Wednesday, September 9, 2015, 4:15 p.m.
Burke Auditorium, Kroon Hall

ENERGY STUDIES ORIENTATION
FALL 2015

Yale CLIMATE & ENERGY INSTITUTE
Energy Studies

Yale Climate & Energy Institute (YCEI) sponsors the Energy Studies Undergraduate Scholars program. The program promotes a multidisciplinary approach to the linked challenges of energy and climate, and provides students with training in the science and technology of energy, the environmental and social impacts of energy production and use, and the economics, planning, and regulation of energy systems and markets. Energy Studies Scholars acquire the broad knowledge and skills needed for advanced studies and for leadership in energy-related fields.

In addition to their participation in the program, Energy Studies Scholars must complete the requirements of a Yale College major. Yale College does not offer a major in energy studies.

Admission to the Energy Studies Undergraduate Scholars program is by application, normally in the second term of the sophomore year. Accepted students are assigned an adviser from the YCEI faculty. Upon successful completion of the program, students receive a letter from YCEI acknowledging their participation in the program and are invited to attend the annual Yale Alumni in Energy Conference.

For additional information, including program requirements and application instructions, visit the YCEI Web site (http://climate.yale.edu/prog-init/energy-studies).

“Energy Studies Scholars acquire the broad knowledge and skills needed for advanced studies and for leadership in energy-related fields.”
Acknowledgments & Thanks

Gary Brudvig
Dave Bercovici
David Evans

Erik Urosa ‘13
Ana Litman ‘13
Clare Henly ‘13
& others

Joe Gordon
Nancy Woodington
Paul Bushkovitch

yaledailynews.com/blog/2013/04/04/yale-unveils-energy-studies-program/
yaledailynews.com/blog/2011/10/13/yale-renews-focus-on-energy-education/
Special Academic Programs

Global Health Studies
Journalism Initiative
Energy Studies
Education Studies
Human Rights Program
YCEI programs bring together teaching and research at Yale to help the world respond to climate change and to understand its links to modern energy use.

Core programs include faculty grants and postdoctoral fellowships to stimulate new partnerships and lines of inquiry; an annual conference, workshops, forums and speaker series to highlight or develop new multidisciplinary research topics; and a new Yale College Special Academic Program for Energy Studies Undergraduate Scholars.

climate.yale.edu
Seeing the forest and the trees, all 3 trillion of them

By Kevin Dennehy

September 2, 2015

A new Yale-led study estimates that there are more than 3 trillion trees on Earth, about seven and a half times more than some previous estimates. But the total number of trees has plummeted by roughly 46% since the start of human civilization, the study estimates.

Using a combination of satellite imagery, forest inventories, and supercomputer technologies, the international team of researchers was able to map tree populations worldwide at the square-kilometer level.

Their results, published in the journal Nature, provide the most comprehensive assessment of tree populations ever produced and offer new insights into a class of organism that helps shape most terrestrial biomes.

The new insights can improve the modeling of many large-scale systems, from carbon cycling and climate change models to the distribution of animal and plant species, say the researchers.

"Trees are among the most prominent and critical organisms on Earth, yet we are only recently beginning to comprehend their global extent and distribution," said Thomas Crowther, a Yale Climate & Energy Institute postdoctoral fellow at the Yale School of Forestry & Environmental Studies (F&ES) and lead author of the study.
First Two Classes of Energy Scholars

**Class of 2014**
Max Preston Andersen  
Stella Limin Cao  
Paul Christian Chandler  
Wendy E. DeWolf  
Benjamin Ross Prawdzik  
Emily Rebecca Schuckert  
Sera Tolgay  
Tara Lois Tomimoto

**Class of 2015**
Landon Acriche  
George Adesanya  
Peter Ambiel  
Brandon Blaesser  
Dalton Carr  
Alexander Co  
Aurora Edington  
Logan Gregoire-Wright  
Russell Hay  
Yumehiko Hoshijima  
Sophie Janaskie  
Sam Kaufman-Martin  
Eleanor Killiam  
Mario Kranjac  
Ethan Kyzivat  
Jacqueline Levere

**Class of 2014 Majors**
- Economics: 10
- Environmental Engineering: 7
- Environmental Studies: 7
- Political Science: 3
- Chemical Engineering: 2
- Chemistry: 2
- History: 2
- Physics: 2
- Geology & Geophysics: 1
- Theater Studies: 1
- History of Science, Medicine, and Public Health: 1
- Humanities: 1
- Mechanical Engineering: 1

**Class of 2015 Majors**
- Economics: 10
- Environmental Engineering: 7
- Environmental Studies: 7
- Political Science: 3
- Chemical Engineering: 2
- Chemistry: 2
- History: 2
- Physics: 2
- Geology & Geophysics: 1
- Theater Studies: 1
- History of Science, Medicine, and Public Health: 1
- Humanities: 1
- Mechanical Engineering: 1
Landon R. Acriche

Has successfully completed the requirements
of the Yale Climate & Energy Institute
Energy Studies Undergraduate Scholars Program.

Landon R. Acriche is a member of the 2015 Class of Energy Scholars,
the first full two-year class of the program at Yale.

Mark Pagani
Director
Yale Climate & Energy Institute
Yale University

Michael Oristaglio
Executive Director
Energy Studies Enrollment

Requirements

Internships

YCEI

Refreshments
Majors of Energy Studies Scholars

56 students (30 seniors), 15+ departments
For assignment of advisers in Energy Studies, all incoming Energy Scholars first need to make an appointment to see the program director, Michael Oristaglio (Executive director, YCEI), by contacting

Cherie Gargano, Senior administrative assistant, YCEI
cheralyn.gargano@yale.edu
203-436-5182
CURRENT Energy Studies Requirements

Six courses plus a senior (capstone) project

Course Distribution Requirements
1 course in each of the 3 tracks
Of the 6 courses, no more than 3 in the student’s major
Double majors can use 3 courses from each of their majors.
CHANGE PHASED IN THIS YEAR*

Energy Studies Requirements

Six courses plus a senior (capstone) project

Course Distribution Requirements

1 course in each of the 3 tracks

Of the 6 courses, no more than 2 in the student’s major

Double majors can use 5 courses total from their two majors.

*New requirements will be implemented flexibly for the class of 2017 energy scholars and go into place fully for the class of 2018.
Energy Science & Technology

APHY 100a, Energy Technology and Society

ARCH 163b, Environment, Energy, Building

CHEM 161a or b and CHEM 165b, General Chemistry I and II*
CHEM 163a and 167a or b, Comprehensive University Chemistry I and II*
CHEM 332a and 332b, Physical Chemistry with Applications in the Physical Sciences I and II*
CHEM 430a, Statistical Mechanics and Thermodynamics

CENG 300a, Chemical Engineering Thermodynamics

EENG 406b, Photovoltaic Energy
EENG 412b, Energy Semiconductor Fundamentals

G&G 274a, Fossil Fuels and Energy Transitions
G&G 275b, Renewable Energy

MENG 211a, Thermodynamics for Mechanical Engineers
MENG 389b, Mechanical Engineering IV: Fluid and Thermal Energy Science

PHYS 180a and 181b, University Physics*
PHYS 200a and 201b, Fundamentals of Physics*
PHYS 260a and 261b, Intensive Introductory Physics*
PHYS 401a and 402b, Advanced Classical Physics from Newton to Einstein*
PHYS 420a, Thermodynamics and Statistical Mechanics

*These full-year courses covering a broad range of topics, in addition to basic energy science, count as only one course toward satisfying the requirements of Energy Studies.
Environmental Impact of Energy

G&G 010, Earth, Resources, Energy & the Environment
G&G 140a, Atmosphere, Ocean, and Environmental Change
G&G 205b, Natural Resources and Their Sustainability
G&G 215, Global Warming: The Carbon Cycle
G&G 322a, Physics of Weather and Climate
G&G 323, Climate Dynamics

CENG 120b, Introduction to Environmental Engineering

ENVE 327a, Atmospheric Chemistry
ENVE 360b, Green Engineering and Sustainable Design
ENVE 373a, Air Pollution Control
ENVE 473b, Air Quality and Energy
Energy & Society: Political, Economic and Social Issues

EVST 120a, Introduction to Environmental History

ANTH 382a, Environmental Anthropology
ANTH 473b, Abrupt Climate Change and Societal Collapse

ECON 330b, The Economics of Natural Resources
ECON 331a, The Economics of Energy and Climate Change
ECON 452b, Contemporary Issues in Energy Policy

HIST 042a, Oil and Empire
HIST 120b, American Environmental History
Recommended Introductory Courses in Each Track

I Energy Science, Technology, and Systems
APHY 100a, Energy Technology and Society
ARCH 163b, Environment, Energy, Building

II Environmental Impact of Energy
G&G 140a, Atmosphere, Ocean, and Environmental Change
CENG 120b, Introduction to Environmental Engineering

III Energy and Society: Political, Economic, and Social Issues
ECON 331a, The Economics of Energy and Climate Change
EVST 340b, The Economics of Natural Resources
Graduate and Professional School Courses

MGT 561a, Energy Technology Innovation
MGT 563a, Energy Systems Analysis

ENAS 609b, Nanotechnology for Energy

F&ES 825a, International Environmental Law

G&G 746b, Seminar in Climate and Energy
Other Course Guidelines

Flexibility is the guiding principle, except for the distribution requirement of 1 course in each track.

A relevant graduate or professional school course can count toward Energy Studies if the course meets the Yale College guidelines for full course credit.

Summer courses outside Yale can count toward Energy Studies, but approval must be requested in advance.

To use a course not on the list to meet requirements, or request approval for a summer course, send an e-mail to YCEI@yale.edu.

A faculty advisory committee for Energy Studies will be making all decisions this year regarding Energy Studies requirements, including course substitution and capstone projects.
Faculty Advisory Committee

Michelle Addington, Architecture
Gary Brudvig, Chemistry
David Evans, Geology & Geophysics
Michael Fotos, Political Science
Paul Sabin, History (DUS Environmental Studies)
Mary-Louise Timmermans, Geology & Geophysics
Sample Curriculum

Science & Technology Focus

CHEM 114 & 115, Comprehensive General Chemistry I & II
ARCH 163, Environment, Energy, Building
G&G 274, Fossil Fuels & Energy Transitions
G&G 275, Renewable Energy

EVST 201, Atmosphere, Ocean & Environmental Change
G&G 205, Natural Resources & Sustainability

MGT 820, Energy Markets Strategy
Sample Curriculum

Environmental Focus

MENG 211, Thermodynamics for Mechanical Engineers
G&G 274, Fossil Fuels & Energy Transitions

ENVE 120, Intro to Environmental Engineering
ENVE 360, Green Engineering & Sustainable Design
EVST 255, Environmental Politics & Law

ECON 330, Economics of Natural Resources
EVST 473, Climate Change & Societal Collapse
Sample Curriculum

Economics Focus

CHEM 114 & 115, Comprehensive General Chemistry I & II
G&G 274, Fossil Fuels & Energy Transitions

G&G 205, Natural Resources & Sustainability

ECON 330, Economics of Natural Resources
ECON 452, Contemporary Issues in Energy Policy
EVST 255, Environmental Politics and Law
Suggested Curriculum Change

In a survey conducted over the summer, the Class of 2015 Energy Scholars recommended that Energy Studies consider establishing either a **Gateway Course** for prospective energy studies students or a **Closing Seminar**.

A Gateway Course taken in the spring of sophomore year would be a prerequisite for enrollment in Energy Studies.

A Closing Seminar would be a required seminar undertaken in the Fall or Spring of Senior Year focused on special topics in energy selected by the class, or on capstone projects.
Capstone Project

(a) A senior essay in the student’s major can serve as the capstone project provided that a topic from one of the three tracks in Energy Studies is an integral part of the essay. The guideline is that the energy-studies topic should constitute at least 30% of the senior essay (or at least 4000 words, whichever is shorter).

(b) A senior project in the student’s major can serve as the capstone project provided that a topic from one of the three tracks in Energy Studies is an integral part of the project.

(c) An individual independent study project undertaken in the senior year, and documented in a written report, can serve as the capstone project provided that the project treats a topic from one of the three tracks in Energy Studies. The guideline for the written report on an independent study project is an essay at least 4000 words in length, in the accepted style of a term essay for a credited independent study course in the department of the student’s major.

(d) A group project undertaken in the senior year by no more than three students, and documented in a written report (same length and style guidelines as for (a)).

(e) An internship undertaken after completion of the junior year, and documented in a written report (same length and style guidelines as for (a)).

All proposals for capstone projects must be approved in advance by the Faculty Advisory Committee for Energy Studies.

Class of 2016 Energy Scholars will be asked to submit proposals by October 15, 2015.

Class of 2017 Energy Scholars will be asked to submit proposals by May 15, 2016.
Sample Capstone Projects, ‘15

Green New Haven: City of New Haven Sustainability Action Plan

The Economics of Coastal Resilience: Examining the Costs and Benefits of Flood Abatement in New Haven, Connecticut

An Assessment of the Safety Risks Associated with Nuclear Power and Potential Solutions

Analysis of Rural Livelihood and Energy Consumption on China’s Grasslands: A Case Study of Inner Mongolia, China

FrackFresh: A low energy, sustainable water treatment system for produced and flowback water

Emissions Trading in a Non-Market Economy: Carbon Cap and Trade System in China

Lessons From a Small Energy Non-Profit: My Time in Cochabamba, Bolivia

Thermo Green Walls

Climate Change: the Musical

*Projects in bold grew out of summer internships. We would like to encourage more such projects.*
Two FAQs

FAQ: Can courses taken Credit/D/Fail count toward meeting the requirements?  
Answer: Generally not. Courses taken Credit/D/Fail are accepted toward the requirements only under exceptional circumstances.

FAQ: Can a summer project or internship undertaken between freshman/sophomore or sophomore/junior years count for the Senior Project?  
Answer: Working guideline for now is “No.” The Capstone Project can build on work done earlier, but must contain an original component undertaken by rising seniors.
Internships

One of the aims of Energy Studies is to help students with placements in internships during your time at Yale and on graduation, drawing on the Yale alumni network working in energy-related fields.

YCEI has established an energy internship program with the City of New Haven.

During the summer of 2014, 5 YCEI energy scholars worked as paid, full-time interns with the New Haven Office of City Engineer and Department of Transportation on energy projects, including the Sustainability Plan for New Haven.

We are working with the Yale Office of Sustainability to identify joint projects between Yale and New Haven that would be suitable for internships year round.

For summer internships, YCEI is working on building a network of connections with the Yale Alumni in Energy organization and directly with companies in energy related fields (takes time and is subject to market forces).

Strongly encourage peer-to-peer networking among Energy Scholars.
New Opportunities Arising

**Clinton (Connecticut) Town Energy Committee:** Develop a baseline energy usage report for our Town. Plan (right now in draft form) is to try and reach out to companies that are developing new energy technologies—everything from hi-tech thermostats to batteries—and see if they will install them in selected homes in town to field test them. Goals is for the town to become a sort of testing ground for any new ideas and technologies that people want to try out. Town of Clinton has passed a resolution to be fully sustainable by 2025 as you are well aware we are never going to meet that goal without trying new things.

**Virgin Earth Carbon Dioxide Removal Project:** In connection with EVST 311, Environmental Communication for Public Engagement & Policy (Instructor, Paul Lussier).
YCEI Events Fall 2015

Speaker Series Spring and Fall: Five talks from YCEI post-docs

- New Ideas in Solar Cells (October 26)
- Climates of History: Extreme climates and social upheaval (November 16)
- Climate and Biodiversity (December 6)
- High-resolution Regional Climate Modeling (January 18)
- Climate Science and Human Health (February 21)

YCEI Fall Workshop

Green Chemistry: Mitigating Climate and Energy Impacts through Design of Chemical Products and Processes, October 2015

Poynter Fellowship in Journalism

Visit by Justin Gillis, New York Times science journalist, October 14-16, sponsored by YCEI and Political Science Department
YCEI Student Leaders

**Undergraduate**
Matthew Goldklang
Nora Moraga-Lewy
Maxwell Payson

**Graduate**
Michael Giannetto
Y-HOUSE

Yale Solar Decathlon