2009 LTER Education Committee Report

Between the 2006 and 2009 All Scientist Meetings, the Education Committee has continued to promote cross-site interactions and network-wide activities, such as the Children's Book Series.

1) Cross-site efforts are underway at a minimum of 9 sites. Three projects serve as examples of the sorts of activities with which educators and scientists are engaged in cross-site efforts (lead site is indicated by bold, participating sites listed alphabetically):

i. The and **SBC**, BES, and FCE sites are partnering with Science Approach on an NSF Innovative Technology Experiences for Students and Teachers (ITEST) grant, *CoastLines*, to provide high quality teacher professional development that focuses on using LTER GIS data in the classroom.
ii. **CAP** has been successful in obtaining funds from NSF's EdEn, Teacher Professional Continuum (TPC), and ITEST programs. TPC funding was obtained for a grant entitled: Teaching Ecosystem Complexity through Field Research involves a collaboration of CAP LTER with AND, JOR, LUQ, and SGS
iii. **SGS** serves as the lead institution along with BES, KBS, and SBC, in an NSF-funded Math-Science Partnership (MSP) entitled: Culturally Relevant Ecology, Learning Progressions and Environmental Literacy. This project follows up on work that was done in conjunction with the development of the ISSE and is the first specific effort to address the suggestions made in that report.
iv. A proposal is in preparation for the

2) The LTER Children's Book Series has continued to review proposals and work with site representatives in the development of their ideas. Members of the Editorial Committee for the Book Series include: Diane McKnight (MCM), Monica Elser (CAP), Claudia Mills (Univ of Colorado), Peter Groffman (BES), Whendee Silver (LUQ), and Carol Landis, with additional assistance provided by Amy H. Rinehart (Moonlight Publishing). The Children's Book Series is highlighted on the LTER Network main page, which links to the project description and contacts.

3) Communications were initiated in March, 2009, to encourage participation of all EduReps in the pre-ASM meeting that occurred on Sunday, Sept. 13. In total, 39 participants attended the education meeting, representing all sites and included visitors from ESA and Ramat Hanadiv Park, Isreal (an ILTER representative.)

4) In March 2008, Landis requested input from the EduReps about their active engagement in education and outreach. Responses were obtained from 13 sites, providing an update about strategies and successes employed across the LTER Network. The summaries are appended to this report.

Andrews Experimental Forest (AND), submitted by Kari O'Connell, 4/16/08:

The Andrews Forest education program addresses the full spectrum of student and teacher audiences. The core of our Schoolyard LTER has been a collaboration with SMILE (Science and Math Investigative Learning Experiences), an OSU program targeting schools in minority (especially Native American and Hispanic) communities. Many of our K-12 activities focus on teacher training, which allows us to most efficiently reach many students. LTER scientists, graduate students, and technicians work with teachers through the Oregon Natural Resources Education Program, the SMILE program, Teaching Ecological Complexity (based at Portland State University), and NSF's Research Experience for Teachers (five teachers since 2003). In the last three years, we started a new partnership with the local school district with programs involving elementary and junior high science students, and the Teaching Ecological Complexity program has expanded to involve other LTER sites, including CAP, SGS, LUQ, and JRN. In 2007, we started a new partnership with the Environmental Leadership Partnership (ELP), a service learning program at the University of Oregon for undergraduates to gain experience delivering environmental education programs. Also, since 2007 we have partnered with the Pacific Tree Climbing Institute to provide opportunities for junior high students to experience and learn about old-growth tree canopies.

The Andrews Forest continues to be a destination for field trips, field courses, and tours for more than 15 colleges and universities and many other organizations. Important new, interdisciplinary endeavors, the NSF-sponsored Ecosystem Informatics (EI) IGERT (for 30 PhD students) and the EI Summer Institute for undergraduates (13 students from 12 universities in 2007, its first of 4 years), have brought together students from math, computer science, engineering, and the biophysical sciences. Much of these EI endeavors are based on the Andrews Forest place and allied with its program.

Baltimore (BES), submitted by Alan Berkowitz, 3/31/08:
BES work in education is proceeding in four areas – 1) school-based ecology centers, 2) professional development, 3) instructional materials development and 4) education research.

School-Based Ecology Centers. This is a new area of emphasis for BES, representing a shift from distributed models of professional and instructional materials development to one focused on establishing long-term partnerships with schools. It will build on the professional development and materials we have worked on in the past.

Professional development in inquiry-based, community-embedded urban ecosystem education. BES has continued to offer workshops in urban ecosystem education to middle and high school teachers each summer, as well as RET experiences to teachers each summer. We now are shifting to a more collaborative approach to teacher professional development, rather than running stand-alone BES workshops. This will maximize efficiency, embed our work in other programs that provide complementary resources and strengths, and help us infuse our unique strengths more broadly. Partners will include the Parks and People Foundation (KidsGrow after school program teachers), Ecological Society of America (workshops for urban teachers), CoastLines project (with Ali Whitmer and Steven Moore), BES/School Ecology Center teachers, Maryland Governors Academies and Climate Change Commission teachers, and ongoing Research Experiences for Teachers programs.

Instructional Materials Development. Units from *Investigating Urban Ecosystems* (middle and high school curricula) and *My City is an Ecosystem* (Kids Grow curriculum) have been developed and pilot tested and are available on the BES website. These are being used to create a more generic (i.e., beyond Baltimore) set of materials that will be part of the Cary Institute's Ecosystem Literacy Initiative *Teaching About* Ecosystems website. Baltimore-specific modules of these revised materials will be made available for use by interested Baltimore teachers. BES also is collaborating with TERC on the high school curriculum, *BioComplexity and the Habitable Planet*, which includes urban ecosystems themes.

Education Research. BES pursues research in education to address one of three guiding questions of the overall project: How can people use an understanding of the city as an ecosystem to improve the quality of their environment and their daily lives? The basic questions guiding our research include: a) What are the patterns, causes and consequences of human-ecosystem knowledge asymmetries in the metropolis? 2) What are the roles of schools and scientists in fostering human-ecosystem literacy and knowledge exchange? 3) What are the relationships between environmental quality, ecosystem literacy and individual and collective human decision making and action?

Central Arizona-Phoenix (CAP), submitted by Monica Elser, 4/8/08:

Ecology Explorers is the K-12 education program of Arizona State University's Central Arizona—Phoenix Long-Term Ecological Research (CAP LTER) project. The aims of the Ecology Explorers program are to: help schools develop and implement a schoolyard ecology program where students collect data similar to CAP LTER data, enter results into our database, share data with other schools, and develop hypotheses and experiments to explain their findings; improve science literacy by exposing students and teachers to research conducted by university-level scientists; enhance teachers' capabilities to design lessons and activities that use scientific inquiry and encourage interest in science; provide access to and promote the use of CAP LTER materials and information; encourage collaboration between CAP LTER researchers and the K-12 community; and provide students an opportunity to share their research with other children, adults and researchers.

We accomplish these goals through a variety of programs. We offer professional development opportunities for teachers that include paid workshops and summer internships. These programs work with teachers to build skills in conducting ecological research with their students. We organize after-school science clubs targeting schools with high minority populations. One of our after-school programs connects the children with a local habitat restoration project. Another after-school program teaches children about interactions between the natural and built environment focusing specifically on the urban heat island. Finally we link with local environmental education providers to develop workshops relating to urban ecosystem and urban sustainability. Our primary funding has been through CAP LTER, but we have also been successful in receiving funding from NSF's EdEn program, TPC program, and ITEST program. In particular, the TPC funding for a grant entitled: Teaching Ecosystem Complexity through Field Research involves a collaboration of CAP LTER with SGS, JOR, AND & LUQ.

California Current (CCE), submitted by Beth Simmons, 4/20/08:
The California Current Ecosystem LTER's Education and Outreach program has benefited greatly from their involvement in the Children's book project, not only resulting in the creation of *Sea Secrets* but also in the construction of new relationships with scientific experts and education specialists from a variety of places. For example, the Point Reyes Bird Observatory, NOAA's National Marine Fisheries, Scripps Institution of Oceanography, Cascadia Research, and Polar Ocean Research Group are to name a few but we are not excluding those new relationships with other professionals such as educators, artists, illustrators, publishers and editors. All of these people helped us to gather and create materials for the book, align photographs with text, generate supporting publications and collect various other materials that we hope will help us extend these relationships and broaden the book's appeal upon its publication in September, 2008.

The book project also allowed us to benefit from the Schoolyard's First Book Fund. This past April we were the recipients of an award which is allowing us to be able to donate more books to schools, tap into informal educational facilities like aquariums, libraries and research related book stores, as well as educational programs like those at Ocean Institute, one of CCE's main outreach partners. The funding has definitely afforded us the ability to broadened the impact that outreach was trying to generate.

CCE Education and Outreach program also launched its outreach website this past February http://cce.lternet.edu/outreach/ increasing their exposure and building a platform for their outreach program to grow. This website is allowing us to generate interest in the Research Experience for Undergraduates (REU). As the program grows the outreach website will feature each undergraduates work and continue to expose the opportunities available. Currently we are interviewing candidates for three new positions in the summer of 2008 http://cce.lternet.edu/outreach/opportunities/reu.php. Additionally, we will be building our Research Experience for Teachers (RET) program through the participation from a local teacher who will be working on a elaborating our Chlorophyll Temperature Time Series Project http://cce.lternet.edu/outreach/projects/chlorophyll_project/. We started this partnership between Ocean Institute (OI) and the California Current ecosystem LTER back in January of 2006. Presently, OI has logged more than 129 distinct events during numerous two-hour cruises. As a result nearly 1200 students have been active participants in ongoing, large-scaled scientific investigations at sea.

Harvard Forest, (HFR), submitted by Pam Snow, 4/4/08:

Harvard Forest LTER Schoolyard Program currently trains and supports approximately 60 K-12 teachers in implementing field ecology research with their students. Teachers choose one of 3 protocol themes: Buds, Leaves, and Global Warming, Hemlock Trees and the Pesky Pest, The Woolly Adelgid, and Water in the Landscape: Vernal Pools. Program participants are trained by HF Ecologists and staff during our Summer Institute for Teachers in August and in two school-year workshops each year. Further information and project data are posted on the HF website at: http://harvardforest.fas.harvard.edu/museum/schoolyard.html .

In addition to our Schoolyard Program, Harvard Forest education staff hosts over 3,000 visitors of all ages, including 30+ K-12 classes, 35+ university classes and 30+ professional groups, at the Fisher Museum each year. These groups and more than 2,500 other visitors coming on their own learn about ecology, land-use history and research results from the HF LTER program at the Museum.

Harvard Forest LTER summer intern/REU program last year trained 22 students who worked directly with senior researcher mentors on their projects. This 12-week program includes seminars by senior researchers, career development workshops, field trips to other regional LTER sites and culminates with a day-long Student Symposium, at which each student presents the results of their summer research.

Hubbard Brook, (HBR), submitted by Jacquelyn Wilson, 4/23/08:
Education and Outreach
Since its inception, HBRF has been deeply committed to environmental and science education. In 2007, HBRF cooperated with the USDA Forest Service to develop its signature Environmental Literacy Program, which seeks to use ecological knowledge to promote informed decision-making for a sustainable future. The Environmental Literacy Program serves as the intellectual framework for all education projects at Hubbard Brook, focusing on professional-development opportunities for teachers, curriculum development, and forging working partnerships with local schools. The program is strengthened by a close relationship with educators at Plymouth State University.

Exploring Acid Rain
In an effort to extend the reach of its successful Science Links products, HBRF produced a curriculum based on its acid rain project. *Exploring Acid Rain* is a guide to acid rain science for secondary school teachers, supported by training sessions and outreach activities. HBRF unveiled the guide in the fall of 2007 at a workshop at the North Country Professional Development Day (sponsored by North Country Education Services) in Whitefield, NH. Workshops for secondary teachers were also held at Plymouth State University, the Maine Environmental Education Association Conference and the Wellborn Ecology Conference. Pre- and post-workshop surveys administered to workshop participants demonstrated a significant increase in acid rain science comprehension after the workshops. Future workshops will be held in participating schools throughout New England in 2008. This project is supported with grants from the USDA Forest Service, Mascoma Savings Bank, and the New Hampshire Charitable Foundation's Wellborn Ecology Fund.

A Forest for Every Classroom
HBRF joined other New Hampshire educational groups and nonprofits to hold the second year of "A Forest for Every Classroom" (FFEC), a year-long interdisciplinary teachers' professional development program. A series of workshops at various locales enabled teachers to develop their own curricula to increase students' understanding of forested ecosystems in their home communities. The strength of FFEC comes from the synergistic contributions of its many sponsors: New Hampshire Project Learning Tree, National Wildlife Federation, White Mountain National Forest, and USDA Forest Service. In 2007, a two-day workshop was held at the Hubbard Brook Experimental Forest with the participation of five Hubbard Brook scientists. The FFEC project is supported with grants from the Bay and Paul Foundations, LTER Schoolyard Program of the National Science Foundation, and the Northeastern States Research Cooperative.

Talks & Tours
Hubbard Brook scientists continue their tradition of reaching out to the general public through the *Ecosystem Science Today* lecture series and educational walks each summer. The free lectures, held at the Squam Lakes Natural Science Center in Holderness, NH, attract year-round residents and summer visitors alike. HBRF thanks Dr. Peter Groffman for his talk on the effects of winter climate change on the Northern Forest; Dr. Nick Rodenhouse who enumerated the threats to neotropical migratory songbirds in their northern habitats; Dr. Lynn Christenson for her talk on moose ecology and the effects climate change may have on this species; and Dr. Charles Cogbill who led a walk through the Hubbard Brook Experimental Forest to look for

clues of past human disturbances and their impacts on the structure of the current forest. HBRF also organized many presentations at schools and nonprofit organizations, and worked closely with the USDA Forest Service to conduct group tours at Hubbard Brook, with support from the LTER Schoolyard Program of the National Science Foundation.

A look ahead to new programs in 2008:

Bridging the Americas: Unidos por las Aves

A cross-cultural initiative that partners elementary school classes in the United States with classes in Latin America and the Caribbean, this program is designed to instill an appreciation for migratory birds and the need to protect habitats. Educators from HBRF and Plymouth State University have developed the program with the Smithsonian Migratory Bird Center and Hubbard Brook avian scientists. To launch this new curriculum, HBRF is hosting a Migratory Bird Seminar for the public, and a Workshop for Teachers in early May 2008.

Research Opportunities for Undergraduates

In summer 2008, HBRF, the USDA Forest Service, and Plymouth State University will work together to increase opportunities for undergraduate ecology students through two new programs: the National Science Foundation's Research Experience for Undergraduates (REU) program and the new Hubbard Brook Consortium. The two programs will bring students to the forest during the summer to engage in hands-on ecological research, mentored by Hubbard Brook and PSU scientists. Ten students will participate in these inaugural programs that include special emphasis on communicating science to broader society.

Jornada Basin (JRN), submitted by Stephanie Bestelmeyer, 3/31/08:

For nearly a decade, the Jornada Basin sLTER program has provided quality, inquiry-based science education opportunities to K-12 students and teachers throughout southern New Mexico and west Texas. Program staff have directly worked with more than 50,000 K-12 students, and thousands more have been indirectly affected by the more than 500 teachers who have participated in one-day, five-day, and two-week teacher professional development workshops.

The key to this volume of outreach continues to be a partnership that was established in 1998 among the Jornada Basin LTER, the USDA-ARS Jornada Experimental Range, and the Chihuahuan Desert Nature Park, a nonprofit science education organization. Using the combined expertise of these partners, we deliver a multifaceted K-12 education program which includes:

Schoolyard studies ˆ The heart of the program is a 400-page teacher,s handbook containing 30 inquiry-based activities that are done in the schoolyard and/or classroom. Activities are divided into seven categories that overlap with LTER research: weather, microclimates, soil, water, vegetation, arthropods, and vertebrates. Each activity includes teacher instructions, background information, sample tables and graphs, reproducible student pages in English and Spanish, and alignment with state (New Mexico and Texas) science standards.

Science investigation kits ˆ Each topic area (e.g., soil) has an associated kit containing all of the equipment and consumable supplies needed to do the activities. Teachers borrow these kits from the Chihuahuan Desert Nature Park for use in their classrooms.

Teacher workshops ˆ Teachers attend professional development workshops with program scientists to practice the schoolyard activities.

Field trips ˆ The Jornada Basin sLTER offers opportunities for students to attend day-long field trips to the Jornada Experimental Range and Chihuahuan Desert Nature Park. Students rotate through three to five hands-on activity stations where they learn about the latest research being conducted in the region by LTER scientists.

Classroom programs ˆ Using part of last year,s supplement, program staff developed one-hour, inquiry-based classroom programs that are delivered by Chihuahuan Desert Nature Park staff. Following the classroom visit, students and teachers continue data collection and analysis using materials and activities provided by the Jornada Basin sLTER program.

Kellogg Biol. Stn (KBS), submitted by Laurel Hartley & Andy Anderson, 4/3/08:

KBS LTER has an active K-12 education and outreach program that involves over 80 teachers from 11 rural school districts in southwest Michigan. We currently have NSF GK-12 funding that allows 8 graduate student fellows to work closely with teachers in high school, middle school, and elementary classrooms, and we host at KBS four 1-day school-year workshops per year as well as a week-long summer science institute for teachers and fellows. Workshops combine science content focused on a particular ecological theme (e.g. biodiversity, biofuels, emerging infectious disease) together with pedagogy – how to build meaningful inquiry science activities into district science curricula. KSB LTER is also involved in a partnership with the Smithsonian Institution. Our teachers serve as reviewers of K-12 curriculum for exhibits at the Smithsonian Museum of Natural History and we are currently working with the museum to create an interactive about greenhouse gas emission for agriculture that may be used in the new "Dig It! Secrets of Soils" exhibit at the Museum of Natural History in Washington, D.C.

In addition to graduate student research and education at KBS, we also involve undergraduates and teachers in KBS research through the REU and RET supplements. Currently we offer 7 REU opportunities and 1 RET opportunity to work on agroecology and ecosystem services from bioenergy cropping systems.

LUQUILLO LTER ANNUAL REPORT 2006-2007
Submitted by Steven McGee, April 3, 2008
To cover period September 2006 - August 2007 (first year of Luquillo LTER 4)

Schoolyard Institute
From November 17-20, 2006, LUQ Schoolyard program hosted a Luquillo Schoolyard Institute for 30 high school students and 4 high school teachers from three Schoolyard schools. The institute took place at the El Verde field station. The students were trained on two protocols – tree census and limnology. Researchers from Luquillo worked with the students to identify tree species and determine dbh for all the trees in a set plot. For the limnology protocol, students examined a number of hydrological and water quality characteristics of a cross section of a stream near the El Verde station. Students also did identification of macroinvertebrates found in the stream. Student teams developed presentations of their results for researchers at Luquillo. In addition to the hands on activities, the students heard lectures from renowned scientists such as Dr. Ariel Lugo and Dr. Frank Wadsworth.

Schoolyard GPS Activity
As part of the Schoolyard Institite, the students participated in a multmedia GPS activity. Each student was lent a handheld GPS device and a digital camera. They received training on the devices and were given opportunities to practice using the devices. The students took the devices with them to their school and took pictures around their school and around their neighborhood. For each picture they recorded the GPS location. The Learning Partnership is currently processing the images and GPS locations on to a GIS map. This will serve as baseline data for ongoing schoolyard protocol to examine land use changes using GIS software.

Computer Learning Center GPS Activity
On March 27 2007 teams of students set out on a learning experience rich in knowledge, community service, technology and fun in Culebra, Puerto Rico. This initiative resulted from students' concern about their beaches. The students of the Antonio R. Barceló High School, wanted to do a "cleanup project" on Flamenco Beach. Fifty nine students participated in what was a cultural and environmental awareness encounter. These twenty one boys and twenty seven girls were involved in activities using technology devices which helped them get information that could be used for their classroom assignments in the areas of Science, Math and Social Studies. We were also assisted by thirteen college students who volunteered their time in the cleanup.

The Global Positioning System (GPS) was one of the devices used by the students in the cleanup activity. GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, and scientific uses. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications. This valuable information acquired and used at the beach cleanup activity enabled students to expand their knowledge and become familiar with the use of new technologies. Students took pictures of the sites for which they were measuring with the GPS devices. These pictures were uploaded to a web mapping site called Panoramio. Finally, the students participated in a treasure hunt activity using the GPS units.

RET Program

Through an application process, Zamaria Rocio, a middle school teacher from San Diego, was accepted into the Luquillo RET program as a representative of the Journey to El Yunque project. From July 29 to Aug 27, she is participating in a variety of research activities. She is gaining exposure to a wide variety of Luquillo research. Elliot Lopez has also been accepted as an RET teacher from the Schoolyard LTER program. He and Zamaria will be collaborating on a pitfall trap protocol to be completed in Florida, PR and San Diego.

McMurdo Dry Valleys (MCM), submitted by Carol Landis, 5/3/08:

The Education and Public Outreach efforts of the McMurdo Dry Valleys LTER have been primarily focused on REU and graduate experiences, the development and enhancement of ancillary materials to accompany *The Lost Seal* book and the field experiences of the research teams via the website and associated blogs.

The Lost Seal is highlighted on the official IPY website:
http://www.ipy.org/index.php?/ipy/detail/the_lost_seal1/

A companion CD was developed for the second printing of the book, which is part of the LTER children's book series. The companion CD incorporates some of the information and graphics designed for the 2007 CD-set about research in the McMurdo Dry Valleys.

In January, 2008, the NSF Site Review team recognized the excellence of the MCM website. Its search features offer direct interaction with the people, pictures, and data associated with study site. Blogs were an important means of expanding our outreach, since that is the only quick form of communication from Antarctica. Chris Gardner (information managee) and Kathy Welch (lead geochemist) offered their insights and experiences via the blog-osphere. Another popular blog by Chris Kannen, an artist with the NSF Artists and Writers program, enriched the MCM website this field season as well. Some of the blogs were associated with specific teachers and classrooms back in the U.S.A.

The SLTER river study information was also organized and made searchable in the past year. The SLTER link now features a zoom-able Google Earth map with information about each of the sampling sites for the Olentangy River project.

This year the Lakes Team stayed in the field through the end of March, observing the Taylor Valley (Antarctica) ecosystem under diminishing light and colder temperatures as autumn slipped into the polar night of winter. This brought additional attention from the International Polar Year research community, including a March 12th web seminar, featuring a “live broadcast” with Dr. John Priscu (speaking from McMurdo Station) and Dr. Jill Mikucki and Dr.Jeb Barrett and also with Mike Lizotte and the students living and working at the Lake Bonney field camp. The web seminar was part of the Live from IPY event, sponsored by the Arctic Research Consortium of the United States (ARCUS) and is archived at:
http://www.polartrec.com/live-from-ipy/archive

Palmer Station (PAL), submitted by Beth Simmons, 4/20/08:
Palmer's Education and Outreach program is working in a variety of ways to incorporate research into ocean science education. We kicked off the year in January during Palmer's annual cruise aboard the Lawrence M. Gould by elaborating on the traditional 'picture-of-the-day' (POD); a unique opportunity to bring ship life closer to those who are land-based and advance ocean education through imagery. This year's POD participants, varying in ages from kindergarten through undergraduates, were also fortunate enough to simultaneously benefit from our partnership with the San Francisco Exploratorium project called "Ice Stories: Dispatches from Polar Scientists" which aired during the cruise as well. This experience featured one of Palmers scientists in an event called, "Melting Antarctica: Measuring Ecological Change and Warming at the Antarctic Peninsula." Allowing online interaction with the scientists during the cruise. http://icestories.exploratorium.edu/dispatches/author/Maria%20Vernet/
Both of these events even inspired one of our youngest participants, 7 year-old Emily Hines to create a science project on penguins. She conducted an online interview with the scientists during the cruise, requested specific materials from outreach, and utilized some of the photographs from POD to create her very own presentation. She won first place!

Another major effort from Palmer's E/O program this year is their devotion to the LTER's Children's Book Project. This cross-site synthesis project, involved collaborating with CCE LTER and aimed at advancing ocean literacy and marine science education through the creation of a children's book. Our book, a unique mystery called *Sea Secrets: Tiny Clues to a Big Myster*y, explores concepts relevant to ocean ecosystems and examines two of the most abundant species of krill *Euphausia pacifica and Euphausia superba*. The story explores krill, their impact, habitat and survival strategies and teaches readers about food webs and the interconnectedness of all things. It was created in recognition of the International Polar Year earning endorsement specifically from the Polar Books Club http://www.grida.no/polarbooks/. An activity guide will accompany the book and consist of a collection of activities, experiments, case studies and fact sheets geared toward elementary through high school level children.

Our participation in the National Marine Educators Association (NMEA) conference this summer will focus on "Translating Science to Teach" and display the book as a means to measure interest level and elicit outreach opportunities. All of this will culminate in the design of an online webpage to teach the general public about science literacy and get children to read and learn about science creatively.

SANTA BARBARA COASTAL SLTER

SBC's Schoolyard LTER (SLTER) program is organized around a theme of watershed ecology. This approach allows for an integrated program that includes K-12 students, K-12 teachers, undergraduate and graduate students. In 2008 we are focusing on developing long-term connections with local middle schools in Santa Barbara County through a partnership with UCSB's Office of Academic Preparation and Education Outreach (APEO). The goal of APEO is to build college-going communities that improve student learning, increase college-going rates, and provide equal access to higher education for California's diverse students. In an effort to forge long-term connections with local schools, primarily those identified as underserved or low-achieving, the office has staff coordinators who work directly on the school campuses with teachers, administrators and students. With the infrastructural support of APEO, the SBC SLTER program aims to engage middle school students and teachers in local schools through the academic year and summers, and throughout their secondary school education.

Program Format: We are using the successes we had with our LACC summer program (2004-2007) to guide development of our Santa Barbara-based program. First, we continue to work with our undergraduate interns in a rigorous and pedagogically sound program of training in marine science and science pedagogy. These interns engage directly with middle school students as teachers and role models. Second, we continue to develop and adapt marine science lesson plans that engage students with learning about their local environment. These lesson plans incorporate ongoing SBC LTER research and include working with data generated by monitoring and experiments. The program is developed to build student's skills in scientific inquiry through a series of activities that move from structured or guided investigation to open-ended experimentation. Third, our program includes a combination of school-based activities, field trips, and an on-campus residential experience that immerses students in the environment of a college campus.

The SBC SLTER program is working with two Santa Barbara County middle schools: Santa Barbara Junior High School and Goleta Valley Junior High School. Both schools serve a diverse population of students with a large population of students on free or reduced lunch programs.

Students selected by APEO coordinators to participate in their education programs comprise the population of students eligible to participate in the SBC SLTER program. In order for students and their parents to become acquainted with the UCSB campus they are invited to an introductory day-long visit to the campus. An estimated 40 students and their parents or guardians are invited to a Saturday orientation to UC Santa Barbara during which they tour the campus, participate in a panel discussion lead by undergraduate students, and engage in a series of hands-on marine biology lessons. Then, beginning in the fall semester, SBC SLTER undergraduate interns conduct biweekly activities for students in an after school program format. As mentioned previously, these activities guide students through marine science activities aimed at improving science literacy and inquiry skills. School year activities also include a field trip to the UCSB aquarium, an SBC LTER research site, and on a Floating Lab trip into the Santa Barbara Channel. Finally, students are invited to participate in a weeklong residential program on the UCSB campus. These students are engaged in SBC LTER research- based learning activities, conduct field research, and explore the possibility of attending a 4-year college. Follow-up with students and their families includes college counseling and application advice as well as support of Spanish language classes for parents on post-secondary education in California, supported primarily through APEO.

An additional benefit expected in future years is the long-term connection we will maintain with participating students both through APEO support (they work with these same students throughout their high school years) and through continued engagement with students as they move into high school. We envision a program that supports interested students with science fair projects, summer research opportunities, and mentoring opportunities with our middle school program.

Research Experience & Education Facility (REEF)

The Santa Barbara Coastal (SBC) LTER outreach, education and training programs benefit from a close association with the University of California at Santa Barbara's Research Experience & Education Facility, better known as the REEF, an interactive aquarium facility. The REEF is equipped with state-of-the-art, aquaria and touch tanks, ranging from 2 to 2,000 gallons. The REEF also utilizes a high-tech life support system for the Research Tank, which highlights current, on-going research at UCSB and the Marine Science Institute, including SBC-LTER research.

One of the joint goals of the SBC LTER and the REEF program is to provide UCSB undergraduates, majoring in Aquatic Biology, with a solid foundation in temperate marine ecology and research. The REEF training provides them with the basis for communicating this knowledge in an educational format. To that end, the REEF develops its curriculum around a number of research programs at UCSB. The SBC LTER is a significant contributor to this endeavor. Support from the SBC LTER schoolyard program has allowed the REEF to obtain teaching supplies and equipment for curriculum and teacher professional development, as well as provide stipends for teachers, undergraduate and graduate internships. The REEF also utilizes graduate students from the SBC LTER to train REEF undergraduate staff, which, in turn, enhances their training as laboratory and field assistants and research divers for SBC LTER research.

The REEF program has been busy during 2008, between outreach visits to schools, community events and on-campus programs, the REEF provided marine science and environmental education to over thousands of children and adults. This includes hosting educational visits from primary and secondary schools from King City in Monterey Co., to Sacramento and San Diego. The REEF also serves as a marine laboratory for many colleges including Cal Lutheran Thousand Oaks, CSU Channel Islands, and UCSB. At UCSB, the REEF serves as an interdisciplinary adjunct laboratory for undergraduate courses including: Geology 4 (Intro to Oceanography), EEMB 3 (Intro Biology), EEMB 106 (Biology of Fishes), Writing 2 and Writing 109 ST. This year the REEF had over 3,000 on-campus visitors. The REEF also serves UCSB outreach and summer programs, including the SBC-LTER Schoolyard Program.

OceansAlive!

SBC LTER students participate in the *OceansAlive!* program of the UCSB Marine Science Institute (MSI), a collaboration with a number of UCSB departments and research programs to provide 125 local junior high, middle school and high school students with UCSB undergraduate and graduate student mentors for science fair projects. These secondary school students then compete at the local level with the opportunity to progress to the state and national levels.

Other SBC Outreach Activities

Direct outreach to the public is an active area for many SBC investigators and students. Al Leydecker, a SBC post doc, assists and helps direct stream and river monitoring, education and

sampling programs for several community environmental organizations including Santa Barbara Channel Keeper, Isla Vista Surf Rider and Ventura Surf Rider and the Friends of the Santa Clara River. Jenny Dugan gave a K-12 teacher workshop on the ecology of sandy beaches in San Francisco in May 2008.

SBC investigators also participated in several public groups to provide education and a scientific perspective including the Santa Barbara Community Environmental Council, Friends of the Santa Clara River, Santa Barbara Creeks Council and the UCSB Shoreline Preservation Fund.

Virginia Coastal (VCR), submitted by Art Schwarzschild, 4/2/08:
The Virginia Coast Reserve Long Term Ecological Research program (VCR-LTER) is located on the rural Eastern Shore of Virginia at the southern end of the Delmarva Peninsula. The VCR includes a chain of barrier islands, coastal lagoons, tidal flats, salt marshes and coastal uplands and is one of the last and largest undeveloped areas along the east and gulf coasts of the United States. In recent years property values have increased as the area has been discovered as a destination for retirement and vacation homes. This rise in property values has resulted in a reduction in state support of public education, making the outreach and education resources made available through the School Yard LTER program even more valuable to the local community.

For the past 7 years the VCR SLTER program has sponsored an environmental science class at Northampton High School. In this class students learn about human and natural impacts on their local environments through routine sampling of water quality parameters at 26 sites throughout the VCR LTER. Two years ago VCR LTER staff assisted the Northampton High School science teachers in the development of a new Ecology course focused on local ecosystems and habitats. Last year we were able to significantly increase our outreach activities with three new programs by coupling SLTER supplemental grants with private donations and a grant from the Virginia Coastal Zone Management Program. First, we conducted a joint teacher training and curriculum development class for science teachers from both Northampton and Accomack counties. This class focused on environmental science issues in the VCR through lectures by several faculty members and guided field trips. The teachers who participated in this two-week summer course earned 3 graduate credits that could be applied to their recertification requirements. They also worked in groups, with support from VCR LTER staff to incorporate the information they were learning into new curriculum material for use in their classrooms. The second new program was the initiation of an internship program for high school students based on the successful NSF Research Experience for Undergraduates (REU program). This new program, Research Experience for High School Students (REHS), paired highly motivated high school students with graduate students and their advisors for 8 weeks during the summer. The REHS interns were expected to assist the graduate students in their research and to develop independent research projects of their own. At the end of the summer, the REHS interns presented their results to the group, and have also been given the opportunity to give their presentations to high school science classes, community groups, and at the VCR LTER All Scientist Meeting. The third new program was a monthly public seminar series focused on the wildlife, habitats, research and management issues of the VCR-LTER. To date, seminar topics have included: ongoing seagrass restoration efforts in the VCR LTER; factors influencing nesting success of local shorebird communities; ecology of sea turtles found in the VCR LTER; barrier island geomorphology and the impact of island migration on plant, animal and human populations; and current efforts to protect, manage and restore native vegetation to enhance habitat for migratory song birds. All three of these programs have increased public awareness of the research efforts being conducted at the VCR LTER while also helping to educate the local population on the impacts changing land use patterns, sea level rise and climate change can have on their local environment.