LCDM Returns Images of Earth

Turning on new satellite instruments is like opening new eyes. In early April, the Landsat Data Continuity Mission (LDCM) released its first images of Earth, collected at 1:40 p.m. EDT on March 18, 2013. The first image shows the meeting of the Great Plains with the Front Ranges of the Rocky Mountains in Wyoming and Colorado. The natural-color image shows the green coniferous forest of the mountains coming down to the dormant brown plains. The cities of Cheyenne, Fort Collins, Loveland, Longmont, Boulder and Denver string out from north to south. Popcorn clouds dot the plains while more complete cloud cover obscures the mountains.

LDCM is a joint mission of NASA and the Department of Interior’s U.S. Geological Survey.

“It’s a really great day,” said Jeff Pedelty, an instrument scientist at NASA’s Goddard Space Flight Center in Greenbelt, Md., who worked on the LDCM Operational...continued on page 4

This is a Landsat Data Continuity Mission (LDCM) image of the area around Fort Collins, Colo. Horsetooth Reservoir lies west of the city. A dark wildfire burn scar from the Galena Fire is visible just to the left of the reservoir. Credit: USGS/NASA Earth Observatory

President’s Message

Our 2013 Annual Meeting is coming up on May 3-4, at California State University, Long Beach http://scas.nhm.org/annual-meeting/. The meeting will take place at the University Student Union.

We have two fabulous plenary speakers lined up for this year’s meeting. Dr. Alan Miller, Professor Emeritus at California State University, Long Beach will be the speaker on Friday. The title of his talk is “Decadal Monitoring of Intertidal Invertebrates: Questions, Answers, Questions”. Dr. William Ailor of The Aerospace Corporation will be the speaker on Saturday. His title is “Defending Earth from Asteroids”. There will be multiple symposia on both...continued on page 6

Election Results:
SCAS Board 2013-2016

The results of the election for the 2013-2016 term of the Board of the Southern California Academy of Sciences are as follows:

Three incumbent members, Ann Dalkey, Julianne Kalman Passarelli, and Edith Read, have been re-elected to the SCAS Board. Two new members, Lisa E. Collins and Danny Tang, will join them. Please congratulate the 2013-2016 Board!

See you at the Annual Meeting.
FROM THE SUSTAINABILITY DESK...

NEW METHODS PROPOSED TO ESTIMATE AVIAN & BAT MORTALITY AT WIND ENERGY FACILITIES

BERKELEY, CA — A study released in February 2013 by the California Wind Energy Association (CalWEA) found that equations commonly used to estimate total bird and bat fatalities from sampling performed at wind energy facilities can produce widely varying results using the same input data. The equations’ results were found to differ by up to a factor of four, with some equations tending to have a negative bias while others showing a consistently positive bias, both carrying the potential to generate results that differ significantly from actual mortality.

The study developed a new equation that, paired with new field sampling protocols, is able to produce unbiased results.

“This research provides the basis for a statistically sound, standardized approach to assess impacts from wind energy facilities,” said Nancy Rader, CalWEA Executive Director. “The new methods will also enable meaningful industry-average and industry-total mortality figures to be generated, which was previously not possible without substantial bias,” she said.

The report cautions against continued use of former estimating equations particularly in conditions that produce levels of bias unacceptable for intended purposes, such as with short fieldsampling intervals.

The study, “Improving Methods for Estimating Fatality of Birds and Bats at Wind Energy Facilities,” was funded by a grant from the California Energy Commission’s Research and Development program and matching funds from the U.S. Fish and Wildlife Service. The principal investigators of the research effort were Dr. Bill Warren-Hicks, currently with Cardno-Entrix, and Dr. Jim Newman of Normandeau Associates.

Dr. Robert Wolpert, a professor of Statistical Science and Environmental Sciences & Policy at Duke University and Elected Fellow of the American Statistical Association and the Institute of Mathematical Statistics known for his work on probability theory and the foundations of both Bayesian and Frequentist Statistical Science, developed the new estimating equation.

The report and a recording of a public webinar presentation on the results are available at CalWEA’s website: www.calwea.org.

GENETICALLY MODIFIED E. COLI BACTERIA CAN NOW SYNTHESIZE DIESEL FUEL

Over the past few decades, researchers have developed biofuels derived from a remarkable variety of organisms—soybeans, corn, algae, rice and even fungi. Whether synthesized into ethanol or biodiesel, though, all of these fuels suffer from the same limitation: They have to be refined and blended with heavy amounts of conventional, petroleum-based fuels to run in existing engines.

Though this is far from the only current problem with biofuels, a new approach by researchers from the University of Exeter in the UK appears to solve at least this particular issue with one fell swoop. As they write today in an article in Proceedings of the National Academy of Sciences, the team has genetically engineered E. coli bacteria to produce molecules that are interchangeable to the ones in diesel fuels already sold commercially. The products of this bacteria, if generated on a large-scale, could theoretically go directly into the millions of car and truck engines currently running on diesel worldwide—without the need to be blended with petroleum-based diesel.

The group, led by John Love, accomplished the feat by mixing and matching genes from several different bacteria species and inserting them into the E. coli used in the experiment. These genes each code for particular enzymes, so when the genes are inserted into the E. coli, the bacteria gains the ability to perform the same metabolic reactions that those enzymes perform in each of the donor bacteria species.

By carefully selecting and combining metabolic reactions, the researchers built an artificial chemical pathway piece-by-piece. Through this pathway, the genetically modified E. coli growing and reproducing in a petri dish filled with a high-fat broth were able to absorb fat molecules, convert them into hydrocarbons and excrete them as a waste product.

Hydrocarbons are the basis for all petroleum-based fuels, and the particular molecules they engineered the E. coli to produce are the same ones present in commercial diesel fuels. So far, they’ve only produced tiny quantities of this bacterial biodiesel, but if they were able to grow these bacteria on a massive scale and extract their hydrocarbon products, they’d have a ready-made diesel fuel. Of course, it remains to be seen whether fuel produced in this way will be able to compete in terms of cost with conventional diesel.
SCAS RTP Graduate’s Continuing Research: Studying Penguins in South Africa

by Bonnie Lei

“It seems to me that the natural world is the greatest source of excitement; the greatest source of visual beauty; the greatest source of intellectual interest. It is the greatest source of so much in life that makes life worth living.” —David Attenborough

“It’s practically impossible to look at a penguin and be angry.” —Joe Moore

I was incredibly lucky to have begun dabbling in research on sea slugs as early as freshman year of high school with the Southern California Academy of Sciences Research Training Program (SCAS RTP). Working alongside my mentor Dr. Angel Valdes of Cal Poly Pomona, and having invaluable opportunities such as presenting my research at the American Association for the Advancement of Sciences (AAAS) annual meetings in Chicago and San Diego, I realized early on I had a passion for marine biology research. Ever since then, I knew I would pursue studies in environmental and conservation biology. And what better way to do that than through glorious first-hand, mucking-through-the-mud, in-the-field research?

When I was a kid, whenever adults asked me what I wanted to do when I grew up, my answer was, “I want to live with the penguins.” This past summer, I found an opportunity to do just that and intern with biologists at the University of Cape Town, South Africa, to study the thermoregulatory behavior of African penguins on their colony on Bird Island. The highlight of this experience was living on an island off the coast of South Africa with one fellow scientist and the largest breeding population of endangered African penguins in the world.

Let me clarify now that although adult penguins are cute as they waddle with happy bellies full of fish, and their chicks are adorable balls of gray fluff begging to be cuddled, looks can be deceiving! Their beaks are razor sharp, designed to tear through flesh, and those powerful flippers of theirs—so efficient at propelling the birds underwater—are also well designed for smacking errant researchers. But I loved them, and I loved the field work. Every day we measured the temperature of different nests and areas on the island and monitored the thermoregulatory behavior (such as panting or raising wings) exhibited. I would walk around the entire island perimeter, keeping bird counts and looking out for predated penguin eggs, and even had time to indulge in some en plein air watercolor painting. I participated in a penguin rescue effort when the largest storm in several years blew in with gale force winds. I was living my childhood dream and exploring my future.

I have seen the difficulties (mosquitoes, no showers for a week, canned beans...again!) and immense joys (convincing local fishermen to join the conservation efforts, running through the storm to bring an abandoned chick back safely) that come with a life of research. I feel so grateful that being involved in SCAS RTP helped me find my passion for this field so early on, and I cannot wait to see what further adventures await me!

Author Bonnie Lei describing her experiences studying African penguins off the coast of South Africa in summer 2012. Photo: Kris Snibbe, Harvard Staff Photographer

Do you know a budding young scientist who might want to join SCAS’ Research Training Program? A program application is inserted in this newsletter—the application deadline is June 1, 2013! For more information please contact Dan Guthrie at dnguthrie@jsd.claremont.edu or Gloria Takahashi at myopick@aol.com.
Land Imager, or OLI instrument, that took the natural color image. He's very impressed with the level of detail they can see with the advancements to the sensor. "It's wonderful to see, there's no doubt about it, and it's a relief to know that this is going to work wonderfully in orbit."

The natural color image showed the landscape in the colors our eyes would see, but Landsat sensors also have the ability to see wavelengths of light that our eyes cannot see. LDCM sees eleven bands within the electromagnetic spectrum, the range of wavelengths of light. OLI collects light reflected from Earth's surface in nine of these bands. Wavelengths on the shorter side include the visible blue, green, and red bands. Wavelengths on the longer side include the near infrared and shortwave infrared. LDCM's second instrument, the Thermal Infrared Sensor (TIRS) detects light emitted from the surface in two even longer wavelengths called the thermal infrared. The intensity of the emitted light at the longer wavelengths measured by TIRS is a function of surface temperature. In the black-and-white image of the first thermal band on TIRS, warmer areas on the surface are brighter while cooler areas are dark.

The first thermal images seen by Dennis Reuter, TIRS instrument scientist at Goddard, were forwarded to him from the data processors. "To say it was exciting was an understatement," said Reuter, who was blown away by the data quality. "Wow! This is beautiful!" he wrote in an email. "Look at those amazing clouds! And the detail!"

Clouds in the colder upper atmosphere stand out as black in stark contrast to a warmer ground surface background. The TIRS images were collected at exactly the same time and place as the OLI data, so all eleven bands can be used together.

The infrared bands on both TIRS and OLI complement the visible bands, said Reuter. "You're seeing things in the visible that you don't necessarily see in the infrared, and vice versa," he said.

Different characteristics on the ground dictate the intensity of the reflection and emission of light in different bands from the surface, ultimately allowing scientists to distinguish between different surface features. To highlight differences across an image, analysts sometimes assign artificial colors to data from different spectral bands for display.

For example, zooming in to the area around Fort Collins, Colo., the natural color image was created from OLI bands 2 (blue), 3 (green), and 4 (red) data. In the image, a dark stripe can be seen just west of the Horsetooth Reservoir, a source of drinking water for the city. The stripe is a scar left in the aftermath of the Galena wildfire. That same burned area bursts out of the image as a bright, rusty red scar with greater contrast between the surrounding areas in the false color image. The false color image was created using data from OLI bands 3 (green), 5 (near infrared), and 7 (short wave infrared 2), assigned the colors blue, green and red respectively. These types of LDCM images and the accompanying data will be used by multi-agency Burned Area Emergency Response teams to plan and carry out wildfire recovery measures.

Similarly, the thermal bands that detect wavelengths dependent on surface temperature show more than just high altitude clouds. This ability to measure differences in temperature across the land surface is essential to one of the major applications of LDCM data: water management. Analysts in western states will use TIRS data in conjunction with OLI data to determine the amount of water being used in irrigated agricultural fields.

Note to Landsat data users: This scene is slightly off set from the standard Path 33, Row 32 Landsat scene as LDCM has not yet reached its nominal 438-mile (705-kilometer) operational orbit.

"When you water plants they take it in through their roots and it comes up to their leaves, and if they have a plentiful water supply, they
transpire,” said Reuter. Transpiration, as well as evaporation from the soil, means that the water goes back into the atmosphere.

“It’s just like when we sweat, we cool down. [Plants] cool down when they have a lot of water,” said Reuter. “It’s a beautiful illustration of the physics of radiative transfer and also the usefulness of the data.” This application of LDCM data will be essential to the effective management of scarce water resources in our arid and semi-arid states.

Both Reuter and Pedelty were impressed with the level of detail they see in the OLI and TIRS data. Part of that detail comes from the push broom design of both instruments. Instead of instruments that scan back and forth across a swath on the ground, push broom data collection looks across whole swath at once, allowing the sensors to observe each patch of ground longer.

“It’s like taking a thermometer and letting it sit there longer to get a more stable measurement,” said Reuter.

But the work is only beginning for validating the data quality and getting ready for normal mission operations. These images were processed using pre-launch settings, which must be checked and adjusted now that LDCM is in orbit to ensure that the data accurately measure the intensity of reflected and emitted light received by the instruments. The mission operations team also needs to ensure that each pixel is accurately located on Earth's surface.

Among the first activities planned in the next two months are reference checks for both OLI and TIRS. OLI will look indirectly at the sun with its solar diffuser panel.

“We let the sun shine on the panel so it makes a bright uniform target and we image that,” said Pedelty, who adds that while it may seem mundane compared to an image of Earth, it’s a key reference measurement for updating OLI’s calibration.

In addition, for both OLI and TIRS calibration, LDCM will view deserts, the ocean and the moon, surfaces with relatively stable and well-known reflectance and emittance properties. The mission operations team also plans to fly underneath the currently orbiting Landsat 7 to collect data at the same time in order to cross-calibrate the two LDCM sensors with the Landsat 7 Enhanced Thematic Mapper-Plus (ETM+) instrument.

“Everything has been very exciting,” said Reuter. These first images are the culmination of a lot of hard work from the people at NASA and USGS, the Landsat Science Team and their industry partners at Ball Aerospace Corp. in Boulder, Colo., that built OLI, and Orbital Science Corp. of Gilbert, Ariz., that built and tested the spacecraft, he said.

“As a tool for science, for looking at the whole planet and seeing how we’re affecting it, and how it’s affecting us, it’s gratifying in all ways.”

LDCM’s normal operations are scheduled to begin in late May when the instruments have been calibrated and the spacecraft has been fully checked out. At that time, NASA will hand over control of the satellite to the USGS, which will operate the satellite throughout its planned five-year mission life. The satellite will be renamed Landsat 8, and data from OLI and TIRS will be processed and added to the Landsat Data Archive at the Earth Resources Observation and Science Center in South Dakota, where it will be distributed for free over the Internet.

SOURCE: www.nasa.gov
President’s Message, Cont.

days (Friday: Sustainable Fisheries, Parasitology, Rocky Reefs, SCAMIT, and Geography; Saturday: Urban Beach Ecology, Archaeology, and Paleontology) and contributed paper talks will also occur on both days. The evening poster session will be on Friday from 5–7pm. Also, our Junior Academy students in the Research Training Program (RTP) will be presenting on Saturday.

A tour of the Los Cerritos Wetlands will be held on Saturday, May 4 from 3:30 to 5:00pm. This is an opportunity to see wetlands that are within an urban-industrial setting featuring tour guides that are experts in a variety of topics. We would like to thank Eric Zahn of Tidal Influence (http://www.tidalinfluence.com) for helping organize the tour and for donating his time. To learn more about the restoration efforts of Los Cerritos Wetlands visit http://www.intoloscerritoswetlands.org. Details on the tour will be provided at the Annual Meeting. Space is limited and will be allocated on receipt of payment with registration. Do not forget to add the TOUR when registering!

Our new website http://scas.nhm.org is up and running and I hope that you have found it easy to use. You now have the ability to register for the annual meeting online and can pay using PayPal. Membership renewal is also now available on our website. Our website is hosted under the Natural History Museum of Los Angeles County and we are grateful to the Museum and hope to continue our long standing relationship. I would also like to thank our Board of Directors webmaster Shelly Moore for all her hard work (Shelly, you are the best!). Please let myself or Shelly know if you have any suggestions for the future of our website.

As the President of the SCAS Board of Directors, and on behalf of the Board, I would like to take the opportunity to thank all of the members, past and present, for your support of the Academy. I would also like to thank my co-organizer of the annual meeting - Bengt Allen, the plenary speakers - Dr. Alan Miller and Dr. William Ailor, all the symposia organizers, and the members of the Board for their contributions and hard work.

Please encourage your colleagues and students to attend the annual meeting! Thank you and I hope to see you at the meeting.

Julianne Kalman Passarelli, President

FYI: Future Annual Meeting Locations

California State University Channel Islands, May 2014
Loyola Marymount University, May 2015
California State University Northridge, May 2016

GMO E. coli Synthesizes Diesel Fuel, Cont.

Additionally, energy never comes from thin air—and the energy contained within this bacterial fuel mostly originates in the broth of fatty acids that the bacteria are grown on. As a result, depending on the source of these fatty acids, this new fuel could be subject to some of the same criticisms leveled at biofuels currently in production.

For one, there’s the argument that converting food (whether corn, soybeans or other crops) into fuel causes ripple effects in global food market, increasing the volatility of food prices, as a UN study from last year found. Additionally, if the goal of developing new fuels is to fight climate change, many biofuels fall dramatically short, despite their environmentally-friendly image. Using ethanol made from corn (the most widely used biofuel in the U.S.), for example, is likely no better than burning conventional gasoline in terms of carbon emissions, and maybe actually be worse, due to all the energy that goes into growing the crop and processing it into fuel.

Whether this new bacteria-derived diesel suffers from these same problems largely depends upon what sort of fatty acid source is eventually used to grow the bacteria on a commercial scale—whether it would by synthesized from a potential food crop (say, corn or soy oil), or whether it could come from a presently-overlooked energy source. But the new approach already has one major advantage: Just the steps needed to refine other biofuels so they can be used in engines use energy and generate carbon emissions. By skipping these steps, the new bacterial biodiesel could be an energy efficient fuel choice from the start.

Springtime brings carpets of colorful spring blooms to large areas of California. Many of these areas are relatively unknown, visited by only a select few during the peak of color. The wildflower season generally starts with an early spring in the desert regions of southern California, and works its way northward. When the wildflower seasons occur, and how lush they are, depends on the weather and can vary widely from year to year.

The federal Bureau of Land Management (BLM) provides a rough guide to blooming seasons in California, which can be downloaded as a .pdf file (visit the following page: http://www.blm.gov/ca/st/en/prog/recreation/wildflowers.html). However, to avoid disappointment, the latest information on blooming activity can be obtained from the BLM California Field Office managing the area you want to visit.

These are some prime wildflower-viewing areas on public lands managed by BLM California, arranged from south to north:

Eastern Mojave Desert: For more information, contact the Needles Field Office at (760) 326-7000.

Santa Rosa and San Jacinto Mountains National Monument: For more information, contact the Palm Springs- South Coast Field Office at (760) 833-7100 or the Visitor Center in Palm Desert at (760) 862-9984.

Western Mojave Desert: For more information, contact the Ridgecrest Field Office at (760) 384-5400 or the Barstow Field Office at (760) 252-6000.

Eastern Sierra: For more information, contact the Bishop Field Office at (760) 872-5000.

San Joaquin River Gorge, Madera County, and the Carrizo Plain: For more information, contact the Bakersfield Field Office at (661) 391-6000.

West side of the San Joaquin Valley (including the Panoche, Tumey, and Ciervo Hills: For more information, contact the Hollister Field Office at (831) 630-5000.

The Merced River: For more information, contact the Mother Lode Field Office at (916) 941-3101.

Cache Creek: For more information contact the Ukiah Field Office at (707) 468-4000.

The Sacramento River Bend Area, just north of Red Bluff: For more information contact the Redding Field Office at (530) 224-2100.

Blue Door Flat - northeast California, south of Alturas: Contact the Alturas Field Office at (530) 233-4666.
THE LAST WORD

In an effort to regularize the publication of this organ, the editorial board of the Smilodon (in consultation with the SCAS Board of Directors) have decided to revise the aforementioned publication’s production schedule. Going forward, the Smilodon will be published twice annually:

April 15 and November 15

To facilitate this schedule, the following deadlines for receipt of articles/input/photographs/etc. will be adhered to.

Deadlines for April 15 (Spring) issue:

Receipt of articles/input: March 15
Draft Smilodon to Board for review: April 1
Board comments on Draft Smilodon to editor: April 8
Smilodon distributed to membership: April 15

Deadlines for November 15 (Autumn) issue:

Receipt of articles/input: October 15
Draft Smilodon to Board for review: November 1
Board comments on Draft Smilodon to editor: November 8
Smilodon distributed to membership: November 15

If you have any questions or concerns about this schedule, or better yet, if you have content to provide (this can be an abstract of a paper or presentation you are working on, an idea you want to share or receive feedback on, an essay on a field experience that was singular and noteworthy, a particularly good photo you want to share...), please contact sgraff@psomas.com or bblood@psomas.com. Thank you!