



# Oregon State University

## ENVIRONMENTAL SCIENCES GRADUATE PROGRAM (ESGP) AREA OF CONCENTRATION IN **CLIMATE CHANGE**

### PURPOSE

The Area of Concentration in Climate Change is designed for students who have some modeling background and want to develop a better understanding of climate processes and impacts. Climate change is considered by many scientists and high-level decision makers in government, business and civil society to be one of the most pressing challenges facing humankind. Examples of climate change include global trends in climate variables and changes in their variability. Direct effects include ecosystem responses outside their range of historical variability particularly obvious in species with climate-related physiological thresholds. Indirect effects include changes in disturbance regimes. Within the Climate Change track, students may choose to focus on integrated aspects of terrestrial, aquatic, atmospheric, and marine systems.

### PROGRAM OF STUDY

The Climate Change track includes: ESGP Core courses, Methods and Numerical Skills courses, Science Focal Area courses, Elective courses, and Thesis or Project. Total credits required are a minimum of 45 Cr for the M.S. and M.A. degrees and 108 Cr for the Ph.D. degree. Typical Programs of Study will include minimum credits as follows:

Subject Area	M.S. & M.A. Degrees	Ph.D. Degree
ENSC Core Courses	6 Cr	6 Cr
Methods and Numerical Skills	6-8 Cr	9-10 Cr
Science Focal Area Courses	15 Cr min.	30 Cr min.
Electives	11 Cr max.	26 Cr max.
Thesis or Project	6 Cr	36 Cr

Total	45 Cr	108 Cr
-------	-------	--------

### ESGP CORE COURSES

ENSC 515 Environmental Perspectives and Methods (3) (Fall term)  
 ENSC 520 Environmental Analysis (3) (Winter term)

### ETHICS

CITI Responsible Conduct for Research (free training through OSU) or equivalent (0 Cr).  
 Instructions are found at this link: <https://gradschool.oregonstate.edu/environmental-sciences/student-handbook-environmental-science-graduate-program>

### METHODS AND NUMERICAL SKILLS COURSES

**6-8 Cr** for the M.S. and M.A. degree and **9 Cr minimum** for the Ph.D. degree. These courses are to ensure students have sufficient skills in research methods including mathematics, statistics, and computer science. Courses are to be selected by the student, advisor, and advising committee from the list below and from other offerings.

**The courses below are a suggested partial listing and are to be selected by consensus of the graduate advisor, advising committee, and student.**

**Additional online courses may be included in the program of study that are not listed below. Search the Schedule of Classes by keyword or prefix for additional course options:**

[https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype\\_02&camp=DB,DI](https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype_02&camp=DB,DI)

ATS 511 Thermodynamic and Cloud Microphysics (4)
ATS 520 Climate Physics (4)
ATS 521 Climate Modeling (4)
ATS 615 Large-Scale Interactions of the Ocean and Atmosphere (4)
BEE 511 Global Environmental Change: using spatial data to inform decisions (3)
CH 584 Instruments and Online Interactions in the Sciences (3)
FOR 525 Forest Modeling (3)
GEOG 580 Remote Sensing I (4)
GEOG 560, 561, 562 GISCIENCE I, II, III : Geographic Information Science (4)
GEOG 565 Spatial-Temporal Variation in Ecology and Earth Science (4)
GEO 566 Advanced Spatial Statistics and GIS Science (4)
H 524 Introduction to Biostatistics (4)
MTH 551 Numerical Linear Algebra (3)
MTH 552 Numerical Solutions of Ordinary Differential Equations (3)
MTH 553 Numerical Solutions of Partial Differential Equations (3)
OC 512 Basic MATLAB for Environmental Scientists and Engineers (2)

ST 511, 512, 513 Methods of Data Analysis (4 each)
ST 515 Design and Analysis of Planned Experiments (3)
ST 517 Data Analytics I (4)
ST 522 Introduction to Mathematical Statistics (4)
ST 531 Sampling Methods (3)

SCIENCE FOCAL AREA COURSES

**15 Cr minimum** for the M.S. and M.A. degree and **30 Cr minimum** for the Ph.D. degree. Focal area courses are intended to develop depth of student understanding of climate change and its causes and impacts.

**The courses below are a suggested partial listing and are to be selected by consensus of the graduate advisor, advising committee, and student.**

**Additional online courses may be included in the program of study that are not listed below.**

**Search the Schedule of Classes by keyword or prefix for additional course options:**  
[https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype\\_02&camp=DB,DI](https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype_02&camp=DB,DI)

ATS 515 Atmospheric Dynamics I (4)
ATS 520 Principles of Climate: Physics of Climate and Climate Change (4)
ATS 521 Climate Modeling (4)
ATS 615 Large-Scale Interactions of the Ocean and Atmosphere (4)
BEE 549 Regional Hydrologic Modeling (3)
ENSC 555 Food for Change (3)
FE 536 Forest Disturbance Hydrology (4)
FES 527 Forest Carbon Analysis for Assessments and Policy Agreements (3)
FES 540 Wildland Fire Ecology (3)
FES 545 Ecological Restoration (4)
FES 560 Green Infrastructure (4)
GEO 550 Coastal Hazards: Processes, response, and Adaptation (3)
GEO 586 Quaternary Paleoclimatology (3)
GEOG 551 Planning Principles and Practices for Resilient Communities (4)
MNR 500 Market tools for managing greenhouse gas emissions (3)
MNR 538 Adapting Forests to Climate Change (3)
MNR 550 Climate Change Impacts on Forest Ecosystems (3)
OC 522 Ocean Biogeochemical Dynamics (4)
OC 523 Ocean Ecological Dynamics (4)
OC 562 Sedimentary Processes in the Ocean Basins (3)
OEAS 520 The Solid Earth (4)

OEAS 530 The Fluid Earth (4)
SNR 540 Global Environmental Change (3)
SOIL 511 Soil: A Natural and Societal Resource (3)
SOIL 545 Environmental Soil Chemistry (3)
SOIL 555 Biology of Soil Ecosystems (4)
WRP 544 Managing Natural Resources for Climate Adaptation (3)

#### ELECTIVE COURSES

**11 Cr maximum** for the M.S. and M.A. degree and **26 Cr maximum** for the Ph.D. degree. Students will work with their graduate advisor and committee to select elective courses to develop necessary background, and to add breadth and depth to the student's Program of Study.

**Search the Schedule of Classes by keyword or prefix for additional course options:**  
[https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype\\_02&camp=DB,DI](https://classes.oregonstate.edu/?keyword=ensc&srcdb=999999&coursetype=coursetype_02&camp=DB,DI)

#### THESIS OR PROJECT

**6 Cr** for the M.S. and M.A. degrees and **36 Cr** for the Ph.D. degree.