molecular Theory and Methods (3.0 cr)
- CEGE 8561 - Analysis and Modeling of Aquatic Environments I (3.0 cr)
- CEGE 8562 - Analysis and Modeling of Aquatic Environments II (3.0 cr)
- CEGE 8572 - Computational Environmental Fluid Dynamics (4.0 cr)
- EEB 4068 - Plant Physiological Ecology (3.0 cr)
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- EEB 5053 - Ecology: Theory and Concepts (4.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- EEB 5605 *{Inactive}*(2.0 cr)
- ESCI 5102 - Climate Change and Human History (3.0 cr)
- ESCI 5351 *{Inactive}*(3.0 cr)
- ESCI 5402 - Science and Politics of Global Warming (3.0 cr)
- ESCI 8401 - Aqueous Environmental Geochemistry (3.0 cr)
- GEOG 5562 - GIS Development Practicum (3.0 cr)
- ESCI 8801 *{Inactive}*(3.0 cr)
- ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
- ESPM 5402 - Biometeorology (3.0 cr)
- ESPM 5245 - Sustainable Land Use Planning and Policy (3.0 cr)
- ESPM 5601 *{Inactive}*(3.0 cr)
- FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
- FNRM 5131 - Geographical Information Systems (GIS) for Natural Resources (4.0 cr)
- FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
- FNRM 5262 - Remote Sensing and Geospatial Analysis of Natural Resources and Environment (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- GEOG 5401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
- GEOG 5426 - Climatic Variations (3.0 cr)
- GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 5839 - Introduction to Dendrochronology (4.0 cr)
- GEOG 8270 - Seminar: Climatology (3.0 cr)
- GIS 5555 - Basic Spatial Analysis (3.0 cr)
- PMB 4111 - Microbial Physiology and Diversity (3.0 cr)
- PMB 5412 - Plant Physiology and Development (3.0 cr)
- PLPA 8103 - Plant-Microbe Interactions (3.0 cr)
- PUBH 6100 - Topics: Environmental Health (1.0 - 4.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)
- SAGR 8010 - Colloquium in Sustainable Agriculture (2.0 cr)
- SOIL 5232 - Vadose Zone Hydrology (3.0 cr)
- SOIL 5555 - Wetland Soils (3.0 cr)
- SOIL 5611 - Soil Biology and Fertility (4.0 cr)
- SOIL 8252 - Advanced Soil Physics (2.0 cr)
- SOIL 8510 - Advanced Topics in Pedology (2.0 - 4.0 cr)
- STAT 5021 - Statistical Analysis (4.0 cr)
- STAT 5302 - Applied Regression Analysis (4.0 cr)
- STAT 5303 - Designing Experiments (4.0 cr)
- WRS 5101 - Water Policy (3.0 cr)

Thesis credits

Take 24 or more credit(s) from the following:
•LAAS 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)