



UNIVERSITY OF CALIFORNIA, SANTA BARBARA






At the University of California, Santa Barbara, we envision a future where we have little to no impact on the environment, and everyone is engaged in sustainability. We are committed to fostering a culture of sustainability through campus-wide sustainability efforts, program development, and promulgating the sustainability work of staff, faculty, and students – our greatest renewable resource. UCSB strives to capitalize on our position as an institution of higher education to ensure that all students understand the interconnectedness of environmental, economic, and social systems and to communicate that we each have a role to play in sustainability.

More specifically, we aim to research, create, and implement solutions for a more sustainable future. We want all students graduating from UCSB to be motivated to integrate sustainability into their future professions, embedding sustainability throughout the workforce. We envision that all members of our campus community will have access to healthy foods and lifestyles and will be able to meet their needs today and in the future with minimal impact on the needs of others. Finally, UC Santa Barbara continues to seek to do business with companies that are integrating sustainability into their strategic planning and operations, as well as assisting their workers in meeting their own needs. Thus, we believe that building sustainable partnerships will result in a stronger local economy.

In order to achieve this vision, UC Santa Barbara continues to prioritize and monitor the implementation and progress of its sustainability initiatives. We encourage and coordinate the efforts of our faculty, staff, and students who are the front line of positive change by taking action today for a better tomorrow. By working with all sectors of the campus community, we look forward to helping UCSB maintain its leadership and attain its shared vision of a sustainable future.



Mo Lovegreen
Director, Campus Sustainability, UCSB

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LEED FOR HOMES

UC Santa Barbara is **Building** a More Sustainable Campus

Leadership in Energy and Environmental Design (LEED) certifications are given by the US Green Building Council (USGBC) to recognize institutions for their remarkable efforts to identify and implement practical and measurable green building design, construction, operations, and maintenance solutions. The LEED program distinguishes its recipients as those who demonstrate “leadership, innovation, environmental stewardship, and social responsibility.” UC Santa Barbara seeks to provide education and to use its resources to transform the campus design, development, construction, and modification process to ensure an environmentally responsible built environment.

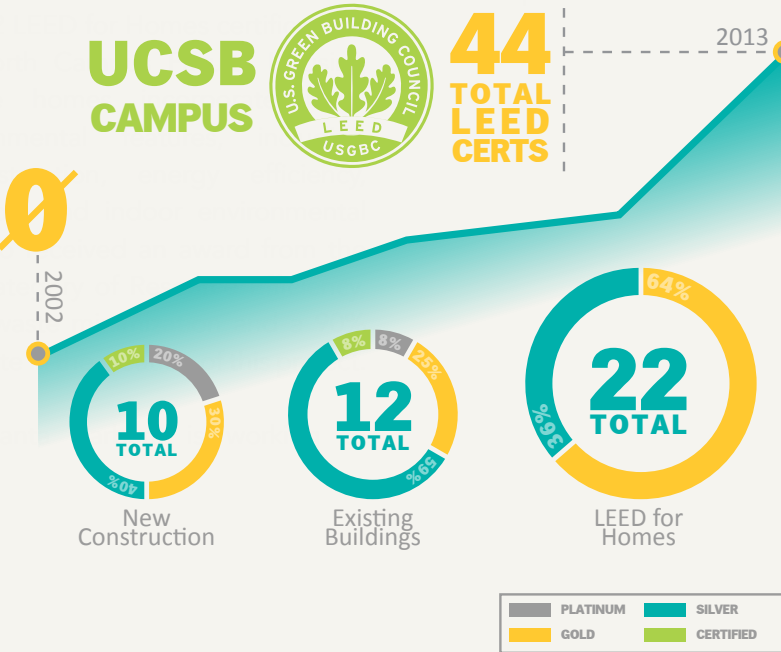
UCSB currently holds 44 LEED certifications. In 2012, two LEED-EBOM (Existing Buildings: Operations and Maintenance) Gold certifications were completed for San Clemente Villages and Ellison Hall. This brings the campus total to 12 LEED-EBOM buildings, which is more than any college or university in the nation! The university also increased the LEED minimum rating on campus for new buildings (approved after July 1, 2012) from Silver to Gold, demonstrating UCSB’s effort to go above and beyond what is required to advance the efficiency of its built environment.

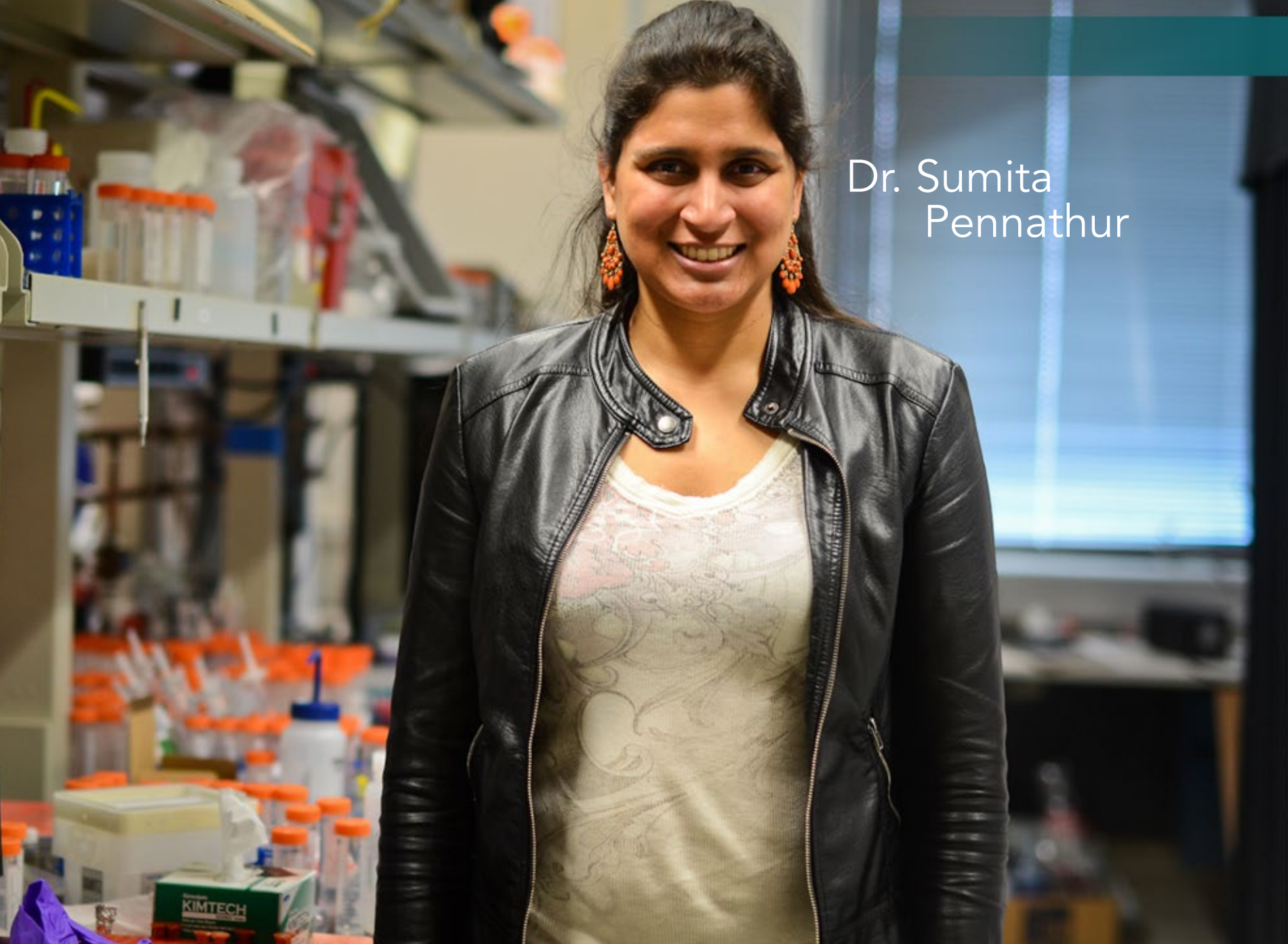
In addition, UCSB has successfully completed the first LEED for Homes project in the UC System. LEED for Homes is a voluntary rating system created by the USGBC that promotes the design and construction of high-performance green homes. UCSB received 22 LEED for Homes certifications for the 2011 North Campus Faculty Housing Phase I. These homes incorporate best-practice environmental features, including sustainable construction, energy efficiency, water conservation, and indoor environmental quality. UCSB also received an award from the USGBC, in the category of Resource Efficiency, for construction waste minimization and a 90%

waste diversion rate in the creation of this project.

Currently, UC Santa Barbara is working to renovate and add to the Davidson Library, while also achieving the campus standard of LEED Gold certification for the building.

UC Santa Barbara’s pursuit and attainment of these LEED certifications exemplifies its dedication to making its campus and the surrounding world more energy efficient. These commitments show that the campus leads by example and is an inspiration to other campuses and communities globally.





Dr. Sumita Pennathur

RESEARCH PROFILE DR. SUMITA PENNATHUR

Sumita Pennathur, a UCSB Professor in the Mechanical Engineering department, researches nanofluidics: the study of the behavior and manipulation of fluids that are confined within spaces 1,000 times smaller than the width of a hair. Pennathur explains, “We work in top-down processes where we’ll take a piece of silicon dioxide (glass) and etch away with precision machines down to the nanoscale. The goal of our research is to eliminate the need for a battery completely.”

Just imagine if you could take a microchip and attach it to the bottom of your shoe. When going on a jog, the pressure applied onto your shoe would convert pressure energy to electrical energy, using the microchip. Rather than charging your cell phone in an electrical socket, you would simply take the chip from the bottom of your shoe and stick it in your phone. Pennathur says that the pressure applied to the chip can be easily attained by putting it on almost anything that could apply force onto the nanofluidic channels within the chip. This pressure could be collected by putting the chip on the tire of a moving car or placed under the bottom of a heavy box. The chip can then be inserted into a cell phone, for example, and, thereby, eliminate the need for batteries. “[With this technology] you would never have to plug your cell phone in again,” Pennathur claims.

The magic of the chip lies within the nanometric channels. Within these narrow passageways, an “electric double layer” forms between electrolytic fluids, such as water, and negatively charged materials, such as glass. Here, the positive ions from the water are

attracted to the negative charge of the glass, creating net charge in the water. By pushing fluid through this tiny channel that has a net charge, ions are moved and a current is generated, essentially creating electricity. “Basically we’re exploiting the electric double layer, which is the spontaneous formation of charge that occurs at the solid-liquid interface,” Pennathur explained.

Dr. Pennathur and her team are in the beginning phases of the process, but the versatile possibilities of nanofluidic-based power could be revolutionary in a world demanding more sustainable technologies. The chip would not only be sustainable, but also practical—people could charge their devices on the go, and communities in developing countries could utilize technologies without access to electrical outlets.

In addition to her research, Pennathur’s values have led to the adoption of a sustainable lifestyle, “I think it’s important for everyone to reduce their energy impact. There are simple things everyone can do, like turning your lights off at night, but there are also the bigger things; the way you design a building can be more efficient.”



CAMPUS WEATHER STATION

UC Santa Barbara is **Combating** Climate Change

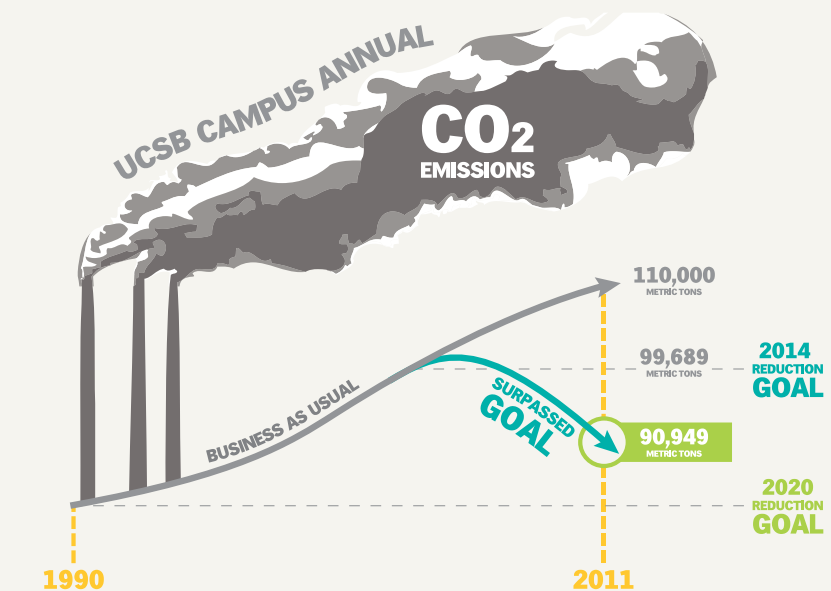
UC Santa Barbara has long been a leader in environmental research and practices. The campus's carbon reduction achievements and targets are outlined in the Climate Action Plan (CAP), which establishes an institutional framework for inventorying, tracking, and strategically reducing greenhouse gas (GHG) emissions, and which is updated on a biennial basis. Specifically, the CAP delineates how UC Santa Barbara will reach its goal to reduce GHG emissions to 1990 levels by the year 2020. We achieved our goal to reduce emissions to 2000 levels by 2014 two years early. Ultimately, UC Santa Barbara aims to attain complete carbon neutrality (meaning zero net impact on the Earth's climate) by the year 2050.

The university has partnered with the State's Investor Owned Utility companies to form the Strategic Energy Partnership. The Partnership was created to reduce reliance on fossil fuels and is doing so through the implementation of lighting and HVAC efficiency projects and upgrades of building systems. In 2011 and 2012, UC Santa Barbara was recognized as "climate efficient" as part of the Southern California Edison (SCE) Cool Planet Project, which is awarded to SCE business customers for their environmental leadership in carbon and energy management.

Meanwhile, student funding has made possible the Student Affairs Zero Net Energy Initiative. The initiative's purpose is to result in zero net purchases from the electrical grid for all eight Student Services buildings, including the heavily visited Student Resource Building and Recreation Center. This initiative is expected to be completed within the next five years.

According to Student Affairs Sustainability Coordinator Andrew Riley, the 425 kW photovoltaic array being built on top of Parking Structure 22 will generate enough energy to "hopefully offset the Student Resource Building's yearly 600,000 kWh energy consumption." Riley is optimistic that the project will be finished in early 2014.

The UC Santa Barbara campus will continue to work alongside its students to combat climate change for a better tomorrow.





Dr. Gretchen
Hofmann

RESEARCH PROFILE DR. GRETCHEN HOFMANN

The ocean is home to some of the most beautifully diverse creatures on the planet. Yet, due to a steady increase in ocean acidification, many creatures are being challenged in a changing ocean. The cause of ocean acidification is a result of the absorption of carbon dioxide (CO_2) into the oceans, and the source of this man-made CO_2 is largely related to burning fossil fuels. After a few chemical reactions, the ocean pH lowers, causing abnormal water acidity.

Dr. Gretchen Hofmann, an eco-physiologist and Professor in the Ecology, Evolution, and Marine Biology (EEMB) department at UC Santa Barbara, is interested in the adaptability of organisms to ocean acidification. In a recent interview, Hofmann explains, "When carbon dioxide is absorbed by seawater, there's a chemical reaction where carbon dioxide interacts with water and forms carbonic acid. There are chemical changes where the concentrations of the protons in the water make the water more acidic...More CO_2 means a lower pH."

When carbon dioxide is dissolved into the oceans, two things happen: it reduces the pH, and it gobbles up carbonate ions which are an important chemical component for building shells of marine invertebrates and skeletons of corals. Steady increases in CO_2 emissions could decrease the ability of organisms to survive successfully and reduce ocean diversity of creatures which rely on carbonate ions to build their shells and skeletons. Hofmann's work investigates an important question: Can organisms adapt to ocean acidification?

Hofmann recently traveled to Antarctica where she monitored the Antarctic pteropod, a small invertebrate known as a "sea butterfly" about the size of the eraser tip of a pencil. The pteropod is one of many organisms that act as an early example of how other sea creatures may be affected when ocean acidity increases. The freezing temperatures of Antarctica cause more carbon dioxide gas to dissolve into the waters, thereby more quickly lowering pH in this area. Antarctica is thought to be one of the first regions that will experience ocean acidification in the future. By studying the affects of ocean acidity in Antarctica, Hofmann's research will provide insight into how ecosystems off the coast of Santa Barbara might react if CO_2 emissions continue to be emitted into our atmosphere.

Hofmann's research forewarns of the depth of the problems that we may soon face. She explains, "pH is a logarithmic scale, so a small change in the number can actually have a really big impact on the biology of our oceans." Although ocean acidification may be anticipated to occur in our oceans, Hofmann's research allows marine biologists to better predict and understand if and how organisms will adapt to changing circumstances.

Hofmann believes that it is important to think about the next energy strategies of this country and how to facilitate next-generation technology. She reflects, "One of the most important things I can do as a scientist is document the study of the impacts of climate change and ocean acidification."



SUSTAINABLE FOOD SERVICE

UC Santa Barbara is **Committed** to Environmentally-Friendly Dining

UC Santa Barbara’s sustainability quest starts with the basis for life – food. UCSB has launched numerous programs aimed at creating a more sustainable campus environment. These efforts include local and sustainable food purchasing, encouraging sustainable eateries on campus, and instilling a culture of sustainable food production and consumption among the student population.

The spirit of sustainability has spread across our campus. Located in UCSB’s University Center (UCen), root 217 is a university owned and operated restaurant designed from the ground up to focus on sustainability from its operations to its menu. In an effort to deliver the best possible food, root 217 has committed to providing a menu composed of fresh, local ingredients. Fan favorites include fresh, sustainably caught seafood and organic veggie burgers. The efforts of root 217 have been acknowledged across the state. In 2011, the UCen received the Higher Education Energy Efficiency and Sustainability Best Practice Award in Sustainable Food Service for this facility.

All of the UCen’s ten facilities and Residential Dining Services’ six facilities (consisting of four dining commons, Concessions, and Catering) were recently Green Business Certified by Santa Barbara County. In addition, all food waste is now composted on campus, increasing diversion from landfill from 20% to over 90%.

In 2012, UCSB Residential Dining Services and UCen Dining Services increased purchases of sustainable food options to 38% of total food purchases, with a goal of 50% by 2015. This year, Residential Dining Services introduced cage-free chicken breasts and replaced conventional milk with 100% certified organic milk. The four dining halls continue to serve grass-fed beef burgers each

week, local and organic produce and organic salad dressings at salad bars, cage free eggs, fair trade coffee, and 100% sustainable seafood. A local distribution hub was formed that provides sustainable produce from farmers within 50 miles of campus - Harvest Santa Barbara (formerly Farmer Direct Produce). Harvest Santa Barbara works closely with UCSB to ensure verification of sustainable cultivation. Residential Dining Services has also partnered with other local farmers and distributors to increase local produce (within 150 miles of campus) to 75% of purchases and to increase organically grown produce to 26% of purchases.

UCSB works to encourage students to make the “greener” choice, both within the dining halls and outside of them. Annual outreach programs have been launched to educate students on environmentally-friendly practices. Events such as Sustainability Week and Nutrition Week are designed to have a long-lasting impact on student diners. In addition, ongoing efforts are made to educate 180 members of the dining staff through educational sustainability tours, including visits to local farms and waste management facilities. These are just some of the many steps taken this year to reach ongoing sustainability goals.



Dr. David Cleveland

RESEARCH PROFILE DR. DAVID CLEVELAND

Santa Barbara County ranks in the top 1% of counties in the U.S. in value of agricultural products, with 80% of that value in fruits and vegetables. Farmers here grow some of the best produce in the country, and organic practices, farmers' markets, and Community Supported Agriculture networks are thriving. To David Cleveland, a professor of Environmental Studies, it seemed as though Santa Barbara County would be a great example of a local food system.

Shipping county produce elsewhere increases the number of food miles, or the farm-to-retail distance. The assumption by advocates is that a local food network would reduce those miles and, therefore, greenhouse gas (GHG) emissions, while also improving nutrition.

Cleveland and his students decided to launch a study of just how "localized" — meaning what is produced here is also consumed here — the agrifood system for fruits and vegetables is in Santa Barbara County and to try to determine the effects of localization on GHG emissions and nutrition. Their results were published in 2011¹.

The researchers found that more than 99% of the produce grown in Santa Barbara County is exported, and more than 95% of the produce consumed in the county is imported. The study also found that if all produce consumed here was grown in the county, it would reduce GHG emissions by less than 1% of total agrifood system emissions, and it would not necessarily affect nutrition.

"Other research has shown that direct transport doesn't contribute that much to greenhouse gases, compared to other parts of the agrifood life cycle," Corie Radka, Environmental Studies and EEMB graduate and second author of the study, added. "It's called the local food trap. The word 'local' should mean better nutrition and a decrease in greenhouse gases, but that's not necessarily so."

"Localization per se is not going to change people's access to food," Cleveland said. "Just having the local food there isn't going to change

people's ability to buy it or their ability to cook or prepare it. Again, it's the food trap."

Cleveland and Radka still think localization is important. But their idea of a localized food system doesn't agree with what researchers heard when they interviewed local grocery store managers, who spoke with pride about their "local produce."

"I talked to a manager who was very excited about his local fruit, Santa Maria strawberries," Radka said. "But he said he got all of his strawberries from the warehouse. I asked him where the warehouse was, and he said it's in the Bay Area."

Going local, according to Cleveland, is just a start. "We have to not let local become the goal," he said. "I think that's the take-home lesson of this study. Local has to be a strategy for getting to the real, bigger goals we have."

One aspect that is often overlooked is the extent to which local agriculture is dependent on imported labor. "Localization of the Santa Barbara County agrifood system may be at the price of de-localization of communities in Mexico and Central America," he said.

These results led to further research on how Santa Barbara County could localize agrifood systems in ways that have significant environmental and social benefits. Cleveland's students completed two studies in collaboration with UCSB Residential Dining Services on what kinds of information would influence student food choices with decreased GHG emissions and on the development of a successful local food hub. Cleveland is now working with students to understand the potential for household and community gardens in Santa Barbara County to produce vegetables in ways that reduce GHG emissions and how climate change could motivate people to garden.

1 Cleveland, D.A., Radka, C.N., Müller, N.M., Watson, T.D., Rekstein, N.J., Wright, H.v.M., and Hollingshead, S.E. 2011. The effect of localizing fruit and vegetable consumption on greenhouse gas emissions and nutrition, Santa Barbara County. Environmental Science & Technology 45:4555-4562 1.



A.S. RECYCLING ROUTE RIDERS

UC Santa Barbara is **Implementing** a Zero-Waste Policy

UC Santa Barbara's Waste Diversion Plan was implemented in the summer of 2012 to achieve University-wide waste diversion targets of 75% by 2012 and zero-waste (95% or better diversion) by 2020. The Waste Diversion Plan, drafted by the Waste Change Agent Team, details UC Santa Barbara's commitment to reducing, reusing, composting, and recycling waste. This plan is necessary in plotting UCSB's course toward achieving the waste goals set by the UC Office of the President. UCSB looks to increase its waste management efforts by introducing new composting and recycling programs, targeting upstream materials, and expanding pre-existing programs throughout the campus.

In 2009, UCSB's Housing and Residential Services (H&RS) piloted the De La Guerra Composting Project. This project resulted in a 90% reduction of food waste. Following this success, H&RS has extended its composting efforts to include all four dining commons.

In addition, the Compost Pilot Project (CPP) was launched in the winter quarter of 2012 with the help of grant money from The Green Initiative Fund. The project's groundbreaking initiative transforms food waste on campus into compost to foster a complete food-to-food cycle. The UCSB Associated Students (A.S.) Recycling Program added six compost bins to in-place recycling receptacles to divert the university's food waste from the landfill. With the launch of the project, volunteers from the CPP, the Program for the Assessment and Certification for the Environment and Sustainability (PACES), and the Environmental Affairs Board collected and sorted 800 pounds of compost from the six locations on campus. Volunteers were able to accurately determine that only 8.32% of the 800 pounds of compost was non-compostable.

As well as educating students about the positive results from composting, the Compost Pilot Project publicizes and supports the University Center (UCen) in its effort to integrate compostable service ware into all UCen eateries across campus.

Now, over one year later, the successfully implemented Compost Pilot Project has resulted in the creation of the Zero Waste Committee (ZWC) and its Towels2Trees paper towel compost project. ZWC co-chair, Lauren Menzer, stated, "Targeting a large waste source, Towels2Trees will both divert more waste than ever before from the landfills and increase awareness with wide exposure in multiple areas." The Compost Pilot Project, in coordination with Towels2Trees, will help educate the campus and ultimately communicate, collaborate, and connect the community with UCSB's zero-waste goals.

UCSB has also remained committed to practicing and promoting responsible recycling measures. The A.S. Recycling Program employs route riders that service bins across the campus, including 100 bins for landfill, recyclables, and office pack. Recently, UCSB has replaced several conventional waste receptacles with solar powered waste compactors in more trafficked areas like The Arbor. The University Center has also introduced post-consumer composting in its first floor dining area.



Dr. Frank Leibfarth

RESEARCH PROFILE DR. FRANK LEIBFARTH

Frank Leibfarth, a recent Chemistry PhD graduate, along with his colleagues in the Materials Research Laboratory of UCSB, investigated how to best reclaim value-added materials in bioplastics (polymers made from biomass). Bioplastics are being used in restaurants, grocery stores, and even in cell phones and copy machines. Seven percent of fossil fuel, a non-renewable resource, is used for the production of plastics, necessitating alternatives based on renewable resources.

Polymerized lactic acid (PLA) is one common form of bioplastic, which Leibfarth studied. "It's way more compostable than other plastics. Once there becomes a critical mass of this polymer being used, people are going to want to actually recycle it to get these useful materials out." The PLA packaging market annual growth is close to 19% with a projected market value of around \$3.8 billion by 2016. It's the fastest growing market segment of bioplastics, making it cost competitive with petroleum-based plastics. In an industry where Americans go through 14 million tons of plastic food packaging annually, these materials can have a big impact.

Polymerized lactic acid can be composted; however, there is currently very little composting infrastructure in the many places where PLA packaging is sold. Compounding these issues, trash is packed tightly together in a landfill and limits oxygen exposure, thus causing long degradation times for PLA materials. In lieu of composting, the current technology for recycling PLA relies on strong acids or bases and high temperatures, which results in high energy use and is not economically practical.

Leibfarth's research team created a catalysis process to break down polylactide into chemical products that can be reused. Their innovative approach only takes approximately 10 minutes at room temperature. It uses an organocatalyst molecule and ethanol to depolymerize the PLA, breaking down the long chains of polymer into individual molecules.

One product of this process is ethyl lactate, a liquid commonly used by the cosmetic and food industry as a component in wine, cosmetics, perfumes, and degreasers and which can be used as food additives, solvents, fragrances, and plasticizers. Ethyl lactate is a non-toxic preservative and is also used as an alternative to more toxic industrial solvents, such as chlorinated and halogenated solvents. "If we can take people's garbage and make ethyl lactate, we're extending the lifecycle of this non-petroleum based material" said Leibfarth.

The recycling process that Leibfarth's group engineered also creates methyl lactate, an industrial commodity used to make flavors, fragrances, and dyes. Methyl lactate can also be used as a starting material for producing pharmaceuticals.

Leibfarth and other polymer scientists see prospects in the chemical afterlife beyond single-use plastics. Lactate esters are just the beginning, and polylactide is just one of many biomass-based materials.

"The entire lifecycle of biomass to plastic to value-added materials could be extended," added Leibfarth. "People think of recycling as producing an imperfect or less valuable product from used plastics, but we can take many kinds of plastic and turn them into new materials that are equally useful and valuable."

Leibfarth and his team also mentor undergraduates who are able to experiment with polylactides in the laboratories at UCSB. In the future, he plans to implement the research into a short lab course for high school students.



WATER ACTION PLAN TEAM

UC Santa Barbara is **Working** to Use Less Water

UCSB's water use statistics demonstrate its dedication to water conservation and sustainability. Potable water use on campus in 2012 decreased for the fourth year in a row. Water consumption for the 2011/12 academic year is the lowest on record, with a 51% reduction from UCSB's three-year baseline. This enabled UC Santa Barbara to surpass the 2020 policy goal of 20% reduction in potable water set by the University of California Office of the President (UCOP) nine years early.

UCSB is the first UC to develop a Water Action Plan that evaluates water use and provides strategies for reducing water consumption. It provides holistic insights and solutions for various types of water: potable, non-potable, reclaimed, wastewater, stormwater, and gray water. UCSB won the Best Practice Award in the category of Water Efficiency and Site Water Quality for its Water Action Plan at the 2013 California Higher Education Sustainability Conference.

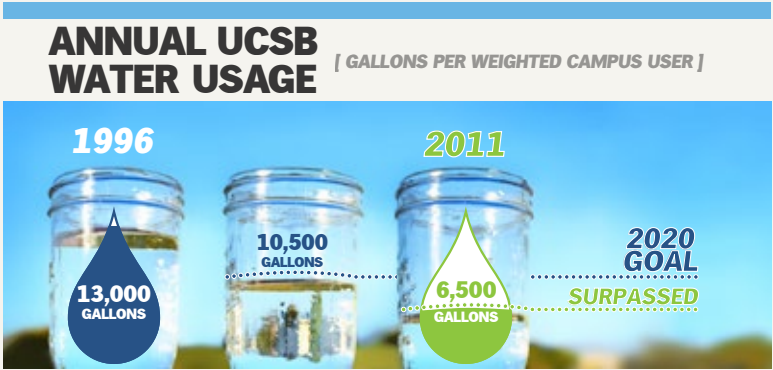
UCSB staff collaborated with students from the Bren School of Environmental Science & Management to produce the Water Action Plan. The project doubled as the students' master's thesis. They collected and analyzed water data to help shape recommendations, giving them the opportunity to implement their academic experiences in the field. Another academic dimension of the Water Action Plan is the inclusion of goals to embed an understanding of the watershed into the curriculum, as well as new demonstration projects that could be used by researchers and by the campus. These features turn UCSB into a living laboratory, a key part of the university's mission to enrich students' educational experience.

Through its many proactive conservation practices, it appears feasible for UCSB to reduce potable water consumption by an additional 20% over the next 15 years, averaging close to a 7% reduction at each Five Year Water Action Plan Assessment. As the university continues

the installation of low-flow water fixtures, such as faucet aerators, showerheads, toilets, urinals, and sprinklers, the prediction of 7% reduction per five years becomes very realistic.

While the university has already achieved success regarding the UCOP mandate, it is committed to remaining a leader in water conservation. With the Water Action Plan in place, UC Santa Barbara is on its way to reduce an additional 20% of potable water by 2028.

Consistent with the goal of maximizing sustainability, the Water Action Plan is designed to be a transferable model. UC Santa Barbara has shared its experiences and findings with other institutions in order to achieve sustainable development across the board. Many aspects of the plan will be exportable to other universities in the UC system and beyond. This project is fundamentally about long-term solutions and investment.





Dr. Arturo Keller

RESEARCH PROFILE DR. ARTURO KELLER

Many professors on campus are working on nanotechnology research; however, Dr. Keller has focused on a different spin—is what we’re working on safe in the first place?

Keller and the University of California’s Center for Environmental Implications of Nanotechnology (UC CEIN) are researching how nanoparticles may be a potential danger to humans when they enter water and soil systems. Nanoparticles are pervasive, existing in paints, cosmetics, electronics, medical materials, and automotive parts. These remarkably small particles are used to make these products, and, “after their use, most of these nanomaterials will end up in landfills, but a fraction is likely to be emitted to soils, water bodies, and the atmosphere,” Keller explains. People are excited about the prospects nanotechnology will have on the world, but many companies have not completed the extensive safety tests necessary to see if the accumulation of nanoparticles over long portions of time could have critical implications for human and ecological prosperity.

Keller explains that the threat of a nanoparticle is determined mainly by the concentration of the particles: “By determining how likely one would be exposed, and how toxic the nanoparticle is, we can decide if this is going to be a significant problem as we use nanomaterials more.”

The results of Keller’s work offer a short sigh of relief: “Of the nanoparticles that are toxic, so far, we have discovered that the exposure level is low. Most people are only exposed to parts per billion (ppb), so we don’t believe that at this point anyone is being exposed to high concentrations of nanoparticles.”

However, Keller made sure to clarify that a lingering potential danger remains. “The risk would be being exposed to high concentrations [of nanoparticles] such as in the air...if you breathe nanoparticles, they

can be toxic and affect one’s lungs, and some may have an effect on your kidney and liver.”

Keller and his colleagues at the UC CEIN also explore the effects of nanoparticles on other organisms, such as plant life. He mentions that nanoparticles are toxic to some bacteria which are important in terms of making nutrients available for plants. Nanoparticles can accumulate in plant tissue, so they can “move up” the food chain. In addition, nanoparticle accumulation can occur within organisms that ingest particles. Oysters and mussels feed by filtering small food particles out of water. In doing so, they are exposed to more nanoparticles. Dr. Keller explains, “[Nanoparticles] can be toxic to these animals and aquatic organisms at concentrations of a few milligrams per liter.” If particles are released into the ocean, organisms such as mussels may feed on the nanoparticles. When the particles are excreted, they are deposited into ocean sediment and are consumed by organisms on the ocean floor, creating an unavoidable cycle—unless some technology is developed to remove them from the environment, which is not yet available.

Due to the incredibly small size of the particles that they study, Keller and his team work closely with the California Nanoscience Institute and the Materials Research Laboratory to use their tools to look at nanoparticles. Keller believes that his work is a step toward becoming more aware of any possible consequences that may occur in a world increasingly using the advantages of nanotechnology. As a response to this rapidly developing science, Keller aims to help scientists understand the risks of this novel technology and assist material scientists and manufacturing companies design safer nanomaterials.



Society is looking to universities to display leadership in finding solutions to our most threatening environmental problems and to take responsibility for educating the next generation in creating a sustainable future. In order for UC Santa Barbara to answer this charge, we must examine our own operations.

UC Santa Barbara aims to reduce our impact on the environment, even as we add more students and buildings to our campus. Our 2010 Long Range Development Plan (LRDP) is a document that identifies and describes the physical development needed to achieve the campus' academic goals through 2025. The LRDP plans to house 100% of additional students (50% of total students) on campus and build nearly 1,800 housing units for faculty and staff. Sustainability has been incorporated into the LRDP, and one of its goals is to meet the campus community's housing need and to reduce transportation impacts.

UC Santa Barbara also advocates offering opportunities to underrepresented populations on our campus to come together and address sustainability challenges. UCSB achieved a perfect score in the Diversity and Affordability section of the STARS rating system for its commitment to diversity and increasing its pool of underrepresented scholars. The sustainability movement, nationally and on our campus, could still improve greatly in engaging people of color and diversifying the movement. During the 2012/13 academic year, the Cooking Coalition brought together environmental, social justice and healthy living organizations to begin offering cooking demonstrations that integrate the considerations of healthy, environmentally-preferred, and budget-conscious food sourcing and preparation. Through partnerships such as this, we have a great ability and opportunity to diversify our efforts.

Finally, as part of a sustainable future, UCSB promotes the well-being of humankind. A sustainable food system is dependent on the accessibility of healthy, fresh, and local options. To date, the Associated Students (A.S.) Food Bank has provided food for over 1,600 students during over 12,000 visits, with a growing number of graduate and international students using the program. Currently, the A.S. Food Bank is investigating the feasibility of integrating a refrigeration unit that would allow them to expand into offering fresh sustainable produce.

With all of these initiatives and many others, UCSB is taking action today to create a sustainable tomorrow.

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