Dear Friends and Colleagues:

At the threshold of the United Nations’ “Decade on Biodiversity 2011-2020,” CECB faculty, graduate students and undergraduates are among those engaged in several research projects on biodiversity and ecosystem health highlighted in this newsletter. Loss of biodiversity continues at accelerated rates in both marine and terrestrial ecosystems, and several efforts are being made to address these important concerns.

Coastal ecosystems, considered to be among the most biodiverse and productive regions on Earth, are the primary focus of research being conducted by CECB faculty associates Les Kaufman, Suchi Gopal, Phil Lobel, John Finnerty and Robert Kaufmann, and their students, including coral reefs ranging from Belize to the tropical eastern Pacific and the biologically rich waters of the Stellwagen Bank National Marine Sanctuary. Loss of coral reefs is highlighted by Nikki Traylor-Knowles, a Ph.D. student in the Finnerty Lab, whose research focuses on how one species of Indo-Pacific coral reacts to environmental stressors at the genetic level.

The importance of biodiversity in the terrestrial domain is also highlighted in recent research by faculty associates Nathan Philips, Thomas Kunz, and Douglas Zook, and their students and post-docs. Their research, based at the Tiputini Biodiversity Station (TBS) in Ecuador, focuses on seasonal transpiration in palms, dynamics of symbiotic life forms, and long-term monitoring of tropical bats for anthropogenic impact assessment, respectively, and on the global conservation significance of Ecuador’s Yasuni National Park, including TBS. In part, based on this and related research by colleagues from many other countries (see Bass et al. 2010), a precedent-setting historic agreement is being developed that may ultimately save the Yasuni-Tiputini region from further threats due to oil exploration. This United Nations Development Program initiative is an important first step toward reaching this goal. In temperate regions, biodiversity is also threatened by human-induced disturbances, many of which have led to marked shifts in forest composition and the emergence of introduced pathogens. Research by CECB associate Pamela Templer and one of her undergraduates highlights how the woolly adelgid, an introduced aphid-like insect species from Japan, threatens hemlock stands in the eastern United States and leads to increased nitrogen concentration in soils. Ongoing research in the Kunz lab on white-nose syndrome, a devastating disease of hibernating bats caused by an introduced fungal pathogen that has killed over one million hibernating over the past four years, is also highlighted.

We also welcome Peter Buston and Sean Mullen, two new members of the Biology Department as CECB faculty associates. Buston’s research focuses on larval dispersal behavior of coral reef fishes, including the clown fish (popularly known as Nemo to many children), whereas Mullen’s research focuses on the role of natural selection in generating diversity in natural populations of butterflies.

Lastly, we acknowledge the important contributions of foundations, agencies and individuals for their continued support of research and outreach being conducted by CECB faculty associates, post-docs and students.

Sincerely yours,
Thomas H. Kunz, Director
The CECB welcomes two new Faculty Associates:  
Peter Buston and Sean Mullen

Pete Buston is originally from the UK. He completed his Ph.D. in animal behavior at Cornell University, investigating cooperative breeding in the clownfish Amphiprion percula (a.k.a. Nemo) in Papua, New Guinea. From there he moved to a postdoc position at the National Center for Ecological Analysis and Synthesis (NCEAS) in Santa Barbara California, developing mathematical models to improve understanding of the evolution of social behavior. Subsequently, he moved to a research position at the Estación Biológica de Doñana in Sevilla, Spain, where he became interested in the ecology and evolution of propagule dispersal while carrying out fieldwork in French Polynesia and Fiji. At Boston University, Pete will be investigating patterns of larval dispersal of coral reef fishes in Belize, trying to understand the causes of those patterns and their implications for the design of networks of marine reserves.

Sean Mullen joins BU from Lehigh University, where he was an assistant professor for three years. His research considers the processes responsible for the evolution of new species and particularly the role of diversifying natural and sexual selection in generating divergence and, as a consequence, barriers to gene flow among natural populations. Butterflies and their spectacular diversity of color patterns, including classic examples of mimicry between more or less closely related species, provide a rich model system for Sean’s research. He is applying modern genomic approaches to test the hypothesis that variation and convergence in butterfly coloration is largely due to repeated evolution of a conserved set of genes responsible for basic wing pattern elements. Sean earned his Ph.D. in Ecology and Evolutionary Biology from Cornell University.

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The UROP Experience: Summer in the field with Batman

As a biology student, I have studied a broad range of topics from cells to ecosystems. Like most undergrads, I did my learning in the traditional fashion: was attentive in class, participated in lab, and toiled the days away in Mugar Library. Participating in UROP this summer as a field assistant for Professor Tom Kunz’s bat lab shook up this routine in a much-needed way. My experience allowed me to rediscover my curiosity and passion for the biological sciences.

My first night of fieldwork began in Framingham, MA, with a bat census at a big brown bat maternity colony. It was a mere introduction to my new subject of study. Outfitted in my fancy new headlamp, I counted 72 bats then proceeded to ask about 100 questions. The next week, we started using the FLIR thermal cameras to capture images of the bats and create three-dimensional tracks of the bats’ flight. During that second week I trapped and handled my first bats, three big browns. We held them to take guano samples to be used later in a virus study. Here I was - working with some incredible equipment and applying concepts I had learned from all my biology courses. Needless to say, I loved it.

With the bat basics down, the bat team and I loaded up the new trailer and truck (aka “the bat mobile”) and began the drive to Johnson City, TX. After a long and tedious drive we arrived at our new summer home, the beautiful Bamberger Ranch. Losing no time, we jumped into work mode. On the property, a man-made cave, the “Chiroptorium,” had been constructed and was now home to about 154,000 Brazilian free-tail bats. We observed the emergence flight pattern the first evening, then proceeded to film bat emergence and return the following night. We made it home that morning with less than half a night of sleep and still found the energy to investigate the insects on the front porch before passing out for the day. We returned the following night and repeated the same procedures using a new camera set-up – an activity we would do throughout the trip. As the summer progressed, I found myself formulating deeper scientific questions concerning behavioral interactions in flight, consequences and benefits of living in a colony of that size, and maintenance of homeostasis during rigorous flight and activity. My train of thought had shifted to that of a biologist.

The following weeks in the field brought us to Davis Cave, Frio Cave, James River Cave, and even to New Mexico’s Carlsbad Caverns National Park. Each location presented a new terrain, a new bat colony to study, and a new set of challenges/obstacles (or opportunities to excel). The largest Brazilian free-tail colonies I observed were at James River Cave and Frio Cave. Witnessing thousands and thousands of bats emerging to form an organized, spiraling vortex each evening was breathtaking. I was even able to catch a couple of them right out of the air with a hoop net to hold for tissue and guano samples.

Fieldwork was unpredictable and hectic. Through the rain, bug bites, and Oreo cookie dinners, the UROP experience sparked my curiosity far beyond what I ever expected. I was embracing the fieldwork lifestyle. Before I knew it, our time in Texas was coming to an end. I had explored and learned about cave ecosystems and the Texas terrain. I had the privilege of working with a diverse group of graduate and undergraduate students, computer scientists, thermal imaging specialists, bat biologists, and a Doppler radar team, demonstrating the ability of scientific fields to converge in study.

I came back to Boston with a wealth of new experiences and a full field notebook to prove it. In the last few weeks of my work as a summer field assistant, I returned to Framingham with my newly acquired field confidence to complete a project on thermal profiles of big brown bats. Using what I had learned in Texas, I helped plan the set-up and procedure for the thermal imaging capture. The UROP adventure had truly come full circle.

~By Lesley Pepin, Undergraduate Student at BU~
White-nose syndrome continues to spread
On-going research imperative to answer challenging questions

White-nose syndrome (WNS), continues to cause catastrophic declines in bat populations across eastern North America. As of April 2010, the fungus associated with WNS (Geomyces destructans) has been found as far west as Oklahoma.

As white-nose syndrome continues to spread, more bat species are vulnerable to mortality from the disease. Members of the Kunz lab continue to investigate the causes and consequences of white-nose syndrome. Several ongoing projects are being conducted to try to help understand and clarify the impact of this disease on the little brown myotis in the Northeastern U.S.

Jonathan Reichard is currently investigating patterns of fat depletion associated with WNS by completing body composition measurements for infected and uninfected (control) bats.

Marianne Moore examined immune correlates of WNS for her PhD dissertation and has continued her work as a post-doctoral researcher, testing immunocompetence of healthy and affected bats with an arsenal of assays.

Nate Fuller is currently studying healing rates of bats’ wings that have been damaged from complications of WNS.

Aryn Wilder is investigating genetic variation in the little brown myotis associated with the spatial spread of white-nose syndrome.

Winifred Frick, post-doctoral associate, recently authored a paper that appeared in the August 2010 issue of *Science*, which presented a population viability analysis of little brown myotis that predicted regional extinction in sixteen years at current mortality rates. Thomas Kunz (CECB director) and Kate Langwig (graduate student) were co-authors on the study.

Kate Langwig, the newest Kunz lab member to study white-nose syndrome, investigates the susceptibility of bat species to white-nose syndrome.

Katherine Gillman, an undergraduate student in the EBE program, worked in the Kunz lab over the summer of 2010 monitoring summer maternity colonies of little brown myotis in Massachusetts that have pre-WNS counts, and used this information to assess impacts of white nose syndrome in the region.

In addition, CECB Director Tom Kunz is working on a project to deploy heat-trapping roost modules, which he, with Scott Reynolds, a former PhD student of Tom’s, developed as a strategy to help mitigate the decline of little brown myotis populations caused by white-nose syndrome.

Many more answers are needed to even begin to prevent this disease from spreading further. Continuous research is imperative and is only possible thanks to the committed individuals who have supported WNS research and, in particular, our work here at BU.
Recent CECB Publications based on research at Tiputini Biodiversity Station

Journal Articles Published


Ph.D. Dissertations


Book Chapter

Historic Ecuador-UN Agreement May Save Yasuni-Tiputini from Further Oil Exploration Threats

A precedent-setting agreement to preserve the vast Yasuni-Tiputini tropical rainforest region (about the size of Vermont) was reached in August 2010. This has major positive implications for the Tiputini Biodiversity Station, in that protection for the region will be solidified.

Worked out over several months by Ecuadorian government officials, scientists, and the United Nations Development Program, the agreement establishes an international fund wherein countries of the world will contribute a yearly total equivalent to at least half the revenue that Ecuador would have received if they had allowed continued non-renewable petroleum energy extraction in the rainforest region. Germany has already led the way by pledging $50 million each year for the next thirteen years. Other countries that see tropical rainforest preservation as a serious part of the answer to countering excess anthropogenic greenhouse gas emissions and for preserving the global water cycle and the benefits of biodiversity, are expected to come forth with additional pledges. Moreover, the international fund will allow businesses, institutions, and individuals to contribute.

Working periodically with Nathan Phillips and sedGreen, I have followed up my visits to Tiputini in recent years (see http://www.bu.edu/today/world/2009/02/18/1-500-acres-life) with a wide range of multi-media presentations at local Boston schools, in my Global Ecology classes, and most recently in a variety of venues in Europe about the priority and importance of tropical rainforests such as this highly biodiverse, wilderness area on the east side of the Andes. With all of the negative news of humans’ continuing war on nature, it is refreshing to report such a potentially significant new, positive pathway led by citizen-scientist coalitions and their enlightened nations such as Ecuador and Germany.

~Contributed by Douglas Zook, Professor of Science Education and Global Ecology

Boston University has established a strong presence in the Tiputini-Yasuni region through its affiliation with the Universidad San Francisco de Quito (USFQ) and the Tiputini Biodiversity Station (TBS) in 1996. In addition to TBS providing facilities for scientific research, it also serves as one of the sites used by BU’s Tropical Ecology Program. Most recently, a new laboratory and housing facilities were constructed at TBS, funded as a collaboration between BU, USFQ and the National Science Foundation through a grant led by CECB Director Tom Kunz and Associate Director Christopher Schneider.

Another important tie that BU has to the Yasuni region of Ecuador is the recent appointment of Pablo Jarrin as the Director of the Yasuni Research Station (http://www.biologia.puce.edu.ec/natura.php?c=226&inPMAIN=2), a field station developed in 1994 and operated by the Pontificia Universidad Católica del Ecuador. Pablo was awarded a Masters degree from BU in 2006 and expects to defend his Ph.D. dissertation under the co-direction of Professor Kunz and Schneider in Spring 2011. BU’s School of Education (SED) Professor Douglas Zook is currently planning to include TBS as part of its experience for Masters students, through a Global Ecology Education Program that he is planning to launch in 2011.
CECB faculty associate MICHAEL SORENSON was appointed Chair of the Biology Department effective June 1, 2010. He replaces Prof. Geoff Cooper who now serves as an Associate Dean for the College of Arts and Sciences.

EDDIE BRZOSTEK, a doctoral candidate in CECB faculty associate Adrien Finzi’s lab, was recently awarded the New Phytologist Award for Best Student Presentation in the Biogeosciences Section at the 2010 Annual Meeting of the Ecological Society of America. Eddie presented his work on the response of the soil nitrogen cycle to global change. In addition, Eddie was also awarded a Doctoral Dissertation Improvement Grant (DDIG) from the National Science Foundation (NSF) this summer to support his thesis research investigating the environmental limits on soil enzyme activities.

The Office of Naval Research (ONR) recently awarded $7.5M for a 5-year project entitled AIRFOILS (Animal Inspired Flight with Outer and Inner Loop Strategies), which will focus on the development of unmanned aircraft inspired by the flight mechanics and flight behavior of bats, birds, and insects. The research team includes CECB Director THOMAS KUNZ and CECB faculty associate, MARGRIT BETKE.

CECB was awarded a 1-year $50k grant from The Woodtiger Fund to support white-nose syndrome research.

In addition, FLIR, a world leader in thermal imaging infrared cameras, designed and donated a fully-equipped mobile laboratory to CECB, named the BatMobile.

ELIZABETH BRALIN DE TORREZ, a doctoral candidate in the Kunz lab, was featured in a newly published children’s book, “The Bat Scientists,” by Mary Kay Carson, on her work on bats in the pecan orchards of Texas.

MARIANNE MOORE, a recent graduate of CECB faculty TOM KUNZ, was awarded the Luis F. Bacardi Conservation Award (supported by the Lubee Bat Conservancy) at the North American Symposium for Bat Research (NASBR) for an oral presentation entitled: “Can hibernating Myotis lucifugus mount cutaneous immune responses to Geomyces destructans?”

Lead author WINIFRED FRICK, a post-doctoral researcher in CECB Director TOM KUNZ’s lab, published a paper in Science Magazine with researchers from the Kunz lab, titled, “An Emerging Disease Causes Regional Population Collapse of a Common North American Bat Species,” on the effects of WNS on the little brown myotis.

NATHAN FULLER, a graduate student in CECB Director Tom Kunz’s lab, recently won the Speleobooks award for best poster at the North American Symposium for Bat Research (NASBR) for his research on wing healing rates in white-nose syndrome affected bats.

MICHAEL CALDWELL, a recent graduate of CECB faculty KAREN WARKENTIN, received the Belamarich Award for best dissertation in 2010.

CONGRATULATIONS
Recent Ph.D. Graduates of CECB Faculty Associates

Jonathan Reichard - Kunz Lab
Marianne Moore - Kunz Lab
Erin Kinney - Valiela Lab
Kari Ryder Wilkie - Traniello Lab
Burton Shank - Kaufman Lab
Emily Marquez - I. Callard Lab
Mario Muscedere - Traniello Lab
Myra Hughey - Warkentin Lab

Thank you to our recent contributors!

FLIR
The Woodtiger Fund
Robert Sanderson
Laurie Harriman
Margaret Hollyer
Changes in the Nitrogen Cycle Caused by the Hemlock Woolly Adelgid and Atmospheric Nitrogen Inputs

Human activities, such as the burning of fossil fuels, have increased the amount of nitrogen deposited onto terrestrial ecosystems. Increased atmospheric deposition of nitrogen onto forests can lead to nitrogen saturation, a series of responses in which excess nitrogen supply leads to nitrate leaching into groundwater and streams. Nitrate leaching can cause detrimental impacts such as forest nutrient imbalances, acidification of stream water and fish mortality. Despite several decades of research on the effects of atmospheric nitrogen deposition, there is still significant uncertainty about the factors that regulate nitrogen retention and loss in forest ecosystems.

In addition to atmospheric N deposition, other human-induced disturbances have led to dramatic shifts in forest composition in the northeastern United States over the past 100 years. For instance, the hemlock woolly adelgid (Adelges tsugae Annand), an introduced aphid-like insect from Japan, threatens hemlock stands throughout the eastern United States. The hemlock woolly adelgid was first reported in forests of the eastern United States in the early 1950s and is currently leading to mortality of eastern hemlock trees from Georgia to Massachusetts. It was introduced to the Arnold Arboretum in Jamaica Plain, MA, in the 1990’s and many hemlock trees have since shown severe symptoms of decline. Previous research has shown that the presence of the hemlock woolly adelgid can lead to a reduction in forest canopy cover and increased nitrogen concentrations in the soil beneath these canopies.

Assistant Professor Pamela Templer and an undergraduate student in her lab, Tiffany McCann, recently published a paper in the journal *Ecosystems* about their work. Their objectives were to quantify rates of nitrogen inputs to the forest and to determine rates of nitrogen losses from healthy, declining and salvage or preemptively cut eastern hemlock stands in both an urban forest at the Arnold Arboretum in Boston, MA, and a rural forest at Harvard Forest in Petersham, MA. The authors found that rates of nitrogen inputs to the forest floor were 4-5 times greater, and rates of nitrogen losses via leachate were more than ten times greater, at the Arnold Arboretum compared to Harvard Forest. The fact that the authors observed larger rates of nitrogen inputs to forests within Boston than estimates from region-wide extrapolations of air pollution data suggests that there is a local source of nitrogen that significantly increases rates of nitrogen deposition beyond what arrives with prevailing winds from the midwestern states.

Although the study was limited to one urban and one rural site, the results also suggest that current management regimes used to control the hemlock woolly adelgid, such as salvage cutting, may be reducing nitrogen losses in urban areas due to rapid regrowth of vegetation and uptake of nitrogen by those plants. In contrast, preemptive cutting of trees in rural areas may be leading to proportionately greater losses of nitrogen in those sites, though the total magnitude of nitrogen lost is still smaller than in urban sites. Results of this study suggest that the combination of the hemlock woolly adelgid, atmospheric nitrogen inputs and management practices lead to changes in the nitrogen cycle within eastern hemlock forest ecosystems.

~Contributed by Pamela Templer & Tiffany McCann
Under the Southeast Asian Sea: Grad Student Investigates Wound-Healing Properties of *Pocillopora damicornis*

During the summer of 2010, Nikki Traylor-Knowles, a Ph.D. candidate in John Finnerty’s lab, visited Chencheng, Taiwan, to work at the National Museum of Marine Biology and Aquarium (NMMBA) as a guest scientist in Dr. C.S. Chen’s laboratory after receiving an NSF East Asia Pacific Summer Institute Fellowship. Nikki studies the Indo-Pacific coral, *Pocillopora damicornis*, and is interested in how they are able to heal when they are wounded.

Corals are colonial animals that harbor symbiotic algae, called Symbiodinium, that live within their tissue layers. These symbiotic algae provide sugars and oxygen to the coral host by photosynthesis, and in turn, they get protection by living within the coral host. Corals also possess cells called calicoblastic cells that secrete calcium carbonate that forms a hard skeleton. On top of this hard skeleton, the coral tissue grows, creating the large reef structures of our oceans. In coral reef habitats, many different animals find shelter within and around corals reefs and many have dubbed the coral reef ecosystem as the “rainforest of the ocean” due to its diversity and fragility. Coral reef habitats are one of the world’s most diverse and valuable environments, but currently, over 50% of the world’s reefs are suffering from widespread coral die-offs or bleaching. In parts of the Indo-Pacific, 30-60% of the species diversity has been lost; while in the Caribbean, over 50% of the coral cover has been lost. The main drivers of this decline are anthropogenic, including worldwide changes in sea temperatures and pH, and local impacts such as over-fishing, nutrient and toxin runoff and the introduction of invasive species.

Much of the world’s surviving coral has been weakened by environmental stressors, leaving it more likely to succumb to mundane natural threats, such as cuts, breaks, and abrasions that can result from storms, dredging, or fish bites. These potentially survivable injuries can expose the calcium carbonate skeleton, leaving the organism vulnerable to invasion by foreign organisms including algae, pathogens, and encrusting competitors. Therefore, a wounded coral’s survival depends on its ability to heal quickly. Unfortunately, little is known about how corals are able to do this and what mechanisms, at a genetic level, are involved in a coral’s ability to heal once injured.

*Pocillopora damicornis* is emerging as a valuable sentinel coral species due to its wide distribution and hardiness in lab culture. In order to understand how this organism reacts to stress at a genetic level, a transcriptome was developed using high throughput 454 sequencing (a transcriptome encompasses all of the expressed genes found in an organism, and 454 sequencing is a fast and comparably cheap way to get all of this information). To obtain the most thorough representation of the transcriptome, RNA was pooled from a number of geographically isolated Hawaiian populations, from both control animals and animals subjected to various stressors, including wounding. From this project, Nikki was able to get approximately 70,000 contigs, or genes, and this preliminary research will thus serve as a first step to reconstructing the wound-healing pathway of corals.

While in Taiwan, Nikki focused on a wounding time series experiment. She took four colonies of corals and from each of these colonies and broke off 4 pieces (nubbins). Three of the four nubbins were wounded using a scalpel and then collected at 1 hour, 6 hours, 24 hours, and then 48 hours after being wounded. She preserved these samples, extracted the RNA from them, and brought them back to Boston University where she is now processing them to look at the transcriptome of each sample to understand how the transcriptomic profile changes during early wound healing. Currently, Nikki is finishing up her project from Taiwan and is working on further characterizing the wound healing profile for the coral *P. damicornis*.

~Contributed by Nikki Traylor-Knowles
The Earth’s highly valued coastlines bring focus to habitats and species of the most biodiverse and productive natural systems known to humankind. It is no surprise that most of humanity also inhabits this razor-thin ribbon of life that wends the world’s margins. Sustaining society along this biodiverse ribbon should be easier than anywhere else, but the corrosive forces of human impacts over millennia have introduced enormous challenges. Learning to meet these challenges requires a new understanding of features that link natural and human systems. It takes tools to visualize and to share this understanding, and it takes practice -- a lot of it -- to achieve sustainability. CECB professors Les Kaufman, Suchi Gopal, Phil Lobel, John Finnerty, Robert Kaufmann, and their students have been researching, fashioning new tools, and working hard on two projects funded by the Gordon and Betty Moore Foundation. The Marine Management Area (MMA) Science Program, in collaboration with Conservation International, was a 5-year study of the ecological and economic effects of coastal zoning schemes in the tropics (see www.science2action.org). Besides the network of four core study regions - Fiji, Brazil, Belize, and the tropical eastern Pacific - the work encompassed 73 MMAs in 23 countries and 400 investigators. Many new species, coral reefs, and nursery habitats were discovered as a byproduct of 45 studies of connectivity, resilience, and management. New tools include the use of cnidarians (relatives of jellyfish and corals) as environmental sentinels that speak through transcriptomics - “Coral Whisperer,” a universal coral reef health index called “CHI,” and coastal decision simulation software led by Professor Gopal called “MIDAS.” Now these lessons are being applied and tools are being advanced in new field and lab endeavors.

One hot place for our next stage of work is Fiji. In October, Les Kaufman returned there to study ecological and social processes that nurture the “Vanua,” the Fijian concept of an inhabited watershed and island shelf ecosystem. He was joined by Stacy Jupiter of the Wildlife Conservation Society (WCS), a jolly crew of skilled folk from the New England and Monterey Bay Aquarium families, and professional photographer Keith Ellenbogen. The expedition explored the robust reefs of Bligh Water and Lomaiviti (central Fiji). After this, Les and his Fijian colleagues toured the villages and watersheds of Viti Levu and Vanua Levu that rise above, safeguard, and are served by the Bligh Water reefs (see http://explorers.neaq.org). The newly minted Vanua Science Working Group designated a strip spanning Bligh Water, from the ridgetops of Nikorotubu to the hillcrests of Kiobo, as their study area for ecological processes and economics of the vanua. One of the core Vanuites is Aaron Jenkins, BUMP alum from Phil Lobel’s laboratory, now with Wetlands International in Suva!

Our second focus lies within our very own vanua, from the hills above the Boston Basin to the fishing ports of Cape Ann, thence out across the thick-with-life waters of Stellwagen Bank National Marine Sanctuary. Here, the BU team leads efforts to create a spatially explicit (visualized as an evolving map) dynamic model of ecosystem service generation and flows essential to the welfare of the Massachusetts coastal economy. This work under the Massachusetts Ocean Partnership is based upon a modeling architecture called MIMES, coupled to visualization and gaming in MIDAS. The models are based on the study of ecological and social trade-offs. The trade-offs help to define a workable balance among oft-competing interests such as fishing, farming, real estate, whale watching, conservation, commerce, and waste disposal. It is an infant science at the core of President Obama’s National Ocean Science Policy, known within the Washington Beltway as CMSP (coastal and marine spatial planning). The Massachusetts work is technologically far advanced beyond typical practices in Fiji. However, it’s the Fijians who win in the management philosophy department, for having a model of ecosystem service at all. When it comes to walking the walk, though, Beantown and Suva are neck-in-neck. The idea of actually living by a vanua credo is new and strange to everybody these days, no matter where you’re from.