



The CENTER for
AGROECOLOGY
& SUSTAINABLE
FOOD SYSTEMS

the Cultivar

The CENTER for AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

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New Farms and Victory Gardens – Apprenticeship Graduates Help Grow the Local Food Movement

Blair Randall wields a trowel in the Civic Center plaza in front of San Francisco’s City Hall. Mike Nolan and Gabe Eggers coax crops from the sagebrush country of southern Colorado. Kelsey Keener, Ryan Power, and Noah Bresler raise vegetables, fruit, and heritage livestock on historic Williams Island near Chattanooga, Tennessee. Amy Rice-Jones manages the brand new Bounty Farm, where she coordinates a team of volunteers growing food for low-income residents of Petaluma, California.

What links these far-flung growers? They all recently honed their skills as students in the Apprenticeship in Ecological Horticulture training course of the Center for Agroecology & Sustainable Food Systems. Like hundreds of other Apprenticeship graduates, these newly minted farmers are helping meet a growing demand for locally produced organic food. And along with growing crops, they’re bringing a unique blend of social awareness, scientific grounding, and the desire to share their knowledge to their work.

MEETING DEMAND, DEVELOPING NEW MARKETS

Whether driven by rising gas and grocery prices, a greater awareness of food’s “carbon footprint,” or a desire to know exactly where their food comes from, more and more consumers are looking closer to home for their produce.

Nolan and Eggers of La Boca Center for Sustainability in Colorado have found a ready audience among the restaurants and grocers of nearby Durango. “We have 20 chefs and stores saying they’ll buy anything we can grow,” says Nolan. Shoppers are just as eager to snap up the fresh greens, beets, brassicas, and other crops that they offer at the weekly farmers’ market. “People are primed for us to be here—there’s a big demand for local food.”

Along with meeting that demand is the need to educate the public about the challenges facing local growers. “We’re trying to get folks to understand seasonality and the limits we have to deal with,” says Nolan. Farming at 6,100 feet, the cropping season is short in the Pine River Valley along the Colorado-New Mexico border. Nolan wryly recalls watching their spring crops of summer squash and green beans disappear under several inches of snow

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Apprenticeship graduate Blair Randall (left) coordinates the community education workshops offered by San Francisco’s Garden for the Environment.

on June 13—and miraculously survive. Now at midsummer, a visitor to La Boca describes “Kale and collards the size of palm fronds, softball kohlrabis, and luscious beds of beets.”

The farming operation at La Boca is part of a 185-acre former homestead now owned by a local land trust. With its mix of cattle, sheep, goats, chickens, llamas, and draft horses, the land offers the potential for an education and research facility that Nolan and his colleagues plan to tailor to local needs.

“Our eventual goal is to create a site that can meet community needs for developing skills to produce food in a sustainable way. We want to have a training program that would be modeled on the CASFS Apprenticeship—which is the best program in the country for this type of education,” says Nolan, who credits the Apprenticeship with giving him the skills to establish a new farming operation in such a challenging environment. “From knowing the best cultivation practices to developing a business plan—without the Apprenticeship I wouldn’t have been able to do this,” he says.

Across the country, 2007 Apprenticeship graduate Ryan Power echoes Nolan’s sentiments: Power, along with fellow graduates Kelsey Keener and Noah Bresler, point to the Apprenticeship as having given them the skills and knowledge to get a farming operation off the ground. “Intuitively, we have confidence from the Apprenticeship. We know we can do it if we use the Farm and Garden as our template,” says Power.

What *Chattanooga Magazine* describes as this “stoic young team of organic farmers” is creating a brand new farm at the mouth of the Tennessee Valley Gorge. The 20-acre site includes 3 acres of vegetables ranging from “arugula to zucchini,” says Power, and features such warmth-loving crops as heirloom tomatoes and melons. The group is also raising heritage breeds of sheep and chickens, along with heirloom varieties of fruit trees.

Local community members are eager to support the Williams Island effort. The farm quickly filled its Community Supported Agriculture (CSA) memberships, a concept that

—like the lemon cucumbers the farmers have introduced—is a new idea to many in the area.

“A lot of folks have never had a CSA before and they love it. We’ll definitely expand our membership next year. Right now we have folks willing to pay just to hold a spot for next season,” says Power. Other outlets include Greenlife Grocery in Chattanooga—“They’ll take anything we can grow,” say the farmers—along with restaurants and a local florist who love the idea of locally produced organic flowers gracing their tables and display cases.

“We take a lot of our marketing philosophy from our Apprenticeship training,” says Power. “Our goal is to produce something that’s very high quality. When I’m marketing I can say with confidence that this is the best quality available because I learned from the best.”

Like many Apprenticeship program graduates, the Williams Island team is eager to share what they’ve learned with others. “We’re going to have interns next year, and our long term goal is to start an apprenticeship program for the south and use more of the island for that,” says Power. For now, they’re working with the nearby Baylor School to introduce high school students to the concepts of sustainable food production, with plans to form educational links with inner-city schools.

TEACHING URBAN FOOD PRODUCTION

If attendance at San Francisco’s Garden for the Environment (GFE) weekly gardening workshops is any indication, growing food close to home—including urban backyards—is an idea that’s caught fire. Blair Randall, a 2005 Apprenticeship graduate, coordinates GFE’s public workshops and manages its one-acre demonstration site. “GFE has offered community workshops for 18 years,” he says, “and this year we’ve seen a 40% jump in enrollment.”

Says Randall, “The public’s appetite has reached a rolling boil for information on how to produce food. And not only that, people are connecting growing food at home to the change they can make for other things they’re concerned about, such as their carbon footprint and global warming.”

The Garden for the Environment is a nonprofit education project of the Haight Ashbury Neighborhood Council. San Francisco’s only organically maintained public demonstration garden, GFE focuses on small-scale urban ecological food production, organic gardening, low water-use landscaping, and urban compost systems.

Through GFE, Randall has found the ideal outlet for sharing his passion for urban food production. “It’s my charge to be a steward for GFE, and to take what I’ve learned through the Apprenticeship and spread it as far and wide and effectively as possible. My goal is to make our public programs accessible to folks who may not know much about gardening.”

Randall acknowledges that gardening in San Francisco presents its own challenges. “Growing food here is a barrelful of conundrums: it’s not hot enough, it’s not cold enough,

Ryan Power



Butternut keeps an eye on the crops at Williams Island Farm in Tennessee .



More than 150 volunteers turned out to plant the Victory Garden in San Francisco's Civic Center Plaza. Food from the garden is being distributed through the San Francisco Food Bank, and the garden will be a centerpiece of this year's Slow Food Nation conference.

the soil is too sandy. Without the technical expertise afforded by the Apprenticeship I wouldn't know what's possible and what's not."

In the past, "what's not" possible would likely have included planting an organic food garden in San Francisco's Civic Center plaza—but a new awareness raised by organizers of the Victory Garden 2008+ program and the upcoming Slow Food Conference was enough to convince Mayor Gavin Newsom to approve the idea.

Says Randall, "Newsom connected Victory Gardens with the idea of gardening at home and larger environmental concerns. A little convincing by folks like Alice Waters probably didn't hurt."

According to GFE's website, "The SF Victory Garden program builds on the successful Victory Garden programs of WWI and WWII but redefines "Victory" in the pressing context of urban sustainability. "Victory" is growing food at home for increased local food security and reducing the food miles associated with the average American meal."

Today the Civic Center boasts more than 4,000 food plants growing in myriad raised beds. As head of the Victory Garden 2008+ effort, Randall is extending the program throughout the city, working with 15 diverse households to install organic gardens in yards, on rooftops, in planter

boxes, and on unused land. For Randall, the project is one more step toward helping the community learn to grow its own food.

ADDRESSING HUNGER WITH LOCAL SOLUTIONS

When the Hub of Petaluma Foundation commissioned a study to address hunger in their community, one recommendation that emerged was to start a farm to provide food for low-income residents and educational opportunities to the community.

Amy Rice-Jones, a 2006 Apprenticeship graduate, recalls her first less-than-promising sight of what is now Petaluma's Bounty Farm. "Last winter it was covered in trash, with a bunch of wooden shacks full of garbage, refrigerators, and computer monitors." But with the help of community members and a local construction company, Rice-Jones has in a matter of months transformed the land into a productive farm at the edge of downtown Petaluma in Sonoma County.

Like her fellow alums, Rice-Jones points to her Apprenticeship training as the reason she was able create a farming operation literally from the ground up. "I would never have been able to start this farm without the Apprenticeship, from the technical skills I learned to the ability to ask the right questions and figure things out on my own. My mentors had such an incredible breadth of knowledge to draw on."

As farm manager, Rice-Jones oversees a bustling site where volunteers and interns help grow and harvest vegetables and flowers from rows of raised beds. This year the marketing effort has focused on raising funds to cover the cost of installing a new well and pump for the farm, as well as providing food for the "Bounty Box" program that serves low-income community members. "Eventually, more and more of the food will support the 'Bounty Box' effort and other programs to alleviate local hunger and malnutrition," says Rice-Jones.

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Courtesy of Bounty Farm

Miranda's family is a member of the "Bounty Box" program serving low-income residents in Petaluma.

from the Director

With food and fuel costs skyrocketing, “going local” and “growing your own” have become the new watchwords in farming and gardening. In our cover story you’ll read about some of the many graduates of the Center’s Apprenticeship in Ecological Horticulture training program who are creating new farms to serve their local communities, and teaching the skills they learned in the Apprenticeship to those who’d like to become more self sufficient.

Also in this issue, we review the burgeoning effort by students, staff and faculty to create “greener” campus food systems (*page 9*). In collaboration with other members of the campus’s Food Systems Working Group, the Center has been at the forefront of this work. This fall, UC Santa Cruz will serve as one of the lead campuses in the rollout of a nationwide “Real Food” campaign, an effort to increase the sustainability of all college and university campus food systems. And a new grant to the Center from the USDA (*page 16*) will help expand research and education efforts on sustainable campus food systems, agricultural literacy, and community food security.

The Center’s on-campus farm continues to serve as an important resource for researchers interested in improving organic farming systems. In our Research Updates (*page 13*) you’ll read about a new study at the UCSC Farm designed to improve tomato flavor while saving on water and nutrient inputs—information that will serve both organic and conventional growers, and has the potential for much broader applications. You’ll also find updates on efforts taking place on the Central Coast to reduce or eliminate pesticide use in strawberry crops both in organic and conventional systems.

For growers looking to refine their cover cropping practices, the report on UCSC Farm manager Jim Leap’s work with cover crop options (*page 7*) offers some ideas. And although it’s important to develop resource-conserving practices, it’s even more critical that growers use them. Understanding more about why growers choose to incorporate cover crops and other conservation practices into their operations is the subject of a recently completed project reported on here (*page 5*). Results of this research, supported in part by a grant from the Center, will help those promoting conservation farming to tailor their efforts to growers’ needs.

From all of us at the Center, we hope you enjoy this issue of *The Cultivar*.

– PATRICIA ALLEN, DIRECTOR

center staff

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The Center for Agroecology & Sustainable Food Systems is located at the University of California, Santa Cruz. Our mission is to increase environmental and social justice in the food and agricultural system. On the UCSC campus, CASFS manages the 3-acre Alan Chadwick Garden and 25-acre UCSC Farm. Both sites are open to the public daily from 8 am – 6 pm year round.

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CASFS, University of California
1156 High Street, Santa Cruz, CA 95064
831.459-4140 or 459-3240 (telephone) 831.459-2799 (fax)
<http://casfs.ucsc.edu>

Study Examines Factors that Influence On-Farm Conservation Practices

Farmers often do much more than grow crops—they may also act as land stewards, working to conserve soil, protect water, and enhance habitat for beneficial insects and wildlife. Since such efforts are often voluntary and don't necessarily add to the bottom line, why would a grower decide to practice—or not to practice—"conservation-based" farming?

That's the question Tara Pisani Gareau sought to answer. A graduate student in UC Santa Cruz's Environmental Studies Department, Pisani Gareau wanted to find out what sort of attitudes, identities, and structural factors (such as income and acreage) affect a grower's decisions when it comes to implementing conservation strategies. Her study was supported in part by a grant from the Center for Agroecology & Sustainable Food Systems.

STUDY DESIGN AND RESULTS

In July of 2007, Pisani Gareau sent an 8-page survey to 600 growers registered in Santa Cruz, Monterey, and San Benito Counties. "The focus of the survey was on growers' experiences with conservation on their ranches and their participation in conservation programs," she says.

With its rich natural resource base, California's Central Coast is a hot spot for such efforts. "The proximity of farmland to sensitive natural areas—particularly wetlands, streams, rivers and other wildlife habitat—makes this an ideal place to develop and promote conservation-based farming practices," says Pisani Gareau. "There is also a growing body of evidence that shows conservation practices also improve important agroecological services, such as biological control, pollination services and soil nutrient storage, so interest in this approach to farming appears to be rising."

Some of the survey questions aimed to measure conservation attitudes, grower identities, the influence of social groups on growers' decisions, and growers' experiences with conservation practices. Pisani Gareau asked growers to list the conservation programs they're involved with (e.g., the federal Environmental Quality Incentives Program, EQIP), the type of conservation practices they apply (e.g., cover cropping, grassed buffer strips, hedgerows), and whether they've increased or decreased the use of these practices over the past five years.

Survey participants were also asked to characterize themselves and their operation, including education and income levels, crops grown, farm size, and whether or not they lived on the farm.



Cheryl Lambert, NRCS

Grassed drainage ditches are one of the conservation practices used by Central Coast growers to limit runoff and protect water quality.

Pisani Gareau found that of the 146 respondents who completed the survey, nearly half were involved in a conservation program of some type, such as EQIP (which pays growers to implement conservation practices), the Conservation Security Program, and the Wetlands Reserve Program. A number of growers also reported participating in non-federal programs, namely the Sustainable Winegrowing Program, organized by the California Sustainable Winegrowing Alliance.

The survey revealed that overall, conservation practices have slightly increased on the Central Coast over the past five years. The most common practices that respondents reported using were cover cropping (58% of respondents), grass buffer strips (36%), grassed drainage ditches (32%), and grassed roadways (31%)—practices that are particularly important in preventing erosion and protecting water quality. Floral insectaries to encourage beneficial insects were also used by 23% of respondents. Not surprisingly, respondents cited "better soil or water quality," "less erosion," "more beneficial insects," and "fewer pest outbreaks" as the "most important benefits gained from applying conservation practices."

Less popular were practices that increase biodiversity on the farm or ranch, such as establishing natural habitat (17%), hedgerows (15%), and constructed wetlands (7%). So too, "more wildlife on the farm" (along with "appeal to tourists," and "windbreaks") was seen as the least important benefit of conservation practices. "This may correspond

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in part to concerns about wildlife and food safety,” says Pisani Gareau.

As she explains, the 2006 outbreak of *Escherichia coli* (*E. coli*) O157:H7 in local spinach fields, which infected 199 people and killed 3, changed the political climate for conservation on Central Coast farms and ranches. “As part of the response to the outbreak, the leading industry group, the Western Grower Association, immediately developed a set of Good Agricultural Practices [GAPs] for improved food safety, a section of which specifically focuses on minimizing domestic and wild animal presence on fresh produce cropland.”

The fact that the berry and vegetable growers surveyed showed the most concern about potential food safety impacts of conservation practices likely reflects the ongoing pressure on these growers to reduce the presence of wildlife on their farms. Other concerns cited by all growers included attraction of rodents, cost to establish conservation practices, and loss of profit. Yet despite such concerns, “Only 17% of respondents reported not applying any conservation practices in their operation,” says Pisani Gareau.

VARIETY OF FACTORS INFLUENCE CONSERVATION CHOICES

When asked about their reasons for taking part in various conservation programs, respondents ranked “water quality protection,” “conservation of wildlife,” and “financial assistance” as the most important factors.

For growers who chose to forego such programs, “Bureaucracy was the number one reason for not participating. Lack of time was the other factor that most discouraged respondents from participating,” says Pisani Gareau. “‘Lack of time’ is a common sentiment I’ve heard from growers over the years,” she says, explaining that this may refer not only to the time it takes to do the paperwork to qualify for various government-funded conservation programs, but the time required to establish and manage a conservation area.

Social factors can also make a difference in the extent to which a grower implements conservation-based farming practices. This includes production group identity: grape, berry (including strawberry, caneberry, and blueberry), and “mixed crop” growers applied a higher number of conservation practices than groups such as livestock, orchard, vegetable, and nursery or greenhouse growers. Berry, mixed crop, and flower groups also reported increasing their conservation practices over the past five years. “Each cropping system really has its own production culture with a highly networked community of growers, so it is not surprising that production group identity would influence conservation practices,” says Pisani Gareau.

In analyzing whether farm management was a factor, “I found a pretty clear difference between organic and conventional growers,” says Pisani Gareau. Organic growers applied almost twice as many conservation practices as conventional growers, than those who identified themselves as “mixed conventional and organic,” and “other” management. Organic growers and “other” growers (which tended

to be no-spray or self-labeled “sustainable” growers) were also more likely to participate in a conservation program than either conventional or mixed conventional and organic growers.

In addition, the survey revealed a positive correlation between crop diversity and the number of conservation practices used: growers that managed a higher number of crops tended to apply a greater number of conservation practices on their farms.

Age also influenced conservation behavior. Middle-aged growers (those between 40–60) were more likely to take part in conservation programs and apply a greater number of conservation practices than either younger or older growers. However, younger growers reported the greatest increase in the use of conservation practices over the past five years.

In examining structural factors, the survey didn’t detect a relationship between educational level and conservation behaviors, although income and acreage being farmed did play a role. Lower-income growers (those making less than \$20,000) reported that the number of conservation practices they used had remained the same, while those making between \$20,000 and \$100,000 reported a slight increase. Growers managing fewer than 10 acres reported applying fewer conservation practices than those managing larger acreage.

Pisani Gareau also found that growers who lived on their ranch applied a greater number of perennial conservation practices, such as hedgerows, constructed wetlands, habitat restoration, or terraces, than those who lived off the ranch. “It makes sense that growers would be more interested in establishing permanent features on the property where they live rather than on land that is only for production, which also tends to be rented land,” says Pisani Gareau.

The surrounding landscape also influenced conservation behavior. “Growers with some perennial habitat, such as a riparian area, woodland, grassland, or wetland, within a half mile of the farm applied a greater number of conservation practices than those farming on land without surrounding habitat,” says Pisani Gareau.

She suggests two possible explanations: “When natural resources are within sight of the ranch, the grower may be more inclined to incorporate a practice to protect them or try to farm in harmony with those resources, whereas a grower farming in a monoculture landscape may not be motivated to incorporate ‘natural’ elements on the farm. He or she may think, ‘why should I do that, if no else is doing it.’” Another potential reason is that agriculture agencies that promote conservation are more likely to target ranches adjacent to sensitive ecological areas.

ATTITUDES AFFECT PRACTICES

Not surprisingly, attitudes toward conservation greatly affected practices. Those who rank natural resource conservation as a top consideration in land management decisions were most interested in a wide variety of conservation practices, particularly habitat restoration. “There’s an incredible

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Expanding Your Cover Crop Options

Growers have long known that cover crops provide myriad benefits: they can improve soil fertility, control erosion, suppress weeds and diseases, and retain and cycle nutrients, making them available to crops through the growing season. But not all cover crops are created equal, and finding the right crop or blend of crops for a particular purpose can help a grower accomplish specific goals in a soil management and cropping system.

For fields where he wants to get in early in the season to plant slower-growing spring crops such as onions, beets, and potatoes, UCSC Farm manager Jim Leap has begun experimenting with mustard as a winter cover crop. “Mustard is fast growing, improves tilth, and does a beautiful job of weed suppression” he says.

But it’s the speed at which mustard breaks down once it’s tilled that has Leap most excited about its potential. In the spring, he uses a flail mower and mechanical spader to cut and incorporate the mustard cover crop. He can then immediately make a seed bed. “Within a couple of weeks the mustard will have decomposed and the beds will be ready for planting, versus the four weeks or more that we have to wait after incorporating our legume/cereal cover,” explains Leap. Relatively dry spring conditions helped the process this year. In wetter springs, mustard can get “woody” (carbonaceous) if rains delay mowing and incorporation.

Unlike legumes such as bell beans or clovers, mustard doesn’t add nitrogen to the soil. But as Leap notes, “Although there’s no net increase in nitrogen, mustard does a beautiful job of taking up or ‘catching’ nitrogen that’s already in the soil and preventing it from leaching.”

Mustard also picks up other nutrients that then become available to crops when the cover crop is incorporated. And a lush stand of mustard will inhibit soil erosion and add a significant amount of biomass to the soil in the spring.

As Leap points out, establishing that lush stand can be tricky. “If you don’t do a good job of preparing your seed beds then mustard isn’t going to grow well,” he says. “It doesn’t like it too wet or too dry and doesn’t seem to handle soil compaction very well.”

Mustard seed is tiny, and ideally should be planted with a seed drill specifically designed for small seed. Leap uses his standard cover crop drill but must change the gearing of the drill to account for the small seed size. As he explains, “Some cover crop seed drills actually have two hoppers—one for large seed and one [often referred to as a ‘grass hopper’] for smaller seed. This type of drill would be the optimum choice for planting mustard with other cover crops since

you could interplant the small-seeded mustards with the larger-seeded cover crops in a single pass.” Leap has been using the mustards Ida Gold (*Sinapis alba*) and Pacific Gold (*Brassica juncea*).

After several years of using mustard, Leap is sold on including it as a regular part of his cover cropping regime at the Farm. “I’ll probably put 10% of the farm in mustard each winter, and then rotate with a standard legume/oat mix to get nitrogen back into the system.”

Leap also notes one less obvious benefit to including mustard in a cover cropping strategy: because of its finicky nature, it can serve as an indicator of soil conditions such as fertility and drainage. Leap had this experience himself when he planted mustard in a field at the UCSC Farm that had traditionally been sown with a winter cover of bell beans, vetch, and cereals.

“In 15 years we never saw any variation in the way that crop established,” says Leap. “But the year I planted mustard, there was a two-foot wide swath running diagonally through the field where the mustard did really poorly. I went and looked at the irrigation line map for the campus and discovered that there’s a deep water line packed in sand buried there; the mustard roots went down and hit that sand and had difficulty with nutrient uptake.”

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CASF

Farm manager Jim Leap mows a standard legume/cereal cover crop for incorporation prior to preparing beds for spring planting.

BOOSTING CEREALS IN THE BLEND

Along with exploring options such as mustard, Leap continues to tinker with more traditional cover crop blends for the Farm's row crop fields. "Historically, we've used a strong legume mix in the field with a little bit of cereal; now we're moving in the direction of a little heavier cereal in the mix for a more stable carbon source."

Leap explains that cereals—he uses Cayuse oats—can significantly improve soil tilth and aggregation. The down side is that they decompose much more slowly than legumes such as bell beans, Austrian peas, or vetch. "That slow breakdown after incorporating the cover in the spring can make it difficult to form a seed bed," says Leap, who notes that the resulting "trash" from the oats will also gather on planter shoes and wrap around cultivating knives.

That slow breakdown also has an up side, as it tempers the nitrogen provided by the legumes in the cover crop. "Legumes can be tricky," says Leap. "They can provide up to 200 pounds per acre of nitrogen, and, depending on the rate of nitrogen mineralization, at certain points in the growing season there may be more nitrogen available than the plants can use. This can create a situation where the nitrogen may be vulnerable to leaching."

"That's why I like the cereal in the mix," explains Leap. "It 'grabs' available nitrogen, then releases it slowly back to the crop over the course of the growing season."

ADDING MUSTARD TO THE MIX

Besides increasing the amount of cereal in his winter mix, Leap has also experimented with oversowing the standard winter cover of bell beans, vetch, and oats with mustards, and has so far been pleased with the blend. "The mustard brought more diversity to the field—it blooms in spring so you get a nectar source for beneficial insects." And because the seed of mustards such as Ida Gold and Ida Pacific are very



Leon Vehaba

Adding mustard to the standard cover crop mix creates a nectar source for beneficial insects in the spring.

slow to mature, they're unlikely to pose a threat of becoming "weedy" as long as they're incorporated in a timely way.

In fact, used alone or in a blend, mustards are great at outcompeting weeds. "The field where I planted the mustard cover crop was the field that was out of control with black mustard [*Brassica niger*]. My intent was to smother it out and I think it worked," says Leap.

A study by research horticulturist Eric Brennan of the USDA's Agricultural Research Service, and weed science farm advisor Richard Smith of UC Cooperative Extension confirms the effects that Leap observed. Brennan and Smith compared a fall-planted mustard cover crop (*Brassic juncea* and *B. hirta*) to oats planted alone and the more traditional legume/oats blends used on California's Central Coast. They found that mustard produced the greatest early season biomass and suppressed weeds and seed production of burning nettle (*Urtica urens*) more effectively than the other two cover crops (Brennan and Smith 2005).

Leap plans to continue fine tuning his cover crop strategy at the UCSC Farm: "I'd like to experiment with various cover crop ratios looking not only at mustards in the winter mix, but also looking at other grasses besides the more commonly used rye and oats."

He is particularly interested in identifying several lower-growing grasses that would be quick to establish and give good weed suppression and erosion control, but would not out-compete the slower-developing legumes. "In this scenario we could get all the benefits of the grasses but not be faced with the breakdown and residue challenges," says Leap. Results of this and other work on cover crop management will appear in future issues of *The Cultivar*.

— MARTHA BROWN

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Brennan, E. B., and R. F. Smith. 2005. Winter cover crop growth and weed suppression on the Central Coast of California. *Weed Technology* 19: 1017–1024.

Leon Vehaba



Mixing cereals such as Cayuse oats with nitrogen-fixing cover crops helps extend the availability of nitrogen over the course of the growing season.

Farm-to-College Programs Drive the “Greening” of Campus Food Systems

With “sustainability” now the watchword in all facets of economics, politics, and education, colleges and universities across the country are tailoring their operations to meet student demand for sustainably produced food, and to create opportunities for students to help build a “greener” campus as part of their educational experience. Students are working collaboratively with dining administrators and other stakeholders on sustainable sourcing, greener facilities, and co-curricular programming to create more sustainable food systems on campus. Under the “farm-to-college” banner, these practices offer insights into models and activities that can build greater awareness of how our food system is interconnected with broader sustainability initiatives and community health and wellness.

Working with UC Santa Cruz’s Food Systems Working Group (FSWG), members of the Center for Agroecology and Sustainability (CASFS or the Center) have helped develop the campus’s farm-to-college effort, including projects to provide food grown at the UCSC Farm to campus restaurants and dining halls, as well as an array of educational opportunities for students. In this article we summarize recent work to improve UCSC’s campus food system, share the lessons learned with a statewide audience, and preview preparations for a major campaign to improve food systems at colleges and universities across the country.

UCSC DEVELOPMENTS

UCSC’s Dining Services Expands Sustainability Efforts

How food is sourced, served, and recycled in dining halls and other facilities represents a significant part of a campus’s “carbon footprint.” With the Spring 2008 release of UCSC’s Campus Sustainability Assessment (<http://sustainability.ucsc.edu/assessment>), Dining Services has begun an aggressive effort to “green” all aspects of its operation.

According to Special Projects Manager Candy Berlin, UCSC Dining Services has purchased over \$800,000 of local, organic produce and sustainable products from regional distributors—including the Monterey Bay Organic Farmers Consortium (MBOFC; see sidebar, page 10)—over the last two years. The amount of certified organic produce served on the campus has increased steadily, from 20% in 2005-06 and 23.8% in 2006-07, to 26.3% so far in 2007-08. The study also showed that 98% of UCSC’s organic and locally-sourced food came from the MBOFC, which includes sales from the UCSC Farm. In addition, 80% of seafood served has been certified through the Monterey Bay Seafood Watch program (www.mbayaq.org/cr/seafoodwatch.asp).



Paul Dileanis

UCSC students enjoy fresh, locally grown organic produce at the annual Fall Festival, one of UCSC Dining Service’s special events that promotes local farms and farmers.

The campus Food Systems Working Group (FSWG), which represents a diverse array of campus stakeholders, is working with Dining Services to examine the options for sourcing other sustainably produced food such as Fair Trade-certified bananas, and humane and sustainable meat products. However, these efforts will have to confront the barriers created by rising food costs and a preset annual purchasing budget. “Campus dining hasn’t seen such inflated food costs in decades. This issue has become our number one challenge,” says Scott Berlin, who directs UCSC’s Dining and Hospitality Services.

With the rising costs of food, finding better ways to manage the waste stream will provide new opportunities for cost savings. With student support, Dining Services is studying the option of introducing tray-less dining in all five all-you-care-to-eat facilities, which serve over 12,000 meals a day. This approach eliminates the trays that are often used at dining halls, thereby encouraging diners to reduce the amount of food they take. Based on results from preliminary studies, this simple action would reduce food waste by over 25% and eliminate the need to wash over 2.8 million trays each year. With the cost and energy savings, UCSC Dining can continue to look at ways to maintain and increase sustainable food offerings to meal plan holders.

This summer, Dining Services initiated a full-scale pre-consumer composting program with the County of Santa Cruz. They’re also processing post-consumer waste through

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a pulper, which heats the food up to levels that kill bacteria and reduces the waste to one-third its original mass. These efforts will increase the amount of compostable product being diverted from the City's landfill and support efforts toward meeting a University of California-wide zero waste mandate set for 2020.¹

UCSC Dining is also scheduled to complete Green Certification of all its food service facilities within the coming year. The certification, which is conducted through the City of Santa Cruz, encompasses energy and water conservation, staff training, and waste reduction and prevention. More information on the Green Business Program is available at www.montereybaygreenbusiness.org.

Clint Jeffries, Dining Unit Manager, has been coordinating the process with much success and teamwork along the way. "It has been a great learning process for us all, and we have much more to understand as we expand our horizon," says Jeffries. For the second year, this fall's staff training, known as "Dining University," will educate and engage dining staff and student employees in the multifaceted ways in which Dining and Hospitality Services is contributing toward best practices and furthering campus sustainability efforts.

Range of Opportunities for UCSC Students

At UC Santa Cruz, students get a chance to learn about organic farming and food systems as freshmen, and expand that learning throughout their college career. As part of their fall quarter "core course," first-year students at College 8 (one of the campus's residential colleges) make the trek from their dorm rooms to the 25-acre organic UCSC Farm near the base of campus, where they learn about the rich history of the campus's farm and the Alan Chadwick Garden, harvest produce from the field to be served in their

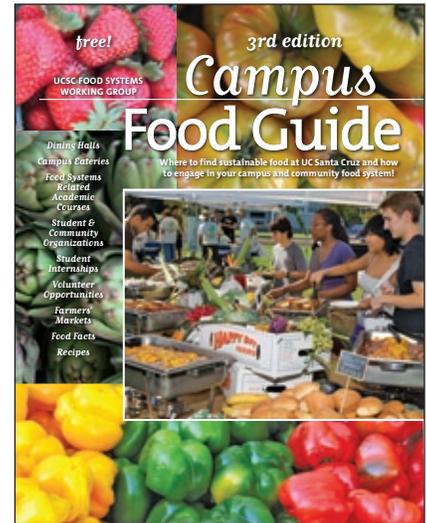
MBOFC a Model for Sourcing Efforts

The Monterey Bay Organic Farmers Consortium (MBOFC) is made up of seven local farms that pool their produce for sales to UCSC, two other local universities and a local hospital. MBOFC's crop planning and produce sales are coordinated through ALBA, a non-profit organization that runs one of the consortium farms.

UCSC's Dining Services contracted with MBOFC through ALBA in part because ALBA's emphasis on "worker supportive" conditions helped UCSC meet one of the preferred criteria—along with local and organic—under its food procurement guidelines. CASFS Farm-to-College Coordinator Tim Galarneau, graduate student Linda Wallace, and other members of the campus's Food Systems Working Group helped create and revise these food procurement guidelines with Dining Service managers, guidelines that are now helping to shape a UC-system wide food procurement policy. The MBOFC model is one subject of USDA-funded studies led by researchers from CASFS and UC Davis looking at the efficacy of farm-to-institution programs across the nation (see *The Cultivar*, Volume 26 Nos. 1 & 2).

Released this summer, the third annual *Campus Food Guide* offers details on how UCSC students can get involved in campus food system activities, lists classes with agroecology and food systems content, and includes campus and other local sources of sustainably produced food.

The guide is available online (<http://casfs.ucsc.edu>) and across campus, and all incoming freshmen will receive a copy in their welcome packets.



campus dining hall, and gain an understanding of how a relationship has formed between the University and organic farms in the region.

Known as Harvest for Health, this core course component is moving into its fourth successful year of connecting UCSC students with the land. Sean Keenan, an Environmental Studies major and undergraduate farm-to-college intern, will help CASFS staff coordinate the program, offering students hands-on learning in a successful model that embodies education through action and reflection.

The Center's work with the farm-to-college effort also offers students the chance to learn how produce sales between the UCSC Farm and University take place. Undergraduates work with CASFS staff to learn about innovative direct market activities, harvest and pack expectations in a retail setting, business tracking tools, and communication systems that lead to successful relationships between the farmer and the consumer.

Building on the Center's Apprenticeship program (see cover story), undergraduates take part in field and garden care, harvesting, delivery, and mentoring support. This year, CASFS's farm-to-college internship, overseen by Field Production Manager Liz Milazzo, combines leading Harvest for Health classes with coordinating campus food service orders and deliveries. Farm-to-college interns will also work with UCSC Dining Services to create educational displays that raise awareness with students and other campus eaters on the intersections of climate change, local and sustainable food sourcing, and how they can better understand the hidden connections within their food system.

In addition to working with the Center, undergraduates at UCSC have a wealth of other food-related programs and classes to draw on. Through the Program in Community and Agroecology (PICA), students can study agricultural and community sustainability, combining classroom and hands-on experiences. The Community Agroecology Network (CAN) offers international internships in Latin American farming communities. These and many other resources are described in the new *Campus Food Guide* (see above).

STATE AND NATIONAL EFFORTS EXPAND

UC Adds Food Services to Sustainability Policy

Across California, students are starting campus farms and gardens, creating new learning environments, and pressing campus administrators to increase sustainable food procurement and practices. In response to this growing interest in sustainable food systems, CASFS has created a Sustainable Agrifood System (SAS) Fellowship program that will strengthen food systems research and evaluation efforts on seven University of California and Community College campuses this fall.

Drawn from a pool of undergraduate and graduate student applicants, SAS Fellows will collaborate with faculty and administrative sponsors to develop and implement education projects and policy research on their campus food system. This pilot program is part of a broader USDA Special Research Grant awarded to CASFS that seeks to foster greater agricultural literacy and education around sustainable food systems (see *Center Notes*, page 16, for more on the USDA grant).

Over the past several years, UC students have worked with statewide administrators and campus representatives to set the course for sustainable practices (see statewide policy: www.ucop.edu/ucophome/coordrev/policy/PP032207guidelines.pdf). Areas addressed in the UC system-wide policy range from green building and transportation to purchasing and waste reduction.

This year the UC Sustainability Steering Committee, comprised of Vice Chancellors and high-level administrators from each campus, launched the statewide Food Systems Working Group (FSWG). The UC FSWG will develop guidelines and target goals to be incorporated in this year's Policy Updates that come before the committee and UC President Yudof. SAS Fellows will participate as student representatives on the committee and contribute to a collaborative process that will add "Food Services" as the next component in the most far-reaching sustainability policy of any public university system in the nation.

Drawing in hospital-affiliated food services, contracted operations, and the plethora of voices and perspectives across a ten-campus system will be no easy task; however, following the group's first conference call, "they appear to be up to the challenge," notes Andy Coughlin, Sustainability Specialist at the UC Office of the President.

Nationwide Challenge Sets Goal of 20% "Real Food"

As farm-to-college and sustainable food initiatives continue to gain traction and spread across the country, students are stepping up their collective efforts. Recently, the California Student Sustainability Coalition's Foods Initiative teamed up with The Food Project based in Boston to create a national campaign called *The Real Food Challenge*. Both organizations recognized the growing interest among student leaders in developing more sustainable campus food systems, and had networks to bring together representatives from land-based learning centers, NGOs, food service affiliates, and other allies to work with students in developing this



Hal Vo

From Field to Fork Addresses Future of Campus Food Systems

The second annual *From Field to Fork* event took place at Cal Poly San Luis Obispo on Thursday, July 31st, 2008. Co-sponsored by CASFS as part of the USDA-funded Farm to Institution project, this event was offered as a pre-conference to the nation's largest gathering for sustainability in higher education to date. Nearly 1,000 attendees came for a full weekend of programs and activities. As a precursor, *From Field to Fork* brought together over 100 food service managers, chefs, campus administrators, students, faculty researchers, and NGO members from across California and the country.

During the event attendees explored food procurement projects, green business practices, campus farm- and garden-based learning, ongoing research, and recent innovations in campus food service efforts. Participants identified barriers and challenges, shared best practices, established innovative solutions, and contributed to a vision of how campus food systems will be transformed over the next ten years. In September, notes and materials from the *Field to Fork* conference will be posted on the main conference website: <http://sustainability.calpoly.edu/>.

ground-breaking initiative. The Real Food Challenge, which officially launches nationwide this fall, is calling on universities and colleges to redirect 20% of all food purchases to "real food" by 2020. Such a target goal will directly affect over \$1 billion in food sales in the US.

The defined metrics for "real food" cover criteria that can be evaluated through a multi-variate calculator using categories that encompass environmental, social, economic, and humane indicators. The calculator tool offers campus food services an opportunity to input their sourcing volumes to better gauge their current levels of "real food" purchases and identify areas with room for improvement.

Over 300 colleges and universities in the US will be hosting Real Food launch events to raise awareness on their campuses during a month of action this fall (September 21–October 21). Both UC Santa Cruz and Stanford have been identified as "lead campuses" for the launch, based on their overall activities and efforts to integrate sustainability

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and student engagement in their campus food system. For more information regarding the Real Food Challenge and the group's definition of "real food," see www.realfoodchallenge.org.

EDUCATION, RESEARCH NEEDED TO IMPROVE PROGRAMS

As a wellspring of creative, "out of the box" programs, research, and learning opportunities, the Center's impacts can be seen both on campus and beyond: statewide policy processes and national campaigns have found invaluable resources from the Center as it continues to enhance its innovative farm-to-college programs.

More research and assessment will be needed to understand the impacts and successes of farm-to-college efforts that are working to create sustainable campus food systems. In tandem with research efforts, fostering greater civic engagement and food system awareness will involve diverse partnerships and collaborative processes of shared learning. As a recent keynote speaker and SAS Fellow from UC Davis, Maggie Lickter, stated at the 2008 Field to Fork event, "We are all educators and learners working together on this."

As educational and operational activities of our colleges and universities find ways to partner, we have a tremendous opportunity to create innovative ways of learning. Drawing on many forms of expertise, from chef and food buyer to student and farmer, will deepen our basic understandings of relationships in the food system and promote both greater agricultural literacy and sustainability.

—TIM GALARNEAU

For more information on farm-to-college programs and activities, contact Tim Galarneau at tgalarne@ucsc.edu

¹"University of California Policy Guidelines for Sustainable Practices" (2007). Accessed 13 August 2007 from UC Office of the President Sustainable Practices website: <http://www.ucop.edu/ucophome/coordrev/policy/PP032207guidelines.pdf>

New Farms & Victory Gardens

continued from page 3

While the idea of a local food system is familiar to many in Sonoma County, Rice-Jones has found a fresh enthusiasm for growing food close to home. "I feel like Sonoma County is one of the communities that's most dialed into a local food system—it's already a trend that's ingrained here. But having said that, many of my volunteers, from construction workers to lawyers, have enjoyed harvesting broccoli and picking carrots so much that they bring transplants home and sow them in their own yards—there's a real excitement about producing their own food, being part of the food system actively, and not having to buy things from miles away."

Besides producing food for local anti-hunger efforts, Bounty Farm serves as a classroom for nearby high schools. Rice-Jones says her training in the Apprenticeship and the teaching experience she gained as a second-year Apprentice have been invaluable in giving her the confidence to teach others the skills she learned. "Above all my forms of education, the Apprenticeship equipped me with the most valuable skill of teaching people how to grow food. I didn't fully realize how powerful a lesson this was until I began teaching people with limited access to healthy food how they can grow healthy, organic food right in their own backyard."

As the local food movement expands, so too will the need for the type of broad-based training that Apprenticeship offers. Thanks to that training—and to their passion for sharing what they've learned—a growing pool of graduates is helping meet demand for both food and the knowledge to build a sustainable food system. Says Randall, "This is the greatest work that can be done."

—MARTHA BROWN

Further Reading

Williams Island Farm

envirolinkhandbook.com/www/docs/204.159

Garden for the Environment and Victory Garden 2008+
www.gardenfortheenvironment.org

Petaluma's Bounty Farm
www.petalumabounty.org
see casfs.ucsc.edu/

The Apprenticeship in Ecological Horticulture

The Apprenticeship training program is offered annually from mid April through mid October at the UCSC Farm & Alan Chadwick Garden facilities of the Center for Agroecology and Sustainable Food Systems. Both sites are located on the UC Santa Cruz campus.

Each year, a group of international participants takes part in a six-month program that combines experiential training with classroom presentations, covering a wide range of organic farming and gardening skills and knowledge.

For more information, see casfs.ucsc.edu/training/index.html, call 831.459-3240, or email apprenticeship@ucsc.edu.

HaiVo



Student leaders at the *Field to Fork* conference examine the ways that consumption, production, the environment, and economies all play into the higher education-focused national Real Food Challenge initiative that will launch this fall.

Updates

Study of Reduced Water Inputs on Tomatoes Underway

We all know the scenario—a red, juicy tomato that looks great but offers little in the way of flavor. In a study now taking place at the CASFS Farm on the UCSC campus, Aziz Baameur of the UC Small Farm Program and farm manager Jim Leap are assessing ways to improve tomato flavor and nutrition while decreasing water use.

“Excess nitrogen and more than adequate water application to tomato plants, among other input culprits, result in less than optimal flavor in tomato fruit, despite genetic potential for good taste,” says Baameur, who notes that, “This lack of flavor is not limited to conventional or organically grown fruit.”

“Stressing” tomato plants by withholding water—a technique used to produce dryland or dry-farmed tomatoes—is a known way to improve flavor. However, as Baameur points out, cutting back on water inputs can also result in undesirable consequences such as yield decline (especially economic yield), reduced fruit size, and increased occurrence of the condition known as blossom end-rot, which can develop when irrigation fluctuates, resulting in calcium not being translocated to young tomato fruit tissue.

To identify an optimum water management strategy for tomatoes, Baameur and Leap established four replicates each of five irrigation treatments: 100%, 75%, 50%, 25% and 0% of water requirements based on California Irrigation Management Information (CIMIS) recommendations. Each replicate consists of a 40-foot row of ‘Early Girl’ variety tomatoes irrigated with drip tape; the water stress treatments began after the plants were established. Soil water moisture sensors (a type of tensiometer) are being used to quantify water depletion at the root level.

Plants in each treatment will be assessed for fruit yield, percent of blossom end rot, culls, as well as plants’ overall reaction to water stress. Baameur and Leap will collaborate with Maria Giovanni, UC Cooperative Extension Advisor, to assess fruit visual and sensory quality as determined by both tasting panels and lab analysis. They will also assess antioxidant levels as a proxy measure of nutrition levels. The researchers plan to correlate fruit quality with water stress and soil water sensor readings in order to identify an optimal irrigation level.

The results of the current project will form the basis for future studies to investigate the link between irrigation practices and flavor of several popular tomato varieties under



Martha Brown

Aziz Baameur (left) and Jim Leap discuss the reaction of tomato plants to various irrigation treatments.

different climatic conditions. “We hope to provide small-scale growers with information on water saving techniques that also yield favorable flavor results,” says Baameur.

Leap believes this trial’s design could have broader applications. Noting that the tendency of most garden and farm managers is to overapply water, Leap says, “I would like to do this trial for a number of other crops. I think nitrogen and water are the two most overused and little understood inputs, and I am certain we can get by with much less of both.”

Lygus Control Research Extended to Conventional Systems

Using techniques they’ve developed over the last several years in organic systems, Center researchers are now helping conventional strawberry growers reduce their use of insecticide sprays to control lygus bugs (*Lygus hesperus*), a major pest of strawberry crops on California’s Central Coast.

With funding from the USDA’s Pest Management Alternatives Program (PMAP), entomologist Sean Swezey and research associates Janet Bryer and Diego Nieto are studying the effects of alfalfa trap crops on conventional strawberry ranches in Monterey County. The alfalfa crops attract lygus, which are controlled with periodic vacuuming and insecticide applications confined to the trap crop. By confining both vacuuming and sprays to the trap crop and the adjacent strawberry row, growers can reduce their use of insecticides on the strawberries themselves, while decreasing

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ing the amount of time and fossil fuel spent spraying and vacuuming crops.

“The grower we’re currently working with created a modified boom for his spray rig that goes over the top of the trap crop bed,” explains Swezey. “So far we’re getting good penetration of the spray in the trap crop, particularly soon after it’s been cut.” By employing these methods, Cosme Marquez of CS & O Farms has substantially reduced the frequency and scope of lygus-directed insecticide applications. In 2007, Larry Eddings of Pacific Gold Farms was able to reduce the number of lygus-directed insecticide applications by up to 60% using similar techniques, when compared with a typical lygus bug control program.

The research team is also working with Charlie Pickett of the California Department of Food and Agriculture’s Biological Control Program to study the effectiveness of an introduced parasitoid of lygus, the braconid wasp *Peristeneus relictus*, in helping control lygus populations in organic strawberry systems. The parasitoid was first introduced to the Central Coast from Europe in 2004 and has since become regionally established (see *The Cultivar*, Vol. 24 No. 1, pp. 5–6 for additional details).

Data collected through 2007 have shown increasing parasitism of lygus by *P. relictus* in alfalfa trap crops at Eagle Tree Farm in Salinas, California (figures 1 and 2). “We’ve seen a long-term density dependent effect of the parasitoid on

Alfalfa trap crops planted between strawberry rows serve as a trap crop for lygus bugs and a release site for a parasitoid of lygus.



CASFS

Lygus, lowering the average density of lygus bugs to below the economic threshold at the site,” says Swezey.

The term “density dependent” means that the parasitoid’s population increases in response to an increase in lygus numbers (i.e., density of lygus), and drops as the lygus population declines. “That density dependent effect is what we are documenting in our long-term study,” says Swezey. “Along with the trap crop vacuuming, the parasitoid is adding an additional mortality factor, and it appears that the lygus population has not been replacing itself at Eagle Tree over the past two years.”

The Center research team is now collecting distance information on the percent of lygus parasitized in 50 strawberry rows between the trap crops, in order to determine how far the parasitoids move from the trap crops into the strawberry rows. Data are also being collected to determine how persistent vacuuming affects parasitism in both trap crops and strawberries. Lygus nymphs are collected and sent to a CDFA laboratory in Sacramento, California to determine whether they have been parasitized.

The research team has also found populations of *P. relictus* on their conventionally managed study site. These have spread from a release point several miles away, and their presence may indicate a potential for alfalfa to harbor this parasitoid in sprayed environments as well as organic systems.

A paper detailing the five-year introduction and establishment project using *P. relictus* for control of lygus in Central Coast organic strawberries, co-authored by Pickett, Swezey, Nieto, and Bryer, along with Martin Erlandson, Henri Goulet, and Michael D. Schwartz (insect identification specialists at Agriculture and Agri-Food Canada) was recently accepted by the international journal *Biological Control* and will appear in an upcoming issue.

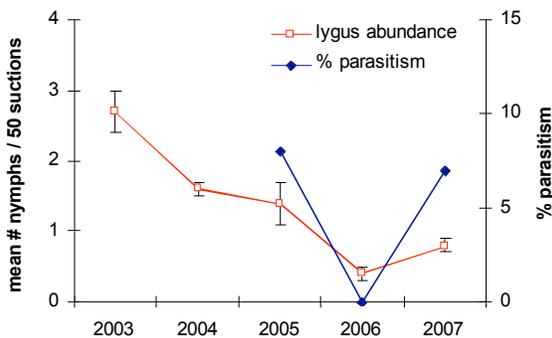


Figure 1. Yearly mean percent parasitism by *P. relictus* and mean density of lygus nymphs in organic strawberries, 2004–2007. 2003 is pre-release year. Eagle Tree Farm, Salinas, CA.

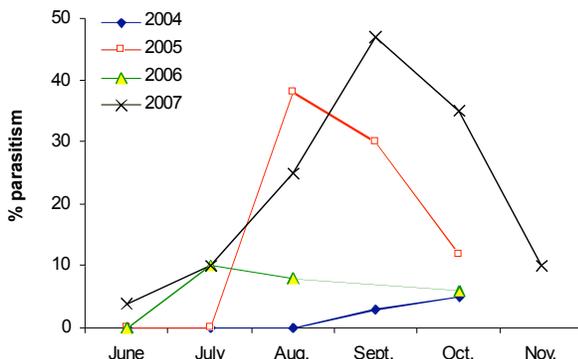


Figure 2. Monthly percent parasitism of lygus nymphs by *P. relictus* in alfalfa trap crops. 2004 is first release year. Eagle Tree Farm, Salinas, CA.

ASD Examined as Potential Alternative to Methyl Bromide

Methyl bromide has long been the soil treatment of choice for California’s conventional strawberry growers, as well as for vegetable growers in Florida—and with good reason. The soil fumigant is extremely effective at controlling soilborne

diseases and preventing weeds from germinating. However, methyl bromide is also categorized as a Class 1 ozone depleter, and although growers can still apply it under what are called Critical Use Exemptions (CUEs), its use is slowly being phased out.

Methyl bromide has never been an option for organic growers, and with conventional growers also searching for alternatives, there is increased interest in finding new ways to create optimal growing conditions for strawberries and other crops without the use of soil fumigants. Professor Carol Shennan of UCSC's Environmental Studies Department, a faculty affiliate of the Center for Agroecology & Sustainable Food Systems (CASFS), and researcher Joji Muramoto of CASFS, along with their colleagues and a group of cooperating growers, are fine-tuning a method to suppress disease organisms and weeds seeds without the adverse effects of methyl bromide. Featuring inputs such as molasses, rice bran, onion skins, and ethanol, the ingredients may sound like a witch's brew, but the technique—known as anaerobic soil disinfestation (ASD)—holds promise as a viable alternative to soil fumigation.

As Muramoto explains, before a crop is planted, molasses or another carbon source (e.g., onion waste from food processing plants) is worked into the soil, and the beds are irrigated. A soluble carbon source such as molasses or ethanol can be applied via drip line with irrigation water. The beds are then covered with an impermeable plastic tarp and left for several weeks. Soil microorganisms help do the rest.

"Microorganisms are always on the edge of starvation," says Muramoto. "By feeding them a carbon-rich input, they multiply exponentially." In the process, decomposers use up the oxygen in the soil, helping create an anaerobic fermentation process that kills disease-borne organisms and may help suppress weed seed germination.

Forms of ASD have been used as successful alternatives to methyl bromide fumigation in Japan and the Netherlands for a number of years. Recent studies at the UCSC Farm have confirmed that ASD can lower the number of *Verticillium dahliae* propagules (a disease-causing pathogen) in soils that were then planted to strawberries (see *The Cultivar*, Vol. 25 Nos. 1 & 2, pp. 17–18).

A grant from the USDA is funding a three-year effort to expand the ASD study initiated at UCSC to conventional California strawberry and Florida vegetable systems. Conventional systems are being used in order to compare the results of ASD to standard methyl bromide fumigation techniques in controlling *Verticillium dahliae* and selected weeds in California, and root-knot nematodes (*Meloidogyne* spp.) and nutsedge (*Cyperus* spp.) in Florida.

In February, Muramoto, Shennan, and researchers from UC Cooperative Extension teamed with two Monterey County-based conventional strawberry growers to create an advisory committee.

Members of the committee—particularly the growers—have already offered some reality checks for developing ASD in commercial strawberry systems. "Our initial proposal included a period of cover cropping prior to the application

of ASD," says Muramoto. But in the hurry-up-and-plant world of commercial strawberries, the window of time between when a vegetable crop is harvested in the fall and when strawberry beds have to be formed is too short for cover cropping, so the researchers dropped that element from the study.

Growers would also like to be able to use their standard plastic tarps rather than invest in thicker, more expensive options that could potentially raise soil temperatures more effectively. Muramoto tested both types of tarps to determine whether the standard, less expensive 1.25-mil thick types can be used effectively for ASD.

Using two types of California soils, Muramoto established a replicated greenhouse trial to test four different types of tarps under conditions that mimic the daily swings between day- and night-time temperatures at the growing sites. Results indicated that regular 1.25 mil plastic would be sufficient in creating anaerobic condition. However, some factors that occur in fields (e.g., stretching and scraping of plastic films) need to be further evaluated in field trials.

Another greenhouse trial used soil from Florida. Says Muramoto, "It is challenging to establish anaerobic condition in their very sandy soil with its low water holding capacity."

Two organic amendments that are locally available in Florida were used in the trial: molasses from the sugar cane industry as a carbon source, and poultry litter from the chicken industry to improve the soil's water-holding capacity. The trial used nutsedge, one of the major weeds in Florida, as a target pest. Results showed germination of nutsedge tubers buried at 6" deep was completely suppressed by the treatments, although those buried 1" deep experienced little suppression.

Based on results from the greenhouse experiments, Muramoto and his colleagues have started or about to start field trials at Ventura and Moss Landing in California and at Fort Pierce in Florida.

A trial in Ventura used 10 tons/ha of rice bran from a rice mill in California, onion waste from an onion processor in Ventura, and ethanol as carbon sources. "A solution of 1% ethanol has been successful in Japan at creating anaerobic conditions," says Muramoto. In the strawberry system in California, diluted ethanol can be injected through drip tapes.

In Moss Landing, four treatments are being compared: 10 tons/ha and 20 tons/ha of rice bran, an irrigation equivalent to 4 acre-inches at 1% solution of ethanol, and a control with no carbon sources applied. *Verticillium dahliae* is the target pest in the California strawberry experiments. The effect on weeds will also be evaluated.

A factorial field trial in Florida, to be started later this summer, will test the effects of molasses, poultry litter, and different irrigation rates on nutsedge and nematodes.

In addition to measuring fruit yields, disease occurrence, and effectiveness at suppressing target pests, all of the field trials will evaluate costs of the most efficient ASD options, which will be compared with costs and effects of conventional methyl bromide treatments.

Center Receives Federal Funds for Agrifood System Research, Education

A grant of \$355,000 from the US Department of Agriculture will fund a Center project to study and develop integrated, model programs for improving health, ecological sustainability, and agrifood system literacy within college and community environments.

The project integrates research, education, and public service in achieving three key objectives: 1) increasing understanding of and literacy about sustainable agrifood systems, 2) increasing capacity for conducting research on agrifood system sustainability, and 3) investigating opportunities for increasing access to and demand for local, organic produce through farm-to-college programs.

As part of the project, Center staff, in collaboration with other groups on campus, will implement pilot education efforts to engage college students in understanding where their food comes from, how it was produced, and the broader food web. These efforts will take place at the many places students purchase and eat food on campus (dining halls, Farm & Garden market stand, coffee carts, campus Community Supported Agriculture project, etc.). Center researchers will evaluate the effects and impacts of these education strategies in order to develop replicable learning modules and materials for others to use.

Other efforts will include organizing the Agrifood Seminar at UCSC to increase understanding of the research needed on sustainable agrifood systems and to foster interdisciplinary collaborations. The project will also fund a Sustainable Agrifood Systems Fellowship program at several UC and community college campuses (see page 11).

To broaden this work into the community, Center staff will explore the needs and opportunities for a regional food systems consortium. A Central Coast consortium could be a key component for furthering sustainable agrifood systems in area. Results of these and other efforts funded by the grant will appear in future issues of *The Cultivar*.

New Summer Course Debuts

A new version of the agroecology “practicum” class debuted this summer, with the Center’s Farm & Alan Chadwick Garden serving as classrooms for the Environmental Studies course offered through UCSC’s Summer Session program. Taught by Katie Monsen, who recently completed her PhD



Katie Monsen

Matt Harder, a student in this summer’s agroecology practicum class, uses a “beat sheet” to collect insects for identification as part of the class’s study of pest management.

in Environmental Studies at UCSC, the course combined lectures and demonstrations with field applications to give students direct experience and knowledge of sustainable agriculture and horticulture practices and principles.

“We designed the summer version of this class as a way for students to take agroecological principles they’ve learned in class and apply them during the height of the growing season. It gives them an opportunity to really examine how those concepts are used by growers on a daily basis in the field,” says Monsen.

Along with UCSC undergraduates, the course attracted undergraduate students from UC Berkeley, Reed College in Portland, a post-graduate of Kenyon College in Ohio, and students from UC Davis and Evergreen State who are about to enter graduate school.

The Center’s Apprenticeship instructors served as a key resource for the students. Orin Martin, Jim Leap, Liz Milazzo, and Christof Bernau provided field demonstrations and guided fieldwork experience on basic soil fertility, seed sowing, transplanting, pest and disease management, and irrigation skills. They also helped the students design and conduct a variety trial of Asian greens. Apprenticeship course participants and second-year instructors shared their knowledge as they worked alongside the students.

The students also got some real-life direct marketing experience by working a shift either at the Farm & Garden’s weekly produce stand, at a Community Supported Agriculture (CSA) pick-up site, or at a market stand run by the youth group “Food! What?,” serving the predominantly low-

income Beach Flats neighborhood of Santa Cruz. Students learned about consumer issues in the food system, as well as the consolidation taking place in both the conventional and organic food industries.

“The Farm & Garden sites have provided a rich environment for learning about the practical aspects of farm management, such as how food distribution works, how to set up drip irrigation or how to properly pick a zucchini, and then relating those to the political economy of the food system, the process of evapotranspiration, or plant morphology,” says Monsen. “The students say this has been an incredible experience.”

For information on upcoming agroecology courses offered through UCSC’s Summer Session program, contact Monsen at kmonsen@ucsc.edu or see <http://summer.ucsc.edu/>.

Generous Gifts and Grants Fund Center Programs, Facilities

A Wallace Genetic Foundation grant of \$50,000 has helped fund the three new greenhouses at the Center’s on-campus Farm and the Organic Greenhouse Education and Demonstration Project. Newman’s Own Organics through Newman’s Own Foundation also granted \$50,000 to the greenhouse construction project last December. Kurt Macleod, a 1991 apprentice, made a \$4,000 contribution online for the greenhouse project from Cambodia where he now lives and works. DreamCatcher Foundation, at the suggestion of Robert Rich III, contributed \$1,500 to the greenhouse project. Johnny’s Select Seeds has pledged three years of support to the Farm & Garden Apprenticeship Program in the form of \$1,000 in seed and product and \$750 in cash each year over the next three years. Johnny’s products include organic vegetable and flower seeds, and this year’s cash donation will be used for the new greenhouse construction. Other seed companies donating to the greenhouse project included Sakata Seeds and American Takii Seeds.

As noted on page 16, a grant from the USDA will fund a variety of agrifood system research and education projects.

We are also grateful for the following recent gifts of support to the Center’s programs –

The Appleton Foundation gave \$25,000 to support research on issues of gender equity in the food system.

The Eucalyptus Foundation awarded \$50,000 to support the Innovative Business Models initiative focused on specialty crop family farmers and value-added agricultural businesses in the Central Coast region.

An anonymous foundation has made a \$7,200 donation for the third year in a row to support international scholarships in the Apprenticeship Program.

Jan and Lynn Dash donated \$3,000 to the Honore Dash Memorial Fund for an Apprenticeship scholarship in 2008.

The Seed Fund of the Studio for Urban Change donated \$10,000 in support of the Apprenticeship Program.



Three new greenhouses constructed at the CASFS Farm this spring now serve as important resources for education and production.

Richard Senior, Alan Chadwick’s nephew who visited the Farm & Garden in 2003, gave \$1,000 to help support the Alan Chadwick Garden.

The Friends of the UCSC Farm & Garden Board of Directors has pledged a \$16,000 gift to the apprentice housing project. The Stocker Family Fund at the Community Foundation of Santa Cruz County pledged \$15,000 to the apprentice housing project to build the solar shower facilities. Page Allison Roper, a 1998 Apprenticeship graduate, donated \$1,000 to the apprentice housing project as did an anonymous donor. Lori McMinn, a 2002 Apprenticeship graduate, donated \$1,000 for second-year apprentice housing. We are also grateful to all the former apprentices and other supporters who have given to the Apprenticeship and the apprentice housing project over the past year.

Jonathon Landeck Hired as Assistant Director

Jonathon Landeck has been hired to fill the Center’s new Assistant Director position. Landeck has been involved in research, education, and management of sustainable agriculture programs and organizations since 1979, most recently as the Deputy Executive Director at the Organic Farming Research Foundation.

His experience and academic background cover many areas of the Center’s work. Landeck has a Ph.D. in Extension Education, an M.S. in Soil Science and a B.S. in Forestry. A sampling of projects he’s worked on includes conducting sociological research on soil management in Guinea, West Africa; coordinating and conducting agronomic research on soil and energy conservation with alternative tillage methods; and developing educational programs about issues relating to agricultural production and marketing, natural resource management, water quality, and agricultural and natural resource policy.

We welcome Jonathon to the Center.

Strawberry-Vegetable Study Confirms Value of Crop Rotations

“Let rotations do the work instead of substituting inputs,” said Stephen Gliessman at this year’s Ecological Farming Conference in Asilomar, California. Gliessman, an agroecologist with UC Santa Cruz’s Environmental Studies department, led a lineup of researchers and growers reporting on a five-year study that examined organic strawberry and vegetable rotations at the Elkhorn Ranch in Moss Landing, California. The study’s goal: to determine how rotations influence such factors as disease occurrence, weed suppression, nutrient levels, yield, and net return.

Although crop rotations are a common practice in many farming systems, there is still limited research on the various effects of rotations in organic agriculture. Funded by a grant from the USDA’s Integrated Agriculture Program, Gliessman, along with researchers Joji Muramoto, Carol Shennan, and Sean Swezey of the Center for Agroecology & Sustainable Food Systems, teamed with grower Dan Schmida of Sandpiper Farms, Robert Stephens of Elkhorn Ranch, and Steve Koike and Karen Klonsky of UC Cooperative Extension to try and fill some of the information gaps on how various rotations of organic strawberries and vegetables can influence agroecosystem health.

Gliessman made the point that crop rotations can accomplish a number of objectives in an agroecosystem. Known collectively as the “rotation effect,” these include disease suppression, improved soil fertility and soil physical properties, decreased soil erosion, increased organic matter, increased biodiversity, and higher yields. For strawberry growers, who face particular challenges from soil disease buildup, one of the biggest questions in designing a rotation is “when can we plant strawberries again?”

To help address that question, the research team established a rotation study at Elkhorn Ranch’s commercial organic strawberry fields, with treatments ranging from a 7-year break between strawberry crops to continual strawberries (strawberries planted every year for 5 years). By the fifth year of the study, all of the research plots were planted to strawberries in order to compare their performance.

DISEASE CONSIDERATIONS

In part because of the high cost—close to \$30,000 per acre (Bolda et al. 2006)—associated with organic strawberry production, and the potential for high returns, shortening the rotation period between strawberry crops is a priority for organic strawberry growers on California’s Central Coast. But short rotations also pose the risk of exposing plants to disease organisms that can build up in the soil when strawberries are present.

Steve Koike of UC Cooperative Extension in Monterey County reviewed some of the reasons that strawberries are particularly vulnerable to soilborne pathogens such as *Verticillium dahliae*, *Phytophthora*, and *Colletotrichum*. “Strawberry plants grow slowly, are in the ground for a long time, and undergo prolonged physiological stress due to their extended fruiting time,” says Koike. This makes them good hosts for a variety of pathogens. In addition, there are no truly disease-resistant strawberry cultivars for growers to rely on.

For these reasons, “Rotations are essential,” says Koike. He noted that although it’s unrealistic to completely eliminate disease-causing organisms from a system, alternating strawberries with crops that don’t act as hosts can lead to a passive, gradual decline of soil pathogens. By choosing rotational crops such as broccoli that actually suppress disease organisms, growers can actively limit soilborne diseases.

Analyzing the potential of broccoli both as a rotational crop and as a “biofumigant” was one goal of Muramoto’s work at Elkhorn Ranch. Muramoto incorporated broccoli and mustard residues along with compost into the soil prior to planting either vegetable (broccoli or spinach) or strawberry crops (Aromas and Seascape cultivars), then measured the response of *V. dahliae* populations. Although mustard showed little effect, populations of *V. dahliae* dropped significantly following the incorporation of broccoli residues.

Using an approach that integrated compost, biofumigation, non-host vegetable crops, and relatively disease-resistant cultivars, Muramoto found that strawberries could be grown organically with a 1- to 3-year break rotation without significant differences in yield. However, he noted, “Part of that result reflects the relatively low disease pressure that was present on the Elkhorn Ranch site.” Strawberries grown after a 7-year interval between plantings showed higher yields than those grown with the shorter rotation periods (see figure 1).

Muramoto also said that the lower yield found in plots undergoing shorter rotations between strawberry crops might be due to sublethal pathogens that were not monitored in this study. He is also examining the effect of different rotations on soil microbial diversity, to see whether that factor might account for differences in pathogen levels and yield.

ROTATION ECONOMICS

Based on the yield data from the Elkhorn Ranch plots, UC Cooperative Extension economist Karen Klonsky evaluated the differences in return for the various rotational treatments. She found that for every year the rotation was

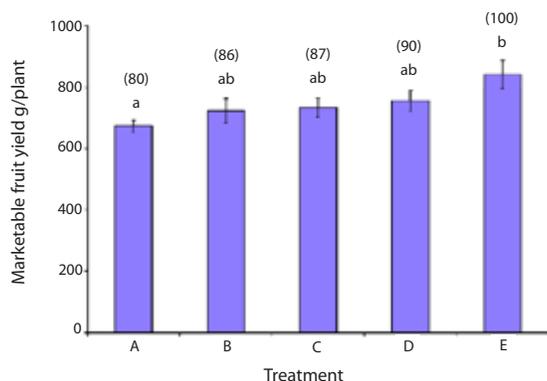


Figure 1. Cumulative marketable fruit yield (2006) where treatment A is continuous strawberries, B is a 1-year rotation (1 year between strawberry crops), C is 2-year, D is 3-year, and E is the control (7 years since strawberries were planted).

extended, average net returns per acre ranged from \$745 to \$1,192, reflecting the increase in yield.

Klonsky noted, however, that just looking at potential strawberry yields in isolation doesn't tell the whole story. Growers have to consider the expected price of strawberries, the potential return from alternative crops and crop mixes, and the input and labor costs associated with strawberry production compared to those of other crops.

She also contrasted the situation of large-scale strawberry growers (20–80 acres) who lease land for 2 to 3 years and then turn the lease over to a vegetable grower, versus small-scale producers (10–20 acres) who may grow 1 to 2 acres of strawberries at a time.

“Larger growers are usually looking for new land to move onto, and need to be aware of the history of the land they're leasing. Finding high quality land is key,” she says. Small-scale growers have to develop a production plan that allows for rotations, and also reflects the costs and potential returns from alternative crops and crop mixes.

ON THE GROUND EXPERIENCE

Steve Pederson of High Ground Organics has developed just such a plan for the approximately 30 acres he farms near Watsonville in Santa Cruz County. In partnership with Mariquita Farm, High Ground markets approximately 80% of its produce through a Community Supported Agriculture (CSA) program, with the rest going to other direct market outlets.

Over the years, Pederson has developed a 5-year rotation strategy for his strawberry crop. Every fifth year, he plants strawberries on one of five 3-acre plots, focusing on Seascape, Chandler, and other UC-developed cultivars that aren't grown by the bigger producers.

Along with the 5-year rotation, Pederson uses Sudan grass as a summer cover crop. “We've found that the plants were healthier following incorporation of Sudan grass—it's become a mainstay of our rotation system,” he says. Pederson also notes that he never plants Solanaceae family crops (tomatoes, peppers, potatoes, etc.) on ground where strawberries will be grown.

“We can't afford to not have land working for us,” said Peterson. Permanent beds allow him to turn crops over quickly, and the land is always covered in either vegetable or cover crops. “We cover crop extensively with a legume/cereal/rye mix to improve soil tilth, organic matter, and the diversity of microbes.”

The result: a productive farming system with few disease problems that reflects the “rotation effect.” Says Muramoto, “We're still getting at the science behind what makes these rotations work. Much of what our study showed is that small-scale growers who employ the types of rotations that Steve Pederson uses are doing the right thing.”

—MARTHA BROWN

Resources

Organic strawberry and vegetable production: rotation, rotation, rotation. <http://www.agroecology.org/Ecofarm08.html>

Bolda, M., et al. 2006. Sample costs to produce organic strawberries, Central Coast. UCCE <http://coststudies.ucdavis.edu>

Conservation Attitudes

continued from page 6

correlation between those factors,” says Pisani Gareau. Those willing to sacrifice profit to protect natural resources showed significant interest in terracing, grass plantings, floral insectaries, constructed wetlands, and habitat restoration.

In a similar way, attitudes toward wildlife play a major role in a grower's interest in conservation efforts. “If growers feel strongly that wildlife on farms is a nuisance, they're not going to be interested in floral insectaries, constructed wetlands, buffer strips, and habitat restoration,” says Pisani Gareau.

She notes that “nuisance” is a broad term that includes potential threats to food safety as well as things like gophers chewing holes in drip tape, ground squirrels munching on strawberries, and birds pecking at tree fruit. Even some of the growers who reported that they enjoy seeing wildlife on farms tempered their response with the disclaimer “as long as they are not deer or gophers.” “This points out the real challenges growers face with certain types of wildlife,” says Pisani Gareau.

SURVEY RESULTS SUGGEST MANAGEMENT ACTIONS

Pisani Gareau points to a number of potential actions that those promoting conservation farming could take based on her survey findings. “For instance, the results regarding attitudes toward wildlife demonstrate the need for more research to understand the advantages, the level of risk, and most importantly the ways to mitigate risks of on-farm habitat and wildlife in order to make habitat enhancement a more appealing conservation option.”

The survey also highlights the way that a grower's social identity—in this case, their participation in the National Organic Program, the California Winegrowing Alliance,

> continues on next page

Santa Cruz area events

► **Fall Plant Sale**, Friday, September 12, 12 noon – 6 pm and Saturday, September 13, 10 am–2 pm, Barn Theatre Parking Lot, UC Santa Cruz

Fall is a wonderful time to plant vegetable crops that will extend your gardening season and to give perennials a good head start for next spring's blossoms. The region's best-suited varieties of organically grown winter vegetables and landscape plants will be available. Friends of the Farm & Garden members receive 10% off all purchases.

For more information, call 831.459-3240 or send email to jonitann@ucsc.edu.

► **A Taste of the Harvest – Life Lab Garden Program's Annual Benefit**, Saturday, September 13, 4 pm – 7 pm, Life Lab Garden Classroom, UCSC Farm

Come enjoy a seasonal tasting prepared by Chef Jon Dickinson of Cafe Cruz on tables set in the garden overlooking the Monterey Bay.

The tasting features produce from local farms including Life Lab's "Food, What?!" Youth Farm. Enjoy wine by Cooper-Garrod

Vineyards and beer by Santa Cruz Mountain Brewery. The silent auction has a large array of gifts and services from local businesses.

\$50 per person; other ticket packages available. For more information or to become an event sponsor, please contact Life Lab at 831-459-4074 or send email to development@lifelab.org.

► **Harvest Festival and Food for Thought Forum**, Saturday, October 4, 11 am–5 pm, UCSC Farm

Join us for this annual celebration of the harvest. Enjoy live music, great food, gardening talks, farm tours, cooking demonstrations, kids' activities and much more. This year's Food for Thought forum will discuss reasons behind the escalating cost of food.

\$5 general admission; \$3 for UCSC students or free for students with coupon from Campus Food Guide; free for kids 12 and under and members of the Friends of the Farm & Garden. For more information, call 831.459-3240 or send email to jonitann@ucsc.edu.

or commodity groups such as strawberry growers that have been a target for conservation outreach—influences their willingness to enact conservation measures in their operations. Thus Pisani Gareau suggests that it may be useful for conservation agencies to tailor their outreach efforts to particular production groups.

The fact that many growers have not enrolled in conservation programs due to the bureaucratic process and lack of time also points out the need not only to streamline enrollment processes, but to reward growers financially for the time it takes to install and manage a conservation area.

When asked what surprised her most about the survey, Pisani Gareau remarks on the underlying conservation ethic that the results revealed. "I thought it was interesting that so many growers have an ethic for conserving natural resources strictly for the value of doing so—not just because they have to, or are mandated to, but because there's an intrinsic value in doing so. Also, while conservation practices were mostly geared towards soil conservation I was surprised to find that nearly a fifth of the respondents were increasing biodiversity on their ranches by creating perennial habitat. It shows that many growers are concerned with not only managing the crops but also the larger agricultural landscape. This type of land stewardship is seen as an important part of sustainable agriculture."

– MARTHA BROWN

Reference

Pisani Gareau, T. (forthcoming). Farmscaping for conservation in the Central Coast of California: An interdisciplinary investigation of the potential of hedgerows to enhance biological control services and the social factors that influence farmers' conservation practices. Dissertation. University of California, Santa Cruz.

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UC Santa Cruz
The Center for Agroecology & Sustainable Food Systems
1156 High Street, Santa Cruz, CA 95064
www.ucsc.edu/casfs

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