

# THE GREEN BOOK

What You Need to Know About Environmental Sciences at Harvard College



Earth & Planetary Sciences  
Environmental Science & Engineering  
Environmental Science & Public Policy  
Integrative Biology  
Energy & Environment

# What's Inside

## Course Sequence Recommendations for Primary or Joint Concentrators 03

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### Earth & Planetary Sciences (EPS) 04

**Primary:** 14 courses (56 credits)

**Joint-Allied:** 11 courses (44 credits)

**Secondary:** 5 courses (20 credits)

**Senior Thesis:** Optional, required for honors and joint concentration

**Department Tutorial:** Required, non-credit

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### Environmental Science and Engineering (ESE) 10

*Environmental Science and Engineering AB degree:*

**Primary:** 14-16 courses (56-64 credits)

**Senior Thesis:** Optional

**Joint-Allied:** Same course requirements as primary, requires thesis

**Sophomore Forum:** Required, non-credit

*Engineering Sciences SB degree, on the Environmental Science and Engineering Track:*

**Primary:** 20 courses (80 credits)

**Senior Thesis:** Required (through ES 100)

**Sophomore Forum:** Required, non-credit

*The SB program does not participate in joint concentrations*

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### Environmental Science & Public Policy (ESPP) 18

**Primary:** 13-14 courses (52-56 credits)

**Joint-Allied:** Same course requirements as primary, requires thesis

**Secondary:** 5 courses (20 credits) and Colloquium required, non-credit

**Senior Thesis:** Required for honors

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### Integrative Biology (IB) 24

**Primary:** 13 courses (52 credits)

**Secondary:** 5 courses (20 credits)

**Senior Thesis:** Required for highest honors

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### Energy and Environment (E&E) 28

**Secondary:** 4 courses (16 credits)

**Colloquium:** Required, non-credit



- Earth & Planetary Sciences
- Environmental Science & Engineering
- Environmental Science & Public Policy
- Integrative Biology
- Energy & Environment (secondary field)

**Environmental Sciences is an interdisciplinary field that integrates the physical and biological sciences.**

At Harvard, these disciplines are divided into four concentrations and one secondary field. Each has its own focus and requirements, but all provide ways to study the natural world and find solutions to environmental problems.

### Course Sequence Recommendations for Primary or Joint Concentrators

For students who are considering a primary or joint in environmental sciences, the chart below lists courses that should, when possible, be taken within the first three terms at Harvard.

	Earth & Planetary Sciences	Environmental Science & Engineering	Environmental Science & Public Policy	Integrative Biology
<b>Introductory Courses</b>	EPS-ESE 6 [or] EPS 10 [or] GENED 1018, 1085, 1094, 1098, 1137, 1158, 1167 [or] Any 50-level EPS course	EPS-ESE 6	EPS-ESE 6 [or] EPS 50 [or] GENED 1085 [or] GENED 1094 [or] GENED 1137 [or] GENED 1158	LS 1a (or LPSa or LS 50a) LS 1b (or LS 50b) OEB 10
<b>Chemistry</b>	Physical Sciences 11 [Plus 1 from either list]  Chemistry 17, 20, 40, or 60	Physical Sciences 11 [and] Life Sciences 1a, Physical Sciences 10, [or] Chemistry 17 or 20	Physical Sciences 1 [or] Physical Sciences 11	Optional
<b>Mathematics</b>	Math 21a,b, 22a,b, 23a,b, or Applied Math 22a,b  [Plus 1 from list below]  EPS 100 or 102 [or] APMTH 111 or 120 [or] CS 109a [or] STAT 109, 110, or 111	Math 1a,b [and] Math 21 a,b [or] Applied Math 22a,b	Minimum requirement is Math 1a and 1b; More advanced courses in math and statistics can be chosen; <i>Begin according to placement.</i>	Optional
<b>Physics</b>	Physical Sciences 12a [or] Physics 15a [or] Physics 16 [or] Physics 19  [Plus 1 from either list]  Physical Sciences 12b, Physics 15b, or Physics 15c	Physical Sciences 12a,b [or] Physics 15a,b [or] Physics 15b, 16 [or] Applied Physics 50a,b	Optional	Optional



# Earth and Planetary Sciences: EPS

EPS is focused on critical events that have shaped the Earth's evolution and its place in the solar system. Our approach is to apply interdisciplinary tools to investigate processes from tectonic plate to microbial scale, and across the full sweep of geological time, from the early Earth to the modern world. Using a combination of theoretical, computational, laboratory, and field-based methods, we study natural experiments in Earth's history, and ultimately test the limits of the Earth's resilience in the geological past and in our progressively warming world.

EPS provides training in the basic sciences, followed by upper-level courses that focus on disciplines within Earth and planetary sciences including:

Atmospheric and Ocean Science

Energy and Climate

Environmental Geoscience

Geobiology

Geochemistry

Geology

Planetary Sciences

Solid Earth Geophysics





## Advising and Research

- Small classes that provide direct access to faculty and engaged student participation
- Individual faculty advisor for each EPS concentrator and secondary fielder
- Personalized reports produced twice a year to track academic progress
- Term-time and summer research and lab opportunities with funding
- January and summer field experiences (Death Valley, Alaskan ice fields) with funding
- Option to conduct original research with guidance from EPS faculty, possibly leading to a senior thesis
- Please visit our website to learn more about research opportunities:  
<https://eps.harvard.edu/undergraduate-research-opportunities>

## Culture

- A mid-size department with a high faculty-to-student ratio
- A tight-knit community with opportunities for informal interactions (daily cookies, weekly pizza) and academic engagement (colloquia, seminars)
- Annual department-funded field trips to locations such as Canadian Rockies, Iceland, and sailing in the Atlantic or Pacific
- Harvard's Senior Survey results show that EPS consistently ranks near the top—#1 or #2 seven times in the past ten years—in student satisfaction
- To learn more about the EPS department, please visit our website:  
<https://eps.harvard.edu/pages/undergraduate>

## Careers

*Common employment for graduates with EPS degrees include:*

- **Energy:** Working in both the renewable and fossil energy sectors
- **Public Service:** Environmental monitoring and analysis, operation and management of environmental facilities, administration of environmental regulations
- **Research:** Conducted at universities or non-profit and governmental research agencies
- **Legal:** Environmental litigation or support in a government agency such as the EPA
- **Education:** Teaching at the elementary school through university levels
- **Medical:** EPS concentration requirements fulfill many of the medical school admission requirements
- **Other:** Broadway keyboardist and musical director, presidential management fellow at the National Park Service, landscape architect, financial portfolio manager

# EPS Course List

## EPS/FOUNDATIONAL

<b>EPS-ESE 6</b>	Introduction to Environmental Science and Engineering
<b>EPS 10</b>	A Brief History of the Earth
<b>GENED 1018</b>	How to Build a Habitable Planet
<b>GENED 1085</b>	Energy Resources and the Environment
<b>GENED 1094</b>	Confronting Climate Change: A Foundation in Science, Technology, and Politics
<b>GENED 1098</b>	Natural Disasters
<b>GENED 1137</b>	The Challenge of Human-Induced Climate Change: Transitioning to a Post Fossil Fuel Future
<b>GENED 1158</b>	Water and the Environment
<b>GENED 1167</b>	Climate Crossroads
<b>MATH</b>	<i>Foundational</i>
<b>Math 21a</b>	Multivariable Calculus
<b>Math 21b</b>	Linear Algebra and Differential Equations
<b>Math 22a</b>	Vector Calculus and Linear Algebra I
<b>Math 22b</b>	Vector Calculus and Linear Algebra II
<b>Math 23a</b>	Linear Algebra and Real Analysis I
<b>Math 23b</b>	Linear Algebra and Real Analysis II
<b>Applied Math 22a</b>	Solving and Optimizing
<b>Applied Math 22b</b>	Integrating and Approximating
	<i>Data Analysis, Statistics, and Computation</i>
<b>EPS 100/102</b>	The Missing Matlab Course: A Practical Introduction to Programming and Data Analysis/ Data Science and Statistical Inference in the Earth and Environmental Sciences
<b>Applied Math 111/120</b>	Introduction to Scientific Computing/Applied Linear Algebra and Big Data
<b>CS 109a</b>	Data Science 1: Introduction to Data Science
<b>Statistics 109/110/111</b>	Introduction to Statistical Modeling/Introduction to Probability/Introduction to Statistical Inference
<b>CHEMISTRY</b>	<i>Foundational</i>
<b>Physical Sciences 11</b>	Foundations and Frontiers of Modern Chemistry: A Molecular and Global Perspective
	<i>Higher Level</i>
<b>Chemistry 17</b>	Principles of Organic Chemistry
<b>Chemistry 20</b>	Organic Chemistry
<b>Chemistry 40</b>	Inorganic Chemistry
<b>Chemistry 60</b>	Foundations of Physical Chemistry
<b>PHYSICS</b>	<i>Foundational</i>
<b>Physical Sciences 12a</b>	Mechanics and Statistical Physics from an Analytic, Numerical, and Experimental Perspective
<b>Physics 15a</b>	Introductory Mechanics and Relativity
<b>Physics 16</b>	Mechanics and Special Relativity
<b>Physics 19</b>	Introduction to Theoretical Physics
	<i>Higher Level</i>
<b>Physical Sciences 12b</b>	Electromagnetism and Quantum Physics from an Analytic, Numerical, and Experimental Perspective
<b>Physics 15b</b>	Introductory Electromagnetism and Statistical Physics
<b>Physics 15c</b>	Wave Phenomena



## CONCENTRATION REQUIREMENTS

### Primary: 14 courses (56 credits) + Department Tutorial

A minimum of six EPS courses with at least one course at the 50- or 100-level sampling all three sub-disciplines in Atmosphere(s) and Oceans; Earth History and Geobiology; and Geology, Geophysics and Planetary Science; senior thesis optional

### Joint-Allied: 11 courses (44 credits) + Department Tutorial

A minimum of five EPS courses; senior thesis required

### Secondary: 5 courses (20 credits) + Department Tutorial

A minimum of two foundational courses and three upper-level EPS courses

## For Primary and Joint-Allied Concentrators

### 2 COURSES EARTH & PLANETARY SCIENCES FOUNDATIONAL COURSES

- EPS-ESE 6 or EPS 10 *or*
- GENED 1018, 1085, 1094, 1098, 1137, 1158, 1167 *or*
- Any 50-level EPS course

*No more than one of these from EPS 10 or GENED 1018, 1085, 1094, 1098, 1137, 1158, 1167*

### 2 COURSES MATH

- Math 21a & 21b *or*
- Math 22a & 22b *or*
- Math 23a & 23b *or*
- Applied Math 22a & 22b

### 1 COURSE DATA ANALYSIS, STATISTICS, AND COMPUTATION

- EPS 100 or 102 *or*
- Applied Math 111 or 120 *or*
- CS 109a *or*
- Statistics 109, 110, or 111

### 1 COURSE CHEMISTRY

- Physical Sciences 11

### 1 COURSE PHYSICS

- Physical Sciences 12a *or*
- Physics 15a *or*
- Physics 16 *or*
- Physics 19

### 1 COURSE HIGHER CHEMISTRY OR PHYSICS

- Chemistry 17, 20, 40, or 60 *or*
- Physical Sciences 12b, Physics 15b, or Physics 15c

### UPPER-LEVEL EPS COURSES

**4 COURSES Primary:** Four additional EPS courses, three of which must be numbered 99 or above

**3 COURSES Joint-Allied:** Three additional EPS courses, two of which must be numbered 99 or above

### 1-2 COURSES ADDITIONAL COURSES

In EPS or selected courses in related fields to complete the requirement of at least 14 courses for primary or 11 courses for joint-allied

### HONORS ELIGIBILITY

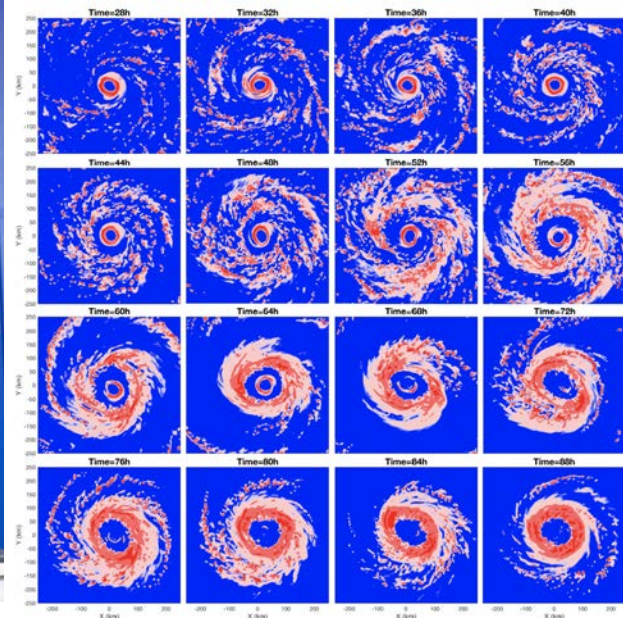
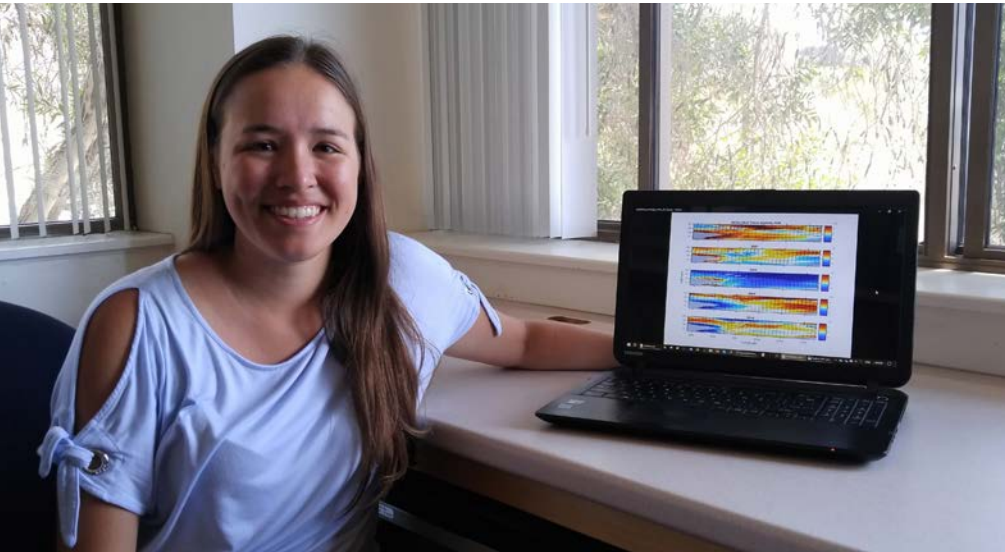
EPS 99 Senior Thesis Tutorial and successful completion of a thesis required

## For Secondary Field Students

### 2 COURSES EARTH & PLANETARY SCIENCES FOUNDATIONAL COURSES

- EPS-ESE 6 or EPS 10 *or*
- GENED 1018, 1085, 1094, 1098, 1137, 1158, 1167 *or*
- Any 50-level EPS course
- *No more than one of these from EPS-ESE 6, EPS 10, or GENED 1018, 1085, 1094, 1098, 1137, 1158, or 1167*

### 3 COURSES UPPER-LEVEL EPS COURSES





## EPS Contacts



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# Environmental Science and Engineering: ESE

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Students in Environmental Science and Engineering study the fundamental processes underlying environmental systems and explore the nexus between scientific knowledge, regulatory frameworks, and engineering solutions for some of the world's most pressing environmental problems. This program is structured around the view that the environmental system is comprised of a complex set of chemical, physical, and biological processes, made even more complicated by the various activities of human society. Throughout their coursework, students learn to understand complex environmental problems in an integrated fashion through a range of approaches from theory and modeling to experiments and observations. As part of the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS), students in ESE are encouraged to participate in experiential learning and state-of-the-art research with faculty. ESE is uniquely positioned to serve as a point of convergence for science and engineering, and exemplifies the pursuit of a technical liberal arts degree.





Students interested in Environmental Science & Engineering have the option to pursue a Bachelor of Arts (AB) in Environmental Science and Engineering or an ABET-accredited Bachelor of Science (SB) in Engineering Sciences on the ESE track. While students in either degree program take many of the same upper-level ESE courses, the AB program offers the opportunity to study complementary disciplines from other natural and social sciences, and the SB program provides a broader basis in engineering fundamentals with courses from other engineering areas and design. The broad-based, multidisciplinary curriculum of the Environmental Science and Engineering program offers rigorous preparation for students preparing for careers in engineering, green technology, public service, business, or government.

### Advising and Research

- A dedicated advising team for each student, including an individual faculty adviser and the Assistant Director of Undergraduate Studies in Environmental Science and Engineering
- A direct connection to the cutting-edge research and facilities at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS), including the Active Learning Labs (ALL)
- All SB students complete a senior thesis through their individual senior capstone design project, and AB students have the opportunity to conduct original research with guidance from SEAS faculty resulting in a senior thesis
- <https://www.seas.harvard.edu/environmental-science-engineering>

### Culture

- Small classes that give students direct access to professors
- Weekly lunches sponsored by the Harvard College Engineering Society every Friday
- Opportunities to learn outside of the classroom through extracurricular activities (e.g., Engineers without Borders). All SEAS students are eligible to apply for SEAS Nectar Funding Grants to support their independent initiatives in engineering and applied science

### Careers

*Here are some examples of what our recent graduates are doing:*

- **Engineering Consulting:** Restoring soil and groundwater through remediation; designing water treatment facilities; developing predictive models to minimize the effect of stormwater run-off; designing buildings with healthier materials and lower carbon footprints
- **Green Technology:** Capturing methane emission and producing fertilizers from organic waste; transforming CO<sub>2</sub> into cost-competitive fuels and chemical products; leading EV battery programs from development to mass scale production; developing energy-efficient hydroponic systems
- **Renewable Energy:** Transforming the energy industry by investing in solar access in overlooked areas; designing and deploying large scale solar power projects; helping businesses and institutions transition to renewable energy
- **Public Service:** Protecting the environment and managing critical infrastructure as environmental engineers (US Forest Service, US Army Corps of Engineers, EPA, etc...); assisting elected officials in the legislative and executive branch
- **Finance:** Investing in climate technologies; facilitating technological/strategic partnership between industry leaders and green startups
- **Further Study:** About 20% of our graduates pursue further study (Masters in engineering, public health, business administration; JD; PhD)

## Core ESE Courses

EPS-ESE 6	Introduction to Environmental Science and Engineering
ESE 50	The Fluid Earth: Oceans, Atmosphere, Climate, and Environment
ESE 101	Global Warming Science
ESE 102	Data Analysis and Statistical Inference in the Earth and Environmental Sciences
ESE 109	Earth Resources and the Environment
ESE 122	Designing Satellite Missions: Research Methods through Lens of Earth Observing Systems
ESE 129	Climate and Atmospheric Physics Laboratory
ESE 131	Introduction to Physical Oceanography and Climate
ESE 132	Introduction to Meteorology and Climate
ESE 133	Atmospheric Chemistry
ESE 136	Climate and Climate Engineering
ESE 137	Energy within Environmental Constraints
ESE 138	Mysteries of Climate Dynamics
ESE 160	Space Science and Engineering: Theory and Applications
ESE 161	Applied Environmental Toxicology
ESE 162	Hydrology
ESE 163	Pollution Control in Aquatic Ecosystems
ESE 164	Environmental Chemistry
ESE 166	State-of-the-Art Instrumentation in Environmental Sciences
ESE 168	Human Environmental Data Science
ESE 169	Seminar on Global Pollution Issues
ES 91	Humanitarian Design Projects <i>(required for SB juniors)</i>
ES 96	Engineering Problem Solving and Design Project
ES 100	Engineering Design Project <i>(required for SB seniors)</i>



## CONCENTRATION REQUIREMENTS

### AB in Environmental Science and Engineering (14-16 courses)

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#### 2-4 COURSES MATHEMATICS (*begin according to placement*)

- Math 1a & 1b *and*
- Math 21a & 21b *or*
  - Math 22a & 22b *or*
  - Math 23b & 23a *or*
  - Applied Math 21a & 21b

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#### 2 COURSES PHYSICS

*One from:* Physical Sciences 12a, Physics 15a, Physics 16, Applied Physics 50a

*One from:* Physical Sciences 12b, Physics 15b, Applied Physics 50b

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#### 2 COURSES CHEMISTRY

*Select 2:*

- Physical Sciences 11 (*recommended*) or Physical Sciences 1
- Life Sciences 1a or LPSa
- Physical Sciences 10
- Chemistry 17 or 20
- Chemistry 60

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#### SOPHOMORE FORUM

*Sophomore year. Non-credit. Spring term.*

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#### 1 COURSE ESE INTRODUCTORY COURSE

- Environmental Science and Engineering 6  
(*may substitute GENED 1085, 1094, or 1137 by petition*)

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#### 2 COURSES ESE BREADTH

*Strongly recommended to select one course on environmental physics and one course on environmental chemistry. With permission, students may substitute alternative ESE courses.*

- Environmental Physics: ESE 101, 129, 131, 132, or 162
- Environmental Chemistry: ESE 133, 161, 164, or ES 112

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#### 5 COURSES APPROVED ELECTIVES

*With permission, up to two courses may be substituted with a relevant upper-level course.*

*Only one course marked with an † can count as an elective.*

- ESE 101, 102<sup>†</sup>, 109, 122, 129, 131, 132, 133, 136, 137, 138, 160\*, 161, 162, 163\*, 164, 166\*, 168, 169\*
- ES 50, 54, 91r (one term), 96\*, 112, 115, 123, 181, 183
- EPS 53, 134, 187
- OEB 55, 120, 157; AM 101<sup>†</sup>, 105<sup>†</sup>, 115<sup>†</sup>, 120<sup>†</sup>; CS 109a<sup>†</sup>

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#### DESIGN EXPERIENCE

*All students must take an approved course (\*) with significant design experience as one of their ESE Breadth or Approved Electives. This requirement may also be satisfied with a design component within a senior thesis or independent research project (ES 91r).*



## SB in Engineering Sciences—Environmental Science and Engineering Track (20 Courses)

### General Engineering Sciences Requirements:

#### 4 COURSES

##### MATHEMATICS (begin according to placement)

- Math 1a & 1b
- Math 21a & 21b or Math 22a & 22b or Math 23a & 23b or Applied Math 21a & 21b or Applied Math 22a & 22b

##### PROBABILITY AND STATISTICS (if starting in Math 1b or higher)

- Applied Mathematics 101 [or]
- Engineering Sciences 150 [or]
- Statistics 110

##### APPLIED MATHEMATICS (if starting in Math 21a or equivalent)

- Applied Math 104, 105, 106, or 107

#### 2 COURSES

##### PHYSICS

- One from: Physical Sciences 12a, Physics 15a, Physics 16, or Applied Physics 50a
- One from: Physical Sciences 12b, Physics 15b, or Applied Physics 50b

#### 1 COURSE

##### COMPUTER SCIENCE

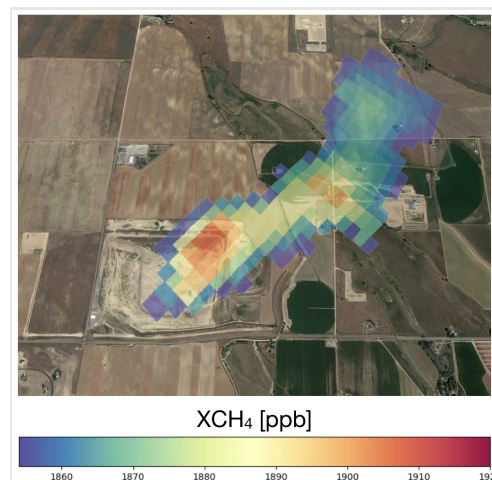
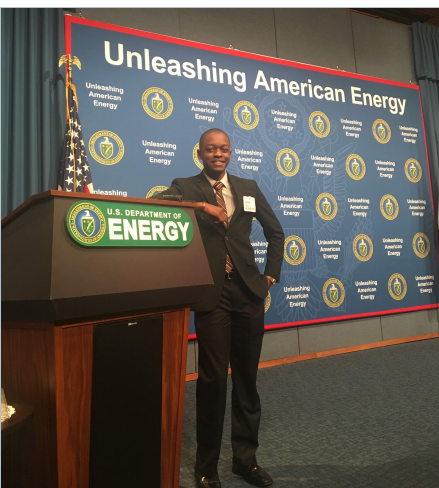
- Computer Science 50, 51, or 61; Applied Math 10

#### 2 COURSES

##### ENGINEERING DESIGN

- Engineering Sciences 96 and Engineering Sciences 100hf

**SOPHOMORE FORUM** *Sophomore year. Non-credit. Spring term.*



***Environmental Science and Engineering Track Requirements:***

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**2 COURSES****CHEMISTRY**

*Select two from:*

- Physical Sciences 11 (*recommended*) or PS 1
  - Life Sciences 1a or LPS a
  - Physical Sciences 10
  - Chemistry 17 or 20
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**5 COURSES****ESE CORE**

- Environmental Science and Engineering 6 *and*

*Select four from:*

- Environmental Science and Engineering 109, 131, 132, 133, 136, 137, 160, 161, 162, 163, 164, 166, 169; Engineering Sciences 112, 123
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**3 COURSES****ENGINEERING BREADTH**

Choose one upper-level (>100) course from each of the following depth areas (*see the Student Handbook for complete list of eligible courses in each area*):

- Mechanics and Materials
  - Electrical
  - Engineering Physics and Chemistry
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**1 COURSE****ENGINEERING ELECTIVE**

Select one course on engineering topics from any engineering depth area (*see the Student Handbook for complete list of eligible courses*)



## ESE Contacts



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# Environmental Science and Public Policy: ESPP

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The concentration in Environmental Science and Public Policy is designed to provide a multidisciplinary introduction to current challenges and issues of the environment. It is founded on the premise that the ability to form rational judgements concerning many of the complex challenges involving the environment that confront today's society requires both an understanding of the underlying scientific and technical issues and an appreciation for the relevant economic, political, legal, historical, and ethical dimensions.

All students have to satisfy a core of requirements in the physical, biological, and social sciences and mathematics. Students in consultation with their faculty advisor identify a field of specialization with a set of advanced courses to provide in-depth understanding of a particular area of environmental science and/or policy. Through their field of specialization, students develop expertise in a particular field of study relating to the environment.



## Advising and Research

- All students are matched with a faculty member who serves as their advisor
- Students create and develop their field of specialization with faculty guidance
- All students undertake an independent research project in their senior year—either capstone or honors thesis, both with faculty guidance
- Students are offered the opportunity to participate in local field trips led by faculty

## Culture

- A mid-size concentration with access to wide range of faculty who oversee the program, including members of FAS departments in EPS, Economics, Government, and OEB, the Business School, Graduate School of Design, the Kennedy School, the School of Public Health, and SEAS
- A welcoming community residing in the Harvard University Center for the Environment where students, faculty, and staff gather for academic and social events (formal and informal)

## Careers

*Common employment for graduates with ESPP degrees include:*

- **Education and Research:** Teaching at the high school through university levels, environmental research at university and government agencies
- **Energy:** Working in both the renewable and fossil energy sectors
- **Non-Governmental Organization:** Public education and outreach, environmental policy advocacy
- **Public Service:** Environmental monitoring and analysis, operation and management of environmental facilities, administration of environmental regulations
- **Medical:** ESPP requirements track with pre-med and many graduates have pursued medical school
- **Legal:** Some graduates pursue law school motivated by environmental concerns





# ESPP Course List

## INTRODUCTORY COURSE OPTIONS

<b>EPS-ESE 6</b>	Introduction to Environmental Science and Engineering
<b>EPS 50</b>	The Fluid Earth: Oceans, Atmosphere, Climate, and Environment
<b>GENED 1085</b>	Energy Resources and the Environment
<b>GENED 1094</b>	Confronting Climate Change: A Foundation in Science, Technology, and Politics
<b>GENED 1137</b>	The Challenge of Human-Induced Climate Change: Transitioning to a Post Fossil Fuel Future
<b>GENED 1158</b>	Water and the Environment
<b>MATH</b>	<i>There are several options for fulfilling the requirement of two courses in mathematics or statistics. The minimum requirement is Math 1a and 1b. (See page 21 for options). More advanced courses can be chosen. Begin according to placement.</i>

## BIOLOGICAL SCIENCE COURSE OPTIONS

<b>OEB 10</b>	Foundations of Biological Diversity
<b>OEB 55</b>	Ecology: Populations, Communities and Ecosystems

## PHYSICAL SCIENCE COURSE OPTIONS

<b>Physical Sciences 1</b>	Chemical Bonding, Energy, and Reactivity: An Introduction to the Physical Sciences
<b>Physical Sciences 11</b>	Foundations and Frontiers of Modern Chemistry: A Molecular and Global Perspective

## SOCIAL SCIENCE COURSE OPTIONS

<b>ESPP 77</b>	Technology, Environment, and Society
<b>ESPP 78</b>	Environmental Politics

## ECONOMICS

<b>EC1661</b>	Economics of Climate Change and Environmental Policy
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## JUNIOR SEMINARS

<b>ESPP 90e</b>	Conservation Biology
<b>ESPP 90g</b>	The Law and Policy of Climate Change: Influencing Decision Makers
<b>ESPP 90k</b>	Applied Environmental Policy Analysis: Air Pollution, Solar Geoengineering, and Environmental Justice
<b>ESPP 90m</b>	Natural Climate Solutions: Feasible or Fantasy?
<b>ESPP 90n</b>	Addressing the Global Climate Crisis: Challenges for Both Developed and Developing Economies
<b>ESPP 90s</b>	The Technology, Economics, and Public Policy of Renewable Energy

## CONCENTRATION REQUIREMENTS

### Primary: 13-14 courses (52-56 credits)

Senior Thesis: Required for Honors

### Joint (Allied Field): 12 courses (48 credits)

Senior Thesis: Required

### Secondary Field: 5 Courses (20 credits) & Non-Credit Colloquium

## For ESPP Primary and Joint-Allied Concentrators

### 1 COURSE      **INTRODUCTORY COURSE**

*The introductory course is designed to provide a multidisciplinary examination of a current environmental challenge.*

- EPS-ESE 6, EPS 50, GENED 1085, GENED 1094, GENED 1137, or GENED 1158

### 1 COURSE      **PHYSICAL SCIENCES**

- Physical Sciences 1 or 11

### 2 COURSES      **MATH**

- Math 1a & 1b; or Math 19a & 19b; Math 21a & 21b; or Applied Math 21a & 21b; or Math 1b & either Math 21a or Applied Math 21a; Math 1b & Stat 100 or 102 or 104

### 1 COURSE      **BIOLOGY**

- OEB 10 or OEB 55

### 1 COURSE      **SOCIAL SCIENCES**

- ESPP 77 or ESPP 78

### 1 COURSE      **ECONOMICS**

- Economics 1661

### 1 COURSE      **JUNIOR SEMINAR**

- ESPP 90

### 4 COURSES      **ADVANCED-LEVEL COURSES/FIELD OF SPECIALIZATION**

*Student's field of specialization; four advanced courses*

At least one course must be chosen from social sciences/policy and from natural sciences/engineering. One course must be in EPS unless a student has taken EPS-ESE 6, EPS 50, GENED 1085, GENED 1094, GENED 1137, or GENED 1158 as their introductory course.

### 1 COURSE      **CAPSTONE PROJECT (Non-honors) or**

### 2 COURSES      **SENIOR THESIS (Honors)**

- ESPP 91 (1 course) Capstone project, students conduct an in-depth examination of an environmental issue consistent with their field of specialization.
- ESPP 99 (2 courses) Senior Thesis Tutorial (required for honors)



## For ESPP Secondary Field Students

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### 1 COURSE

#### INTRODUCTORY COURSE

- EPS-ESE 6, EPS 50, GENED 1085, GENED 1094, GENED 1137, or GENED 1158
- 

### 4 COURSES

#### ADVANCED COURSES

- 2 advanced courses in the social sciences/policy
  - 2 advanced courses in the natural sciences/engineering
  - *List of advanced course options available on ESPP website*
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#### COLLOQUIUM

- During each semester, there are several opportunities for secondary field students to come together to explore various energy and environmental topics through facilitated discussions. These discussions require preparatory readings and/or prior attendance at a public lecture on campus, and students are required to attend at least one session per semester once they have been accepted into the program.

## ESPP Contacts ([espp.fas.harvard.edu](http://espp.fas.harvard.edu))



**HEAD TUTOR**  
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**UNDERGRADUATE  
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# Integrative Biology: IB

The distinguished ecologist George Evelyn Hutchinson described the history and dynamics of life as an evolutionary play in an ecological theater. The concentration in Integrative Biology (the concentration overseen by the Department of Organismic & Evolutionary Biology, OEB) is dedicated to Hutchinson's vision, and is therefore inherently interdisciplinary, encompassing mathematical and computational biology, functional and genetic approaches to morphology and development, as well as genetics, evolution, and ecology.

IB students have many chances to study in the field. Courses take students to Australia (OEB 11 Tropical Ecology), Mexico (OEB 190 Birds), Brazil (OEB 103 Plant Systematics), Panama (OEB 51 Invertebrates), and Costa Rica (OEB 167 Reptiles & Amphibians).

IB provides opportunities to engage with a wide range of topics:

Ecology

Animal Behavior

Anatomy and Physiology

Evolutionary Biology

Paleobiology

Plant Biology

Development & Evolution

Courses on specific groups:  
insects, fish, mammals,  
reptiles & amphibians, birds,  
invertebrates

## Advising and Research

- All students, in both concentration and secondary, are advised by IB's Assistant Director of Undergraduate Studies, Dr. Andrew Berry
- Funded term-time and summer research opportunities in lab and/or field
- Wide-ranging opportunities to do independent senior thesis research with faculty from OEB or related departments
- Harvard provides strong financial support for undergraduate research:  
<https://uraf.harvard.edu/uraf-administered-programs>

## Culture

- With 35 members of the faculty in OEB and around 40 students per year in IB (for a total of around 120 concentrators), IB provides plenty of opportunities—through coursework, research, and more—to become a part of the OEB family
- IB students run their own undergraduate group, OEBug (OEB Undergraduate Group), which organizes weekend activities, social events, and more
- Because of the many opportunities to go away for a week or more on course field trips, students in IB often get to know each other well, and form a tight community

## Careers

*As with any science degree from Harvard, IB provides a platform for exploring just about anything after Harvard. Common destinations for graduates with IB degrees include:*

- **Public Service:** Whether through environmental NGOs or through organizations like the National Park Service, IB graduates often end up working in public service
- **Research:** Typically in PhD programs in the US or overseas, but sometimes through Master's programs
- **Legal:** Every year, some IB graduates go to law school, often motivated by environmental concerns
- **Education:** Teaching at the elementary school through university levels, sometimes through organizations like Teach for America
- **Medical:** IB concentration requirements fulfill most of the medical school admission requirements
- **Veterinary:** Most of Harvard's pre-vet students concentrate in IB



# IB Course List

## LIFE SCIENCES

<b>Life Sciences 1a</b>	An Integrated Introduction to the Life Sciences: Chemistry, Molecular Biology, and Cell Biology (fall)
<b>Life &amp; Physical Sciences a</b>	Foundational Chemistry & Biology (fall)
<b>Life Sciences 50a</b>	Integrated Science (fall)
<b>Life Sciences 1b</b>	An Integrated Introduction to the Life Sciences: Genetics, Genomics, and Evolution (spring)
<b>Life Sciences 50b</b>	Integrated Science (spring)

*\*Pre-medical students should consider Physical Sciences 1 or 11 (spring) to allow them to take the Organic Chemistry sequence (Chemistry 17-27) as sophomores.*

## OEB

<b>OEB 10</b>	Foundations of Biological Diversity (fall)
<b>OEB 11</b>	Introduction to Tropical Ecology (spring, with January field trip to Australia)
<b>OEB courses</b>	OEB 50-290 on wide-ranging topics including ecology, evolution, animal behavior, plant biology, paleobiology, genetics, population genetics, deep sea biology, entomology, herpetology, ornithology, etc...
<b>Senior Thesis</b>	Required for highest honors

# IB Contact



## CONCENTRATION AND SECONDARY FIELD ADVISOR

**Andrew Berry**

BioLabs 1082  
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617-495-0684  
berry@oeb.harvard.edu

## CONCENTRATION REQUIREMENTS

### Primary: 13 courses (52 credits)

Senior Thesis: optional (typically completed by around 45% of concentrators)

### IB does not participate in joint concentrations

### Secondary: 5 courses (20 credits)

Any five courses taught by OEB faculty

## For Primary Concentrators

### 3 COURSES FOUNDATIONAL COURSES

- LS 1a/LPSa/LS50a; LS1b/LS50b; OEB10

### 4 COURSES MATH, APPLIED MATH, COMPUTER SCIENCE, STATISTICS, PHYSICS, CHEMISTRY

- Any four courses (at or above the level of Math 1b in Math and of CS 50 in Computer Science)

### 4 COURSES MID-LEVEL COURSES

- Four courses chosen from OEB 11, OEB 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 65; MCB 60, 63, 80, 121; SCRIB 10; LS 2

### 2 COURSES ADVANCED-LEVEL COURSES

- Any two courses from any area in the Life Sciences (including OEB, HEB, MCB, etc...) that are not listed above as mid-level courses

### HONORS ELIGIBILITY

Honors and high honors may be attained on the basis of within-concentration GPA; highest honors requires a senior thesis

## For Secondary Fielders

Any five courses taught by OEB faculty






# Energy & Environment: E&E

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The energy-environment challenge is a defining issue of our time, and one of Harvard's greatest contributions to meeting that challenge will be the education of a new generation of leaders in science, business, law, design, and public service. To this end, the Environmental Science and Public Policy (ESPP) program, in coordination with the Harvard University Center for the Environment (HUCE), is pleased to offer the secondary field in Energy and Environment (E&E). Through coursework and a colloquium, students engaged in the E&E secondary field will increase their exposure to, and literacy in, the interdisciplinary nature of issues related to energy and the environment.



The Environmental Science and Public Policy Concentration, in coordination with Harvard University Center for the Environment (HUCE), offers the Secondary Field in Energy and Environment (E&E) to increase Harvard students' exposure to, and literacy in, the interconnecting set of issues related to energy and the environment while maintaining a focus on their home concentration.

## E&E Course List

### FOUNDATIONAL

<b>EPS-ESE 6</b>	Introduction to Environmental Science and Engineering
<b>EPS 50</b>	The Fluid Earth: Oceans, Atmosphere, Climate, and Environment
<b>GENED 1085</b>	Energy Resources and the Environment
<b>GENED 1094</b>	Confronting Climate Change: A Foundation in Science, Technology, and Politics
<b>GENED 1137</b>	The Challenge of Human-Induced Climate Change: Transitioning to a Post Fossil Fuel Future
<b>GENED 1158</b>	Water and the Environment

### UPPER-LEVEL COURSES

At least one course must be chosen from each of two elective categories:

- Social Sciences and Humanities
- Natural Sciences and Engineering

### Secondary Field Requirements (4 Courses)

#### 1 COURSE

#### FOUNDATIONAL COURSE

- GENED 1085, GENED 1094, GENED 1137, ESPP 11, ESE 6

#### 3 COURSES

#### UPPER-LEVEL

- One from Social Sciences and Humanities
- One from Natural Sciences and Engineering
- *The complete list of options can be found on the ESPP website: <http://espp.fas.harvard.edu/>.*

#### COLLOQUIUM

- During each semester, there are several opportunities for secondary field students to come together to explore various energy and environmental topics through facilitated discussions. These discussions require preparatory readings and/or prior attendance at a public lecture on campus, and students are required to attend at least one session per semester once they have been accepted into the program.



#### E & E SECONDARY FIELD CONTACT

**Lorraine Maffeo**

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617-496-6995  
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# Harvard University Center For The Environment

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The Harvard University Center for the Environment (HUCE) encourages research and education about the environment and its many interactions with human society. The most pressing problems facing our natural environment are complex, often requiring collaborative investigation by scholars versed in different disciplines. The Center draws its strength from faculty members and students across the University who make up a remarkable intellectual community of scholars, researchers, and teachers of diverse fields including chemistry, earth and planetary sciences, engineering and applied sciences, biology, public health and medicine, government, business, economics, religion, design, and law. By connecting scholars and practitioners from different disciplines, the Center for the Environment seeks to raise the quality of environmental research and teaching at Harvard and beyond.

## GET CONNECTED

Stay connected to the Center's news and events at [www.environment.harvard.edu](http://www.environment.harvard.edu), including a mailing list and weekly events calendar, social media platforms, and an annual newsletter.



Through a variety of programs and funding opportunities, the Center connects people and supports research related to the environment at every level, from undergraduates through senior faculty members. The following resources may be of particular interest to undergraduate students:

### Secondary Field in Energy And Environment

The Environmental Science and Public Policy Concentration, in coordination with HUCE, offers the secondary field in Energy and Environment (E&E) to increase Harvard students' exposure to, and literacy in, the interconnecting set of issues related to energy and the environment while maintaining their focus in their home concentrations. Students from a broad spectrum of concentrations identify the obstacles, highlight the opportunities, and define the discussion for an energy-environment strategy for the 21st century and beyond. To learn more or apply, visit: [www.espp.fas.harvard.edu/energy-environment](http://www.espp.fas.harvard.edu/energy-environment).

### Summer Undergraduate Research Fund

Students can apply for the Summer Undergraduate Research Fund, which provides financial support for independent student research projects and faculty research assistantships related to energy and the environment. Award amounts are usually between \$500-\$3,500. To learn more about funding sources, visit: [www.environment.harvard.edu/summer-undergraduate-research-fund-0](http://www.environment.harvard.edu/summer-undergraduate-research-fund-0).

### Environmental Course Guide

HUCE annually updates the *Environmental Course Guide*, a list of Harvard courses most relevant to energy and environmental studies. The *Course Guide* is searchable by keyword, school, research area, and semester. Visit [www.environment.harvard.edu/course-guide](http://www.environment.harvard.edu/course-guide) to access the guide.

### HUCE Lecture Series and Special Events

HUCE hosts a number of lecture series, symposia, conferences, and special events each academic year. To watch videos from past talks, visit [www.environment.harvard.edu/videos](http://www.environment.harvard.edu/videos). To learn more about energy and environmental events at Harvard and the Greater Boston area, visit: [www.environment.harvard.edu/events/calendar/list](http://www.environment.harvard.edu/events/calendar/list).

### Faculty Associate Directory

Nearly 250 Harvard faculty from a variety of disciplines are affiliated with HUCE. As leading scholars in their fields, they provide expert knowledge on a number of energy and environmentally-related topics. The database of Faculty Associates, available on our website, is searchable alphabetically, by research area, school, department, and keyword: [www.environment.harvard.edu/people](http://www.environment.harvard.edu/people).



## How to Find Us

### EPS

**Hoffman  
Laboratories**  
20 Oxford Street  
Cambridge, MA 02138  
617-384-9760  
[eps.harvard.edu](http://eps.harvard.edu)

### ESE

**Harvard John A.  
Paulson School of  
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Applied Sciences**  
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[seas.harvard.edu/  
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engineering/  
environmental-science-  
and-engineering](http://seas.harvard.edu/programs/engineering/environmental-science-and-engineering)

### ESPP

**Harvard University  
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Environment**  
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[espp.fas.harvard.edu](http://espp.fas.harvard.edu)

### E&E

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### IB

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