Greetings from Walter Hall where we have had another exciting fall of change.

This was Jon Waage’s last semester as a regular faculty member, as he retires and heads off to Florida with his camera, golf clubs and emeritus status January 1. As most of you know, Jon is the grandfather of EEB. He was recruited to Brown to teach the ecology course in 1974 and he did such a spectacular job that undergraduates lobbied for more ecology at Brown. This Waage-initiated inspiration led to the recruitment of Doug Morse and ultimately the founding and success of EEB at Brown. Jon’s legendary teaching spawned a grateful generation of Brown students (Waagets) and our Department. So, thank you Jon. Good luck as a snowbird.

We are extremely pleased to announce that Sohini Ramachandran will join EEB this summer as the newest Assistant Professor to come to Brown as part of the Computational Cell and Molecular Biology Initiative. Sohini is a human geneticist who studies human genetic variation, both spatially looking at human migration patterns and within genomes. She will add a new dimension to EEB, while strengthening our ties with the growth of computational biology at Brown.

Congratulations to Andy Clifford, Jim Palardy and Keryn Gedan who all recently completed their PhDs. Andy is currently a postdoc with Sharon Swartz, Jim has moved to Boston to try his hand at environmental consulting and Keryn is post doc stalking in the DC area while doing a remote post doc with Heather Leslie.

Keeping everyone well informed and entertained, Casey Dunn’s Creature-cast.com (check it out!), designed to bring invertebrates into every home and computer, is being featured on Nature’s collaborative on-line learning site, Scitable. Tom Robert’s lab took a field trip to the famous frog jumping competition of Calaveras County to see why they are so good at what they do.

Here’s to an even more exciting 2010.

New to EEB in 2009!

Angus Angermeyer: Graduate student from University of Washington, Weinreich Lab

Monica Arakaki: Postdoc from University of Florida, Gainesville, Edwards Lab

Hua Bai: Postdoc from University of Kentucky, Tatar Lab

Leann Barnes: Lab Manager-Rand Lab

Ariel Camp: Graduate student from Hofstra University, Brainerd Lab

Sarah Corman: Graduate Student from University of Rhode Island, Leslie Lab

Erika Giblin: Lab Manager Brainerd/Swartz Lab

Freya Goetz: Research Assistant, Dunn Lab

Rebecca Helm: Graduate student from Eckerd College, Dunn Lab

Ana Hernandez: Postdoc from Texas A&M University, Tatar Lab

Nicolai Konow: Postdoc from Johns Hopkins University, Roberts Lab

Pernille Konow: Research Assistant, Roberts Lab

Kathleen McCauley: Herbarium Collections Manager

Leila Sievanen: Postdoc from University of Washington, Leslie Lab

Stefan Siebert: Postdoc from Christian-Albrechts University Kiel Germany, Dunn Lab

Veronique St. Louis: Postdoc from University of Wisconsin, Madison, Sax Lab

Kaya Schmandt: Research Assistant, Edwards Lab

Erika Sudderth: Postdoc from Harvard University Sala Lab

Sheila Walsh: Postdoc from University of California-San Diego Leslie Lab
This has been a banner fall, with two new co-edited books by EEB faculty: *Ecosystem-based Management for the Oceans* by Karen Mcleod and Heather Leslie (Island Press) and *Marine Macroecology* by Jon Witman and Kaustuv Roy (University of Chicago Press). Both of these distinctly titled compendia fit into conspicuously vacant niches and thus should encourage further advances of their respective fields. Both sets of editors have assembled impressive fields of contributors, as well as adding major contributions of their own. Congratulations to Heather and Jon!

*Ecosystem-based Management* is the first comprehensive guide of its sort to the management of marine ecosystems. Here, the focus is at the level of the major functioning unit (the ecosystem), and the management incorporates both human well-being and that of the coasts and oceans themselves. Hitherto, literature in this nascent field has been scattered. This book presents case studies from an extremely broad range of habitats and regions, as well as syntheses and proposals for the future. Given the fundamentally different physical nature of these environments and the legislation associated with them, standard procedures applied to terrestrial environments are clearly inadequate.

Ecosystem services: food, clean water, renewable energy and coastal protection all figure in this equation. Biodiversity, the current gold standard of the conservationists, might not always be enhanced by ecosystem-based management procedures. This approach, which focuses on the whole and the connections among its parts, differs fundamentally from classical efforts to focus on a single species or service. In the process it integrates natural and social sciences, traditionally two different worlds. It also places human concerns first, which sometimes raises important ethical issues.

The editors contribute an important concluding chapter, in which they identify common threads emerging from the chapters, what changes we need now, and possible ways of moving forward over the short and long terms. They emphasize the importance of moving to a multi-based perspective that focuses on the interconnections of the system.

In turn, *Marine Macroecology* for the first time ties together much of the literature accumulating on large-scale phenomena in the sea. As such, it focuses on variables like diversity patterns, abundance, body size and range size and explores the roles played by history, dispersal, competition and other factors in determining the nature of these variables. Macroecology in its own right is a new field, and to date most of the inquiry has focused on land-based aspects. However, the fundamentally different physical structures of aquatic and terrestrial environments suggest that we have much to learn from studying both, and that eventually the contributions of the two may be greater than the sum of the whole. The chapters of the book address large-scale patterns and the processes that drive them, providing a background for efforts to make these meaningful comparisons between the oceanic and terrestrial realms. As the editors note, this book is not comprehensive, and many aspects of the marine realm remain poorly known, such as the deep sea and the potentially modifying effects of currents and upwellings.

Initial work in macroecology was descriptive and correlative, with a focus on searching for broad trends, involving statistical treatments of large masses of observational data. However, experimental studies are now beginning to explore the causation of conclusions reached thus far, an aspect amply represented in the last section of the book. Of course, experimental approaches have their limits when dealing with phenomena so large that they may involve, say, entire ocean basins, since manipulations can never approach that scale.

Nevertheless, much may be learned from sets of experimental studies carried out over large latitudinal gradients. This section includes contributions from our own Witman and Bertness laboratories, including past postdocs (Eric Sanford, Andrew Irving). Clearly Brown is on the cutting edge of this nascent field!

These two books bring together a broad range of information and theory about the oceans that serve as a welcome antidote to the current terrestrial bias of their respective fields. Simultaneously they serve as catalysts that when eventually integrated with the terrestrial literature will lead to yet further general insights.
EEB fielded a 2009 Cape Cod Marathon relay team (“Walter Haul”) comprised of Emily Abbott, Andrew Alti-eri, Regan Early, Sheila Walsh, and Jon Witman. The team placed in the top third overall and in their co-ed division, which is impressive given that scholarly pursuits kept training to a minimum, and since Sheila was “recruited” less than 12 hours before race time at a late-night dinner party! The team wishes a speedy recovery to Andrew Clifford who pulled out of the race due to a leg injury. MBL has a long-standing tradition of competing in the Relay, and when we saw them at this year’s race they suggested a Brown vs. MBL trophy to be claimed by each year’s victors. Let’s bring it home next year!

Susan Dudley, a former post-doc in the Schmitt Lab (’92-’95) was recently honored by Wings Worldquest Women of Discovery. “Wings” honors women in various fields including those who have made fundamental scientific discoveries. She was honored for finding that plants can recognize their kin. Her postdoctoral research with Johanna Schmitt on density-dependent stem elongation introduced her into plant communication.

Tune into Casey Dunn’s new podcast blog, creaturecast.org. The first episode alone has been viewed more than 50,000 times and has been picked up by NPR show “Science Friday” and other places.

Incidentally, creaturecast provides a wonderful venue for boning up on the wonderful and often indescribably bizarre things that go on in and among living things. A brief perusal is bound to introduce you to some new organism or fact that you had probably never even thought of. What better place to discover the mitochondrial lenses of flatworms, to ponder why hagfishes tie knots in their bodies, or to learn how jellyfish can hide submarines? All this and more at creaturecast.org, with new entries appearing regularly. [ed.]

Steve Gatesy and Tom Roberts are gearing up to study bipedal locomotion in guinea fowl using the new Keck X-ray Reconstruction of Moving Morphology (XROMM) facility. (more about this new facility in the next newsletter).

Steve Kilpatrick, a 1995 Ph.D. graduate from David Rand’s lab, is a co-author of a book that was published in March 2009; Krebs, J.E., E.S. Goldstein, and S.T. Kilpatrick, *Lewin's Essential Genes*, 2nd ed. Sudbury, MA: Jones & Bartlett. Steve is an Associate Professor at the University of Pittsburgh, Johnston Campus.

Dan Riskin has gotten an assistant professorship in the Department of Biology at City College of New York, starting next September.

Osvaldo Sala gave talks at University of Connecticut, University of New Mexico, Grassland Conference in China, Ecological Society of America, and Cornell. He also participated in the meeting of the Science Council of United Nations Environmental Program in Nairobi, NSF Advisory Board in DC, LTER All-Scientist Meeting, SCOPE General Assembly in London, Margalef Prize Jury in Barcelona and the Rhode Island Ocean Special Area Management Plan Scientific Council.

This fall Dov Sax completed the Aldo Leopold Leadership Program, which is designed to train mid-career environmental scientists to communicate more effectively with the media and policy makers. Subsequently, he was asked by the Ecological Society of America to join their "Rapid Response Team", which provides input to policy makers and the media on emerging issues in ecology and conservation.

Erika Sudderth received a L’Oreal USA Fellowship for Women in Science over the summer to work with Osvaldo Sala. The post-doctoral award will support a large-scale extension of her research on the response of grasslands to global change.


Congratulations to Lucía Vivanco on being awarded the Harper Prize by the British Ecological Society. This award recognizes the best article published in the Journal of Ecology by a young author, ‘Tree species identity alters litter decomposition through long-term plant and soil interactions in a natural forest ecosystem in Patagonia’, vol. 96:727-736, with A.T. Austin. Upon reading the paper, some of you will remember hearing about it at a brown-bag lunch a few years back. Lucía has now finished her postdoc with Jennifer Martiny at Irvine, and she and Pedro have returned to Argentina, where she will continue to study the *Nothofagus* forests and he will chase ocean bacteria.
‘It's another sunny day in New Mexico’, we said, and got ready for one more day of fieldwork in the Chihuahuan desert. A typical day starts in the trailer camp at the Jornada Experimental Range Headquarters, a 100 year-old ranch in southern New Mexico, now operated by the USDA-ARS. Then, we drive a few miles and through many cattle guards to pasture 13, where we can see the reflection of 60 acrylic rainout shelters above the vegetation. This was the fourth consecutive summer that I spent doing research in the Jornada Basin Long Term Ecological Research site, but I am still amazed at the deep-blue skies and the bare mountains that frame our study, “Precipitation controls on carbon and nitrogen cycles in arid-semiarid ecosystems”. In this project, we have been studying the relationship between precipitation and aboveground net primary production (ANPP) in arid ecosystems.

You will probably be surprised to learn that the relationship between rainfall and primary production in arid and semiarid ecosystems is not adequately understood and that annual precipitation accounts for only 20-40% of the interannual variability of biomass production. This means that deserts are not all about water, or the absence of it! It seems like there might be indirect mechanisms that mask the ANPP-precipitation relationship. My research is guided by the hypothesis that ANPP in arid ecosystems is constrained not only by annual precipitation but also by biogeochemical and structural constraints that create lags in the ecosystem response to changes in water availability. Predicting the response of arid and semi-arid ecosystems to changing climate requires an understanding of these indirect mechanisms.

Starting in 2006, I’ve been manipulating the incoming precipitation in 132 plots, with 80% reduced, 50% reduced, control (ambient precipitation), 50% increased, and 80% increased precipitation treatments. I designed, built and installed 60 “rain-out shelters” in the field. I also installed an irrigation system, for which I used 3,000 meters of PVC pipe and lots of glue. But perhaps the most challenging task was to drive the “hulk”, a green water-truck that we drove after each rain to add supplemental water to the +50% and +80% treatments. To finish the experimental work, I reversed the treatments last spring so plots that had received elevated rainfall experienced a drought and vice versa.

This experimental design allowed us to study whether previous-year precipitation constrains production by changes in tiller density or by changes in the frequency of active axillary buds, or “points of growth”, per tiller. After counting the number of Bouteloua eriopoda tillers in the field and the number of active axillary buds per tiller under a microscope, I have found that tiller density increased with increasing precipitation; it was 50% higher in irrigated treatments than in drought plots. More importantly, the number of active axillary buds per tiller doubled with increased precipitation treatment, which produced a fourfold increase in the density of active buds per unit of area. This means that the effect of precipitation on active buds per tiller was greater than the effect on tiller density, and that the number of active buds may constrain productivity response to changes in water availability.

Biogeochemical responses to the manipulations will help to understand the mechanisms for N limitation on primary production in these systems. To our surprise, N mineralization was not affected by precipitation treatments, even though precipitation ranged from 50 to 450 mm. Another striking result was that soils from drought plots accumulated more inorganic N than watered plots, which might be a result of decreased plant uptake with drought, or due to augmented leaching in the wet treatments. Increased N availability with drought makes the system susceptible to large nitrate losses when wet conditions arise and may lead to a nitrogen limitation phase for the ecosystem.

I hope that these results will enhance our ability to predict the consequences of precipitation variability – more frequent or intense droughts or extreme wet years – on ecosystem functioning. During the past four years, I have walked from plot to plot thousands of times, avoiding rattlesnakes and startling horned toads. I have been rewarded with seeing this project grow and welcoming new students and collaborators. The desert at Jornada has taught me about research and ecosystem science, and I have also had unforgettable adventures and a few sunburns under the endless sunny skies!
Brown Bag Seminars
Talks that catch up on research and work within the department.

9/18 Monica Arakaki, Post-Doctoral Research Associate. Systematics of tribe Trichocereeae (Cactaceae).

9/25 Rebecca Helm, Graduate Student. From the abyss to Africa: an introduction to the world of jellies.

10/2 James Palardy, Graduate Student. Flow neutrality and the control of diversity in marine epifaunal communities.

10/9 Margarita Brandt, Graduate Student. Urchin identity effects in the Galápagos Islands.

10/16 Heike Lotze Visiting Speaker. Dalhousie University. Lessons from the past: emerging patterns of historical declines in large marine animals.


10/30 Regan Early, Post-Doctoral Research Associate. Improving predictions of the ecological impact of climate change: assessing the fundamental climate niche and where it might move to.

11/6 Heather Leslie, Assistant Professor. Managing for resilience of coastal marine systems.

11/13 Tom Roberts, Professor. The celebrated jumping frogs of Calaveras County.


12/4 Ariel Camp, Graduate Student. Playing with your food: prey-processing mechanics in teleost fish.

Monday Colloquia
A more formal colloquium that features speakers outside of the University.

9/14 Joshua Lawler, University of Washington. Assessing potential climate impacts on the fauna of the Western Hemisphere.


9/28 Matthew Bracken, Northeastern University. Effects of realistic biodiversity changes on marine ecosystem functioning.

10/5 Steve Franks, Sc.B. ’93, Fordham University. The genetics of evolutionary responses to climate change in an annual plant.

10/19 Jonathan Flowers, New York University. Genome evolution in Asian Rice: the legacy of 10,000 years of artificial selection.

10/26 Mark Patterson, College of William and Mary. Autonomous underwater vehicles: water quality, fisheries, seafloor mapping and beyond.


11/9 Frederick Cohan, Wesleyan University. The origins of bacterial species.

11/16 Darrin Hulsey, University of Tennessee, Knoxville. Mechanisms and tempo of diversification in cichlid fishes.

11/23 Claire Lunch, Post-Doctoral Associate, MBL. Global change meets the local environment: Dynamics of primary production in an annual grassland.

12/7 John Bruno PhD, ’00, University of NC-Chapel Hill. Understanding the degradation of the world's coral reefs: a macro-ecological approach.
In the Greenhouse

By Fred Jackson

Plant research programs in the greenhouse are limited temporally and/or spatially by greenhouse functional constraints: inadequate temperature controls restrict greenhouse research with some species to only part of the year. Other limitations like the inability to grow some species in the greenhouse over the summer due to high temperatures are especially detrimental because faculty members are free to devote 100% effort to research during the summer months and yet cannot use this period to implement new projects requiring the greenhouse.

But more help may be coming! There could be more sunlight coming through the glass in the greenhouse. Biology Professor Judith Bender and ECI Director Johanna Schmitt have submitted a proposal to the National Science Foundation’s Academic Research Infrastructure Program: Recovery and Renovation to renovate the research greenhouse section of the Plant Environmental Center. Other faculty and staff members from EEB and MCB who utilize research facilities in the greenhouse have also contributed to this proposal and would also reap the benefits of a newly updated technical facility. James McLaughlin, the associate director for Bio-Med Facilities, has also played a major role in developing and implementing the logistics of this grant proposal. So stay tuned!

T. Rex and All That

Dinosaurs have long fascinated us all. Once hooked on these strange fossils, probably one of the first questions that enters a child’s mind is, Could I escape if a *Tyrannosaurus rex* chased me? One of my worst early nightmares was that of being chased by a *T. rex*, so terrifying that I can’t for the life of me remember whether it was brown or green! But how active really were these reptiles, and what were their lives really like – long a source of fervent debate. These questions were energized in the 1970’s by Robert Bakker’s proposition of “hot-blooded dinosaurs”, in which he proposed that these animals were endothermic and very active. Since then the story has waxed and waned, though never reaching the hype, or level of activity on the part of the dinosaurs themselves, advocated by Bakker. Suffice to say, dinosaur speed, gait and stance remain the basis for argument.

Steve Gatesy, with colleagues Martin Bäker and John Hutchinson, presents the newest insight into what *T. rex’s* locomotor attributes really might have been (J. Vert. Paleontol. 29:535-544, June 2009).

Although it’s not that complementary about the dino’s abilities, I still probably wouldn’t have fared very well in its presence as a six-year-old! At its enormous size, *T. rex* may have been able to run slowly, but certainly not at high speeds.

Gatesy et al. focus on *T. rex’s* huge hind limbs. A problem immediately arises: no 6000 kg bipeds exist today – or any that even closely approach that size. As a result they lack direct information about possible coordination among joints or about velocity, duration, or frequency of movement. Lacking a living model, they take a quite different approach, considering all possible poses of the hind limb (parts of the leg skeleton relative to each other). It turns out that only a few possible solutions remain: *T. rex* is confined to a small area in configurational space. After establishing the possibilities from skeletal information, they reconstruct soft tissues (muscles, etc.) around this skeletal base. They then search for viable leg postures (flexion and extension at hip, knee and ankle, and angles obtained) near the middle of the stance at maximum force applied to the substrate, applying the minimal possible assumptions in the process, saving considerations of stride cycles for the future. They validate their method by comparing mid-stance poses with those of ostriches and emus, the largest extant bipeds, and then calculate comparable results for other extinct theropod dinosaurs: *Allosaurus*, *Velociraptor*, etc.

Interestingly, it looks as if some of *T. rex’s* problems are unique to bipeds over 6000 kg; thus, bipeds much larger than *T. rex* might not even be able to run slowly. *T. rex* may thus have pushed the envelope as far as it would go. Even the modestly smaller *Allosaurus* may have been capable of relatively rapid running.

Gatesy et al. conclude that one cannot solve such locomotor problems on the basis of the skeletal elements alone – that it is essential to treat the entire limb – bone, muscle, nervous innervation, tendons, etc. as a functional unit. More keen insights should follow from this promising start. (ed.)


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