

CLASS OF 1998: Aimee (Mimi) Kessler (Wellesley '01) is in her 6th year of a Ph.D. program in professor Andrew Smith's lab at Arizona State University School of Life Sciences, focused on conservation biology. She leads the Central Asia Great Bustard (*Otis tarda*) Project. Only about 2000 of these unique birds, among the largest capable of flight, remain in Mongolia and Kazakhstan. Mimi and her team are monitoring this population with a combination of direct observation, telemetry tagging, satellite tracking and genetic studies. Mimi has been traveling in the region since 1993 and speaks Mongolian, Russian, and Uzbek.

CLASS OF 2002: William Webster (Trinity '04) was graduated from University of Texas, Dental Branch in Houston in 2010. He is currently practicing in Humble and Huntsville, Texas. He and his wife Jennifer have 2 daughters. **Chris Freeman (Connecticut College '04)** is a Ph.D. candidate in environmental studies at the University of Alabama Birmingham where he studies ecology of coral reef sponges.

CLASS OF 2003: Eve Garsarch (Bates '05) is a teaching and research assistant at INSTAAR-Institute of Arctic and Alpine Research and is pursuing a Ph.D. in evolutionary biology at the University of Colorado, Boulder.

CLASS OF 2004: Katie Nolan (Bates '06) is a media specialist at the Climate Project, part of the Alliance for Climate Protection in Washington, D.C. **Noam Ross (Brown '05)** is a Ph.D. candidate in ecology at University of California, Davis, studying catastrophic shifts in ecosystems, how to forecast them, and how to manage related economic risks. **Sarah Hicks (Hampshire '06)** is a Ph.D. candidate at University of New Mexico and a teaching assistant in the biology department. **Sarah Foster (Hampshire '06)** is pursuing a M.S. in Boston University's Earth Sciences Department. She plans to study conditions of hypoxia/anoxia in temperate estuaries and track the effects on microbial production of N₂O.

CLASS OF 2005: Natalie Levy (Berkeley '06) is in a master's program at Louisiana State University in the School of Plant, Environmental and Soil Sciences. She writes: "I have

done some research work with *Spartina alterniflora* and it has been reminding me of the great time Nicole (Travis) and I had doing our SES research project in the marshes up north. My education at LSU has only increased my interest in wetland ecosystems, with the complexity of Louisiana's coastal environment." **Jen Peters (Bard '06)** is a student in the Ph.D. program at University of Otago, New Zealand.

CLASS OF 2006: Yasuke Kumai (Vassar '08) is pursuing a M.Sc. at University of Ottawa in comparative physiology. **Yukari Kaito (Sarah Lawrence '07)** is a researcher at Crisis and Environment Management Policy Institute in Japan. **Lucy Robbins (Vassar '08)** is studying for a master's degree in education at Harvard University. **Angela Burnett Penn (Brandeis '07)** published "The Virgin Islands Climate Change Green Paper, A Snapshot" for the Conservation and Fisheries Department in the Ministry of Natural Resources and Labor.

CLASS OF 2007: Richard Brereton (Colorado '08) is a Ph.D. candidate at the University of New Hampshire, studying effects of land-use

on water quality. **Lindsay Schwarting (Clarkson '08)** has finished her M.S. degree at the University of Vermont, studying natural resources with a focus in aquatic ecology and watershed science. She recently took a job in Baton Rouge, LA as a Research Associate with LSU's Department of Renewable Natural Resources. She will be working on coastal reef restoration.

CLASS OF 2008: Stef Strebel (Franklin and Marshall '10) returned to MBL in Fall 2010 to serve as the SES dorm resident teaching assistant in the program. She is now working as a field biologist for the BioDiversity Research Institute (BRI), on the oiling of colonial waterbirds from the Deepwater Horizon (MC 252) oil spill, attempting to quantify the proportion of visibly oiled birds for a Natural Resource Damage Assessment (NRDA).

CLASS OF 2009: Marianne Tekverk (Haverford '10) is enrolled in a Ph.D. program at Scripps Institute of Oceanography. **Monica Stegman (Haverford '10)** is enrolled in a Ph.D. program at the University of Delaware. ■

SES Class of 1997 West Coast Mini-Reunion

Alumnae from the inaugural class of the SES met in April 2010

"We're all practicing scientists now!" — Amy Townsend-Small

Left to Right: **Sophie Parker** (Wellesley College '99, U.C. Santa Barbara Ph.D. '07, now scientist for Nature Conservancy); **Marlene Tsie** (Brandeis '99, Univ. of Maine MSc. '06, Research technician); **Amy Townsend-Small**, (Skidmore '98, Univ. of Texas Ph.D. '06, now Assistant Professor in Dept. of Geography, U. of Cincinnati); **Shana Rapoport**, (Brandeis '99, College of William & Mary MA '02, Research technician U. California). ■



SES News

Semester in Environmental Science

at the Marine Biological Laboratory in Woods Hole, Massachusetts

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Studying Arsenic Contamination of Groundwater in Bangladesh



research has been instrumental in developing estimates of how groundwater arsenic concentrations may change in heavily contaminated shallow aquifers as Bangladesh becomes more economically developed and water use increases. In the deep, low arsenic aquifers her work on adsorption has been employed in hydrological models of the Bengal Basin to estimate the sustainability of this water resource.

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Karrie Radloff (SES '98, Mt. Holyoke College '00) studied naturally-occurring arsenic contamination in Bangladesh as a graduate student in Environmental Engineering at Columbia University (Ph.D. '10). For her work, she won the prestigious Karen Wetterhan Memorial Award presented annually by the National Institute of Environmental Health Sciences Superfund Research Program in recognition of excellence in graduate and post-doctoral research.

Shallow groundwater is the primary drinking water source to millions of people in South Asia, but it often contains unsafe levels of arsenic: Up to 1,000 ppb and the WHO health guideline is 10 ppb. Deeper aquifers often have low levels of arsenic, and slowly, more wells are tapping this important resource.

Karrie's research has focused on estimating arsenic adsorption on the sediment in both high and low arsenic aquifers. Her

University of Iowa Appoints Two SES Alumni to Professorships in Biology and Chemistry



Tori Ziemann Forbes (SES '99, Beloit '01) and **Andrew Forbes** (SES '01, Colgate '03) were recently appointed assistant professors at the University of Iowa in the departments of chemistry and biology, respectively. They both received Ph.D.s at Notre Dame in 2008 and completed postdoctoral fellowships at University of California, Davis. They are shown here with their son Alexander.



Left to right: SES faculty member, Ed Rastetter, Marshall Moore, Amy Markstein (SES '08, Colorado College '10), Will Longo (SES '05, Haverford '07), SES faculty member Anne Giblin, and Will Daniels (SES '06, Lawrence University '07).

SES Alums Intern in the Arctic

A North Slope Experience – by Marshall Moore (SES '09)

During the summer of 2010, four SES alumni participated in research at the Arctic Long Term Ecological Research site at Toolik Lake, Alaska. To date, at least 19 SES graduates (about one in ten) have spent a summer at Toolik field camp as undergraduate interns, research assistants or graduate students.

Located 140 miles north of the Arctic Circle on the North Slope of Alaska, the camp provides a rare and extraordinary experience for researchers, both in terms of living in an unspoiled natural setting and in participating in cutting edge scientific research on climate change. **Marshall Moore**, SES '09 and **Brown '11**, summarizes his Toolik experience in the article that follows.

Not long after crossing the Arctic Circle, the gargantuan mountains of the Brooks Range begin to rise from the horizon. Waterfalls gush down the sides of snow-capped limestone peaks, feeding the bouldered, braided meltwater streams. I spot white Dall sheep high on the slopes of the Atigun Pass. The North Slope, which boasts a population density of one person per 13 square miles, is treeless—only grassy moist tundra stretches across the landscape. We finally reach Toolik Lake after 12 hours of travel. This would be my home over the next two months during my MBL summer research internship.

Insights derived from research in this unique environment provide some of the most important information we have on how climate change is affecting our planet. Why? The Arctic is sensitive to climate change as a result of the reflectivity of the ice that blankets the region—when Arctic ice melts, the darker surfaces that become exposed absorb more solar radiation and warm rapidly. Paleo-climate studies confirm that the polar regions of the planet have exhibited the largest range of variation in temperature during past climate change

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OPPORTUNITIES FOR SES ALUMNI

- The Ecosystems Center NSF REU Internships (at least four in 2011) www.mbl.edu/hr/employment.html

- MBL's Biological Discovery in Woods Hole Internship Program www.mbl.edu/education/courses/other_programs/reu.html

- NOAA's Northeast Fisheries Science Center www.nefsc.noaa.gov/sstudent

- Woods Hole Diversity Initiative's Partnership Educational Program www.woodsholediversity.org/pep

Studying Groundwater in Bangladesh, cont.

Karrie's training at SES offered her a first glimpse of the joys and trials of field research. "I absolutely credit the SES for introducing me to 'real science' and preparing me for graduate school," she noted.

After completing a postdoctoral position at Columbia University's Lamont-Dougherty Research Institute, Karrie moved to Boston, MA, and is now employed as Senior Associate Environmental Engineer at the consulting firm, Gradient. In addition to being a well-respected scientific and environmental consulting group, Gradient is certified as a Women's Business Enterprise and is a regional partner of the Women's Business Enterprise National Council. ■

Arctic Interns, cont.

events. When Earth is cold the poles are very cold, and when the planet is warm, temperatures at the poles are much closer to the global average.

With these facts in mind, a collection of scientists including SES faculty members, John Hobbie and Gus Shaver came to Toolik Lake in the mid-1970s to study the changing Arctic ecosystem. They succeeded in turning the location into a Long Term Ecological Research (LTER) site. There are now 26 LTER sites across the globe, ranging from the northernmost site in Toolik down to Antarctica, where Hugh Ducklow, another SES faculty member, leads the Palmer Station LTER. These projects share a common goal of providing knowledge about the long-term (multi-decadal) behavior of the world's ecosystems. The ultimate objective of this research is to understand how human activities are affecting ecosystem functions and services.

As we pull into the Toolik field station, the Midnight Sun, which will refuse to set until August, illuminates the gravel patch on which camp is set and gleams off the snow-capped Brooks Range 20 miles to the South. Large tents and trailers line the dusty paths around camp. Twin helicopters rest on the gravel landing pad, waiting for the next flight across the desolate tundra to an even more distant and isolated research site.

Research on the frontiers of climate change means living in a community of friendly, amazing people, who can throw together a great string band after dinner or play a mean game of soccer with goals constructed from PVC pipes, duct tape, and fishing net. It means seeing the broad shoulders of a moose crossing the rushing turquoise blue waters of the Itkillik River while flying back from field work. It means 75 degrees and sunny on the fourth of July and falling snow on the fifth. Finally, it means long periods of time away from civilization, family, and an otherwise "normal" life.

I am excited to apply the skills and knowledge I learned during the Semester in Environmental Science at the MBL. But on my first day of work at Toolik, I am the rookie on the research team and am still guided by my mentor, Gus Shaver. We take a stack of two-by-four boards to the experimental plots that Gus started in 1979—almost a decade before I was born. The boards are needed to build a platform for a new instrument that will measure greenness of the plants.

These plots simulate different possible changes to the tundra - a greenhouse plot produces extreme warming, a fertilized plot creates increased nutrient availability,

and a fenced plot simulates the loss of caribou from the system. The plots seem to go on forever, with no limit to the number of treatments or replicates.

Gus, stout and bearded, with an ever-present smile, is excited. "The thrilling thing about being a scientist," he says, "is that you get to be so many things: we get to be carpenters right now, when we bring the instrument out we will be electricians, and when the lake thaws we will be boaters!"

Much of the work on these plots deals with the element carbon, the building block of life on this planet. In the process of photosynthesis, plants strip carbon dioxide (CO₂) from the atmosphere and 'fix' it into sugars that make up plant biomass. The opposite process, respiration, occurs when plant material is broken down by microbes to produce CO₂. By measuring the changing rates of photosynthesis and respiration in the warming Arctic and in the experimental plots, Gus and his colleagues are able to assess how the balance between these processes may change in the future.

Of course, a challenging aspect of this research is that changes do not always involve one cause and one effect. Take fire, for example. During 2007, an unusually warm dry year on the North Slope, lightning ignited the normally fire-resistant wet tundra about 40 miles northwest of Toolik Lake. The fire burned for months, ultimately scorching over 1,000 square kilometers. Will fires like this become more frequent in a warming world? And what will the long term effects of the fire be on the ecosystem?

After my first week at Toolik, I fly out to the burn site with Adrian Rocha, a post-doctoral researcher with Gus's team. I am told to pack a sleeping bag, warm clothes, and plenty of food. When the helicopter lands, we unload quickly beneath the whizzing blades so that it can take off without delay to attend to other research parties. As the reverberating chop of the rotors fades into the distance, I understand why I packed all that gear. We are standing in barren tundra stretching to the horizon. Our research plot within the massive burn scar has instruments set up to measure CO₂ fluxes, energy inputs and outputs, and plant cover. It is surrounded by a thin white fence. Adrian explains that this fence—a bear fence—was just built, because last year a grizzly attacked the instruments and all the data from the end of the summer was lost.

"But don't worry too much," he says, "no bears have come around while we have been out here yet..."

That's just life on the frontiers of climate change. ■



Environmental Fixes: SES Alums Work in the Energy Industry to Develop Renewables, Biofuels and Improve Air Quality

Gabriella Engelhart Farnham (SES '02, Lafayette '05) took a full-time research and development position with ConocoPhillips in its Sustainability Technologies Division. She wrote, "I am working to build an air quality program here to understand the fundamental science behind the fate and transport of fugitive emissions and tailpipe emissions. Perhaps having environmentalists on the inside will help prevent future disasters for the oil and gas industry?" Gabi, who was awarded highly prized Udall and Goldwater Fellowships as an undergrad, finished her Ph.D. in chemical engineering at Carnegie Mellon University in May 2010.

Beth Bernhardt (SES '03, Lawrence University '05) recently started a new job as analytical chemist/research technician at Cellana in Hawaii. "Cellana is a relatively new company, established in 2007 as a joint venture between Shell and HR BioPetroleum to develop technology for the sustainable commercial production of biofuels and animal feed from algae," said Beth. "I am particularly excited about the work they are doing and the ultimate goal: to create a renewable alternative fuel source. Clearly, alternative energy sources to fossil fuels are an urgent need. Additionally, they are proceeding towards that goal rather quickly and everyone working there that I spoke with was very positive and excited about the work they are doing." After graduating from Lawrence University, Beth returned to MBL to work as the SES dorm-resident teaching assistant in 2006 and 2007. She received her master's degree from the University of Minnesota in 2010.

Nicole Travis (SES 05, Brown University '07) is a research assistant in the photosynthesis research department at Aurora Algae Inc. Nicole writes, "Aurora attracted me because it was working at the forefront of green energy technology — trying to create biofuels from unicellular algae at a commercial scale. The idea of harnessing the power of photosynthesis and basically farming these oil-rich algae strains seems like a very viable solution to some of the world's energy needs. It was a perfect combination

of my academic interests in marine biology and my desire to be a guardian of the environment."

"One of my current projects is to develop methods to manage grazer populations in our open-raceway algae ponds," Nicole said. "I am also working to find new proprietary strains of algae that will utilize light in the most efficient way possible for biomass



production and lipid accumulation. I am using techniques I learned while in SES."

"In recent months, we've expanded on our original goal to produce biofuels from algae, and are now working to also produce pharmaceuticals, foods, and aquaculture products from our ponds. I am looking forward to my next big adventure with Aurora, when I will travel to Australia to help our commercial demo facility get up and running!"

Toby Ahrens (SES '97, Connecticut College '99) is Senior Scientist at BioProcess Algae LLC (Portsmouth, RI) and, prior to BioProcess, worked as a scientist for one of the pioneers in the recent surge in interest in algae-to-biofuels, GreenFuel Technologies (Cambridge, MA). He received a Ph.D. in Biogeochemistry and a Master's degree in Engineering, both from Stanford. Toby also worked as a Research Assistant at the Ecosystems Center from 1999 to 2002.

"I have been working in the algae private sector for the last few years and absolutely love it," Toby said. "I am currently heading up commercialization efforts at BioProcess. We are producing algae for animal feed and high-value markets in addition to biofuels, but the bulk of our work is firmly focused on economics. The idea of a generating a renewable biofuel from algae is nice, but doing it economically is quite a challenge. BioProcess is focused on two of the big bottlenecks for low-cost algae production: productivity and dewatering." ■

SES Student Research Reveals Impaired Stream Quality in Cranberry Bogs



Research by **Holly Engel** (SES '10, Clarkson '12) supports what Cape Cod cranberry growers already suspected: The traditional "flow-through" bogs have a negative impact on stream quality.

Since passage of the 1996 Massachusetts Rivers Protection Act, cranberry growers have not been allowed to construct new flow-through bogs, which are directly adjacent to rivers and streams. There is significant concern that such bogs compromise the health of streams by impeding the migration routes of fish, such as herring, and by polluting the streams through fertilizer and pesticide use. Current practice is to construct bogs away from natural water sources and pump water through them mechanically. However, flow-through bogs are "grandfathered" and currently account for 10-15% of cranberry agriculture on Cape Cod.

As part of her independent research during the semester, Holly compared the health of streams in eight sites on Cape Cod. Of these, two were in flow-through bogs that are being actively used for agriculture, four were in flow-through bogs in either early or older stages of natural restoration, and two were in natural rivers that had never been altered or used for cranberry production. Holly compared the diversity of the streams' habitat structures, the invertebrate populations that provide food for fish, food webs, and nutrient pollution. She found that the actively farmed flow-through bogs and those whose restoration is less advanced had less healthy stream systems than the older restoration sites and the sites never used for cranberry growing. ■