

Program in Environmental Studies

Class Day

2017



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Congratulations Certificate Recipients!

Class Day 2017

Monday, June 5, 2017

1:00 p.m., 10 Guyot Hall

Welcome and Presentation of Prizes

Daniel I. Rubenstein, Director, Program in Environmental Studies

Sarah Jane White, Visiting Associate Research Scholar

François M. Morel, Director, Princeton Environmental Institute

Environmental Studies Book Prize

Environmental Humanities: **Janice Sung**, Art and Archaeology

Environmental Science: **Christian Gray**, Chemistry

Environmental Policy: **Brett Usinger**, Woodrow Wilson School

Environmental Senior Thesis Prize

Awarded to a senior in the Environmental Studies Certificate Program who has written the best thesis in the broad area of environmental studies.

Zoe Sims, Ecology & Evolutionary Biology

Peter W. Stroh '51 Environmental Senior Thesis Prize

Awarded to the senior who has written the best thesis on an environmental topic.

Marcus Spiegel, Civil & Environmental Engineering

Adrian Tasistro-Hart, Geosciences

T.A. Barron Environmental Leadership Prize

Awarded to a senior who has distinguished him or herself by demonstrating exceptional dedication to environmental concerns, not only in formal classes and independent academic work, but also by leading and encouraging other activities among fellow students and in the community at large.

Shannon Osaka, Independent Major

Princeton Environmental Institute

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François M. Morel

Director

Katharine B. Hackett

Executive Director

Daniel I. Rubenstein

Director, Program in Environmental Studies

Angela J. Petsis

Undergraduate Administrator

Refreshments will be served immediately following the ceremony in the Guyot Hall Atrium.

environment.princeton.edu

Support for thesis research projects has been generously provided by the following friends:

- Anonymous - Undergraduate Studies
- T.A. Barron Environmental Leadership Prize
- The Barron Family Fund for Innovations in Environmental Studies
- The Becky Colvin Memorial Award
- The Charles W.H. Dodge '51 *53 Senior Thesis Fund
- Dean of the College/Fisher 250th Anniversary Fund
- Director's Fund (Anonymous)
- Gatto Family Undergraduate Research Fund
- Edmund Hayes, Sr. '18 PEI Senior Thesis Fund
- Newton Family PEI Scholars Fund
- The Bob and Kathy Solomon Undergraduate Research Fund
- Michael P. M. Spies '79
- Peter W. Stroh '51
- Sandra Wilson W '56

Recognition of Certificate Recipients

Daniel I. Rubenstein, Director, Program in Environmental Studies
Angela J. Petsis, Undergraduate Administrator

Anthropology

- Aubree Andres
- Susan Farrell

Architecture

- Adam Ainslie
- Emily Miller
- Peter Pak

Art and Archaeology

- Emily Kamen
- Alexander Quetell
- Janice Sung

Chemical & Biological Engineering

- Justin Mehl
- Samantha Walter

Chemistry

- Christian Gray
- Hannah Yang

Ecology & Evolutionary Biology

- Maria del Pilar Bennett
- Amanda Chang
- Allison Conwell
- Ryan O'Connell
- Zoe Sims
- Olivia Trase

Economics

- Jason Choe
- Claire Egan
- Andrew Tynes

Geosciences

- Jana Suriano
- Vivian Yao

History

- Derek Colaizzo

Independent Major

- Shannon Osaka

Operations Research and Financial Engineering

- Joy Zou

Philosophy

- Jenna Spitzer

Psychology

- Sofia Hiltner

Religion

- William Lathrop

Woodrow Wilson School

- Konadu Amoakuh
- Brett Usinger

The following abstracts have been edited for length.

Adam Ainslie, Architecture
Giving Architecture

To reduce New York City's reliance on banks for tax revenue after the economic recession of 2008, Mayor Michael Bloomberg created the Applied Sciences Facility Competition wherein institutions of higher education proposed a graduate campus focused on bolstering the city's technology industry. Ainslie examined how the architecture of the new campus, which is currently being built by Cornell University, manifests an important shift in the relationship between public and private by establishing a gift economy at a large scale and formalizes this non-capitalist, supplementary economy through architecture.

Konadu Amoakuh, Woodrow Wilson School
Barking up the Wrong Tree? Challenges to Implementing a Timber Legality Verification System in Ghana

In 2008, Ghana signed a Voluntary Partnership Agreement (VPA) with the European Union to curb widespread illegal logging and deforestation in the country by verifying the legality of timber exports to Europe, and also pledged to ensure the legality of timber sold in domestic and non-EU markets. Yet, these policies have not come to fruition. Through interviews conducted in Ghana, Amoakuh found that these efforts have been hindered by a lack of timber-industry support, an absence of a system to deal with illegal domestic timber, and few structures to manage non-timber drivers of deforestation.

Aubree Andres, Anthropology
& thunk: An Exploration of Chaos and Control Through Installation

"& thunk" was a thesis exhibition that explored the intersection of and conversation between chaos and control in the environment and in Andres' art work. The pieces were made with found objects and recycled materials. The installation was meant to overwhelm the viewer at first, then, upon further reflection, become recognizable and known.

Hannah Yang, Chemistry
Desalination via Flow-Electrode Capacitive Deionization

Desalination separates salt and water to provide freshwater to regions of water scarcity. Reverse osmosis is the current industrial standard; however, it releases a concentrated brine that is harmful for local ecosystems. Flow-electrode capacitive deionization is a recently discovered method which allows for retention of the brine without significant drops in efficiency. Furthermore, it is most efficient at 1.1V and slower flow rates, thereby offering a lower-energy means of desalination.

Vivian Yao, Geosciences
*Stable Isotopic Signatures in Symbiotic Bermudian Corals: A Study of Nutrient and Light Variability on $\delta^{15}N$ in *Porites astreoides* at Bermuda*

Nitrogen and carbon isotopes provide a non-invasive and integrative measure of modern biogeochemical cycling and can be used to study past environmental conditions. The principle objective of this study was to examine the effects that light level and nutrient level have on nutrient recycling within a symbiotic coral. A three-phase approach was taken in the field and culture studies. Preliminary results suggest that corals in elevated nutrient conditions uptake more nitrogen from environmental sources than do corals living in lower nutrient conditions. Our results reveal the utility of stable isotopic signatures to study coral responses to eutrophication and highlight the importance of coral-symbiont nitrogen-recycling efficiency.

Joy Zou, Operations Research and Financial Engineering
The Israeli Kibbutz: A Simulation and Analysis on the Optimality of Privatization Versus Degrees of Central Planning

The purpose of this project is to create and evaluate the total utility generated by the individual members of a kibbutz, and how this utility compares to similar environments in which individuals are given all or no control over their allocation of resources. Zou created simulated utility curves used to mirror the decision-making process of rational individuals within the kibbutz. Overall, she found that the introduction of a central planner reduced the overall utility of the society when looking at a single period of time. However, in the long run, having a central planner increases the overall utility of the community. In addition, varying the level of privatization in a community affects the utility generated but not the growth. Finally, there is evidence to suggest that the increase in utility of privatized goods is correlated with the variability of the good.

Andrew Tynes, Economics

Commodity Price Shocks and Credit Supply in Resource-Dependent Economies

This model estimated the elasticity of bank lending to changes in commodity prices in resource-dependent countries. Using foreign subsidiaries of multinational bank holding companies as a natural experiment, Tynes found little evidence of a relationship between commodity price shocks and credit supply in resource-dependent economies between 1991 and 2015. A local projection indicated that GDP growth, historical lending growth, deposit growth and exchange-rate changes play more substantive roles in explaining the evolution of credit over time. These results imply that while their balance sheets are exposed to home-country conditions in general, foreign subsidiaries are insulated from resource shocks.

Brett Usinger, Woodrow Wilson School

Beyond the Pale Blue Dot: Sustainability in Space Resource Policy

Asteroid mining is currently in transition from science fiction to reality. However, the legal environment surrounding its regulation is still hazy, as private property rights in outer space have clashed with the traditional conception of space as the “common heritage of mankind.” Usinger argued that near-Earth asteroids may one day function as a common-pool resource due to decreased access costs to space, which introduces unique difficulties for regulators. Under such a scenario, he recommended that an Asteroid Permit Agency be established through the United Nations to help ensure the sustainable exploitation of outer space’s natural resources.

Samantha Walter, Chemical and Biological Engineering

Visualizing the Dynamics of the Electricity Grid through Diffusion Maps

The next-generation electricity grid must be more flexible and resilient. Current models used to design, manage and analyze the electricity grid can produce data sets that are hard to analyze due to their complexity. This thesis sought to reduce the complexity of the day-ahead economic unit commitment and dispatch model for the Pennsylvania-Jersey-Maryland electricity grid through dimensionality reduction tools, namely diffusion maps. By using diffusion maps, a new representation of the data in a lower dimensional space was found. This indicates that one can use fewer variables to run the simulation. Through this analysis, one can gain a better understanding of the system’s dynamics.

Maria del Pilar Bennett, Ecology and Evolutionary Biology

*An Evaluation of a Mitigation Proposal for the Red-Cockaded Woodpeckers (*Picoides borealis*) of Cainhoy Plantation, South Carolina*

The 9,087-acre Cainhoy Plantation in South Carolina, which contains 16 groups of the endangered red-cockaded woodpecker (*Picoides borealis*), received approval to develop significant portions of the bird’s longleaf pine habitat. Bennett evaluated the plantation’s draft off-site mitigation proposal from a biological perspective. She then considered a “no-take,” on-site mitigation alternative that called for a revised urban design to eliminate the need for incidental-take permits.

Amanda Chang, Ecology and Evolutionary Biology

The Impact of Selective Logging on Bird Biodiversity

There continues to be uncertainty on how bird populations respond to selective logging. Chang studied the impact of selective logging intensity on species richness, total abundance and community composition in the recently protected Harapan Rainforest Ecosystem Restoration Concession on Sumatra, Indonesia, which was previously heavily logged. She focused on 12 focal species, including the critically endangered helmeted hornbill. Her study suggested that there are limited short-term benefits to some bird species in selectively logged forests but the long-term implications are still not understood.

Jason Choe, Economics

A Predictive Model for Wilderness Designation Legislation Success

The Wilderness Act of 1964 authorized Congress to designate for public use wilderness areas that are to remain underdeveloped and untrammeled. Choe sought to model the likelihood of wilderness legislation success through a predictive regression using the Tobit and Craggit frameworks and a variety of macro political and economic factors. Bills introduced in the Senate tended to perform better than those introduced in the House. Otherwise, factors such as the state of the national economy, the political party in control, and the reliance of the state(s) being affected on recreational and extractive industries had little effect. Likely, micro factors such as grassroots advocacy and perceptions of environmental issues have larger roles in determining legislation success.

Derek Colaizzo, History

Capsicum: From Spice to Medicine and Back

Colaizzo mapped the use of cayenne/chili pepper in Western medicine. First cultivated in South America, cayenne was used for a variety of purposes — including medicine — by Amerindians, then by Europeans and enslaved Africans. With its potent anti-inflammatory, analgesic and mucilage properties, became popular in the 19th century for the treatment of cholera. For various reasons that included the decline of the botanical-medicine movement, the development of new medicines, and the decline of cholera in the West, cayenne eventually returned to serving chiefly as a spice.

Allison Conwell, Ecology and Evolutionary Biology

*Fire and the Florida Scrub-Jay: An Investigation of Fire Suppression's Effect on Provisioning Inequality in *Aphelocoma coerulescens**

Studies have shown that the threatened Florida Scrub-Jay (*Aphelocoma coerulescens*) experiences trade-offs in actions as their territory undergoes longer periods of fire suppression. This thesis investigated fire suppression's impact on adults' investment in total fledgling provisioning and in preferential provisioning. Furthermore, measurements of fledgling-provisioning inequality were investigated to determine if provisioning inequality could potentially affect the ultimate fitness of resulting independent jays. Understanding fire suppression's effect on the Florida Scrub-Jay will allow for better conservation and species-management decisions to be made in the future.

Claire Egan, Economics

The Effectiveness of U.S. State-Level Renewable Portfolio Standards in Promoting Renewable Capacity Development

An increasing awareness of the environmental effects of fossil fuels has accelerated the adoption of policies in the United States designed to increase the use of renewable energy for electricity. Egan used panel data to examine the effectiveness of state-level Renewable Portfolio Standards (RPS) in promoting wind, solar, biomass and geo- and hydrothermal capacity development. Employing a difference-in-differences design, she estimated whether adopting RPS increases renewable capacity development. Egan considered a variety of different specifications and concluded that there is no robust effect of RPS on renewable capacity development. However, when the effect of RPS dependent on the renewable potential in the state was considered, RPS had a mild positive relationship with renewable capacity.

Janice Sung, Art and Archaeology

Place, Performance, and Possibility: Interconnectivity in William Sidney Mount's "The Power of Music"

William Sidney Mount's "The Power of Music" (1847) is an exemplar of depicting music listening. Existing interpretations of the work focus almost exclusively on the black identity of the central listener. Using a framework derived from ecocriticism, Sung proposed that all entities — not just humans — are defined relationally. By mapping relations in Mount's genre paintings — scenes from everyday life — Sung illuminated previously unexamined dynamics, which ultimately enhance our understanding of why Mount pictures listening in "The Power of Music." Through the act of listening and his spatial placement, the central figure becomes the locus of interconnectivity among entities that include not only humans and the environment but also the viewer.

Jana Suriano, Geosciences

*Survival and Metabolism of *Methanosarcina soligelidi* Under Simulated Martian Subsurface Conditions*

The methane composition of the Martian atmosphere and soil may be sufficient to allow methanogenesis. This project investigated if a terrestrial methanogen could survive and metabolize under low-pressure conditions in an environment similar to the shallow subsurface of Mars. Permafrost methanogen *Methanosarcina soligelidi* has been previously shown to survive under Martian surface temperatures. A secondary goal was to determine which metabolic pathway and substrate this methanogen prefers under low pressure. *M. soligelidi* cultures at all conditions survived and produced methane for the duration of the experiment, utilizing both the hydrogenotrophic and acetoclastic pathways.

Olivia Trase, Ecology and Evolutionary Biology

Intraspecific Competition Mediated by Mycorrhizal Fungi Alters Photosynthetic Response to Herbivory in Soybean

Mycorrhizal fungi in agriculture can aid plant nutrient uptake and reduce the negative effects of many abiotic soil stressors. However, little is known about how mycorrhizal colonization affects the defense response and resource allocation of plants simultaneously stressed by competition and herbivory. This thesis studied the immediate photosynthetic response of herbivore-stressed plants connected to both stressed and unstressed plants via mycorrhizal network. The findings indicated that intraspecific competition mediated by mycorrhizal networks drastically affects the immediate plastic responses of soybeans to herbivory and, more specifically, negatively affects its compensatory photosynthetic response.

Alexander Quetell, Art and Archaeology

Excess

As a combination of his visual arts and dance theses, Quetell's production "Excess" sought to build and deconstruct a party in order to reveal the dissonances propagated in humanity's pursuit of technology and progress. The hour-long performance explored themes of nature, classism and oppression. The dancers oscillated between various states of control and manipulation, expressing both a collective political revolution and the consequential reconstruction thereafter. Beside the live production, Quetell's certificate work congeals as a first-hand reflection of the methodology and inspiration for the show. The written work discusses how he managed an ethos of sustainability throughout the process, and examines the implicit environmental considerations of "Excess."

Zoe Sims, Ecology and Evolutionary Biology

Where the Groundwater Meets the Sea: Ecological Impacts of Nutrient-Enriched Groundwater Discharge on Bermuda's Near-Shore Coral Reefs

In Bermuda, the world's third-most densely populated nation, over 60 percent of residential sewage enters the groundwater through untreated cesspits. However, the impacts of sewage-enriched groundwater discharge on Bermuda's coral reefs have been little studied. This project quantified water quality in Bermuda's groundwater at a coastal groundwater-discharge vent and across three North Shore reefs, finding high levels of nitrogen enrichment — a sign of sewage contamination — and stunted coral growth. As climate change increasingly stresses coral reefs globally, it is important to mitigate local factors, including pollution, that can push reefs past their resilience thresholds.

Jenna Spitzer, Philosophy

From the Nature of Existence to Persistence through Time: A Structuralist Approach to Understanding Identity through Causal Relationships

If we live "good" or "moral" lives based on our capacity to respond to relevant reasons for action, then our ability to live well and morally hinges upon our ability to appropriately perceive the identities of ourselves and the other elements of our environment, according to which we recognize our reasons for action. This thesis attempted to provide a coherent framework for understanding who or what an entity is and how it can be considered the same entity over time. Spitzer suggests that we can recognize the practical purpose of our practice of identification and enhance our perception of the relevant reasons for action by understanding each entity's nature and diachronic identity over time in terms of that entity's impermanent and interdependent role in causal relationships. She argued that a causal theory of identity better enables us to understand each entity's temporary and interdependent nature and identity over identity.

Susan Farrell, Anthropology

Women in the Wild: Changing the Story We Tell Ourselves

Farrell explored notions of why and how women internalize the societal belief that they are unsafe in the wilderness, the problematic effects of this internalization, and how it can be dismantled. She also examined the recent upward trend in the number of women participating in wilderness activities. Farrell took into consideration Cheryl Strayed's popular autobiography "Wild" as an important motivator, but also pushed back against the notion that women hike only to re-experience the book.

Christian Gray, Chemistry

Lock-and-Key Model Incompatible with Tropical Panamanian Legumes

Nitrogen fixation provides an important ecosystem service in the world's diverse tropical biome, but different species of legumes are known to fix nitrogen at vastly different rates regardless of nutrient levels. This study used a culture-independent method and high-throughput sequencing of the 16S rRNA and nifH genes to examine the structure of the microbial community at the level of both the ecosystem and individual nodules. The results showed that unique host-rhizobia relationships are rare, and that the overall microbial community is dominated by a few strains of *Bradyrhizobia*. These results reveal the lack of unique, evolutionarily stable symbiotic relationships with evolutionarily old and young legume species, indicating that tropical forests of Panama favor a dynamic, competitive model of symbiosis. This information on the underlying structure of the legume-rhizobia symbiosis is imperative to understanding the functions of the associated bacteria.

Sofia Hiltner, Psychology

Visions of the Future: Parenthood and Perceptions of Climate Change

Climate change poses various challenges to human cognitive systems, among them psychological distance. Climate change is perceived as an issue that will affect distant others, in particular future generations. Hiltner sought to reduce social distance between present and future generations by prompting individuals to imagine the life of their child or an anonymous member of the future generation in the year 2050 while considering the effects of climate change.

Emily Kamen, Art and Archaeology

Finding Ground: Exploring the American Terrain of the Center for Land Use Interpretation

This thesis investigated the ecocritical context of the Center for Land Use Interpretation (CLUI), an educational non-profit organization “dedicated to the increase and diffusion of knowledge about how the nation’s lands are apportioned, utilized and perceived.” Through interviews and site visits, as well as secondary research into the history of post-war earth/art practices and performance art, this thesis found that CLUI makes those who experience its content aware of the complicated networks and systems of which they are part, and invites them to ask questions and explore their surroundings. CLUI is an organization that is terrain-specific to the city of Los Angeles and asks its experiencers to consider what constitutes her own terrain.

William Lathrop, Religion

Home and Wilderness: John Daido Looi’s Visions of Zen in the Catskill Mountains of New York

John Daido Looi founded the Zen Mountain Monastery in Mt. Tremper, New York, in 1980. Until his death in 2009, Looi served as abbot of the monastery and developed a Zen practice sensitive to the geography of the Catskill Mountains. Looi developed a photographic practice that informed — and was informed by — his teachings in Zen environmental thought. By reading Looi’s nature photography against his environmental teaching, we can observe how Looi developed a way of seeing the Catskills that revealed to him the reality of “no distance” between the self and the landscape. Looi’s Zen narrative in the Catskills is that of continuous discovery and transformation.

Justin Mehl, Chemical and Biological Engineering

*Applications of Protein-Level Regulation and Optogenetics in Metabolic Engineering of *S. cerevisiae**

In metabolic engineering, balancing the production of desired metabolites and basic cellular function limits yields. However, some of these basic functions are required only at certain developmental times. Using temporal-control to optimize the magnitude and timing of the expression of these pathways, it is possible to redirect flux toward desired metabolites while ensuring cell viability. This project hypothesized that temporal control using optogenetics and nanobody-mediated protein-level inhibition could increase yields and serve as new tools in metabolic engineering. While yields were low, the results serve as an important proof of principle for two-stage fermentation, and it has potential for significant optimization, including the addition of induced nanobodies.

Emily Miller, Architecture

Green Diamonds: Designing Sustainability Under a Network of Pressures

Sustainability and architecture both have complex definitions. Thus, sustainable architecture has taken on many different forms, focusing namely on aesthetic or energy efficiency. Miller’s thesis unravels the various pressures — from history, clients, certification systems and the public — that are pushing on award-winning sustainable architecture.

Ryan O’Connell, Ecology and Evolutionary Biology

Cascading Effects of Large Herbivore Loss on Liana-Tree Dynamics in an African Savanna

Recent research shows that large-herbivore loss may have negative net effects on local flora. One threat is the release of rapidly growing, dominant plant species that herbivores normally control. This project monitored the effects of herbivore exclusion on lianas, a common opportunistic woody vine. Working in Kenya, we found that herbivore exclusion led to increases in both the incidence of the lianas species *Cynanchum viminalis* and the severity of liana infestation. Liana infestation was associated with reduced fruit production among host trees. A model revealed that loss of herbivores would cause the liana-tree system to shift toward a stable equilibrium at which liana infestation is double its control levels. Together, the empirical and theoretical results demonstrate the importance of herbivores in maintaining stable plant community composition.

Shannon Osaka, Independent Major

Modeling the Anthropocene: Determinism and Nature/Culture Division in a Climate-Changed World

How has the Anthropocene changed our conceptions of the agency of climate over human affairs? This thesis examined this question through the lenses of history, environmental theory, and science and technology studies. It argued that climate modeling is expanding the reach of climatic agency in the present and future, creating both a neo-environmental determinism and a new nature/culture divide.