EPSCoR HAWAI'I

A Program Administered by the University of Hawai'i System

Aloha!

Treasure Hunting by Satellite" See Page 2..

New Core Facility Lab Manager in Manoa, See Page 5.

Carbon and nitrogen analysis, See Page 6.

We are very pleased to introduce this issue of IMUA NSF Hawaii EPSCoR's newsletter. This issue features some of the shared use facilities that EPSCoR has enabled the University of Hawaii to establish. We're certain you will find these facilities interesting and will agree that the work and activities they allow our researchers, staff, and students to engage in are exciting.

The spirit of IMUA NSF Hawaii EPSCoR is really embodied in these facilities: they are places where people can come to pursue their own research and to discuss new ideas with others. Students can interact with world class researchers in these facilities and faculty get a chance to directly impact their students and staff members. Visiting researchers and employees of agencies alike can take advantage of the cutting edge tools and techniques available. Our lab managers not only keep things running smoothly, but they also act as instructors and mentors for the many people who use their facilities.

UH Hilo Chancellor and IMUA NSF Hawaii EPSCoR Statewide Committee Chair, Rose Tseng

IMUA NSF Hawaii EPSCoR was recently honored to host the 20th National NSF EPSCoR Conference at the Waikoloa Beach Marriott Resort. Don't let that word resort in the title fool you, we kept everyone busy with panel discussions, presentations, and break out sessions. We had great interactions between researchers, students, administrators, NSF personnel at very high levels, and the jurisdictions' VIPs.

Special thanks go to Donald Price and Terrilani Chong for their hard work in putting this conference together. The UH Hilo Conference Center Director Judith Fox Goldstein and her magnificent staff were indispensable in keeping the complex schedule running smoothly. Waikoloa Beach Marriott Resort staff and management were the ultimate professionals.

UH Vice President for Research and IMUA NSF Hawaii EPSCoR Principal Investigator, James Gaines

To view the slide show retrospective of the Conference, go to the following web site: http://www.flickr.com/photos/20400631@N07/sets/72157603113338030/show/ . You'll see our keynote speaker, Ms. Edgy Lee, along with UH President David McClain and of course, Senator Daniel Inouye, who sent a video greeting to the attendees. We were also fortunate to have NSF Deputy Director Kathy Olsen, Inspector General Christine Boesz, and many others speak to our attendees. We had a wonderful cross section of the private sector and the National Academies of Science as panelists too. A full list of all their presentations is archived at http://uhhconferencecenter.com/nsf-epscor-november-6-9-2007.html .

Please read on to find out more about how our project works, and how we interact among each other.

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Empowering Research Through UH Hilo Spatial Data Analysis Labs

by Lisa Canale

Spatial Data Analysis Labs (SDAL) is a small, active, "regional-class" Cyber /Geo/ Eco/ Informatics center at the University of Hawaii at Hilo. SDAL provides the following resources to UH faculty and their non-UH collaborators:

- Access to state of the art Geographic Information Science (GIS), Remote Sensing (RS), and Global Positioning System (GPS) facilities.
- Access to field equipment including differential GPS units, handheld GPS units, a spectroradiometer, laser locator binoculars, and tablet PCs.
- Partnerships with airborne digital imagery collectors and the Hawaii IKONOS Consortium (HIC) for satellite imagery.
- Access to advanced statistical software, publishing software, and printing, including large format printer use.
- Training to empower faculty to use visualization, modeling, and (soon) supercomputer facilities.
- Training of exceptional UH Hilo undergraduates who can serve as research assistants such as programmers or field assistants.
- Access to SDAL's web portal, URL http://www.uhh.hawaii.edu/~sdalhelp , presenting information on all aspects of SDAL services and easy access to Hawaii-based weather, climate, hydrologic, and soils data.
- Website development including design, creation, and training.
- Mapping services including data collection, analysis, production, and training.
- Access to technical support in designing, implementing, and maintaining field sensor networks and associated communication systems.
- Facilities and programs that foster interactions and collaborations.

TCBES graduate student Michelle Norman showing Na Pua Noeau students how to use a handheld GPS. "Treasure Hunting by Satellite" event was organized by TCBES graduate students Cheyenne Perry, Raymond McGuire, and Michelle Norman, under the guidance of Toni Mallow.

Dr. Kassis, W.M. Keck Observatory, and Dr. Park, UHH, measuring the relative throughput of optical elements in the overhead projectors used at W.M. Keck Observatory as flat fielding lamps for MOSFIRE, a near-IR (~0.97-2.45 im) spectrograph for the Cassegrain focus of scientific instrument Keck-1.

SDAL's focus on technology transfer, technical support, training and outreach, and facilitating interactions and collaborations is shown in the success of its users. In fall 2007, UH system researchers using the SDAL included 12 faculty members (representing five departments at UH Hilo and one at Hawaii Community College), five staff members, 13 student researchers, and 28 graduate students. The following is a partial list of discovery and analysis activities being conducted with cyber/geospatial technology:

- Creation of georeferenced marine resource maps to be used for selection of monitoring sites and investigation of patterns of fish recruitment.
- Examination of MODIS satellite imagery to understand the interactions between climate and vegetation dynamics.
- Examination of damaged coral tissues, tumors, and stress.
- Tracking hawksbill sea turtle migrations and analyzing foraging habitat in relationship to environmental factors.
- Evaluation of the impacts of land use on water quality by analysis of surface runoff and nonpoint source pollution.
- Creation of vegetation maps that will be used in wildland fire management and management of invasive plant species.
- Creation of land cover classification maps that are used to explore relationships between land cover and bird abundance.

TCBES Master's of Science candidate Junichi Sugishita demonstrates how he used the Leica Laser Locator to measure tree heights and pre-calibrate distance estimates of his bird survey census plots.

From April 2006 till now, SDAL has sponsored or put on 33 presentations, short workshops, or group training sessions. This is in addition to providing facilities for an additional 39 events totaling 57 event days for organizations such as UHH Keaholoa STEM program, Na Pua No'eau, USDA-PBARC, Hawaii Island Environmental Systems Research Institute (ESRI) users group, Hawaii Island GPS users group, Pacific EMPRINTS (Emergency Management, Preparedness, and Response Information Network and Training Services), Trimble, and the Center for the Study of Active Volcanoes.

Thirteen undergraduate and graduate courses emphasizing geospatial technologies have also been taught in the SDAL training facility and two classes are offered this semester. During Fall 2007, extensive trainings in a one-on-one format were conducted, several websites were created for UH Hilo faculty, and several faculty members were sent to advanced training classes conducted by software companies. *Continued on page 7*

Hawaii EPSCoR Cyberinfrastructure to Enhance Paleoecological Research at the Makauwahi Cave Reserve Site on Kauai

by Michael H. Kido

Lida and Dave Burney with the InteleCell weather station / cell phone repeater deployed above the sinkhole opening of the Makauwahi Cave Reserve site on the south shore of Kauai.

The development of cyberinfrastructure, defined as the coordinated aggregate of computer hardware/software and other technologies used to change "data systems into knowledge systems," has become a priority initiative for the National Science Foundation. In 2003, an ecological – engineering collaboration initiated by Hawaii EPSCoR began development of an environmental cyberinfrastructure that ultimately merged the use of wireless sensor networks, internet portal-based grid computing, and 3D geospatial data visualization/exploration into a platform that has proved viable under rigorous testing in regional-scale environmental monitoring applications in the Hawaiian Islands. Hawaii EPSCoR and InteleSense Technologies, Inc. (a Hawaii-based high-tech company) is fervently pursuing further development of this cyberinfrastructure to increase its power and applicability in real-world settings in collaboration with ecologists, engineers, educators, and information technologists from public and private sectors. One such collaboration is with Dr. David Burney and the National Tropical Botanical Garden (NTBG) on Kauai to demonstrate the ability of the technology to enhance ongoing paleoecological research and ecosystem restoration activities at the Makauwahi Cave Reserve site on the south shore of Kauai.

The Makauwahi Cave Reserve site has provided researchers with a unique opportunity to document from fossil, archaeological, traditional, and historical sources, the climatic and biotic changes of the Hawaiian Islands extending back to the late Pleistocene and documented extinctions and environmental changes probably associated with prehistoric human impacts. The site is a remarkable geological feature that is apparently unique in the Hawaiian Islands – a sinkhole paleo-lake inside a large cave system formed in eolianite limestone. Stratigraphy and radiocarbon dating reported for the caves and sinkhole there provide a detailed picture of a Hawaiian landscape before and after human arrival.

Nearly 10,000 years of sedimentary record from the sinkhole paleolake has been analyzed for vertebrate bones, invertebrate shells, plant macrofossils, pollen, diatoms, sedimentology, and in the upper layers, human artifacts. The story revealed by the unprecedented richness of paleontological and archaeological information is a familiar one of a natural landscape transformed by humans. The research details the human material culture and ethnohistory from the millennium during which occurred a decline from an avifauna of more than 40 species, plus over a dozen endemic land snail species and a botanically diverse forested environment, to a modern biota missing nearly all native elements and dominated by a handful of cosmopolitan plants and animals—weed species from around the world.

The Kauai case provides a chronicle of the human transformation of an ancient environment in the isolated setting of a mid-Pacific microcosm. The trends described are comparable to events of recent millennia throughout the globe. This work has tested the hypothesis that, prior to human arrival, the coastal zones of the Hawaiian Islands contained much more diverse plant communities that included many species now found only at higher elevations that are somewhat more isolated from human impacts.

In collaboration with Dr. Burney's research team, cyberinfrastructure technology is being developed to completely automate environmental data collection at the Makauwahi Cave Reserve site through deployment of InteleSense-based wireless sensor arrays. "Smart sensor" networks will monitor in near real-time meteorological and soils data previously collected manually, water quality characteristics of the freshwater lake below the cave, as well as gas exchange in the deep cave environment where endemic Hawaiian blind animals are found.

To send data to internet servers from this remote location, an innovative cell phone modem device was developed by InteleSense Technologies through a cooperative EPSCoR Research Enhancement Activities Program (REAP) grant awarded to NTBG. Cave sensor data is being integrated with an extensive (and growing) repository of environmental information housed in mirrored servers maintained by InteleSense Technologies that are accessible to researchers via a secured internet-portal.

When completed, this demonstration site will serve as a template for integrating cyberinfrastructure technology into large, ongoing scientific research projects as well as in promoting science & technology learning for students at all levels.

Interactive On-line Key to Pollinators

by Andy Taylor

Pollination Webs is one of three main projects within the EPSCoR II Ecosystem Responses to Environmental Change (EREC) focal area. It focuses on capacity building in analyzing interactions among plants and pollinators. The ultimate goal of the Pollination Web project is to integrate studies of interspecific interactions into ecosystem research. Many important ecosystem processes are mediated by such interactions so understanding them is an important component of understanding ecosystems.

Most research on species interactions is done at the scale of only a few species, rather than at an ecosystem scale. Our aim is to facilitate study of community-wide webs of interactions by developing protocols and informational resources. We will focus at first on pollination interactions as a relatively self-contained and simple subset of all the interactions occurring in any ecosystem.

An obvious obstacle to community-wide studies of interactions is the difficulty of identifying a possibly large and diverse set of species. This taxonomic challenge is particularly daunting in a place like Hawaii, where the terrestrial invertebrate fauna in particular still is very poorly known. In fact, a substantial fraction of species here are yet undescribed. A central part of the research infrastructure being developed by the Pollination Web project is an interactive on-line key to pollinator species. This key will make all available information on the identification of these animals easily accessible to researchers.

An interactive on-line key has several advantages over traditional dichotomous keys or field guides:

Interactive keys can make use of a variety of characteristics.

- With traditional dichotomous keys, an inability to answer one in a fixed sequence of questions about characters can completely stymie the user. Computerized keys instead use a database of species' characteristics, to which whatever information a researcher has on an organism can be compared to systematically narrow down the possible identity of the specimens.
- While identification of species may not be possible without all characters, the key still can be useful with incomplete information. For the same reason, the key can usefully combine characters ranging from those easily seen on free specimens in the field to those requiring microscopic examination and dissection.
- When identification to species is not possible with the available character data, the key also can tell the researcher which additional character(s) would be most effective in distinguishing among the possible species identities.

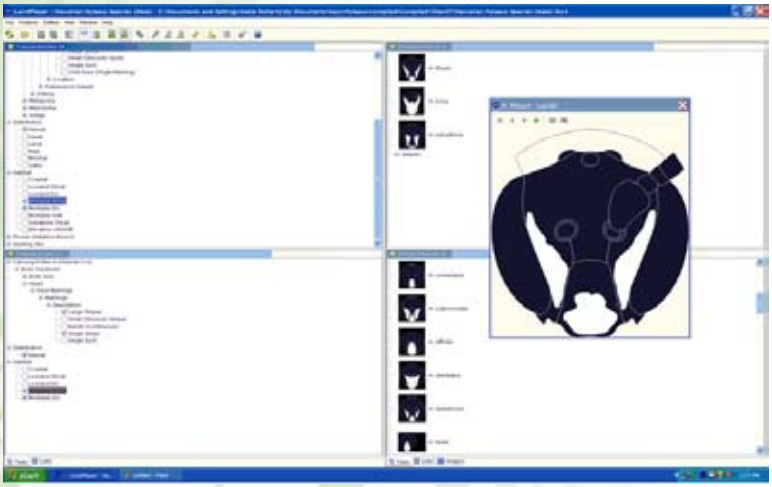
Hylaeus bee on a fennel flower, illustrating the general appearance and size of these insects (this species is approximately 4 mm in total length).

Computerized keys can be multi-media.

- They can include not only diagrams and color photographs, as would be found in a traditional key or field guide, but sound and video, for instance to illustrate diagnostic behaviors.
- They also can link to resources elsewhere on the web.
- All these resources, and others such as a glossary, can be "pop-ups" or links giving easy access directly from the interactive on-line key.
- They can be used in many formats.
- In addition to being "published" on the web for use online, the interactive on-line keys can be used off-line on a laptop computer or even a handheld device.

It therefore is easy to take the full power of the key (apart from links to other websites) out into the field where observation of interactions are made.

We have started with an interactive on-line key to the native species of Hylaeus yellow-faced bees. These are the most important single group of native pollinators, but also are a taxonomic challenge. There are 60 species native to Hawaii, as well as two alien species. In some places numerous species co-occur and visit the same flowers. The bees are small, and generally similar in appearance. Identification, especially in the field, can be extremely difficult. Fortunately an excellent monograph with a dichotomous key and species descriptions was published recently (Daly & Magnacca 2003) and is the basis for our online key. Its authors, especially Karl Magnacca (U.C. Berkeley), have helped us greatly.



The Hylaeus key in use. The upper-left panel shows some of the complete set of characters; the lower-left panel shows those character states that have been selected for this specimen. The upper-right panel lists the species consistent with the selected character states, and the lower-right panel lists all other species (i.e. those ruled out by those character states). Species names are accompanied by thumbnail diagrams of their facial markings; the full-size diagram for one species has been opened.

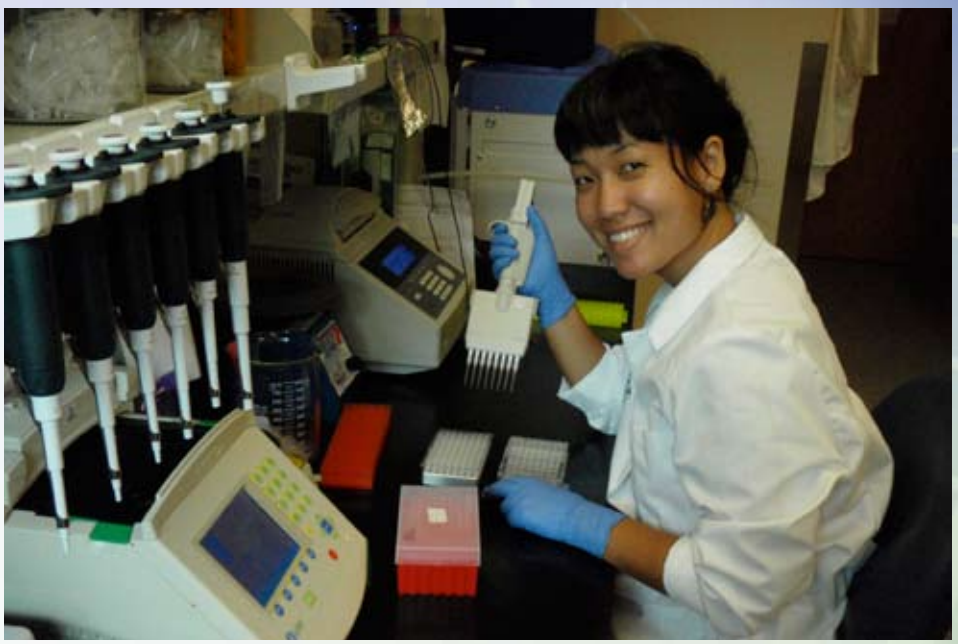
The Hylaeus key is nearly finished, and currently is being tested by members of our project and other colleagues familiar with these bees. While continuing to improve the Hylaeus key we next will expand the interactive on-line key to include non-native Hylaeus and other bees. We intend eventually to include all insects that visit flowers in Hawaii. We plan also to develop an interactive on-line key to the pollen of animal-pollinated plants in Hawaii, for identification of the pollen being carried by animal visitors.

The interactive on-line keys are being built using the Lucid™ program produced by the Centre for Biological Information Technology at the University of Queensland (Brisbane Australia). Further information about Lucid™ keys, and examples of published keys, can be found at the website www.lucidcentral.org.

Highlights of UH Manoa's Evolutionary Genomics Core Facility

by Mindy H. Mizobe

The Evolutionary Genomics Core Facility at UH Manoa, located at the Hawaii Institute of Marine Biology (HIMB), provides genomic services, specifically sequencing and fragment analysis, to the faculty and students of the Hawaii Institute of Marine Biology, the University of Hawaii System, and visiting colleagues and students from other universities and research affiliates. We provide access to various instruments used in molecular biology such as a LC-MS, bacterial colony picker, a microarray scanner and printer, and a real-time PCR system. We also provide the HIMB community with access to fundamental equipment such as autoclave sterilizers, spectrophotometers, refrigerated centrifuges, shaker/incubators, a centrifugal vacuum evaporator, a lyophilizer, thermocyclers, and a water purification system.

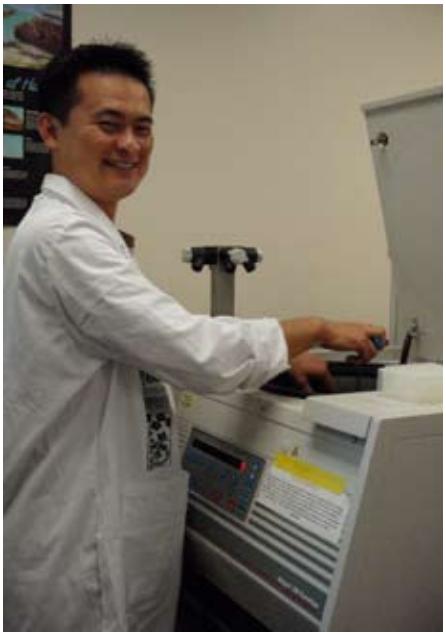


Mindy Mizobe, Core Facility Lab Manager, preparing samples for sequencing.

Research Projects

There are many projects within the HIMB community that we have provided services for. The Lewis Lab has been identifying ectoparasites such as *Neobenidinia* from wild amberjacks (Kahala). The Rappe Lab is investigating the roles that bacterioplankton play in the cycling of nutrients and energy in coastal and open ocean ecosystems. They have been working to sequence a Pelagibacter (SAR 11) and the OM43 genome as well as conducting growth studies on bacterioplankton.

The Toonen-Bowen Lab is engaged in a wide variety of genetic studies. One project is working to resolve the genetic architecture of the four different species of the *opihi*, the Hawaiian endemic limpet, specifically the patterns of connectivity between species within the main islands as well as between the Northwestern and main Hawaiian Islands. Another has been tracing patterns of the deepwater snapper genetic stock between the Indo-Pacific and Atlantic Oceans. There are also studies being conducted on the phylogeography and connectivity of Hawaiian reef fauna such as the Hawaiian monk seal and carcharhinid sharks.



Ichiro Misumi, Ph.D. candidate. using the centrifuge

The Gates Lab has been working on refining the phylogeny of *Symbiodinium* and their relationship with their coral hosts. They also have been working to identify, using a DNA bar-coding method, harmful algal bloom species within ballast water transported into Hawaiian harbors.

Outreach Programs

During the summer of 2007, the Pauley Program was once again held at HIMB. This program brought together students with varied levels of formal and informal education from all over the world. This year, the Pauley Program was partially funded by World Bank and students from the Caribbean, Europe, Africa, Australia, Israel, Mexico, and the United States were able to come together to learn the latest techniques and developments in marine biology from the forerunners of the field. They also had the opportunity to participate in collaborative experiments with the resulting data to be used in future publications. We were able to provide this progressive learning opportunity with the tools they needed to achieve meaningful data. Many of the students had a molecular facet to their interests and we provided the equipment, technical support, and genomic services that enabled them to move forward and keep pace with their intense and exciting schedules.

Coconut Island is an active participant in the Bay Watershed Education and Training (B-WET) Hawaii Program. The B-WET Program aims to create environmentally aware students and teachers through education. This is an important part of National Oceanic and Atmospheric Administration (NOAA)'s goal to support the development of a community that will protect our marine and watershed ecosystems. We have participated in this program by presenting lectures about DNA and the sequencing process to high school students. This more detailed aspect of science coupled with the more broad-reaching and accessible concepts and activities they are exposed to on Coconut Island hope to provide a well-rounded experience for the students.

We at Coconut Island's Hawaii Institute of Marine Biology are happy to be a part of IMUA NSF Hawaii EPSCoR's continued efforts to increase collaborations across the UH System, in Hawaii, and throughout the research community interested in evolutionary and ecological genetics.

UH Hilo Analytical Laboratory

by Randi Schneider

The Analytical Laboratory at UH Hilo, located in the Marine Science Building, was established in 2003 as part of the original NSF EPSCoR award under the direction of Dr. Michael Parsons, Assoc. Professor of Marine Science. Randi Schneider assumed the position of Laboratory Manager in October 2003. Dr. Parsons set up the Analytical Revolving fund in July of 2004. Dr. Tracy Wiegner, Asst. Professor of Marine Science, succeeded Dr. Parsons as the Laboratory Director in January 2006. A graduate research assistant, Trisha Atwood, and an undergraduate research assistant, Ashley Heard, assisted in operating the laboratory in 2007.

The Laboratory's mission is to support research at the University of Hawaii. Our primary focus is supporting Water Quality and Ecological Research. We provide analytical services for researchers throughout

Dr. Michael Parsons and student research asst. Nadine Eisenkolb photograph dinoflagellates using a fluorescent microscope and digital camera.

the University of Hawaii System, as well as federal, state, and county agencies' research projects in Hawaii. We also provide analytical services for visiting researchers from other universities. The researchers using the laboratory span many disciplines at UH Hilo including, Marine Science, Chemistry, Geology, Biology, Agriculture, and the College of Agriculture, Forestry, and Natural Resource Management (CAFNRM). In addition, UH Manoa researchers utilizing the laboratory represent Oceanography, Geology, Botany, and the College of Tropical Agriculture and Human Resources (CTAHR). Federal and State of Hawaii agency users include the USDA Forest Service, USGS-Biological Resources Division, National Park Service, and State of Hawaii Department of Health. As a result of collaborations between UH researches and other universities, the laboratory performs analyses for researchers at Stanford University, University of California-Berkeley, Oregon State University, University of California- Los Angeles (UCLA).

Dr. Marta de Maintenon prepares invertebrate tissue samples for microtome preparation of slides using an automatic tissue processor. The Analytical Facility includes a freeze dryer, autoclave, an E-Pure Reagent Water system and other sample preparation equipment.

We developed a laboratory website (in partnership with the Spatial Data Analysis Laboratory) where services and fees for analytical services are described, as well as an overview of the laboratory and its facilities (http://www.uhh.hawaii.edu/~analab). Laboratory use has increased steadily since 2004 with a doubling of sample volume between 2005 and 2007. Revolving funds support instrument repairs and upgrades, supplies, and salaries for laboratory personnel. The goal is for the Laboratory to be self-sufficient at the end of the current EPSCoR project.

The services provided by the laboratory include

- Nutrient analysis of water samples using a Pulse AutoAnalyzer
- Total organic carbon and nitrogen analysis of water samples with a Shimadzu TOC-V and TNM-1 Analyzer
- Particulate carbon and nitrogen analysis of soil, sediment, plants, and plankton using a Costech Elemental Analyzer
- Stable Isotopic analysis of particulate carbon and nitrogen using a Delta V Advantage mass spectrometer
- Elemental analysis of major and minor elements in water, plants, soils, sediments, and animal tissue using a Varian Vista-MPX ICP spectrometer.

The laboratory also provides educational services by analyzing samples for classes at UH Hilo (Marine Science, Biology, Chemistry, Agriculture, Aquaculture, and the Tropical Conservation Biology and Environmental Science [TCBES] graduate program).

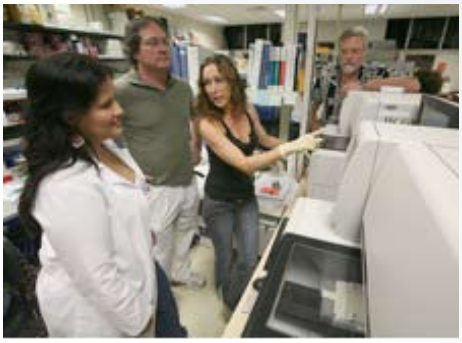
Student research asst. Olivia Lee takes fluorescence readings of dinoflagellate cultures for Dr. Parsons' ciguaterra screening project.

Dr. Tracy Wiegner and student intern Cooper Guest prepare particulate sample for carbon and nitrogen analysis by the Costech Elemental Analyzer.

The Hilo Core Genetics Facility

by Anne Veillet

The Hilo Core Genetics Facility (HCGF) at the University of Hawaii at Hilo was established in 2003 through the IMUA NSF Hawaii EPSCoR grant to improve the science and technology infrastructure of Hawaii. The facility gives researchers, educators, and students the opportunity to gain access to technological services and technical training that may not be otherwise available. The bridges built between faculty and students from both UH Hilo and UH Manoa campuses create an atmosphere of collaboration throughout the University System, improving the scientific recognition of the University, and ultimately the diversification of the economy.



Tatiane Varys, Donald Price, Anne Veillet, and Cam Muir examine the Beckman Coulter CEQ 8000 in the Hilo Core Genetics Facility. This is the main instrument used in sequencing and genotyping in the lab.

The laboratory provides access to a wide variety of equipment and services available for use by UH faculty, staff, and students, as well as other institutions in the area. It also supports researchers doing preliminary research to help with grant applications. The facility provides DNA sequencing, genotyping services such as SNP, tRFLP, STR, and Real-Time PCR.

The Hilo facility functions as a support lab, containing instruments for various molecular biological uses, including CEQ 8000 Genetic Analysis Systems, microarray, PCR and Real-Time PCR thermocyclers, centrifuges, electrophoresis systems, a NanoDrop specrophotometer, and Revco freezers for storage. In addition, reference materials and analytical software are available.

Usha Herold, undergraduate laboratory assistant in her senior year (major Agriculture, minor Biology).

The Hilo facility runs workshops and training sessions to introduce current molecular and biotechnological techniques to students, faculty, and researchers as well as elementary and high school teachers. Current workshops include DNA isolation, PCR Basics, Gel Electrophoresis, Microsatellite Basics, DNA Sequencing, Real-time PCR Basics, and Molecular Cloning. Future workshops will introduce technologies such as microarray.

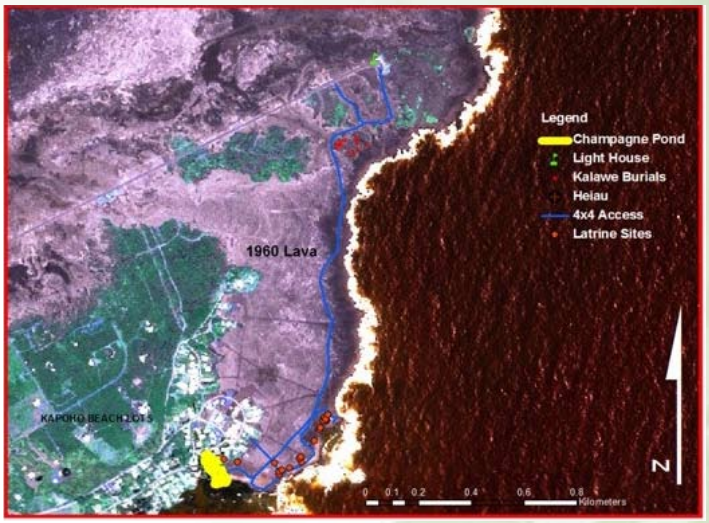
The HCGF is currently collaborating with the following institutions: University of Hawaii at Hilo, University of Hawaii Manoa, Hawaii Community College, United States Geological Survey- Biological Resource Discipline, United States Department of Agriculture, Hawaii State Department of Land and Natural Resources- Division of Aquatic Resources, National Parks Service, Smithsonian Institution, University of California Berkeley, Humboldt State University, Auburn University, Stanford University, and Bishop Museum.

Continued from page 2

SDAL is building on its knowledge transfer successes by hosting the "Spatial Tech Talks -2008" lecture/workshop series this spring. "Spatial Tech Talks -2008" will highlight the analytical software available through SDAL facilities. February featured Definiens eCognition, the software that created the new paradigm of object-based image analysis, with a webinar on the 14th and a hands-on workshop on the 28th. March features ITT ENVI, a premier software solution to quickly, easily, and accurately extract information from geospatial imagery. April's emphasis will be on ESRI ArcGIS and GPS. In May the topic is on Light Detection and Ranging (LIDAR) collection and manipulation. SDAL is also hosting a NOAA workshop on Coastal Applications of ArcGIS for coastal resource managers in March. SDAL also hopes to build and install a GPS base station providing centimeter-level accuracy and real-time correction broadcasts to the greater Hilo community in the next six months.

TCBES graduate student Lauren Pagarigan working in the SDAL research facility with ArcGIS to analyze the surface area of coral skeletons.

SDAL consists of two computer-based facilities: a training lab of 21 workstations and a research lab with five workstations; 15 "outrigger" workstations located in various colleges, departments, and labs about campus; and a Dell Server Complex with 1.6 TB of storage.



Map created by Field Methods in Geography & Environmental Science Fall 2007 class as part of their analysis of the "Natural and Cultural Resource Considerations for Kapoho". Course led by Dr. Jim Juvik and assisted by Kealoha Kinney.

The Lab is supported by a staff of four part-timers: lab manager Lisa Canale, and undergraduate student assistants Augustus Elias, Vladimir Ivanov, and Kohei Miyagi, all UH Hilo Computer Science majors.

The work of SDAL is funded by the Cyberinfrastructure for Environmental Research & Education (CERE) area of the IMUA NSF Hawaii EPSCoR RII grant and overseen by CERE Principle Investigator, Dr. Jené Michaud. If you would like to participate in or learn more about any of the SDAL activities please email the SDAL staff at sdalhelp@hawaii.edu.

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