CASFS

The CENTER *for* AGROECOLOGY *&* SUSTAINABLE FOOD SYSTEMS

The mission of the Center for Agroecology & Sustainable Food Systems is to research, develop, and advance sustainable food and agricultural systems that are environmentally sound, economically viable, socially responsible, nonexploitative, and that serve as a foundation for future generations.

1999 – 2001 Activity Report and Research Summary

Center for Agroecology & Sustainable Food Systems

University of California, Santa Cruz

"Controversy Over Agricultural Biotechnology Continues"[1]

"Central Valley Evolving into Patchwork of Poverty and Prosperity"[2]

"Pesticides Linked to Frog Decline"[3]

These recent headlines touch on the range of issues challenging the long-term sustainability of agriculture and the human and natural resources it impacts. At the Center for Agroecology & Sustainable Food Systems (the Center) these and many other issues drive our research, education, and outreach efforts as we work to create agricultural and food systems that sustain both human communities and the environment.

The past two years have been a period of both growth and challenge for the Center. We have received unprecedented support from within the University for our work. The Division of Social Sciences—our bureaucratic "home" at UC Santa Cruz—has provided funding for new and upgraded facilities, grants, and program development. Thanks to the efforts of UCSC chancellor M.R.C. Greenwood, Social Sciences dean Martin Chemers, and other campus administrators, the UC Office of the President added a permanent funding augmentation to increase our operating budget. In addition, they negotiated a five-year award from the UC Division of Agriculture and Natural Resources to support the Center's farm and watershed extension programs.

Support has also come from outside the university, making possible several special projects. Congressman Sam Farr helped secure a substantial allocation from the US Department of Agriculture, which we used to initiate research and extension activities on water quality, organic production, and food systems in the Central Coast region. Grants from several foundations underwrote development of an organic farming training manual based on the Center's *Apprenticeship in Ecological Agriculture* curriculum. A benefit concert by singer-songwriter Tracy Chapman raised funds for apprenticeship scholarships. And efforts by the California Sustainable Agriculture Working Group and California legislators, including Assemblyman Fred Keeley, focused attention on the need for the state to better support its University-based sustainable agriculture programs, including the Center.

New and renewed partnerships have strengthened our current work and laid the groundwork for new projects.

California BioAg Initiative Passes

Thanks to the efforts of the California Sustainable Agriculture Working Group and many individual growers and consumer activists, California governor Gray Davis signed Assembly Bill 2663, the California BioAg Initiative, in October 2000. This initiative calls for the University of California to provide permanent and adequate funding for all of the UC system's sustainable agriculture research and education programs, including the Center.

We teamed with faculty and academic programs at UCSC to develop plans for expanded research and education in farmscaping, landscape ecology, and conservation; sustainable agriculture and rural change; and organic agriculture. We hope these plans will result in additional faculty positions with departmental and Center responsibilities.

On a broader front we continued to work with regional and national academic and non-governmental organizations. Along with the Organic Farming Research Foundation (OFRF), the Center co-hosted the first Scientific Congress on Organic Agriculture, a gathering of researchers and farmers charting a course for organic agricultural research. We were also invited to join the Organic Agricultural Consortium, a nationwide cooperative of groups with programs in organic farming research and education. Locally, we helped establish a network of researchers conducting organic farming investigations.

Jim Leap

Melanie Okamoto harvests strawberries from a variety trial at the Center's on-campus organically managed research fields.

Despite the growing interest in organic farming, investment in research, education, and extension on alternative and organic production methods continues to lag. OFRF's "State of the States" study reports that only 0.02% of the available agricultural land in the land grant system is being used for certified organic research. The Center's organic farm on the UCSC campus represents a major portion of certified farmland devoted to research and teaching on agroecology and organic production methods in the UC system.

Stephen Gliessman

A UCSC agroecology class takes part in a field-based experiment on intercropping at the Center's on-campus farm.

Among the challenges the Center faces are plans by UCSC to build faculty and staff housing on a section of certified farmland that had been on loan to the Center. The proposal triggered a search for new field sites to permanently preserve and expand our on-campus research and teaching capacity, an effort that will continue in the coming year.

The Center's own growth has prompted the need to upgrade and expand office and laboratory facilities to accommodate additional staff and graduate students as we add new teaching, research, and outreach components. Although challenging, we view this growth as a positive step toward developing a more effective Center that can help meet the demand for sustainable farming and food systems. In the following pages we summarize Center research projects and highlight accomplishments of our education and outreach efforts from July 1999 through June 2001.

Funding Sources, 1999-2001

Funding for research, education, and community outreach efforts was provided by the University of California, the UCSC Division of Social Sciences, and by grants and endowments from the following individuals and organizations –

The Arkay Foundation
BioLogixs
California Environmental Protection Agency
Mary A. Crocker Trust
Honore Dash Family
Foundation for Deep Ecology
Friends of the UCSC Farm & Garden
Margoes Foundation of San Francisco
Newman's Own
Newman's Own Organics
Organic Farming Research Foundation
Stanley Smith Horticultural Trust
True North Foundation
UC Division of Agriculture and Natural Resources
UC Sustainable Agriculture Research and Education Program
US Department of Agriculture
US Environmental Protection Agency
Harry O. Warren Endowment

Research

The breadth of research undertaken by Center staff, faculty, and students over the past two years reflects the complexity of the sustainable agriculture and food systems movement. Much of the work in farming systems and agroecology *(page 4)* was conducted as part of the Center's Farm Extension Program, which provides on-farm research and extension services to organic and transitional (those converting from conventional to organic practices) farming clients, as well as clients who want to reduce their use of synthetic agricultural chemical inputs.

The following is a summary of ongoing and completed research projects; also listed are related research reports and publications produced from July 1999 through June 2001 (additional publications are listed on page 12), as well as extramural funding sources that augmented Center contributions.

Sustainable Food Systems

ALTERNATIVE PRODUCTION, MARKETING, AND RESEARCH PROGRAMS ON CALIFORNIA'S CENTRAL COAST

California's Central Coast is home to a range of organic farms, farmers' markets, Community Supported Agriculture (CSA) projects, research on organic production, and other alternative programs. But how effective are these programs in improving the environment and conditions for farmers and consumers? As part of a USDA-funded study of Central Coast farming practices and food systems, the Center's social issues staff is examining the effect of alternative production, marketing, and research efforts on both ecological sustainability and social conditions for growers and consumers.

CASFS: Patricia Allen, James Murrell, Keith Warner

Funding: US Department of Agriculture

COMMUNITY FOOD SECURITY

Over the past two years, Center social issues staff were involved in analysis of food and agricultural policy and food security issues; analysis of concepts of localism, agrarianism, and gender in sustainability and food security; analyses of the concepts and practices of sustainable agriculture and food security in the U.S.; and social movements around sustainable agriculture and community food security. Senior issues specialist Patricia Allen wrote extensively in these areas and is active in food security policy at the local and national levels.

CASFS: Patricia Allen

Related publications

Allen, Patricia. 2000. Fitting into Procrustes bed?: Sustainable agriculture and community food security programs in the United States. In *Consuming Foods, Sustaining Environments*, S. Lockie and W. Pritchard (editors). Brisbane: Australian Academic Press.

Allen, Patricia. 1999. Out of the mouths of babes: An exploration of contemporary U.S. farm and food policy. In *Hunger-proof Cities: Sustainable Urban Food Systems,* ed. M Koc, R. MacRae. L. J. A. Mougeot, and J. Welsh. Ottawa: IRDC Books.

"GREEN CONSUMERISM" AND THE ORGANIC FOOD INDUSTRY

Can shoppers change the food system? The Center's social issues staff studied the impact of the "green consumer" movement, to assess the extent to which the public's growing interest in organic products can continue to influence food production practices and agricultural policies in the U.S. They also evaluated changes in the organic farming movement as larger-scale growers and markets enter the industry.

CASFS: Patricia Allen, Martin Kovach

Related publication

Allen, Patricia and Martin Kovach. 2000. The capitalist composition of organic: The potential of markets in fulfilling the promise of organic agriculture. *Agriculture and Human Values* 17:221-232.

Farmers' markets offer an alternative to conventional grocery stores and give consumers the chance to directly support small- and medium-scale farmers.

Victor Schiffrin

PERSPECTIVES AND STRATEGIES OF ALTERNATIVE FOOD INITIATIVES IN CALIFORNIA

People are increasingly concerned about food—how it is produced and distributed, the health effects of industrially produced food, the environmental consequences of chemically-intensive farming practices, and the political and economic implications of a concentrated and globalized food system. Addressing these issues are a growing number of alternative food initiatives (AFIs) organized by consumers, activists, and farmers. These groups seek to incorporate values such as regionalism, seasonality, community, environmentalism, and food security into the food system. In 2001, the Center's social issues researchers received a grant from the UC Sustainable Agriculture Research and Education Program (UC SAREP) to study a number of the groups and programs spearheading AFI efforts in California.

This project involves in-depth interviews with organization leaders, and focus groups with members and clients of alternative food initiatives. These initiatives range from farmers markets, eco-labels, Community Supported Agriculture projects, and farmer-school projects to urban gardens and community food security efforts. From these interviews, the researchers will assess the different visions of food system alternatives that the organizations propose, the issues and problems they confront, and the strategies they use in their projects. The research group will use this information to develop recommendations designed to make these programs more effective. The goal of this work is to assist the many farmers, consumers, environmentalists, activists, and citizens working to develop agrifood alternatives.

CASFS: Patricia Allen, James Murrell. *Cooperators:* Margaret FitzSimmons, Mike Goodman, Keith Warner, UCSC Environmental Studies Department.

Funding: UC Sustainable Agriculture Research and Education Program

ROOTS OF CHANGE – SOCIAL INNOVATIONS AND ALTERNATIVE FOOD INITIATIVES

Concerns about the agrifood system reach across communities of class and circumstance, and have given rise to a remarkable range of new initiatives and civic organizations engaged in the critique of the conventional food system and the search for new alternatives and initiatives.

In a project initiated in 2000, Center researchers and faculty affiliates are analysing the various alternative production, marketing, and education approaches that are currently favored in the sustainable agriculture and community food security movements. They are evaluating these approaches in terms of their potential for creating progressive change in the agrifood system. This work complements the AFI study described above.

CASFS: Patricia Allen, Ann Lindsey. *Cooperators:* Margaret FitzSimmons, David Goodman, Michael Goodman, Andrew Marshall, UCSC Environmental Studies Department; Shelly Errington, UCSC Anthropology Department; Robert Gottlieb, Occidental College.

Farming Systems and Agroecology

BENEFICIAL INSECT HABITAT IN ORGANIC BROCCOLI

Like many crops, broccoli doesn't provide the floral resources that support key beneficial insects. In an ongoing study initiated in the spring of 2001, Center researchers are testing beneficial habitat mixes grown as hedgerows in broccoli plantings to see whether the mixes will attract natural enemies of broccoli pests. These natural enemies include syrphid flies, bigeyed bugs, and parasitic wasps, which prey on or parasitize aphids, cabbage loopers, and other broccoli pests. The project is located at the former Ft. Ord military base, where UC Santa Cruz leases land to Dynasty Farms for organic vegetable production.

Beneficial habitat plantings are sampled weekly to find out what types of insects are attracted to the mixes. The extension program is also developing a sampling protocol for pests in the broccoli crops and studying the influence of cropping patterns on pest population levels. They will release lacewings into some of the beneficial plots to analyze this natural enemy's impact on pest populations. The research will continue through early fall 2001, with plans to extend this research to other organic vegetables.

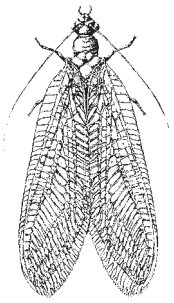
CASFS: Janet Bryer, Polly Goldman, Diego Nieto, Bill Settle. *Cooperator:* Dynasty Farms.

Funding: US Department of Agriculture

BENEFICIAL INSECT REARING PRACTICES

Green lacewings are generalist predators whose larvae prey on a number of agricultural pests, including aphids, mites, and lygus bugs. Growers often release insectary-reared lacewings to control pests in a variety of crops.

In this study, conducted in 2000, Center researchers tested alternative diet preparations with the goal of simplifying the way lacewings are reared in the lab in order to cut the cost of rearing these predators for mass release. Further lacewing studies are planned.



Luke Bennett

CASFS: Janet Bryer, Polly Goldman, Amanda Lewis, Eri Mizuno, Sean Swezey

Funding: BioLogixs

BIOLOGICAL AGRICULTURE SYSTEMS IN COTTON (BASIC)

Initiated in 1996, the BASIC project teams cotton growers with researchers and technical advisors in an effort to reduce pesticide use in northern San Joaquin Valley cotton crops. The project focuses on farm-based, production-oriented research on alternative farming methods and facilitates information exchange through grower meetings, field days, and a newsletter distributed to cotton growers throughout the region. In this ongoing effort, Center research staff conduct weekly monitoring of enrolled organic and low-pesticide acreage to give growers information about

their crop's development and to identify potential yield-limiting factors. Researchers also assess the yield and economics of organic and BASIC cotton production methods compared with cotton in the region grown using conventional methods.

CASFS: John Bailey, Janet Bryer, Merrilee Buchannan, Polly Goldman, Diego Nieto, Sean Swezey. *Cooperator:* Sustainable Cotton Project.

Funding: California Department of Pesticide Regulation, California Environmental Protection Agency, US Environmental Protection Agency

Related publications

Brown, Martha. 2000. Pros and cons of growing organic cotton. *Arizona-California-Texas Cotton Magazine* 32:3, 8-9.

Swezey, Sean L., and Polly Goldman. 2001. Cotton yields, quality, and insect abundance in the Northern San Joaquin Valley, CA, 1996-2000: Comparison between organic, conventional, and grower-led, reduced-input production systems. In *Proceedings, Beltwide Cotton Conferences, Anaheim, CA* (in press).

Swezey, Sean L. and Polly Goldman. 1999. Pest and beneficial arthropod abundance in California organic and biointensive cotton fields: The "BASIC" experience, in *Proceedings, 1999 Beltwide Cotton Conference, Orlando, FL, Volume 2,* pp. 1136-1141.

BIOLOGICAL/ORGANIC AGRICULTURE SYSTEMS IN STRAWBERRIES (BASIS/OASIS)

In 2001, production and use of the soil fumigant methyl bromide underwent a 50% mandatory reduction, with cancellation scheduled for 2005. Most conventional strawberry growers have relied on methyl bromide to control soil diseases and weeds, and the search for alternatives has taken on new urgency now that the phaseout is underway.

The BASIS/OASIS working group is examining a wide range of alternatives to methyl bromide and other conventional pest control inputs. As part of the study, Center researchers established plantings of non-crop vegetation within and adjacent to commercial strawberry fields (both conventional and organic) in the Monterey Bay region. For the past two seasons the group concentrated on managing trap crops to determine how to most effectively control *Lygus hesperus,* a major pest of strawberries. Center personnel monitored trap crops and adjacent strawberry crops to determine the impact of the plantings on populations of pest and beneficial insects. In 2001 they began experiments with early- and late-season trap crops; early season crops consisted of a mix of mustard and radish, which blooms in late winter and early spring. The spring crop includes alfalfa and sweet alyssum, which should attract lygus through the late season.

In 2001 the research group also began testing the efficacy of "vacuuming" some of the trap crops with a bug vac to remove lygus from the fields. In addition, they released two species of lygus nymph parasites, *Peristinus stygicus* and *P. digoneutis,* into a subset of the trap crops to see whether the parasites can become established in the trap crops and control lygus nymphs.

Jon Kersey

Center researcher Amanda Lewis collects insect samples from a trap crop as part of the BASIS/OASIS project.

CASFS: John Bailey, Janet Bryer, Polly Goldman, Amanda Lewis, Eri Mizuno, Diego Nieto, Bill Settle, Sean Swezey. Principal Investigator: Carolee Bull, USDA – Agricultural Research Service. *Cooperators:* Reggie Knox, Community Alliance with Family Farmers; Steve Koike, UC Cooperative Extension; Charles Pickett, USDA; Swanton Berry Farms, Pacific Gold Farms (management-team members).

Funding: UC Sustainable Agriculture Research and Education Program, Organic Farming Research Foundation

CONSERVATION TILLAGE TRIAL

Growers in the Midwest have long used no-till and low-till systems to help preserve soil organic matter and minimize tillage costs. However, most of these systems rely on chemical herbicides to control weeds.

Center researchers, in collaboration with UC Cooperative Extension researcher Jeff Mitchell, are experimenting with ways to incorporate conservation tillage practices into organic row crop systems. A key to this effort is to identify cover crops that will grow vigorously and produce a high-residue surface mulch to suppress weed growth, but will also die back at the time vegetables are transplanted in order to minimize competition for water and nutrients.

In 2000 and 2001, cover crop trials were planted at the Center's on-campus farm. Initial results show that the Triticale/Merced Rye/Common Vetch and the Barley/Common Vetch treatments generated approximately equal amounts of biomass, creating a thick surface mulch. However, the Lighting Persian Clover/Paradana Balansa Clover/Antas Subclover did not generate enough surface mulch to suppress weeds. Winter squash were planted into the flail mowed or chopped cover crops in June 2001, and a tillage treatment was established for comparison. Crop performance and yield will be evaluated at the end of the growing season.

CASFS: Jim Leap, Carol Shennan. *Cooperator:* Jeff Mitchell, UC Cooperative Extension.

Funding: Organic Farming Research Foundation

COVER CROPPING TRIALS

In 2000, Center researchers and affiliated faculty established trials at the Center's Farm and at the former Ft. Ord site to compare two cover cropping strategies: a one-year fallow cover cropped with perennial rye grass, overseeded after a few months' growth with crimson clover, versus the common practice of using winter cover crops and additions of compost. The researchers are examining soil fertility, organic matter dynamics, and subsequent crop growth and health of the two systems. The goals of this study are to better understand how the fallow impacts different aspects of soil quality and crop growth, and to determine whether this could be a good strategy for transitioning land low in organic matter to organic vegetable production. While it would mean losing a year of production, the fallow cover crop period may prove more desirable than incurring losses during the transition phase.

CASFS: Jim Leap, Marc Los Huertos, Carol Shennan. Cooperators: Weixin Cheng, Michael Loik, UCSC Environmental Studies; Dynasty Farms.

Funding: US Department of Agriculture

FARM LANDSCAPE ANALYSIS AND MANAGEMENT PROJECT

Center researchers are developing a multiple use Geographic Information System (GIS) to support resource management, teaching, and research at the Center's 25-acre Farm, located on the UCSC campus. Beginning in 1999, project staff prepared GIS base layers using aerial photography, a digital elevation model (DEM), and Global Positioning System (GPS) technology. Land use and perennial vegetation cover patterns have been identified and mapped across the UCSC Farm.

User-friendly management record sheets are being created for inputting data on cropping history, management, yields, and pest problems to build a historical record that can aid farm management and be used as a resource for analyzing farm performance over time. In the spring of 2001, Antonio Abboud, a visiting researcher from Brazil, began developing nutrient budgets and soil fertility maps for selected sections of the Farm. These will be combined with data on fertility inputs such as compost to help analyze the effectiveness of cropping and soil management practices.

CASFS: Jim Leap, Barbara Maximovich, Carol Shennan. *Cooperators:* Brian Fulfrost, GIS Laboratory, UCSC Environmental Studies Department; Antonio Abboud, Universidade Federal Rural do Rio de Janeiro, Brazil.

GARDEN SYMPHYLAN MONITORING AND CONTROL

The garden symphylan *(Scutigeralla immaculata),* also known as the garden centipede, is a tiny, active soil pest that feeds on developing plant roots, sapping the plant of nutrients and stunting or killing germinating seeds and transplants.

Symphylan infestations at the Center's on-campus organic farm have prompted staff to search for organically acceptable control strategies, which have not been well characterized and tested to date. An ongoing study, initiated in 1998, is examining various monitoring techniques and control options for symphylans.

Results from two years of study at UCSC and the Student Experimental Farm at UC Davis showed that none of the various cover crop, shrimp shell inputs, or tillage treatments controlled symphylan infestations. Center staff are currently examining the potential of potato crops to suppress symphylan populations, an effect that farm manager Jim Leap has noticed even in heavily infested fields.

CASFS: Jim Leap. *Cooperators:* Mario Ambrosino and Jon Umble, Oregon State University; Mark Van Horn, UC Davis Experimental Farm.

Funding: Organic Farming Research Foundation

Related publication

Brown, Martha, Caroline Seydel, Mark Van Horn. 2001. Researchers seek organic solutions to symphylans problem. *Newsletter of CCOF, California Certified Organic Farmers* 17:3, 2-3, 27.

WATER QUALITY MONITORING IN THE MONTEREY BAY WATERSHED

Maintaining water quality is an ongoing challenge in the Monterey Bay watershed, where industry, urban development, and farming all affect sensitive waterways. Center researchers are collaborating with researchers and growers throughout the Monterey Bay region to monitor water quality, identify pollutant sources, and develop practices that minimize environmental impacts.

Monitoring efforts are focusing on nitrate and phosphorous levels above and below outfall sites, as well as on farms themselves. Center researchers are establishing a baseline of nitrate levels in order to measure the effects of sustainable farming practices once they are implemented.

In the 2000-2001 season, the researchers found that nitrate-N concentrations were <1 mg N L^{-1} in creeks bordering grazing lands, oak woodlands, and forests, but increased to a range of 3 to 5 mg N L^{-1} as surface waters passed through agricultural lands. In several agricultural ditches—especially those receiving drainage from underground pipes ("tiles")—very high nitrate concentrations (>50 mg N L^{-1}) occurred. Some ditches remained high in nitrate both during and after rain events, indicating that nitrate is not being flushed out of the soil profile. The researchers hypothesize that the shallow groundwater in the tile-drained fields is nitrate saturated due to long-term nitrogen loading from agricultural practices.

Results of this ongoing monitoring work will be used to help landowners and resource managers understand the relationship between land use activities and local water quality, and to help growers reduce runoff from their fields.

CASFS: Lowell Gentry, Marc Los Huertos, Sahara O'Hanlon, Carol Shennan. *Cooperators:* Community Alliance with Family Farmers, Monterey Bay National Marine Sanctuary, Natural Resources Conservation Service, Santa Cruz County Farm Bureau, UC Cooperative Extension, USDA-Agricultural Research Service, Watershed Institute at CSU Monterey Bay.

Funding: US Department of Agriculture

ROTATIONAL MANAGEMENT IN THE TULELAKE REFUGE

This project seeks to balance the needs of farmers and those of wildlife in the Tulelake National Wildlife Refuge on the California-Oregon border. One of the country's critical waterfowl habitats, the Tule Lake region is also home to a number of farms, many of which are located on leased land within the refuge. In the past four decades, the quality of marshland has declined, leading to a drop in plant and animal diversity and limiting wildlife habitat and food supply. Increased nematode populations and declining soil fertility levels on the region's farms have led to high inputs of pesticides and fertilizers.

To develop alternative management strategies for the refuge, Center researchers assessed the effects of both long and short cropland/wetland rotational management cycles. Areas of existing cropland were periodically flooded to create new diverse wetlands, and areas of existing wetland were drained to create more fertile cropland free of soil borne pathogens.

Researchers monitored water quality, soil fertility, and vegetation after conversion of cropland into wetlands. In sites that had been farmed for over 40 years, vegetation shifted from agricultural weeds to the desired "moist soil plants" within 2–3 years and soil P fertility increased, while little change in soil C and total N occurred. Wetland surface water nutrient levels were variable, with lower N concentrations often seen in the new wetlands versus input water. Localized peaks in ammonia, nitrate, and ortho-P also occurred, presumably due to local variations in water depth, temperature, algal growth, and plant decomposition driving nutrient fluctuations.

When seasonal marshes were drawn down in early summer, the drainage water produced tended to be of poorer water quality than the surface waters, with lower dissolved oxygen and temperature, and elevated ortho-P and ammonia. However, refuge water models show high canal flows during the draw-down period, which could minimize any adverse water quality impacts from seasonal marshes. Crop production was excellent in the pilot sites returned to cropland after 2–3 years in wetlands. Furthermore, populations of soil nematodes that attack potato and other crops were greatly reduced by the wetland management period.

Overall, the wetland/cropland rotational management was shown to be an effective strategy for improving wetland habitat and sustaining good agricultural production, and may be phased in on additional areas within the refuge. However, the recent drought and conflict over water in the Klamath basin threatens both the wetlands and the future of agriculture in the region.

CASFS: Carol Shennan, Marc Los Huertos. Graduate students: Collin Bode, UC Berkeley; Dorothy Overpeck, UCSC Department of Environmental Studies. Cooperators: UC Intermountain Research and Extension Center, Tulelake; U.S. Fish and Wildlife Service, USFWS Klamath Basin National Wildlife Refuges; U.S. Bureau of Reclamation; California Waterfowl Association.

Funding: US Department of Agriculture

Related publications

Shennan, C., and W. M. Jarrell. 1999. Assessing sustainability of a managed multi-use ecosystem: A case study of wetland and cropland management in the Tulelake National Wildlife Refuge, California. In *Agriculture and Ecological Resilience: Striking a Balance in the Pacific Rim,* S. Nagavajara (ed.), Beijing, October 1998. Washington, DC: AAAS.

Shennan, C., M. Los Huertos, and C. Bode. 2000. Soil and water quality changes during a wetland-cropland rotation in Tulelake Wildlife Refuge, California. Poster presentation at the 2000 Agronomy Society Meetings, Minneapolis, MN.

STRAWBERRY VARIETY TRIALS IN ORGANIC SYSTEMS

The impending phase-out of the soil fumigant methyl bromide has triggered interest in identifying strawberry varieties that perform well in organic management systems. This project established variety trials in three organic fields representing different soil and climatic conditions in Monterey and Santa Cruz counties. The Center's on-campus farm was selected as a study site because of its long history of organic management.

The trial's main objectives included determining which strawberry varieties generate the highest yields in organic production systems, and the effect of mycorrhizal inoculants (beneficial root fungi) on yield and plant disease. In October of 1999, 4 replicates each of 10 strawberry varieties were planted on a 1/3-acre site and managed with organic fertility inputs and alternative pest control measures (e.g., beneficial insect releases, insectary hedgerows). From the study's first season, researchers determined that 3 standard varieties grown on the Central Coast—Aromas, Pacific, and Seascape—were the best-performing cultivars at all three organic trial sites. The trial was replanted in fall 2000 for evaluation in the 2000-2001 season.

CASFS: Jim Leap, Carol Shennan. *Cooperators:* Carolee Bull, USDA-Agricultural Research Service; Steve Koike, UC Cooperative Extension.

Funding: California Department of Pesticide Regulation

Second-year apprentice Angie Tomey and farm manager Jim Leap plant strawberries for a variety trial on the UCSC Farm.

Martha Brown

Education

The Center supports both UCSC academic classes and student research projects, as well as experiential training through its *Apprenticeship in Ecological Horticulture* course. Over the past two years Center members also focused on developing classes to serve undergraduates interested in incorporating hands-on skills into their theoretical training.

Academic Instruction

The Center's facilities and programs are available to all UC Santa Cruz undergraduate and graduate students. In addition to class work based at the campus Farm and Chadwick Garden sites, students can take part in ongoing Center research and education efforts, design their own projects in collaboration with affiliated faculty and staff members, and apply to the Center's competitive grants program to fund their research.

Students also work with the Center through internships or independent studies developed with faculty in a variety of campus departments, including Community Studies, Education, Environmental Studies, and Latin American and Latino Studies.

New Faculty Affiliates Strengthen Center Partnerships

A number of UCSC faculty joined the Center's group of faculty affiliates in the past two years. With our existing affiliates, they broaden our ability to develop classes, research projects, and other opportunities for UCSC students.

New faculty affiliates and their areas of interest –

• Jenny Anderson, Environmental Studies – environmental interpretation and experiential learning

• Weixen Cheng, Environmental Studies – ecological interactions between soil and plants

• Gregory Gilbert, Environmental Studies – ecology of plant disease in natural ecosystems, agroecology, conservation biology

• Dennis Kelso, Environmental Studies – intersections of environmental policy, natural resource use, social theory, and emerging technology; biosafety questions and policy implications

• Michael Loik, Environmental Studies – plant responses to natural and anthropogenic environmental stress

• Manuel Pastor, Jr., Latin American and Latino Studies – macroeconomic stabilization in Latin America; distribution, democracy and growth in the developing world; Cuban economic reform; Mexican economic reform: urban poverty and regional development

• Ravi Rajan, Environmental Studies – the interface of environmental history and political ecology

• Alan Richards, Environmental Studies – environmental and natural resource economics, economics of sustainable development

• Patricia Zavella, Community Studies – gender, work, and family; race-ethnicity; Chicana/o studies; U.S.-Mexican transnational migration; poverty, sexuality

New Class Series Offers Hands-On Experience

Building on work by faculty affiliate Steve Gliessman, Center staff and director Carol Shennan developed the first class of what will become a course series for UCSC undergraduates seeking practical knowledge to complement their theoretical training. The Agroecology Practicum, taught by Center faculty affiliates and the Center's apprenticeship instructors, will focus on seasonal aspects of farm and garden management. The practicum, which will begin in winter 2002, was designed for students who have completed basic class work in agroecology and want to study the concepts behind management practices while gaining hands-on skills.

Working Group Examines Social Issues

In this ongoing effort, Center issues specialist Patricia Allen works with UCSC faculty to facilitate the multi-disciplinary Working Group on Sustainable Agriculture and Food Systems. This group meets frequently each academic quarter and provides a forum for graduate students and faculty to discuss their research and emerging debates in the field.

Center Grants Program Supports Student Research

In 2000, the Center initiated a competitive grants program for UCSC students. The grants offer undergraduate and graduate students both financial support and practice in grant writing; many recipients used the awards to fund fieldwork for their thesis or dissertation. Examples of 2000–2001 student awards include –

An Evaluation of Alternative Orchard Management Strategies: Synthesis of Ecological Theory and Farmer Knowledge. Investigator: J. Robert Sirrine

An Investigation into the Potential Agroecological Effects of the 1999 Pajaro River Joint Powers Bill. Investigator: Keith Douglass Warner

An Oral History of the Farm & Garden. Investigator: Maya Hagege

Cooperative Protection of the Elkhorn Slough Watershed: A Model of Integrated Environmental Management. Investigator: Melanie Bojanowski

Early Season Monitoring of *Lygus hesperus* Movement out of an Annual Trap Crop Blend into Commercial Strawberry Fields of the Central Coast. Investigator: Beth Howard

Evaluating the Benefits of On-Farm Diversification for Smallholder Farmers in Malawi. Investigator: Dorothy Overpeck

Pest Control, Avian Diversity and Coffee Farm Management in Southern Mexico. Investigator: Suzanne Langridge

Sustainable Agriculture, Folly or Fortune? Organic Cotton Production in California and Central India. Investigator: Lisa Bunin

Traditional Shade, Rural Livelihoods and Conservation in Small Coffee Farms and Cooperatives of El Salvador. Investigator: V. Ernesto Mendez

Understanding the Role of the Farm Apprenticeship in Sustainable Agriculture Knowledge Exchange and Establishment of Local Social Networks. Investigator: Andrew Marshall

Soils Lab Expands Research and Teaching Capacity

In the spring of 2001, the Center installed a soils and plant processing laboratory on the UCSC Farm. This includes new sample-drying facilities, a grinder room, and a root washer to extract roots and seeds from soil samples. The lab supports teaching and research efforts by Center faculty affiliates, research staff, and students.

Experiential Training

With a history that dates back to the UCSC Student Garden's founding in 1967, the six-month *Apprenticeship in Ecological Horticulture* is the oldest of the Center's programs. During the six-month course participants learn the basic skills of organic farming and gardening through hands-on training, lectures, and field trips. Each year the course attracts apprentices from all regions of the U.S. and abroad. Graduates of the program use their training to start their own farms and market gardens, develop school and community gardens, work in international development programs, and pursue research and teaching in agroecology and organic farming techniques.

Training Manual Project Developed

For years, Apprenticeship staff members have had requests for the program's curriculum, but until now no formal manual for the course existed. In 1999, the staff initiated development of a project entitled the *Training Manual for Intensive Organic Production in the Garden and Small Farm* that encompasses the core concepts and skills taught during the six-month Apprenticeship program.

Developed by seven Center staff instructors and seven guest lecturers from the agricultural community, the draft manual was pilot tested in spring and summer of 2000. Fifteen classes and demonstrations were conducted at the UCSC Farm & Garden sites, with 30 to 38 apprentices attending and evaluating each session. Center staff will make final revisions of the manual during the summer and fall of 2001 with production and printing planned for December 2001.

Don Burgett

Instructor Christof Bernau shows apprentice course members how to use a push seeder to plant crops.

Tracy Chapman Sings in Support of Apprenticeship Scholarships

Acclaimed singer-songwriter Tracy Chapman has long supported sustainable agriculture initiatives. The cover and album notes of her 1995 release, *Telling Stories,* featured photos of the artist in the fields at the UCSC Farm. In August 2000 Chapman played a sold-out concert at the San Jose Center for the Performing Arts that funded scholarships for the Apprenticeship course as well as work by the Organic Farming Research Foundation.

Grants Fund New and Continuing Programs

In 2000, the Margoes Foundation of San Francisco committed an additional three years of funding for participants from Africa to take part in the Apprenticeship. This support has brought African apprentices from Kenya, Uganda, and Sudan to the program since 1996. Many of the Margoes scholarship recipients have used their Apprenticeship training to develop programs in sustainable agriculture in their home countries.

In 2001 the Chez Panisse Foundation, headed by famed chef Alice Waters, gave a gift to the Apprenticeship program to support a new cooking training project as part of the course. Amy Linstrom (1993 apprentice) and Heidi Schlect of Skyland Natural Foods catering company began the project in April 2001. They teach cooking classes, work side-by-side with apprentices as they prepare meals, create and consult on menus and recipes, and offer demonstrations to the course's 35 students.

The Community Supported Agriculture (CSA) component of the Apprenticeship course also attracted support over the past two years. The CSA model is ideal for small- and medium-scale growers who want to run a diversified farm and connect directly with a community of consumers —a profile that fits many of the Apprenticeship participants. Grants from the Foundation for Deep Ecology and the True North Foundation funded staff positions and curriculum development for this important training effort.

Community Outreach

Whether introducing kids to the magic of worm compost or traveling overseas to train growers and extension agents, Center members committed extensive time and energy to outreach projects over the past two years. Through tour programs, conferences, field days, publications, workshops, and other public outreach efforts, we reached thousands of people interested in learning about and creating sustainable agriculture and food systems.

New Garden, Camps, Tours Serve Center Visitors

A new children's garden began to take shape at the Center in the spring of 2001. Created by the Life Lab Science Program, which develops garden-based education programs, the "Garden Classrom" is located near the public entrance to the on-campus Farm. Life Lab and the Center shared the vision of a children's garden on the Farm when Life Lab first joined the Farm community in 1987. The new garden will serve as a teaching facility for local students as well as a demonstration garden for visiting teachers.

The Garden Classroom includes wheelchair-accessible paths, seasonal beds for student plantings, a "sensory awareness" garden, native plants, a compost demonstration area, edible landscaping, and many other kid-friendly features. Grants from the Packard Foundation, the Richard and Rhoda Goldman Fund, and the Stocker Family Foundation helped make the project possible.

The Center's "Wildlands and Watering Cans" day camps gave kids a taste of farm life over the past two years. These sold-out summer camps offered a week of garden- and farm-based activities and trips to nearby parks and beaches. The 1999 and 2000 camps were so popular that an additional session was added for summer 2001.

John Fisher

Kids visiting the Farm show off "red wriggglers" from the worm compost bin.

Volunteer docents, UCSC interns, and Center staff guided 5,450 visitors on tours of the Center's Farm and Alan Chadwick Garden during the 1999 and 2000 tour seasons, with the 2001 season still underway. More than half of our visitors were children taking part in the Kids Tour program, including classes visiting UCSC as part of the campus-wide Kids Around the University project. The Center also hosted 350 international visitors, including groups from China, Japan, Pakistan, Yap, Albania, Russia, Germany, Australia, and Ethiopia.

Center Conducts International Training Courses

Center farm manager Jim Leap and post-doctoral researcher Marc Los Huertos traveled to Palestine in September 1999 to conduct training in organic farming techniques for Palestinian extension agents. Sponsored by American Near East Refugee Aid (ANERA), the program took place in both Palestine and Israel, and included workshops on production systems, fertility, compost, cover crops, and marketing.

The summer of 1999 brought participants from around the world to UC Santa Cruz for the International Short Course on Agroecology, offered through the Center and the Environmental Studies Department. Center faculty affiliate Steve Gliessman headed the course, designed for extensionists, farm advisers, trainers, NGO managers, farmers, researchers, and other agricultural professionals. The course focused on sustainable management practices in small farm systems and their function in supporting farming communities and environmental health worldwide.

Conferences Provide Platforms for Sustainable Agriculture and Food Systems Topics

John Fisher, the Center's community outreach coordinator, helped organize the 1999 *California Farm Conference* held in Berkeley and took on chairmanship of the Santa Rosa-based conference in 2000. Each of these successful meetings offered short courses and workshops to more than 600 farmers, environmentalists, marketers, students and others, with an emphasis on the long-term viability of family farms. Center staff presented workshops at both of the farm conferences.

The annual *Agriculture, Food, and Human Values Conference* offered the Center's social issues researchers the chance to present their work to a national audience of

academics and activists. Patricia Allen, the Center's social issues specialist, chaired sessions at the 2000 and 2001 national meetings, as well as presenting her research on alternative food systems. Researcher James Murrell, Environmental Studies graduate students Mike Goodman, Andrew Marshall, and Keith Warner, and Center faculty affiliates Margaret FitzSimmons and David Goodman also presented their research.

Center farm manager Jim Leap hosted the University of California Small Farm Workgroup Continuing Conference held in Watsonville, California in May 2000. Leap worked with UC farm advisor Mark Gaskell to plan and organize the two-day conference and field tour.

The Center co-hosted the inaugural meeting of the Scientific Congress on Organic Agricultural Research (SCOAR) at the Asilomar Conference Center in Pacific Grove, California in January 2001. SCOAR, which is headed by the Organic Farming Research Foundation, is a collaborative effort by researchers and farmers to develop a national research agenda for organic agriculture. The January meeting was the start of a multi-year project to plan and promote organic farming research and information-exchange to improve organic agricultural systems. Center members Patricia Allen, Jim Leap, and Sean Swezey also took part in a gathering of university-based sustainable agriculture centers at Madison, Wisconsin.

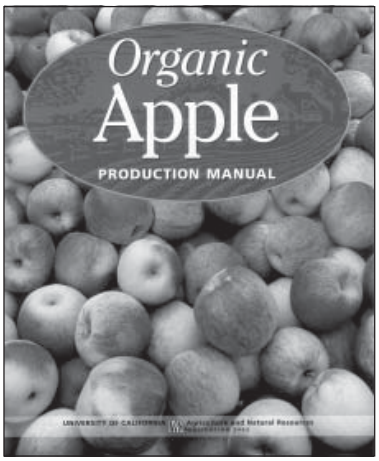
Center director Carol Shennan and researcher Marc Los Huertos took part in the Agronomy, Soil Science, and Crop Science meeting, the American Water Resources conference, the Klamath Basin Fish and Water Management Symposium, and the Monterey Bay Sanctuary Symposium, where they discussed their crop rotation and water quality work.

In addition to the above meetings, Center staff presented talks and workshops at numerous other regional, national, and international conferences, field days, workshops, and college courses over the past two years.

Center Promotes Local Farming, Research Communities

In 2000 the Center initiated a series of lunch meetings that brings together farmers and members of the Monterey Bay region's sustainable agriculture and food systems organizations. Designed to encourage networking and discussion of current issues and activities, the lunches take place at the Center's on-campus Farm. Participants included representatives of the Santa Cruz County Farm Bureau, California Certified Organic Farmers, Community Alliance with Family Farmers, California Sustainable Agriculture Working Group, Organic Farming Research Foundation, UC Cooperative Extension, USDA-Agricultural Research Service, and the Santa Cruz Homeless Garden Project.

In June 2001, Center director Carol Shennan and bacteriologist Carolee Bull of the USDA-Agricultural Research Service organized the first meeting of the Monterey Bay Region Organic Researchers. This working group of scientists who conduct organic research in the Monterey Bay area now meets regularly to exchange ideas, discuss research projects, and coordinate efforts.



Center staff helped research and develop the University of California's first organic production manual.

Center Efforts Lead to UC's First Organic Farming Manual

In March 2000, UC's Division of Agriculture and Natural Resources published the *Organic Apple Production Manual,* its first production manual focused on organic techniques. Based on research conducted by Center staff members and other UC scientists, the manual provides commercial apple growers with a comprehensive guide to organic orchard management, postharvest handling, and industry economics. Center researchers also maintained a "hot line" for Monterey Bay region apple growers with updates on pest and disease information. In 2001, Center members and other UC researchers and growers began work on an organic strawberry production manual.

New Center Web Site On-Line

Thanks to technical support from UCSC's Public Information Office, the Center's Web site was completely redesigned in 2001. The new site (www.ucsc.edu/casfs) features information on Center research, education, training, public events, and other aspects of our work. Site visitors can download many of our publications, check on job announcements and upcoming events, and find out details of undergraduate and graduate student opportunities.

Friends Sponsor Public Education, Fundraising Projects

The Friends of the UCSC Farm & Garden helped sponsor more than fifty public workshops, talks, classes, and other events in 1999-2001. These events were designed to reach members of the local community with information on organic gardening and farming. The community flocked to our plant sales, featuring organic starts raised at the Farm & Garden, as sales levels reached all-time highs.

Thanks to the success of their first cookbook project, the Friends of the Farm & Garden produced a second cookbook as part of their fundraising efforts in 2000. *Seasonal Recipes from the Great Chefs of Santa Cruz County* includes recipes from twenty-one of the county's most popular restaurants and catering companies, featuring seasonal, locally grown produce. Proceeds from cookbook sales supported the *Apprenticeship in Ecological Horticulture,* the Wildlands and Watering Cans summer camp, the docent program, and the Farm & Garden facilities.

ADDITIONAL RESEARCH PUBLICATIONS

Cavero, J., R.E. Plant, C. Shennan, D.B. Friedman, J.R. Williams, J.R. Kiniry, and V. W. Benson. 1999. Modelling nitrogen cycling in tomato-safflower and tomato-wheat rotations. *Agricultural Systems* 60: 123-135.

Mitchell, J. P., D. W. Peters, and C. Shennan. 1999. Changes in soil water storage in winter fallowed and cover cropped soils. *Journal of Sustainable Agriculture* 15:19-31.

Mitchell, J. P., C. D. Thomsen, W. L. Graves, and C. Shennan. 1999. Cover crops for saline soils. *Journal of Agronomy and Crop Science* 183:167-178.

Mitchell, J. P., C. Shennan., M. J. Singer, D. Peter, R. O. Miller, T. Prichard, S. R. Grattan, J. D. Rhoades, D. M. May, and D. S. Munk. 2000. Impacts of gypsum and winter cover crops on soil physical properties and crop productivity when irrigated with saline water. *Agricultural Water Management* 45 (1):55-71.

Shennan, C., C. L. Cecchettini, G. B. Goldman, F. G. Zalom. 2001. Profiles of California farmers by degree of IPM use as indicated by self-descriptions in a phone survey. *Agriculture, Ecosystems and Environment* 84 (3):267-275.

Swezey, S. L., and J. Broome. 2000. Growth predicted in biologically integrated and organic farming systems. *California Agriculture* 54:4, 26-35.

Tourte, L., R. L. Bugg, and C. Shennan. 2000. Effects of foliar-applied seaweed and fish powder on yield and fruit quality of organically grown processing tomatoes. *Biological Agriculture and Horticulture* 18:15-27

The Center for Agroecology & Sustainable Food Systems is located at the University of California, Santa Cruz. For more information about the Center and its activities, contact us at:

CASFS, University of California
1156 High Street, Santa Cruz, CA 95064
831/459-4140 or 459-3240 (telephone) 831/459-2799 (fax)
http://www.ucsc.edu/casfs

References from page 1 –

[1]Anon. 2000. Science briefs, *California Agriculture* 54:4, 15.

[2]Taylor, J., and P. Martin. *California Agriculture* 54:1, 26-32.

[3]Anon. 2001. Science briefs. *California Agriculture* 55:3, 5.

center staff

CAROL SHENNAN, PH D	Director
PATRICIA ALLEN, PH D	Specialist–Social Issues, Assoc. Dir.
ERIN BARNETT	Apprenticeship Coordinator
ORIN MARTIN CHRISTOF BERNAU	Apprentice Course Associates
ANN LINDSEY	Apprentice Course Grant Writer
ANNE MARIE NAPOLI	Apprentice Course Assistant
JIM LEAP	Operations Manager
MARTHA BROWN	Senior Editor
JOHN FISHER	Outreach Coordinator
NANCY VAIL	CSA Cooordinator
SEAN SWEZEY, PH D	Specialist–Extension, Assoc. Dir.
WILLIAM SETTLE, PH D	Specialist–Extension
POLLY GOLDMAN LOWELL GENTRY	Postgraduate Researchers
JANET BRYER	Research Assistants
MERRILEE BUCHANAN, AMANDA LEWIS, DIEGO NIETO	
MARC LOS HUERTOS, PH D JAMES MURRELL, PH D	Post-Doctoral Researchers
BARBARA MAXIMOVICH	Assistant to the Director
JONI TANNHEIMER	Program Assistant
THOMAS WITTMAN	Operations Assistant
ALBIE MILES	Curriculum Editor
TIM ASHTON,	Second-Year Apprentices
JOHN BAILEY, MARY ANN BROOKS, KERRY GLENDENING, SUSIE MELICAN, ELIZABETH MUKUNGA, KATE SULLIVAN, ANGIE TOMEY	

faculty affiliates

Jenny Anderson, Weixin Cheng, Laurel Fox, Margaret FitzSimmons, Greg Gilbert, Steve Gliessman, David Goodman, Karen Holl, Deborah Letourneau, Michael Loik, Manuel Pastor, Ravi Rajan, Alan Richards, Patricia Zavella

266

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

NON-PROFIT
ORGANIZATION
US POSTAGE
PAID
PERMIT NO. 32
SANTA CRUZ, CA