

CA&ES OUTLOOK

A publication for alumni and friends of the College of Agricultural and Environmental Sciences • UC Davis • Fall 2006



REINVENTING THE WASTE STREAM



MFROM THE DEANESSAGE

Getting Value from the Waste Stream

We may all look back on 2006 as a pivotal year when increasing energy costs created a major shift in how we view the solid waste stream. Every household and business in California is affected by escalating energy costs. Disposing of waste in landfills is expensive and threatens the environment. The research community here at UC Davis is finding opportunity in these twin challenges.

We are fully engaged in creating the tools and technologies to move society toward an economy that depends on greater use of renewable resources. For instance, research by Professor **John Krochta**, Department of Food Science and Technology, has developed a multi-million dollar industry for whey, a byproduct of cheese making.

Much attention is now focused on biomass -- both as a source of energy and as a source of "bioproducts" that can be used to create everything from construction materials to clothing. Professor **Bryan Jenkins**, Department of Biological and Agricultural Engineering, has taken a leadership role in surveying California's biomass resources from farms, forests, and cities. In this issue of *CA&ES Outlook*, Jenkins explains the growing significance that biomass will play in the state's energy needs.

Basic research on how plant cells behave in the presence of microorganisms and enzymes is crucial to unlocking the potential in biomass. Professor **John Labavitch**, Department of Plant Sciences, and others on campus are conducting research on this.

One of the most exciting projects on campus involves the work of Professor **Ruihong Zhang**, Department of Biological and Agricultural Engineering, whose prototypical Biogas Energy Project has gained international attention. Zhang is pictured on the cover of this issue, along with Jenkins and **Sharon Shoemaker**, director of the California Institute of Food and Agricultural Research (CIFAR). This institute has been at the forefront of fostering dialogue among industry, government, and academia on the emerging "carbohydrate economy."

Our CA&ES heritage is firmly rooted in finding long-term solutions to the resource challenges we face. It's exciting to see how we are creating a new mindset about waste. We will continue to explore the potential in the waste stream to create a more sustainable and economically prosperous future.

Neal K. Van Alfen, Dean
College of Agricultural and
Environmental Sciences

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In This Issue



The Cover

Department of Biological and Agricultural Engineering faculty Ruihong Zhang (left) and Bryan Jenkins (center) join with Sharon Shoemaker (right), California Institute of Food and Agricultural Research, at the Biogas Energy Project designed by Zhang at UC Davis. The three are campus leaders in biomass research and development.

PHOTO BY: John Stumbos

DESIGN BY: Margarita Camarena



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CA&ES scientists are focused on creating value out of waste, thus protecting our environment and resources.



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REINVENTING THE WASTE STREAM

By John Stumbos

More than energy independence emerging from the new “carbohydrate economy”

California has a vast and still largely untapped energy reserve – an estimated 80 million “bone dry” tons of biomass from farms, ranches, forests, and municipalities that can be mined to produce electricity for power plants, biofuels for homes and automobiles, and bioproducts for everyday uses like plastics, solvents, construction materials, even the clothes we wear.

Interest in biomass research and development jumped markedly in 2006 – as Americans continue to wrestle with their “addiction” to oil, gasoline prices shot to new heights, and a searing heat wave once again threatened the state’s power grid. A different world is emerging as we begin to shake the petroleum habit and embrace a more reliable and environmentally sound future that depends on renewable resources. Some see it as a resurgent “carbohydrate economy” that is creating value out of waste.

Whatever you call it, UC Davis has had, and will continue to have, an integral role in its development – in no small measure because of its core strengths in agriculture, plant sciences, biological and agricultural engineering, and related disciplines throughout the campus.

Sizing up biomass resources

California’s biomass resources are extensive – manure from livestock operations; orchard and vine clippings; field residue from seed and vegetable crops; food processing leftovers like winery pomace and yeast cake; forest thinnings, logging slash, and mill residue. Most of it – 40 percent – is contained in municipal solid waste: garbage. We also “import” biomass in the form of packaging from out-of-state sources.

“Not all of these resources can be collected for energy and products,” says biological and agricultural engineering professor **Bryan Jenkins**. “About 30 million tons, half of which are from forestry, are thought to be available on a sustainable basis.”

Additional biomass resources will become available from dedicated energy crops planted to reclaim waterlogged and salt-damaged soils. Research in plant biology and improved conversion processes will further enlarge the role of biomass in the state’s economy. Jenkins has been analyzing the potential in these resources under contract with the California Energy Commission and other sponsors of the statewide California Biomass Collaborative, an organization for which he currently serves as executive director. Collaborative partners include a broad cross-section of individuals in industry, government, academia, and the environmental community. Their charge is to build on policies laid out in the state’s Bioenergy Action Plan and create a “road map” for biomass utilization.



G STREAM

"The state of California and the federal government have ambitious goals for developing alternative energy sources," Jenkins says. "Our role is to help identify what those resources are, what limitations need to be overcome and how best to foster new research, technology development, and education to get us there."

California aims to produce 20 percent of retail electricity sales from renewable resources like biomass in 2010. As electricity demand expands, the amount of biomass needed to meet the state's goals will also grow. If the amount of biomass available in California today were used solely to produce electricity, it could generate about 10 percent of current demand. Jenkins estimates the potential is there to produce 15 percent of the state's electricity by 2017.

Biomass can also play a crucial role in the development of alternatives to imported oil. The federal government set a goal to replace 30 percent of transportation fuels with biofuels by 2030. Ethanol, already used as a motor vehicle fuel additive, will become an increasingly important part of the mix. It could have a major impact in the United States, as it has in other countries. Thirty million dry tons of biomass could be converted into enough biofuel to run more than two million automobiles at today's efficiencies.

Other alternative fuels in development include biodiesel and liquids produced by thermal processing of biomass. These more closely resemble existing gasoline and diesel fuels and could be distributed using existing pipelines and service station fuel dispensers.

"Electricity will also have a role in supplying our transportation energy needs," Jenkins said. "As plug-in hybrids and other transportation technologies emerge over the coming years, there will be an increasing need for multiple energy sources."

Breaking it down

Ethanol production starts with the breakdown of plant biomass into its constituent sugars. One way to create it is similar to the way that wine and beer are made – with microorganisms like yeast and fermentation. The campus is rich with experts who understand fermentation science as nowhere else. **Charles Bamforth**, Anheuser-Busch Endowed Professor of Brewing Science, is a leading authority on wheat and barley biochemistry and one of many who've been identified for inclusion in a campuswide bioenergy research group.

Currently, the nation's limited ethanol production (about four billion gallons a year) is derived from Midwest corn. California's diverse agricultural production and millions of acres of forestland represent a potential biomass bonanza. The grains of corn, barley, wheat, and rice, because they are naturally high in fermentable sugars, can easily be converted to ethanol. But the sugars in the cell walls of agricultural residue like stalks, stems, and stovers are locked up in complex carbohydrates that need to be pretreated before their energy potential can be tapped.

One group of researchers in the Department of Plant Sciences is looking at ways to improve plant biomass for fuel alcohol production. "Conversion of the plant cell wall into fermentable sugars and ultimately into alcohol represents the greatest promise for using biomass as a practical source of energy," says **John Labavitch**, a plant sciences professor who has studied how pathogens and a plant's own enzymes begin the process of breaking down cell walls.

It also represents one of the greatest challenges. "A major impediment to the practical conversion of the plant cell wall is the harsh pretreatments required to release cellulosic polymers," Labavitch adds. He and plant sciences colleagues **Eduardo Blumwald, Alan Bennett, and Ann Powell** are seeking to enhance the way enzymes break down this material through genetic engineering technologies. They are joined in this effort by **Jean VanderGheynst** (Biological and Agricultural Engineering) and researchers at Novozymes, an international leader in enzyme technologies. Other campus scientists are studying cellulose-degrading enzymes and the mechanisms of deconstruction that would help overcome limitations to cellulose conversion.

Garbage in, biogas out

One of the pioneers in developing a viable system to process solid waste and turn it into biogas for energy production is Professor **Ruihong Zhang**, a bioenvironmental engineer in the Department of Biological and Agricultural Engineering. She designed a prototypical "anaerobic digester" that can consume about three tons of organic waste a day and produce enough combustible biogas to generate about 600 kilowatt-hours of electricity per day.

Anaerobic digestion is one of many biomass conversion processes under study at UC Davis. Zhang incorporated innovative design features that enhance the conditions for microbial

degradation and speed up the conversion of organic matter. It doesn't require pretreatment of most feedstocks – one of the main limitations of previous systems. Green waste, food processing wastes, crop residue, and animal waste can all be fed directly into the system.

Among the products produced from anaerobic digestion are methane and hydrogen gases that can be used as fuel. The undigested solids can be turned into organic fertilizer. The process was patented by the university in 2001 and is currently licensed to Onsite Power Systems, which constructed the prototype on the Davis campus and is developing commercial applications of the technology with a wide range of potential clients.

The project has generated a great deal of interest – from food processors like Campbell Soup Company, the nearby Sacramento Municipal Utility District, and the government of Tahiti, whose president personally visited the digester on campus in June. Researchers from nearly a dozen different countries have also visited the site. The facility was formally dedicated in October 2006.

"This technology has proven to be more efficient and more versatile than previous anaerobic digesters," Zhang says. "Our gradual scaling up of this technology is successfully moving it from the research laboratory to commercial applications that will transform solid waste into useful bioproducts."

Right: Biological and Agricultural Engineering Professor Ruihong Zhang loads green waste into the Biogas Energy Project at a dedication ceremony at UC Davis on Oct. 24, 2006. The event was attended by several hundred people, including numerous media outlets. The project began in Zhang's laboratory. The technology is licensed by the university to Onsite Power Systems, which constructed the prototype on campus.



PHOTO: John Stumbos

Bioproducts research

Transforming the waste stream into alternative energy is only part of the story. Throughout the campus you'll find examples of research into bioproducts derived from the waste stream. Innovation with immediate impact has a long tradition here. For instance, food science and technology professor **John Krochta** long ago figured out how to take whey from cheese production and turn it into invisible coatings that preserve the shelf life of fruits and vegetables.

Similarly, processed biomass can create useful compounds such as ethyl lactate that can be transformed into nontoxic "green" solvents and biodegradable plastics. With new membrane-based technologies, ethyl lactate and other chemicals can now be produced more cheaply from carbohydrate-based sources than from petrochemicals. The U.S. Department of Energy estimates the U.S. market for these products is in the billions.

Textiles Professor and Department Chair **You-Lo Hsieh** is researching a new generation of functional fibers affecting the binding capacity of biomolecules that could be used to improve drug delivery, as well as in biotechnology and other biomedical, industrial, and consumer applications. She is also investigating the use of fats and oils to create water-repellent cotton and biofuels. Her colleagues are developing commercial-grade, activated carbon from rice straw. Another project would reclaim farm drainage salts for textile dyeing.

Cultivating a green future

What will it take to make this new green world a reality? Simple economics is part of it. "The emerging technologies in bioenergy are quite promising," says **Andrew Hargadon**, director of the new UC Davis Energy Efficiency Center. "Bioenergy solutions will offer advantages over existing energy sources in niche markets where the cost of bringing in existing fuels and of managing waste streams make bioenergy a commercially feasible alternative."

Those markets may be closer to fruition than many people realize. **Sharon Shoemaker**, founder and executive director of the California Institute of Food and Agricultural Research (CIFAR), has been conducting research and tracking developments in biomass conversion technologies for more than 30 years. She cites growing policy and financial support in

government and investment in new technology by industry as very positive signs of needed changes. Recent advances in the development of cost-effective enzymes, new dedicated biomass crops and knowledge of the microorganisms that make bioconversion possible have Shoemaker smiling and saying, "It's about time."

"There's no magic bullet," Shoemaker says.

"Multiple approaches are necessary to utilize biomass resources coming from our farms, forests, and cities. And while much of today's commercial focus is on corn-based bioethanol production, tomorrow's big opportunity will be tailor-made for California's agricultural and food systems."

CIFAR has been instrumental in bringing together experts from throughout government, industry, and academia to keep California on the leading edge of biomass conversion. In September the institute sponsored a conference at UC Davis called "Overcoming the Hurdles of Lignocellulosic Biofuels" – the central challenge to freeing the potential in much of California's biomass energy reserve.

UC Davis is accelerating its commitment to reengineering solid "waste" into an energy resource. Fourteen new faculty positions are being recruited for the campus Energy for the Future Initiative. CA&ES continues to bring nationally recognized investigators to campus to facilitate dialogue and stimulate new research projects among faculty.

"The bar has been set high," Shoemaker says.

"But UC Davis is in a prime position to help society move away from its petroleum dependency to the emerging new carbohydrate economy." ■

Additional resources:

California Biomass Collaborative
<http://biomass.ucdavis.edu>

California Institute for Food and Agricultural Research
www.cifar.ucdavis.edu

California Energy Commission
www.energy.ca.gov

Department of Energy's Biomass Program
<http://www1.eere.energy.gov/biomass>

Department of Energy's "Genomes to Life" Project
www.doegenomestolife.org

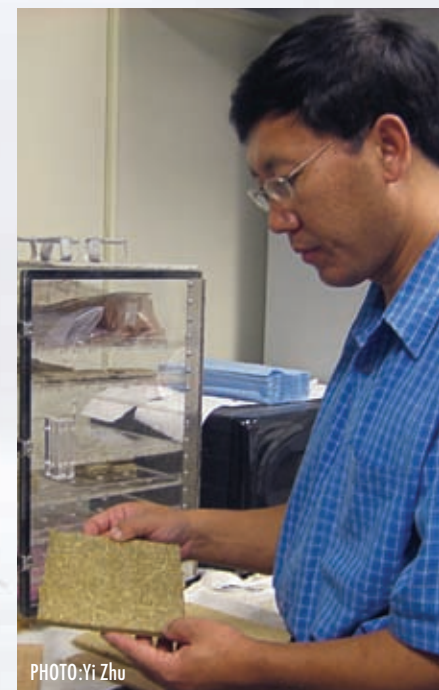


PHOTO: Yi Zhu

Building Better Bioboard

Zhongli Pan, an adjunct professor in the Department of Biological and Agricultural Engineering, is developing bioproducts from agricultural waste. One of the limitations to greater use of rice straw in construction materials like particleboard is the cost of adhesives. The adhesives needed to bind agricultural materials together are different – and more expensive – than those used for wood-based particleboard. Pan has developed a patent-pending adhesive formulated from rice bran that will overcome this obstacle. The adhesive also can be used with other types of field waste like wheat straw.



FACULTY SPOTLIGHT

PHOTO: John Stumbos

Above: Genetics graduate student Ying Peng (left) studies disease resistance in rice under the direction of plant pathology professor Pamela Ronald (right).

By John Stumbos

Schoolchildren learn the art in science

Imagine a national system of biorefineries to supply fuel for Americans. That's the idea behind a great deal of biomass research under way in many areas of the country. The U.S. Department of Agriculture has identified switchgrass (*Panicum virgatum* L.), a perennial plant native to North America's prairies, as a suitable candidate to help feed this biofuel infrastructure.

CA&ES Professor **Pamela Ronald**, Department of Plant Pathology, wants to adapt the same genetic approaches she is using to make improvements in rice to lay the groundwork for improvements in switchgrass. She also sees an opportunity to educate youth about their energy future while teaching them about science and stimulating their creativity.

Ronald plans to build on an existing National Science Foundation-supported program at Cesar Chavez Elementary School in Davis. For two years, graduate student **Becky Bart** and local artist **Ruth Santer** have visited fourth- and fifth-grade classrooms to explain rice genetics. Hands-on activities included botanical drawings and discussions on plant genetics and grass evolution.

Student artwork was incorporated into a Picnic Day exhibit in the UC Davis Plant Genomics Building. Parents and students were able to

see the artwork in place. Ronald is now raising funds to incorporate a bioenergy aspect into the outreach program.

"Sustained and regular art instruction hones the skills required to conceptualize, execute, and analyze a science project," Ronald says. "Production of energy from biomass, instead of fossil fuels, will reduce the net emission of greenhouse gases. If we can teach this concept to children at an early age, it will influence them for the rest of their lives." ■

Right: Davis artist Ruth Santer points out plant detail to Cesar Chavez Elementary School student Jacob Muller. Art helps school children learn science more effectively.



PHOTO: Pamela Ronald

FACULTY NOTES

International Research Medal

Richard Bohart, professor emeritus of entomology and namesake of the R.M. Bohart Museum of Entomology on campus, received the International Society of Hymenopterists Distinguished Research Medal, one of only three ever awarded. During his career, Bohart identified more than one million mosquitoes and wasps, authored 230 publications, and wrote six books on mosquitoes and wasps. The coveted medal has been given only to Bohart, Charles Michener at the University of Kansas, Lawrence, and Zdenek Boucek at the Natural History Museum, London. Bohart retired in 1979 from the Department of Entomology.

The Bohart Museum, founded in 1946 and dedicated to teaching, research, and service, houses seven million specimens in its worldwide collection. Located at 1124 Academic Surge, it has the seventh largest insect collection in North America and the second largest university collection, after Harvard.

Food Safety and Security

Linda Harris, a specialist in Cooperative Extension in the Department of Food Science and Technology, has been named associate director of science and research at the UC Davis Western Institute for Food Safety and Security (WIFSS). Harris is a leader in research aimed at addressing issues related to foodborne pathogens. Her research on food safety issues of importance to the fruit, vegetable, and nut industries has been used to guide growers, consumers, and the food industry in safer handling and preparation methods for these products.

Harris and **Jerry Gillespie**, director of WIFSS, address issues such as foodborne pathogens, food safety, *E. coli*, agroterrorism, and international health concerns. Visit WIFSS at <http://wifss.ucdavis.edu>.



PHOTO: Lorena Ramirez

Boosting Iron in Infants

Just a two-minute delay in clamping a baby's umbilical cord can boost the child's iron reserves and prevent anemia for months, according to a report by nutrition professor **Kathryn Dewey** and graduate student **Camila Chaparro**.

Iron deficiency is a concern for both wealthy and poor nations. It is a problem particularly in developing countries, where half of all children become anemic during their first year, putting them at risk of developmental problems that may not be reversible, even with iron treatments.

"By simply delaying cord clamping for this brief time, we can provide the infant with the extra blood, and the iron it contains, from the placenta," said Dewey, an expert in maternal and infant nutrition, who conducted the study at an obstetrical hospital in Mexico City. "This is an efficient, low-cost way to intervene at birth without harm to the infant or the mother." More on this study: http://www.news.ucdavis.edu/search/news_detail.lasso?id=7729.

Left: Camila Chaparro, Aurora Villares, Isabel Ángel, Santiago Estrada, and Nadia Altamirano, left to right, at Hospital Gineco Obstetrica #4 "Luis Castelazo Ayala" del Instituto Mexicano del Seguro Social, in Mexico City.

FACULTY

AROUND *The College*

Right: Charles Bamforth, chair of the Department of Food Science and Technology, at the pilot brewing opening.

New Pilot Brewery in Food Science and Technology



The 'ceremonial mash' of grains and hot water was the highlight of the grand opening of the updated pilot brewery in the Department of Food Science and Technology in Cruess Hall earlier this year. New equipment for the pilot brewery was acquired over the past several years, with assistance in design and installation from Anheuser-Busch brewing company.

The department's premier brewing science program, which offers a doctoral degree, is one of the top few worldwide. **Charles Bamforth** is chair of the food science and technology department and is the Anheuser-Busch Endowed Professor of Malting and Companies.

Several representatives from Anheuser-Busch were at the opening, along with faculty, staff, and students in the food science and technology department. Anheuser-Busch is also supporting the construction of a brewing and food-processing laboratory in the new Robert Mondavi Institute for Wine and Food Science on campus.

Agricultural Sustainability Institute has a Director

Thomas Tomich, an agricultural economist with a doctorate in food systems research, has been selected to lead UC Davis' new Agricultural Sustainability Institute and the statewide UC Agriculture and Natural Resources' Sustainable Agriculture Research and Education Program. In connection with his appointment, Tomich has been named professor and first holder of the

UC Davis W.K. Kellogg Endowed Chair in Sustainable Food Systems.

The new Agricultural Sustainability Institute draws together several programs in the College of Agricultural and Environmental Sciences and other campuswide faculty whose research and teaching interests include plant and animal sciences, pest and disease sciences, natural resource conservation, food science and nutrition, economics, sociology, education, agricultural and environmental policy, and community development.

"We are fortunate to have Tom Tomich assume this new and exciting position," said **Neal Van Alfen**, dean of the College of Agricultural and Environmental Sciences. "He has an international perspective and an appreciation of California agriculture, and shares our vision for establishing UC Davis and the UC system as an international hub for research and training in sustainable agriculture."

According to Tomich, "The UC system, and the Davis campus in particular, can play a central role in developing the scientific foundations for sustainable agriculture in California and for the planet. To me, sustainability means a healthy bottom line for farmers, thriving rural communities, wholesome and nutritious food, and a healthy environment."

Entomology Has New Chair

Walter Leal, a professor of entomology who is internationally known for his research on chemical ecology and how insects detect smells, is the new chair of the Department of Entomology. He replaces interim chair **Robert Washino**. Leal is a fellow of the American Association for the Advancement of Science. Entomology professors **Frank Zalom** and **Thomas Scott** are vice chairs of the department. ■

HAPPENINGS

Students Learn Organic Vegetable Farming at Campus Market Garden

By John Stumbos

Tucked away on the western edge of campus is a four-acre parcel of ground that gives students practical experience in organic vegetable farming – the Market Garden at the Student Farm.

Produce from the year-round operation is sold to the ASUCD Coffee House and to students, staff, and faculty through a community-supported agriculture project. Depending on the time of the year, visitors might see gypsy peppers, pak choy, grapes, Rosita eggplant, broccoli, vine-ripened tomatoes, and watermelon.

Students like **Catherine Dilley**, pictured below right, leading a fall 2006 tour of the garden, are involved in all phases of vegetable production and marketing. They grow transplants in a greenhouse, seed crops into the field, learn about irrigation, control pests organically, and harvest and market the end product. The Market Garden also participates in university research projects.

Adjacent to the farm is a composting operation fed by organic waste from the Coffee House and campus dining halls. Straw from campus animal barns also makes its way into the compost heap. Learning to tend compost and encourage its use has been a valuable educational experience for biological engineering students like **Derek Downey** (right). "I've learned more from this than I have just about anything else," he said. "You're dealing with people and giving presentations. I used to be really shy."



PHOTO: John Stumbos

Dilley is a graduate student in the international agricultural development group. She is preparing for field work in the social and cultural impacts of agricultural development internationally and in the U.S.



PHOTO: John Stumbos

Since its inception in 1977, the Student Farm has grown to serve a broad cross-section of the campus community with information about sustainable agriculture. Leadership of the Student Farm is provided by Director **Mark Van Horn**, while the market garden and CSA project are managed by **Raoul Adamchak**.

To learn more about the market garden and related activities, visit <http://studentfarm.ucdavis.edu>. ■



PHOTO: John Stumbos

Left: Freshly turned compost at the Student Farm.

HAPPENINGS

GS



PHOTO: Ellen Zagory

RESEARCH *SPOTLIGHT*

Above: A Washington hawthorn tree in the UC Davis Arboretum.

By Ellen Zagory, Director of Horticulture, UC Davis Arboretum

Focus on Sustainable Landscapes

While many alumni and visitors to campus view the UC Davis Arboretum as the jewel of the campus, or just a pleasant place to picnic, the arboretum plays a pivotal role in educating the public and horticultural professionals about sustainable landscapes.

Through its All-Star program, new garden developments, and new exhibits, the public will have exciting opportunities to learn how to incorporate sustainable gardening practices into their own gardens, thereby becoming environmental stewards of their own small piece of California.

Work is under way on new exhibits for the Ruth Risdon Storer Garden, featuring best plants and gardening practices for Central Valley gardens. This project highlights sustainable garden practices such as composting and recycling of garden waste, using least-toxic pesticides to prevent watershed contamination and conserve beneficial insects, and using water conservation techniques such as mulches and drip irrigation systems to reduce water loss.

A comparison of various irrigation systems is being built into the display for visitors interested in the pros and cons of different methods of irrigation water delivery. California native

plants are highlighted in displays throughout the arboretum because of their importance as nectar, pollen, fruit, and larval food sources for native insects and birds.

Individual signs highlighting arboretum All-Star selections are part of the project. These plants, picked by staff horticulturists for their ability to survive hot, dry conditions with less water were also selected based on aesthetic merit, low maintenance needs, and wildlife value.

After visiting this garden, visitors will have a greater appreciation for the beauty and value of drought-tolerant, low-impact gardens, will learn the best plants for low-water gardening, and will learn how to grow these plants successfully. Using this information they will be better able to create their own, drought-tolerant, low-input, and more-sustainable landscapes.

The next time you find yourself on the UC Davis campus, plan an hour or two to stroll through the arboretum -- from the Storer Garden on the west end of campus to the Arboretum Terrace Garden in downtown Davis -- and enjoy not only the beauty and serenity of nature at its finest, but learn about tried-and-true gardening practices that promote healthy and stable environments.

To learn more about the arboretum's All-Star plants, its many educational programs, and other events and activities, visit the arboretum's Web site at www.arboretum.ucdavis.edu. ■

RESEARCH ^{NOTES}

RESEARCH

Chevron to Fund Biofuels Research

UC Davis and Chevron Corp. announced a new partnership in September that will fund up to \$25 million in campus research over the next five years to develop affordable, renewable transportation fuels from farm and forest residues, urban wastes, and crops grown specifically for energy.

The research will span a wide range of variables -- everything from genetics to thermochemical reactions to economics. California's huge agricultural industry could be a key source of the raw material for new biofuels.

Once developed, next-generation processing technology will allow locally grown biomass to be harvested, processed into transportation fuels, and distributed to consumers.

Researchers hope to take biofuels beyond conventional fuel feedstocks to the much larger energy source of "lignocellulosic materials" -- the matter that makes up plant stems, leaves, trunks, and branches. Food farming and processing already produce excess cellulose biomass that could become biofuels.

We could one day be driving on fuels made from leftover rice straw, wheat straw, orchard tree prunings, nutshells, fruit pits, and wine-grape skins and seeds.

For more detailed information about the Chevron grant, you can access a UC Davis news release at www.news.ucdavis.edu/search/news_detail.lasso?id=7873. ■

In Memoriam

Orville Thompson
Professor Emeritus,
Human and Community Development
October 2006

Robert Feeney
Professor Emeritus,
Food Science and Technology
September 2006

Ted Bradshaw
Professor,
Human and Community Development
August 2006

Robert Brazelton
CE Specialist (retired),
Biological and Agricultural Engineering
June 2006

Harold Olmo
Professor Emeritus,
Viticulture and Enology
June 2006

Robert Price
CE Specialist (retired),
Food Science and Technology
June 2006

William Hamilton III
Professor Emeritus,
Environmental Science and Policy
April 2006

Robert Fridley
Professor Emeritus,
Biological and Agricultural Engineering
March 2006

Bert Lear
Professor Emeritus,
Plant Pathology
November 2005

Anton Kofranek
Professor Emeritus,
Plant Sciences
March 2006

Royce Bringhurst
Professor Emeritus,
Plant Sciences
November 2005

Ellen Sutter
Professor,
Plant Sciences
November 2005

Robert Laben
Professor Emeritus,
Animal Science
August 2005

Frank Murrill
CE Specialist (retired),
Animal Science
June 2005

Harlan Pratt
Professor Emeritus,
Plant Sciences
September 2005

Carol Rodning
Professor Emeritus,
Human and Community Development
January 2005

George "Andy" McClelland
Professor Emeritus,
Entomology
January 2005

Duane Mikkelsen
Professor Emeritus,
Plant Sciences
November 2004



PHOTO: John Stumbos

MAKING A DIFFERENCE

By Christine Schmidt

Planned Gift Will Support Student Farm

Supporters of UC Davis come from many places. Many are grateful alumni and parents. Others benefit from the university's research. Others are community members who value the university's contributions.

Doug and **Alice Margraf** fit into this latter category. The couple has taken a creative approach to their gift planning, with each choosing an important cause to include in their estate plans. Alice chose to support UC Davis' MIND Institute. Doug chose to support two programs in the College of Agricultural and Environmental Sciences' Agricultural Sustainability Institute: the Long-Term Research in Agricultural Systems project (a 100-year farming experiment to investigate long-term sustainability) and the Student Farm.

It is UC Davis' practical approach to agricultural sustainability that Doug Margraf wants to support with his gift. Doug is a retired instructional aide from Sierra College (Rocklin, Calif.), where he taught forestry and other natural resource courses. An avid gardener, Doug has always loved growing things but has become worried about the future of California agriculture. He realizes that California's land use patterns often devalue the importance of food production.

The Student Farm has a strong focus on the "food system," a big picture view of our food supply. Topics include food production, distribution, and healthfulness. The Student Farm was founded in 1977 and serves UC Davis students, along with faculty, farmers, gardeners, school children, and others. The program harnesses student leadership and creativity to learn about, develop, and experiment with sustainable agricultural practices. As with many other issues tackled by UC Davis, waste reduction is an important component of sustainability.

For more than 20 years, the Student Farm has collected organic material from campus animal facilities and kitchen scraps from the campus food facilities. Every day, more than 1,000 pounds of waste is collected. In collaboration with other student leadership organizations, the Student Farm turns this waste into several tons of high-quality compost each year, which serves as a key component in building the fertility of the Student Farm's soils, including in its Market Garden program and research fields.

UC Davis is grateful to Doug and Alice Margraf for their thoughtfulness and generosity.

For More Information:

Student Farm: Mark Van Horn, (530) 752-7645, or mxvanhorn@ucdavis.edu

Giving: Christine Schmidt, (530) 752-6414, or cmschmidt@ucdavis.edu. ■

By Melissa Haworth

Reducing Waste While Feeding the Hungry

Passionate is the perfect adjective to describe **Harold McClarty**, a California fruit grower. When he talks about the qualities of a perfect piece of fruit, Harold's excitement is infectious -- but his passion extends far beyond the quality of his product to the way he operates his business.

Harold McClarty's family has been farming in the Central Valley since 1887 and Harold is putting practices in place that will sustain the farm through the next 100 years. He works with UC Davis faculty on cutting-edge environmental practices that focus not just on the fruit but on employees, air and environmental quality, waste reduction, and ultimately the health and safety of the consumer. McClarty says, "I sincerely believe when you want something done right, you call UC Davis first, and when you've got a tough problem, that's who you call."

A decade ago, McClarty pioneered a recyclable, reusable box in which to pack his peaches, thereby reducing the use of nonrecyclable, wax-impregnated cardboard. He also uses integrated pest management, nontillage and cover crop practices, and other environmentally sensitive farming techniques to reduce the impact of his operation on the land.

What might be considered waste elsewhere is put to good use at McClarty Farms. Tree

clippings are mulched and turned back into the soil and fruit too ripe for traditional distribution is sent to California food banks. Nearly 80,000 pounds a week of high quality, fresh fruit help feed the hungry rather than filling the landfill.

McClarty's commitment to the environment stems from a recognition that his actions affect the quality of life not just for his family but for his employees -- who are also his neighbors -- and their families. As he says, "We're doing everything we can because we live here and our neighbors live here and we care about the environment and our quality of life."

UC Davis research supports Harold's efforts to improve the quality and reduce the impact of his operations. In return, Harold and his wife, **Deborah McClarty**, support the campus. They are members of the Davis Chancellor's Club and the College of Agricultural and Environmental Sciences' Dean's Circle. They have also made a gift to support the construction of the Anheuser-Busch Brewing and Food Science Laboratory, part of the Robert Mondavi Institute for Wine and Food Science.

The McClartys, and donors like them, help UC Davis maintain its excellence in the agricultural and environmental sciences. To make a gift to CA&ES, go online at <http://giving.ucdavis.edu> or call Melissa Haworth at (530) 754-8562. ■



Left: Fruit grower Harold McClarty with his harvest.

PHOTO: Melissa Haworth

ALUMNI SPOTLIGHT

Chris Rose -- Habitat Conservationist and Educator

By Richard Engel and Mary Kimball

During his sophomore year at UC Davis, **Chris Rose** was faced with a dilemma. He wanted to explore his interests in the environment, wildlife habitat restoration, and agriculture, all while pursuing a degree in the social sciences. Rose then met **John Anderson**, a local farmer and veterinarian with the UC Davis Primate Research Center, and Chris Rose found his calling.

Anderson was experimenting with creating wildlife-friendly habitats in an agricultural setting on his Hedgerow Farms, near Winters, Calif. Working together, Rose learned farming practices that promote wildlife habitats -- and the value of sharing best management practices with others, especially farmers.

Rose graduated from UC Davis in 1995 with a degree in Political Science/Public Service with an emphasis in Environmental Studies and Policy and a minor in Natural Resources.

Upon graduation, he went to work for the Yolo County Resource Conservation District, working on several ecosystem and vegetation projects.

Rose's knowledge of conservation practices, as well as agricultural production systems, enabled him to facilitate communication among irrigation districts, government agencies, high school students, farmers and ranchers, and nonprofit organizations to enhance environmental sustainability through agriculture.

Chris Rose now serves as chief habitat restorationist for Audubon California's Landowner Stewardship Program. He manages more than 45 habitat restoration projects with Sacramento Valley landowners. He also helps students in the Student and Landowner Education and Watershed Stewardship Program adopt restoration sites. Including students in habitat conservation projects helps promote a better understanding of the interface between agriculture, the environment, and our growing population.

Since his days at UC Davis, Rose has recognized the need to be an advocate for agricultural and environmental sustainability. Recognizing the value of his UC Davis education, Rose said, "Dr. David Campbell's local government class had a huge impact on my direction. His class infused sustainable agriculture, community development, and natural resource management with local governance."

Chris Rose exemplifies the ideals of the learning, discovery, and engagement missions of UC Davis in the agricultural and environmental sciences.

Richard Engel is director of college relations for CA&ES, and Mary Kimball is director of the Center for Land-based Learning in Winters, Calif. ■

Below: Chris Rose conducting field work.



Pamela Tom - Seafood Education Program Manager

By John Stumbos

Pamela Tom knows noses. The UC Davis alumna (B.S., '71, Home Economics; M.S. '75, Consumer Science) helps train people in the art of assessing seafood quality with the most sensitive of instruments – the human nose.

"More than 80 percent of the seafood we consume in the United States is imported," Tom says. "Seafood importers and government regulators accept no compromises on safety or quality, so this kind of training is vital."

Tom has helped educate the public about a wide range of seafood safety issues with the California Sea Grant Extension Program for more than 20 years. One of her more interesting projects is with federal experts or "noses" to show seafood industry professionals how to spot early signs of spoilage. They've held workshops in California, other coastal states, and more recently in Thailand and Vietnam – much of our seafood comes from Asia. Attendees are taught how to rate tuna, mahi, shrimp, and other seafood on a numerical scale.

"The extraordinary sensitivity of the human nose is the easiest, quickest, and most reliable method to measure seafood quality," Tom says.

She had her sights set on becoming a teacher as an undergraduate but eventually became interested in food safety issues and earned her master's degree in consumer science.

Margaret Rucker, a professor in the Division of Textiles and Clothing, recalls Tom as "a bright and diligent student."

"Peg was very helpful to me," Tom said. "I was the first on both sides of my family to get

a master's degree. I came from a bilingual environment and my English skills were poor. It was Peg who helped me and showed me how to write better and guided me through the process. She was wonderful. I was her first graduate student."

Tom was also one of the first Asian females hired by Cooperative Extension. In her 32 years with UC Davis, she's worked with several food scientists and communicators – **Marie Ferree**, **Christine Bruhn**, **Robert Pearl**, and **Robert Price**. From her office in Cruess Hall at UC Davis, Tom manages a comprehensive seafood Web site (the Seafood Network Information Center) that has helped earn her numerous state, national, and international awards.

"I did not foresee my career path unfolding as it has," Tom said, "but making sure our seafood is safe is very rewarding. I'm grateful for the wonderful people I've worked with in academia, industry, and government, providing an essential public service on behalf of the university." ■

Below: An interest in food safety issues helped guide Pamela Tom into a career in seafood education. She works with industry "noses" and runs a highly regarded Web site for the California Sea Grant Extension Program.



PHOTO: John Stumbos

ALUMNI NOTES

'73

Michael Savage ('73, Soil and Water Science; M.S., '78, Civil Engineering), of Irvine, Calif., is a senior vice president and water resources manager with Camp Dresser & McKee. He and his wife, Patti, have been married for 29 years.

'76

Stephen Krebs ('76, Plant Science; M.S., '77, Horticulture; Ph.D., '95, Agricultural Ecology) has chaired the Viticulture and Winery Technology program at Napa Valley College since 1986.

Michal C. Moore, Ph.D. (M.S., '76, Ecology, Agricultural Economics), is a research fellow with the University of Calgary in Alberta, Canada.

'79

Dan Hoyt ('79, Environmental Planning & Management) is an associate vice president with Costa Pacific Communities, based in Portland, Ore. His company develops smart growth communities in the Northwest and California. Hoyt has three children.

'87

Kristine Hayes Gagliardi ('87, Zoology), based in the Bay Area, is vice president of Accuray Incorporated, a company that makes medical equipment for cancer patients.

'92

Kristen (Paulsen) Pickus ('92, EPAP) is the director of Planning Services for the Davis, Calif., office of Moore Iacofano Goltsman, a planning, design, management, and communications firm. She and her husband, **Derek** ('94, Psychology), have a two-year-old son.

'96

Liz Warren ('96; Ph.D., '03, Physiology) is the deputy project scientist for artificial gravity at NASA's Johnson Space Center in Houston, Texas. She investigates the use of centrifugation

'96 *continued...*

to ameliorate the deconditioning effects of bed rest, a spaceflight analog.

'97

David Johnston (Ph.D., '97, Food Science) is a research food technologist with the USDA's Agricultural Research Service (ARS) in Wyndmoor, Pa. He was awarded the Herbert L. Rothbart Outstanding Early Career Research Scientist of the Year, the highest honor presented by ARS to early career scientists.

Greg Price ('97, Design) and **Suzanna (Martinez) Price** ('06, Human and Community Development) of West Sacramento, Calif., welcomed the birth of their daughter, Audrey, in April 2006.

'99

'01

Ming-Wai Chen ('01, Biotechnology) is a research associate with MedImmune, Inc., in Gaithersburg, Md.

'04

Edward Chu ('01, Managerial Economics) is a trading desk support engineer with Thomas Weisel Partners in San Francisco, Calif.

Matthew Hurley ('04, Environmental and Resource Science) was accepted into the Teach for America corps, and is teaching biology at a Washington, D.C. public school.

'05

Theresa M. (Bertagna) Schneider ('05, Environmental Horticulture & Urban Forestry) is a farm manager for A&J Family Farms in Chico, Calif.

We'd like to hear from you!
Take a moment to drop us a note at outlook@agdean.ucdavis.edu or online at www.caes.ucdavis.edu/newsevents/news/outlook/defaultform.aspx

100 Years of Service

By John Stumbos

CA&ES College Celebration

Eight individuals were honored at the annual College Celebration in October with the highest recognition given by the College of Agricultural and Environmental Sciences – the Award of Distinction. The award is presented to those whose contributions and achievements enrich the college and enhance its ability to provide public service.

“College Celebration is an opportunity to celebrate the advancement and accomplishments of our college, its graduates and friends, and the impact they are having on the world,” Dean Neal Van Alfen said. “We are pleased to be able to give these individuals the public recognition they deserve.”

The 2006 recipients include:

- **Richard Cotta**, president and CEO-elect of California Dairies, Inc. Cotta is an ardent supporter of the college, including the Dean’s Advisory Council, and the animal science department’s Dairy Cattle Day and the Animal Science Development Board.
- **David Hosley**, president and general manager of KVIE public television, is committed to regional planning and helping the community understand the contributions that UC Davis and the college have made to the public.
- **Gary Hudson**, president of Hudson & Associates, serves on the Dean’s Advisory Council, the advisory council for the campus’ Seed Biotechnology Center, and is co-chair of the implementation committee for the new California Center for Urban Horticulture.
- **Bruce Berkman** president and CEO of Pacific GeoPRO in Taiwan, is a UC Davis alumnus, and is devoted to sustainable development and environmental protection and conservation in Asia.
- **Richard Ortega**, mayor of Tulare, Calif., is a retired lifelong dairyman and is a strong advocate for education. He is a charter member of the UC Davis Chancellor’s Club and is a former board member for the Cal Aggie Alumni Association.
- **Herbert Stone**, president of Tragon Corp., is noted for extraordinary professional accomplishments in the food science industry. In his international travels, he promotes the outreach efforts of our college and UC Davis.
- **Carol Cooper**, an undergraduate academic advisor in the Department of Food Science and Technology, has helped countless food science majors complete their academic requirements and prepare for careers and graduate school.
- **Gary Anderson**, a distinguished animal science professor at UC Davis, has received nearly every teaching award offered on the Davis campus. Anderson has also received national awards for his research on embryonic transfer in livestock.

Read more about College Celebration and the Award of Distinction recipients at www.caes.ucdavis.edu/NewsEvents/Events/Celebration/Default.htm. ■

Editor’s Note: This is one of a series of articles highlighting the importance of our alumni, friends, and employees as we reflect on our 100 years of service to Californians and communities worldwide. UC Davis will officially celebrate its centennial in 2008



PHOTO: Margarita Camarena

Left: Pictured with CA&ES Dean Neal Van Alfen (left) and UC Davis Chancellor Larry Vanderhoef (right) are, from left to right, Award of Distinction winners Bruce Berkman, David Hosley, Gary Anderson, Richard Cotta, Gary Hudson, Carol Cooper, Herbert Stone, and Richard Ortega.

JOIN THE CA&ES DEAN'S CIRCLE

"It's what's good about the world," is how Dean's Circle member **Harold McClarty** describes the teaching and research going on at UC Davis. The same could be said about the work he is doing on his family farm in Kingsburg, Calif. (see p. 15 for details).

Research being done at UC Davis to develop environmentally sensitive farming practices has helped Harold improve his family's 120-year-old farming operation and is one of the reasons he, and his wife **Deborah** ('78, Human Development), support the UC Davis College of Agricultural and Environmental Sciences through the Dean's Circle.

You, too, can join the CA&ES Dean's Circle and support research that benefits all Californians and prepares students for productive and prominent careers in agricultural, environmental, and human sciences.

As a CA&ES Dean's Circle donor, your financial support enhances the academic environment for the next generation of Aggies and creates opportunities for our faculty to achieve higher levels of excellence in teaching, research, and public service.

Experience the pride of knowing that your contribution helps to continue the college's 100-year tradition of preparing today's brightest students for tomorrow's successes.

Donors to the CA&ES Dean's Circle are invited to campus events such as the "Dean's Circle Evening Out" and an annual briefing with the dean. Donors also receive recognition in college publications.

The CA&ES Dean's Circle is open to donors who wish to make regular annual gifts of \$1,000 or more to the College of Agricultural and Environmental Sciences. You may designate your gift to one of many CA&ES departments or programs, or give to the unrestricted CA&ES Dean's Circle Fund. Your donation is renewable annually, and your employer's matching gifts count toward the total.

A response envelope is included in this issue of *CA&ES Outlook* so that you can join our prestigious circle of donors now. If you have questions or need more information, please contact Donna Gutierrez at (530) 754-8961 or djgutierrez@ucdavis.edu.

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