

**UNIVERSITY OF CALIFORNIA
DIVISION OF AGRICULTURE AND NATURAL RESOURCES**

**2009 Combined Research and Extension
Federal Annual Report**

Agricultural Experiment Station
and Cooperative Extension

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University of California
Agriculture and Natural Resources



2009 University of California Combined Research and Extension Federal Annual Report

I. Report Overview

Executive Summary

The University of California Division of Agriculture and Natural Resources (UC ANR) is the major land grant arm of the University of California, part of the nationwide public university system "built on behalf of the people" (Abraham Lincoln). The Agricultural Experiment Station was established to develop cutting-edge research information that can be applied to solving real-world problems in agriculture and natural resources. Cooperative Extension was created as a cadre of academics housed in local communities to translate and test research findings for practical, local solutions. ANR is unique in its three way partnership with federal, state and county governments to provide these local and statewide research and extension programs that address the critical issues of California. Through its partnerships and collaborations, UC ANR is able to leverage its resources to increase its ability to address these issues.

Within UC, ANR's mission is to:

- Maintain and enhance connections that fully engage UC with the people of California
- Achieve innovation in fundamental and applied research and education that supports
- Sustainable, safe, nutritious food production and delivery systems
- Economic success in a global economy
- A sustainable, healthy, productive environment
- Science literacy and youth development programs

Agricultural Experiment Station faculty conducted research and taught in four colleges/school on the Davis, Berkeley and Riverside campuses. Ten research and extension centers (RECs), located in a variety of ecosystems across the state, provided a core research and extension base. Sixteen statewide programs focused on specific issues that engage ANR academics and UC faculty from all the other campuses, allowing integrated teams to work on complex issues that need multidisciplinary approaches.

The AES has about 700 academic researchers, most of whom also have professorial appointments representing dozens of scientific disciplines. Cooperative Extension, the principal outreach arm of the Division, comprises academic appointees attached to campus departments as CE specialists or county offices as CE advisors; there are about 120 specialists and 235 advisors.

FY 2008-2009

This year saw an unprecedented reduction in state funds available to the University and ANR. Diligent and prudent action was required to meet the permanent cuts to the Division of \$9 million. Numerous alternative strategies were generated from the all staff ANR Statewide Conference, the two divisionwide administrative groups, Program Council, Executive Council, and numerous other meetings. These strategies were evaluated and reductions and restructuring decisions were made. An important point was stressed - that ANR members are its strongest asset so this was kept in mind as ANR leaders considered various options.

At the same time the state budget cuts were being determined, the Division embarked on a comprehensive strategic planning effort. The goal was to determine the critical issues that would face California in 2025 and to identify how the Division could best address these issues. ANR members at all levels were involved in this effort as well as the Division's stakeholders. Working groups were formed to develop white papers on programmatic issues of the future and input/feedback on these issues were solicited both internally and externally. The result was the ANR Strategic Vision, issued in April 2009 at the ANR Statewide Conference (<http://ucanr.org/vision/anrstrategicvision2025.pdf>).

The Vision identified nine multidisciplinary, integrated Strategic Initiatives that represent the best opportunities for ANR's considerable infrastructure and talent to seek new resources and new ways of partnering within and outside the University to find solutions to the issues that will be facing California in 2025.

- Improve Water Quality, Quantity, and Security
- Enhance Competitive, Sustainable Food Systems
- Increase Science Literacy in Natural Resources, Agriculture and Nutrition
- Enhance Sustainable Natural Ecosystems
- Enhance the Health of Californians and California's Agricultural Economy
- Provide for Healthy Families and Communities
- Ensure Safe and Secure Food Supplies
- Manage Endemic and Invasive Pests and Diseases
- Improve Energy Security and Green Technologies

Decisions on the budget cuts were guided by the new Strategic Vision with an emphasis on reducing administrative overhead and minimizing the impact on our colleagues and our stakeholders. The resulting organization will be responsive to the needs articulated in the Strategic Vision and represent a strong administrative and programmatic platform for the future. Although these cuts are severe, realistically they may not be the last, depending on the state's budget and ANR's ability to find alternative ways to support our programs.

Although unprecedented budget reductions demand significant and disruptive change, ANR leadership recognized the need to also prepare for the future. As with all evolutionary change, implementation will be an iterative process. The decisions on budget reductions will reduce administrative overhead while focusing ANR programs and people on the future through our Strategic Vision. The Division now has the opportunity to realize its vision, to strengthen its proven commitment to the people of California, and to shape the future all Californians share.

The following narratives describe program highlights of FY 2009 by the California Federal Planned Programs.

California Families, Youth and Community Development

There are 96 Hatch and Regional Research projects funded through Multistate Research sources at UC Riverside, Davis, and Berkeley with a focus on California families, youth and communities. There are also 23 research activities conducted by UCCE Advisors and 409 extension projects conducted by UCCE advisors and campus based specialists under the Federal Planned Program: Sustaining California Families, Youth and Community Development. In-service training and web-based newsletters and fact sheets in other topic areas (nutrition, health, youth development, parenting, etc) reach a wide audience, including health professionals, school administrators and teachers, paraprofessional staff from public health programs (such as WIC). Projects are being conducted in several areas; a few illustrative examples follow.

Human Nutrition and Health:

AES research has examined health-promoting components of legumes, amaranth, other plants, and human milk. New methods have been developed to determine exposure to dioxin and other toxic compounds; assay vitamin A in different biological samples; and evaluate consumer needs, perceptions, and behaviors related to food choices. To ensure food safety and quality, research has examined the storage life of frozen foods; control points for food contamination and quality; and influence of agronomic practices on nutrient composition. Obesity and diabetes research has examined diets for improving weight and metabolic status; genes involved response to the amount and type of dietary fat and lipid metabolism; how knock-out gene technology can improve energy balance and insulin sensitivity; and psychobehavioral factors related to response to nutrition programs in African American youth. Other AES studies have identified polymorphisms in genes related to folate; effects of trace element deficiencies on the fetus, maternal complications, and child growth and development; factors influencing early breastfeeding success; genetic influences on risk for renal disease; and hormonal responses in the gut invoked by nutrients.

Caregivers (of young children and seniors) are reached through informal educational programs. In 2008-09, EFNEP reached low-income families with children in 16 counties; FSNEP Supplemental Nutrition Assistance Program (SNAP-ED) reached food stamp eligible youth and/or adults in 35 counties. Coordination across nutrition, 4-H, and Master Gardeners has enabled advisors to teach low-income students about plants and nutrition, as well as to improve food choices and food safety practices. Extension programs in the schools have tied nutrition education activities to the California content standards. In 2008-9, a new curriculum, *Walkfit*, was developed, tying nutrition and physical activity education to the mathematics standards. A series of 5 webinars, using Adobe Connect Professional, provided training to 65 EFNEP and FSNEP staff without incurring any travel costs. Other new school-aged curricula, "Eating Healthy From Farm 2 Fork" for grades K, 1st and 2nd, were evaluated as part of a comprehensive agriculturally based nutrition and health program that includes every aspect of the school environment. New tools have been developed and tested to determine barriers to milk consumption in adolescents and rapid, feasible ways to evaluate nutrition education programs, particularly among low-income youth and limited literacy audiences.

Youth Development:

AES research has focused on diverse topics, including ways that socio-cultural factors shape cognitive development in children; the effects of negative peer interactions during adolescence; and perceptions and use of outdoor environments among youth. The 4-H Science, Engineering, and Technology (SET) Initiative was formally launched in California to address national and state interests in improving human capacity and workforce abilities in these fields. Sixty county-based 4-H academics and program staff representing 46 counties attended a two-day conference to kick-off the 4-H Science, Engineering and Technology (SET) initiative. UC 4-H advisors volunteers from 4 counties developed and tested a training script for the new SET "Power of the Wind" curriculum. More than 200 4-H adult volunteers, teens and UC 4-H staff gathered at five locations in California for a 4-H SET Workshop, which focused on science education facilitation using inquiry in experiential learning, delivery in club and camp settings, and partnering with campus and community collaborators. School-age programs (including 4-H clubs, classroom enrichment, summer camps, and after school activities) reach both the children at risk, as well as the general child population.

Families and Consumer Well-being:

A longitudinal study has explored how early economic disadvantage in the family of origin has a negative impact on the emotional well-being and social functioning of the next generation of children. Other research has examined the interactions of individual, family, community, and policy contexts on physical and mental health outcomes in diverse, rural low-income families.

Community and Economic Development:

The California Communities Program completed an interim evaluation of a community action program designed to build community capacity and implement strategies that increase meaningful support and opportunities for youth. Other research has examined the impact of immigrant farm workers on the competitiveness of the California commodities and community viability; policies related to undocumented status and labor/employment laws; and planning and urban design issues of concern to immigrant and minority communities. A new money management bilingual online program, Making Every Dollar Count, was tested among limited literacy audiences.

California Pest Management

The scope of activities in pest management in California is extensive and very diverse. There are 130 Hatch and Regional Research projects funded through Multistate Research fund sources to investigators at UC Riverside, Davis, and Berkeley that have a pest management focus. In addition there are 143 research projects reported by UCCE Advisors and 409 extension projects conducted by UCCE advisors and campus based Specialists under the Federal Planned Program: California Pest Management.

California's moderate environment allows tremendous specialty crop and animal diversity, but it also provides niches for various pest organisms, including weeds, insects, plant diseases, nematodes, mites, and vertebrate pests that can affect the cost of production and the loss of yield. The management of key pests in California's diverse agricultural, natural, and urban ecosystems continues as ongoing efforts to reduce the impact of both native and exotic pests and diseases.

Thrips-vectored Viruses:

During the past few years, vegetable growers in California's central coast have seen their crops affected by outbreaks of a mysterious virus disease. For crops such as lettuce, pepper and basil, these problems were new and caused significant losses in quality and yield. Virus outbreaks were particularly extensive in lettuce, with numerous fields affected in a number of counties (Monterey, San Benito, Santa Cruz). For the Salinas Valley, this problem developed in fields in the north (Salinas, Chualar, Gonzales) as well as in the south (Soledad, Greenfield, King City). Disease losses ranged from minimal (less than 1 percent) to over 65 percent. Affected lettuce plants were stunted, yellowed, and developed extensive brown, dead spots and lesions that rendered the plant unmarketable. Iceberg, romaine leaf and butterhead lettuce were all affected. Resistant lettuce cultivars are not currently available. In addition to this coastal situation, similar symptoms have been observed in lettuce grown in the San Joaquin Valley.

A collaborative research team consisting of county-based farm advisors and campus-based researchers initiated a multi-year investigation of the problem. They discovered that the disease was caused by the Impatiens necrotic spot virus (INSV), a virus that had not previously been documented on lettuce. Similar disease outbreaks on other crops were also caused by INSV. Because this virus is spread to plants by thrips insects, the team conducted intensive surveys to collect and identify which thrips were vectoring the virus. They discovered that the western flower thrips (*Frankliniella occidentalis*) was virtually the only thrips found on lettuce in the Salinas Valley. The campus-based team members developed molecular tests that confirmed that these thrips contained INSV. The San Joaquin Valley problem was attributed to another thrips-vectored virus, Tomato spotted wilt virus (TSWV), which has long been known to occur in California. These California findings support the worldwide trend in which this group of thrips-vectored viruses (the tospoviruses) is becoming more important, and is spreading into previously unaffected areas.

Disease Agents Among Animals and Between Animals and Humans:

Introduced disease-causing viruses and other pathogenic organisms represent a critical threat to animal agriculture production in California. Thus, it is vital to understand the relationships between potential vectors of these pathogens and the epidemiology of the diseases they cause.

Research examining the potential role of flies in the transmission of exotic Newcastle disease (END) to poultry demonstrated that several species of flies (*Musca domestica*, *Fannia canicularis*, and *Phaenicia cuprina*), collected at an END outbreak site, were infected with the virus. This virus was subsequently shown to be 99% identical to the END virus strains infecting commercial poultry throughout southern California. While the viral titers on these flies was low, these findings demonstrate that flies are coming into contact with virus in the field and are able to pick up and move this virus from one location to another.

Further laboratory studies showed that flies fed on food substrate inoculated with virus could harbor this virus in their mid and hind gut for up to 5-7 days, and that within the first 1-2 days these flies carried enough virus to possibly infect a chicken that consumed the fly. While virus in field collected flies was very low, laboratory studies have demonstrated that virus concentration on flies is high enough just after exposure to virus to potentially infect a chicken. This work adds to the body of evidence supporting the role of insects (especially flies and beetles) as carriers and transmitters of disease agents among animals and between animals and humans.

Studies to examine fly dispersal were also conducted. *Fannia canicularis* flies were readily dispersing up to 1.5 km from their development sites on a poultry farm, while house flies in the residential areas appeared to be produced in those residential areas. Dispersal of "canyon flies" (*Fannia conspiciua*) showed these flies to be poor dispersers from their development sites. In efforts to control populations of disease vectoring flies, studies demonstrated that composting manure with green waste, wood shavings, or even without amendment can reduce fly development over more conventional manure management methods such as thin drying. To reduce fly development, the moisture content of the outer portion of the compost piles must fall below 40% (flies will not lay eggs on the compost material at moisture concentrations below 40%), which is quickly accomplished due to the heat generated by bacterial degradation within the pile. Piles must also be turned periodically to keep internal temperatures high, and water must be added to compost piles only immediately before turning the piles. The poultry facility where this research was conducted is now composting all their poultry manure, and has no nuisance complaints from neighbors due to flies for the first time in over 10 years. Further, the composted product is being sold

as a soil amendment and is bringing additional profit to the operation.

Key Citrus Pests:

Currently, key pests of San Joaquin Valley citrus include California red scale, citrus thrips, citricola scale, cottony cushion scale, citrus red mite, katydids, citrus leafminer and citrus peelminer. The citrus peelminer and the citrus leafminer have recently arrived in the San Joaquin Valley and are difficult to control with insecticides. Research is being conducted to find suitable biological control agents as an alternative to pesticides and the use of pheromone confusion is being evaluated for citrus leafminer. A brochure was developed to assist growers with IPM approaches for the miners, thereby reducing pesticide applications. Studies of the impact of cottony cushion scale and citricola scale on sooty mold and yield of citrus re-emphasizes the need for keeping these pests below an economic threshold. Appropriate economic thresholds will reduce the number of pesticide treatments applied for non-damaging populations. Studies of the effects of insecticides and acaricides on citrus pests and natural enemies will help growers retain or obtain new California registration of these products, help growers to use pesticides efficiently, integrate pesticides into the citrus IPM program, and manage resistance to older products. These activities produce a long-term sustainable pest management program. Studies of resistance of pests to insecticides keeps growers from using insecticides that are no longer effective and reinforces the importance of reducing reliance on pesticides for pest control. Through the Center for Invasive Pests website, brochures, meetings, radio, and newspapers, the citrus industry, general public and regulatory agencies were made aware of the threat of exotic pests and diseases including glassy-winged sharpshooter, citrus leafminer, brown citrus aphid, Diaprepes root weevil, Asian citrus psyllid and Huanglongbing disease. Awareness is critical for assisting regulatory agencies in suppression programs that protect the citrus and other crops.

Biological Control of Avocado Pests:

Significant results have been achieved in on the biological control avocado pests in California. First, work on a new avocado pest that invaded California in late 2004, the avocado lace bug, *Pseudacysta perseae* has resulted in the completion of natural enemy surveys, pesticide evaluations, phenology, developmental biology studies, and foreign exploration in Mexico for avocado lace bug natural enemies. The DNA of collected lace bugs has been analyzed to determine the area of origin in Mexico from where the Californian population is derived. Work has been completed in Guatemala on potential new pests that attack avocado fruit and threaten California avocado production. This work has identified seven pest moth species, two are new to science. Completed surveys have documented the natural enemy fauna associated with these pests. The sex pheromone for one of these moth pests, *Stenomoma catenifer*, the avocado seed moth, has been isolated, synthesized, and field tested in Guatemala for efficacy.

The completed work has provided invaluable information on invasion pathways of avocado pests into California. It has provided growers and home owners with reduced risk control options for control of new avocado pests, and research has provided answers to critical questions posed by California avocado growers on the biology, ecology and sustainable management of avocado lace bug. Completed work in Guatemala on pest moths attacking avocados is proactive and forward-leaning and is the first time potentially invasive pests have been studied ahead of time in their country of origin. Use of the sex pheromone for *Stenomoma catenifer* in countries exporting fresh avocados to the USA that have endemic populations of this pest should reduce the invasion risk posed by this moth. Deployment of the pheromone in areas likely to be invaded in the USA will greatly aid identification of incipient populations, which could make eradication feasible.

Exotic Insect Species in the Central Valley:

The San Joaquin and Sacramento Valleys constitute the Central Valley of California. Within this agricultural region, much of the perennial fruit and nut crops are produced in our nation. These commodities include grapes, almonds, walnuts, pistachios, olives, and stone fruits. Among the stone fruits are peaches, nectarines, cherries, plums, and prunes. These crops share many traditional arthropod pest species, and these are managed using a variety of tactics. Agriculture is always changing due to a variety of reasons (e.g., varying market prices, imposed local or foreign quarantines, changes in consumer demand, improved pest control tactics, increased pesticide resistance, loss of registered pesticides because of environmental concerns such as air and water pollution).

Within the last few years, several exotic insect species have invaded the Central Valley, and these have tremendous potential to cripple fruit and nut production, thereby resulting in economic devastation for California agriculture. Among these species are the glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis* (previously was *coagulata*), and the olive fly (OLF), *Bactrocera oleae*. Others such as the light brown apple moth, *Epiphyas postvittana*, and the olive psyllid, *Euphyllura olivine*, have been found in California, but have not established in the Central Valley; however, they may do so if their populations expand from their present distributions. All these species are highly susceptible to pesticides under laboratory conditions, but for various reasons total reliance on chemical control is undesirable, disruptive, impractical, or impossible at the present time. A more complete understanding of the biology and ecology of these species within the Central Valley would enable the development of more efficient management programs that reduce dependence on pesticidal inputs while maximizing pest suppression.

Most California olive growers in the San Joaquin Valley are aware that high summer temperatures in July and August have a devastating impact on OLF. Because of this, some relax their routine weekly pesticide treatments (i.e., GF-120) for OLF management. This suggests a change in actions. However, olive growers in the Sacramento Valley cannot afford to follow the actions of their neighbors to the south (i.e., San Joaquin Valley) and need to learn when it is safe to relax GF-120 treatments and when treatments should be continued through the summer because of cooler temperatures in their regions. Many presentations on this subject were given to the agricultural community and growers appear to understand this concept. Initial work on olive psyllid alerted table olive growers to the threat of this insect and the industry has supported further research funding on this pest to better understand its potential dispersal in the state and what natural enemies may be attacking it.

Temperature studies on GWSS provide the foundation to estimate the impacts of winter temperatures on adult GWSS populations so that GWSS overwintering survival can be estimated across geographical regions and mapped using GIS methods. The resulting predictions may aid in the more efficient allocation of GWSS management resources to areas where spring populations of GWSS pose a greater threat to California agriculture. Representatives from the California Department of Food and Agriculture have sought information regarding the use of cooling day-degrees to estimate the impact of overwintering temperatures on GWSS survival in California. This action indicates a change in knowledge among the chief regulatory agency dealing with GWSS infestations within California.

Sustainability and Viability of California Agriculture

At UC Davis, Riverside, and Berkeley, there are 285 Hatch and Regional Research projects funded through Multi state Research sources with an agricultural focus. There are also 124 research projects conducted by UCCE Advisors and 517 extension projects conducted by UCCE Advisors and campus based Extension Specialists under the Federal Planned Program: Sustainability and Viability of California Agriculture. The following projects illustrate the types of that projects are being conducted in the area of sustainability and viability of California's agriculture.

Economic Innovation and Viability of Agriculture:

There are a wide range of projects being conducted by UC, large and small which address basic production and economic viability issues for American agriculture. California agriculture is the most diverse agricultural system in the US, and UC agricultural research and extension programs reflect this diversity. California agriculture is worth more than any other state at more than \$35 billion/year. California agriculture also must contend with severe environmental restrictions, public concerns and regulations which are well beyond those of most other states.

Examples include work on specialty and commodity crops, animal systems, and economics. In vegetable crops, extension scientists have conducted ongoing weed control studies on broccoli, cauliflower, and lettuce in Salinas Valley and the Imperial Valley. A rice fertility research project led to recommendations to farmers about fertilizer and water management, prevention of burning of straws, and estimation of fate of nitrogen in rice systems that will impact calculations for efficiency, and global climate change; this has the potential to affect the 220,000 acres of rice in California. An animal system research project sought to utilize the many plant-derived products from tomato pomace (a waste available in large quantity in California) to enhance poultry health and to impact molt in laying chickens.

Studies to understand and explain the extreme volatility in national and world markets in 2007-2009 are ongoing. For example, economic studies on forward pricing and price volatility in commodity markets have shown that payoffs on commodity futures positions have been insignificantly different from zero for most commodities. Understanding of commodity derivatives markets are important in risk management and cost minimization for producers. In addition, the introduction of new and novel crops has resulted in new economic opportunities. For example, the introduction of improved artichoke varieties enhanced the ability of artichoke growers to provide for that market.

These are but several examples of the important work on agricultural and crop production programs of importance to California. A critical component of the research and extension projects in the Division of Agriculture and Natural Resources is addressing economic viability for farmers, ranchers and the greater public.

Water Use Efficiency and Water Quality, and Environmental Protection:

Water issues were paramount during 2009, with severe cut-backs and deficits in many irrigation zones. This precipitated a crisis in many regions, as unemployment soared in the major agricultural areas in 2009, particularly in the San Joaquin Valley, primarily due to water cutbacks, but also due to the global economic downturn. Water quality contamination also is continued importance in specific areas: primarily the coastal valleys, the southern San Joaquin Valley, and the all-critical San Joaquin-Sacramento Delta locations. Many of these caused by natural weather patterns, but also regulatory and legal decisions.

UC ANR has a large commitment to research and extension in water use and water quality. For example, to have an ongoing drought response, a website was developed to provide key information on how to produce crops under reduced water availability situations. Deficit water management methods, combined with selective pruning, were promoted for a variety of fruit and nut crops. By minimizing irrigation events, pruning tower use and spraying operations, reliance on fossil fuels can be decreased while minimizing pesticide usage. Employing these techniques would provide direct benefits to growers by decreasing costs of production and reducing potential for worker and environmental pesticide exposure, while producing products with the lower pesticide residues that consumers desire. In addition, recent research explored water use and nitrogen use of new biofuels including switchgrass, Miscanthus, jatropha, sugarbeet sugarcane, and sweet sorghum. Extension delivered water quality education that was culturally and linguistically appropriate for ethnic Chinese farmers. Another example is the comprehensive measurement of alfalfa evapotranspiration across multiple environments; this research should enable water planners and farmers to accurately assess the impact of California's number one water-using crop and allow for voluntary water transfers in drought years. Also, to inform policy makers and others who need to make critical decisions about these important issues, economic evaluation of the impacts of the drought and analysis of economics of water transfers have been conducted.

ANR scientists have worked to provide science-based information to policy-makers as they struggle with global climate change and its agricultural impacts. A broad range of plant species, including important crops such as wheat, tomato, and sugar maple, were surveyed as well as timber species for their response to elevated carbon dioxide under nitrate and ammonium as nitrogen sources. The results on nitrogen source and assimilation provide a new perspective on the role of photorespiration in plant metabolism in response of plants to rising atmospheric levels of carbon dioxide. In addition, the benefits and challenges of new grinding and recycling methods for orchard waste have shown the enhanced ability of those orchards for carbon dioxide sequestration. Other work has described the spatial-temporal characteristics of the adverse effects of current ambient ozone levels on crop productivity, including the development of numerical models to establish cause-effect relationships that apportion the ozone contribution. Researchers also demonstrated that ozone is driving the local horseweed population toward glyphosate resistance by synergy with glyphosate in removing glyphosate-sensitive individuals from the population. The data developed by this project was used to inform California Air Resources Board and US EPA in devising ozone air quality standards. Lastly, research was conducted to characterize the relative impacts of manures, animal emissions, and forage emissions on air quality surrounding dairies; this widely dispensed of some of the mis-information on the air quality impacts of dairy farms. This work has been widely cited by regulators within California and internationally.

Food Safety and Quality:

Food safety is a critical issue for California growers and the nation's food supply. California produces more than 75% of more than 200 commodities in the US, particularly vegetable, fruit, and nut crops, and now produces 21% of the nation's milk, and is a major meat livestock producer. Food safety affects both consumers and producers through sudden market shifts and price penalties. UC researchers have been studying food borne pathogens and crop quality of crop and animal products for a number of years.

In the past 4 years, there have been outbreaks of incidences of Salmonella poisoning or food product contamination in crops ranging from pistachios to strawberries, onions, tomatoes to leafy vegetables. These have caused widespread economic hardship, health threats and concern. Concerted efforts by Monterey County farm advisors along with food safety specialists investigated several of these important outbreaks, and designed studies to understand the path of contamination, as well as to mitigate these problems for farmers by developing safety educational efforts to improve food safety for large and smaller farms doing either very large-scale marketing, or those marketing through other means such as farmers markets. Another food safety example is the poultry research that was conducted which has both food safety and animal welfare as a goal. These results demonstrate that providing light during incubation can have positive effects on broiler chicken welfare, decreasing fearfulness and stress susceptibility, without negatively affecting productivity. This enhances both animal comfort, public acceptance, and food safety.

There are also examples of food quality work. Research linked fruit softening and pathogen susceptibility, which suggests an excellent strategy for modifying the progression of ripening and spoilage. In addition, work on the effect of aging methods on postmortem biochemistry and meat quality has been important due to changes in method of merchandising meat after slaughtering of meat animals in recent years. This work has shown differences in protein breakdown, tenderness, and ethnic preference for different aging processes for meat. Lastly, research investigated edible coatings to improve food quality and food safety, reduce cost and environmental waste. This demonstrated the protection of peanuts from oxidation and smoked salmon from growth of microorganisms.

The scientific infrastructure provided by UC programs at Riverside, Davis, and Berkeley and the county-based UC Farm Advisors provides a key strategic value to the health of Californians and indeed the nation, since so much of California's produce is consumed nationally.

Crop and Animal Improvement and Genetic Engineering:

ANR scientists are fully committed to the long-term development of genetic expertise, including genomics, proteomics, marker-assisted selection, biotechnology techniques, maintenance of genetic biodiversity, plant and animal improvement using conventional breeding and newer techniques. Variety testing, release, disease evaluation, and adaptation are also key components. UC is a leader in the development of varieties of several key specialty crops including strawberries, tree and vine crop rootstocks, grain legumes (cowpeas, beans), wheat, and alfalfa; during this reporting period such varieties have been released and/or adapted and evaluated.

For example, a long-term project at UC Riverside is working to develop improved avocado lines, which has resulted in a wide range of varieties that are suited for different markets and survive shipping: essentially creating the US avocado industry. UC Riverside has also conducted citrus genetic research on disease and insect resistance for the California citrus industry, which has brought tremendous value to citrus growers in Southern California and the San Joaquin Valley. Genetic work at UC Davis and the RECs to evaluate the resistance levels of grape and tree rootstocks have brought tremendous value to California viticulture and pomology industry. In addition, ANR's wheat improvement and testing program has had to continually test improved varieties for new strains of rust which has been devastating in California and the West. Lastly, comprehensive statewide testing of improved lines of wheat and alfalfa, cotton, and biofuels have provided critical, independent data that enables farmers to make wise choices.

Work on gene flow and genetic engineering policy informs the public about the broader issue of genetic engineering and the safety of non-GE crops. In addition, work to develop massive databases on bovine genetics and interpret how these genes impact milk production and animal performance is of key interest to California's number one agricultural industry: dairying. The outcome of this project will provide the dairy industry the knowledge necessary to select animals to produce milk with a desired milk

composition.

Small Farms, Urban Horticulture, and Public Education about Food Systems:

University of California has a long history of commitment to the needs of small farmers, the public need for horticultural beauty and health, and to educate the public about food systems.

ANR extension programs provided in-depth assistance to small farmers who produce many types of specialty crops. Many are from ethnic minorities, who have developed specialty markets, including locally-grown, organic, grass-fed beef, specialty Asian vegetables and fruits and vegetables who appeal to the state's Mexican- and Latin-heritage citizens. In the coastal cropping systems, which are highly diverse, resources were developed to help direct farmers, especially those with small operations, limited resources and limited English skills, to the agriculture-related agencies and organizations. In addition, organic production guides for apple, grapes, pears, alfalfa, and several other crops were developed. Expertise on marketing and new crop development was also provided to organic farmers.

Public education programs included the UC Master Gardener program, which trains thousands of citizen-volunteers in urban horticulture and gardening statewide. These volunteers are active in their community, training others in gardening and environmental stewardship. Other horticultural programs provided horticultural skills to jail inmates in some counties. There were also extension led Farm-to-School programs that encourage good nutrition in schools, while benefitting the smaller vegetable and fruit producers.

California's highly diverse plant and animal production systems demand a wide diversity of expertise across many disciplines, and within a wide range of environments.

Sustaining California's Natural Resources

California's environment is extremely diverse and wide ranging, from urban areas to wildlands to coastal areas to deserts to mountains, involving aquatic, terrestrial and atmospheric ecosystems. There are 163 Hatch and Regional Research projects funded through Multi state Research sources to investigators at UC Riverside, Davis, and Berkeley with a natural resources focus. There are also 40 research projects conducted by UCCE Advisors and 353 extension projects conducted by UCCE advisors and campus based specialists under the Federal Planned Program: Sustaining California's Natural Resources. Projects are being conducted in several areas that are essential to sustaining California's natural resources; a few illustrative examples follow.

Water Quality:

Projects are being conducted to reduce the loading of pesticides, nutrients, pathogens, sediments, and salts from agriculture, rangeland, oak woodlands, and urban runoff into surface and ground waters. ANR is providing dairies in the San Joaquin Valley with science-based tools and practical methods to meet new waste-discharge regulations and implement cost-effective nutrient management and monitoring practices for environmental protection. ANR academics are working closely with producers and such agencies as Cal EPA and CDFA, and other non-governmental organizations, such as The Nature Conservancy, to develop management strategies that maintain water and air quality.

Air Quality:

Projects are being conducted on greenhouse gas emissions and climate change, used in the development of California's greenhouse gas legislation; data used to predict formation of ozone and secondary particles; improved models for prediction of greenhouse gas emissions from agricultural soils; reducing dust emissions using native plants; impacts on native and invasive species; and developing BMPs for feedlots.

In one specific project, rice growers, with the help of ANR scientists, solved a rice straw disposal problem in the Sacramento Valley, while creating more than 100,000 acres of seasonal wetlands habitat for migratory waterfowl through research showing the benefits of winter flooding of harvested fields. These strategies also dramatically decreased the open burning of rice straw in the fall, improving air quality in this heavily populated airshed.

Land Use:

Projects are developing regional models to make more reliable estimates of impacts of land use changes and anthropogenic activities (e.g., greenhouse gas emissions, aerosol formation) on climate; and on developing planned growth strategies to address population growth, loss of agricultural land, poor air and water quality, and urban encroachment on wildlands.

Sustainable Use:

Data was provided to agencies on the impacts of agricultural and environmental contaminants on wildlife, waterfowl, and aquatic organisms. Projects are developing strategies for management and restoration of the Bay-Delta and for implementation of California's Marine Life Protection Act. Projects are also being conducted to examine the effects of invasive species and environmental stresses (natural and anthropogenic) on biodiversity, and on developing a rangeland health indicators system to allow landowners to assess ecological and economic health of their lands. A number of projects have been initiated on the development of alternative fuels, such as biofuels.

ANR is researching and developing more sustainable farming, livestock production, and timber harvest practices to maintain the economic viability of these business sectors, while improving environmental quality and conserving natural resources. As an example, a local CE office in the North Coast coordinated an innovative acquisition of redwood forestland by a conservation trust organization that provided cash flow through sustainable timber harvesting benefitting the timber industry, fisheries, and ecosystem services.

Water Supply and Allocation:

Projects developed economic models allowing policy makers to calculate agricultural costs vs. environmental benefits of agricultural/urban water trades and land fallowing schemes in Salton Sea region. Other projects are developing a user-friendly model for growers to assess impacts of irrigation with reclaimed wastewater. One specific example involves ANR academics seeking solutions to problems facing the Sacramento and San Joaquin Delta exemplified by declining ecosystems, reduced water exports to farms and Southern California, risk of levee failure, and competing demands for land and resources. ANR faculty led a recent policy review, coordinated with the Public Policy Institute of California, of alternatives for the Delta.

Wildland Fire:

ANR developed an interactive website to assist residents to prepare for wildfire and deal with the aftermath. Projects are being conducted on forest management practices to reduce wildfire risk and enhance long-term forest productivity; elevated soil nitrogen effects on fuel load that supports increased fire frequency; and the impact of prescribed burns and wildfires on the erosion potential of soils.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2008	Extension	Research
	1862	1862
Plan	284.4	342.3
Actual	282.7	318.8

II. Merit Review Process

The Merit Review Process that was Employed for this year

- Internal University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

Brief Explanation

Scientific Peer Review

Each project funded under the Hatch Act was peer reviewed at the department level in the colleges and School of Veterinary Medicine at Berkeley, Davis, and Riverside. A peer review committee is appointed by the department chair. The committee evaluated the relevance, quality and scientific value of the proposed research. Upon completion of the peer review, the project was reviewed at the dean's office for USDA compliance and forwarded to the Vice President's Office for final review and submission.

Merit Review

The Division's organizational structure emphasizes that resource allocation decisions are driven by programmatic considerations and developed through a broad participatory process. This process includes review of the quality and relevance to program goals for all of the Division's programs.

Workgroups provided grassroots leadership for program development and evaluation at the statewide level. Structured to bring together CE and AES personnel with non-ANR partners to work on emerging and continuing issues, they look at the Division's program priorities and determine the programs that will best address these needs.

The UC ANR Program Council is charged with coordinating statewide planning and program policies and providing statewide leadership for coordination of resource allocation. Chaired by the Associate Vice President -Academic Programs and Strategic Initiatives, it was composed of the Associate Deans for Research and Extension at the three colleges and the School of Veterinary Medicine at the Berkeley, Davis, and Riverside campuses, three CE Regional Directors, and four Program Leaders. The Associate Vice President and Assistant Vice President - Administrative Services served as ex officio members.

In a normal budget year, the Program Council would review all ANR budget proposals, program area budget proposals, and position proposals from a statewide perspective and develop recommendations for a comprehensive ANR program budget. These recommendations would then be considered by the associate vice president and vice president for final decisions on allocations. However, in the current economic situation with the drastic cuts to state funds for the University, the Program Council developed options to meet the budget cuts and made recommendations to the ANR senior leadership.

The Program Council is also charged with providing leadership for five-year program reviews of statewide programs. Each of the Division's 16 statewide programs undergoes a program review initiated by the appropriate program leader every five years. A review panel of ANR members and external stakeholder representatives is appointed and conducts the review. The review results are presented and discussed by Program Council members who make recommendations to the associate vice president for possible actions. During FY 2009, the Sustainable Agriculture Research and Education Program and the Sea Grant Extension Program, were reviewed by panels composed of ANR members, academics from other institutions and appropriate agency representatives. The review reports were presented at a Program Council meeting and the Program Council made recommendations to the associate vice president and vice president on potential actions.

Academic Reviews

Two reviews were conducted in conjunction with the ANR strategic planning process. These reviews were designed to provide a broad assessment of the quality of ANR's programs, evaluate its responsiveness to needs in the state, assess its impact in changed behavior and policy implementation, and suggest where changes in structure, organization and policy are in order.

1. CRSREES Review of Cooperative Extension

Since the Cooperative Extension of ANR had never been formally reviewed, USDA's Cooperative State Research, Extension and Education Service (CSREES) was asked to conduct a comprehensive review of CE programs. The CSREES review members met on the Davis campus from Jan. 11 to 14, 2009. The CSREES Review Panel was co-chaired by Mike Fitzner of USDA CSREES and Jim Zuches of North Carolina State University. Other members of the review panel included Ted Batkin (Citrus Research Board), Helene Dillard (Cornell University), Linda Kirk Fox (Washington State University) and Paul Guitierrez (New Mexico State University).

The review panel was provided a copy of ANR's self-evaluation document with a broad overview of budgets, facilities and programs (see <http://danr.ucop.edu/ce-review/>). During the review, the panel met with ANR's leadership, including the vice president and his immediate senior staff, the four deans of the colleges and school with ANR programs, the three regional directors, the four program leaders and a panel of county directors. They also were presented with a series of eight case studies, involving 31 members of ANR, as well as two panels of external stakeholders. These were designed to highlight a broad cross-section of Cooperative Extension programs, and the impact of the programs in addressing the needs of the state.

The review panel report "finds the University of California's Cooperative Extension (CE) program to be well managed and effective in achieving its stated mission, which is to 'serve California through the application of knowledge addressing critical issues in agricultural, natural and related human resources, through a system of community-driven research and extension programs with CE advisors supported by CE specialists and AES scientists.' In general, UC CE faculty, county advisors and staff are doing good quality applied research and extension education that is greatly appreciated by stakeholders. The program is regionally and nationally recognized for its effective and innovative programs."

The review team made the following recommendations:

Strategic Planning

- Ensure engagement and inclusiveness throughout the process
- Adopt a systems approach to develop strategic plan with focus to address complex issues
- Develop institutional plan and organizational commitment to diversity within the planning process

Program Quality

- Emphasize use of logic model for program evaluation
- Develop culture of leadership and risk taking
- Review charge of workgroups and mission-driven relationship between centers and workgroup

Linkage of Campus to State and Local Programs

- ANR leadership, deans, faculty actively involved in roll-out of strategic plan
- Explore potential for greater use of technology in enhancing engagement of campus and county staff in delivery of CE programs

Collaborations with External Groups

- Invite stakeholder representatives to provide input on critical decision-making processes (budget decisions, searches, program reviews)
- Ensure ethnic, gender and organizational diversity of stakeholder advisory committees

Academic Personnel Policies

- Strong support for proposal to provide "equivalent rank" status to CE Specialists
- Develop high quality orientation and mentoring system and provide rewards and incentives for teamwork

2. UC Provost's Review of UC Division of Agriculture and Natural Resources

The panel was provided with a broad, self-evaluation document highlighting ANR's broad range of programs, its role in graduate and undergraduate education, a measure of the quality of ANR academic members, as well as a budget and infrastructure overview (see <http://danr.ucop.edu/anr-review/>). The Provost's on-site review was held Feb. 8 to 11, 2009.

The review started on the Berkeley campus with an opening dinner attended by the chancellors of UC Berkeley, UC Davis and UC River-side, interim Provost Lawrence Pitts, Vice President Dooley, as well as the four deans and the senior ANR leadership from Oakland. The results of the CSREES Review of Cooperative Extension were provided to the Provost Review Panel by the chair of that review. The panel traveled from Berkeley to Davis and ended its deliberations at the Riverside campus. They were presented with a series of nine case studies, involving 35 ANR members, plus meetings with key external

stakeholders.

The panel was "uniformly impressed with the scope of work, the depth and quality of research, the robust infrastructure created for identifying high priority problems facing Californians, and catalyzing research and outreach related to those problems and their solutions, within the land grant mission."

The panel endorsed and supported "the unique role played by ANR with the University of California but recommends that it could build on its strengths and expand its impact by refining and modifying the focus of its work, telling a better story to the public, broadening its audience and making some internal corrections."

The panel made the following recommendations:

Focusing the work

- Lead and frame discussions on California major issues in agriculture, natural resources, people through ANR's strength and use of dedicated funds for high priority research
- Consider concept of agriculture and natural resources to issues of broader relevance in California, such as sustainable communities
- Clarify ANR's role beyond California
- Enhance ANR visibility through "brand identity" - provide visibility for UC as a whole
- Develop high level metrics to evaluate ANR research and extension program impacts and use to report on accomplishments; incorporate into strategic planning
- Provide visibility and advocacy for ANR programs and priorities with UCOP, Regents, Legislature

Working with others

- Assure strategic planning is inclusive
- Attend to diversity of ANR workforce and development of talent pipeline
- Engage with more diverse stakeholder base
- Leverage public-private partnerships

Internal Changes

- Connect differently and create greater synergy with other disciplines in UC systems (engineering, public health, medicine)
- Require priority programs develop and report on set of metrics to demonstrate program impacts
- Continue to consider ways of defining and recognizing outreach contributions by CE specialists

III. Stakeholder Input

Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from general public

Brief Explanation

The University of California, Division of Agriculture and Natural Resources (UC ANR) continued to use a variety of mechanisms to seek stakeholder input on the development of Division program priorities and use of its research, extension and education funds. CE advisors delivering programs in 57 California

counties receive input on local needs from their local clientele on a daily basis. All of the input received from stakeholders is used by ANR members in program planning and implementation at the local, regional, and statewide level.

In addition, the Division's program workgroups and coordinating conferences are primary mechanisms for accomplishing ANR's high priority research and extension goals through grassroots leadership. They brought together AES and CE personnel and non-ANR partners to work on emerging and continuing priority issues in the Division program areas. Non-ANR participants are identified by the academics working in specific program area and invited to participate in workgroup activities, including needs assessment and issue identification and evaluation and reporting program results. In 2009, workgroups met in conjunction with six coordinating conferences and the divisionwide Statewide Conference, as well as through web conferences and conference calls.

ANR Strategic Planning Initiative

In the summer of 2008, the Division began work on a comprehensive strategic planning initiative to anticipate the research and extension priorities of California in 20 years and analyze ANR's current capacity to address them and to focus on the future demand for services. Five teams were recruited and charged to identify general themes and issues anticipated for California in the year 2025 and ANR's capacity to address future trends and issues. The vice president charged five working groups with answering this question: How do we position ANR to respond to the needs of the state in keeping California competitive globally in providing safe, nutritious and healthy food and conserving natural and human resources? The five working groups included both internal and external stakeholders. The groups consulted with their colleagues and contacted external stakeholders to solicit their input through interviews, surveys and meetings. As the draft strategic vision statement was finalized in FY 2009, additional consultation and feedback was sought from a wide variety of external stakeholders through meetings, presentations, town halls, and survey instruments. The final ANR Strategic Vision was unveiled at the April 2009 ANR Statewide Conference, attended by 600 ANR members. ANR members began developing ideas for the implementation of the Strategic Vision at strategic planning sessions at the conference.

Formal Advisory Groups

The President of the University chairs the President's Advisory Commission on Agriculture and Natural Resources to identify the education needs of California's agricultural, natural and human resources interests and to advise him on how the University can best meet these needs through its science based research, classroom instruction and educational outreach. The members represent 28 business, consumer, youth and government leaders from throughout California and met twice last year to provide input. The Vice President Agriculture and Natural Resources participated as a member of this Commission and brought the Commission's advice to the ANR Executive Council, the Division's administrative group charged with divisionwide strategic planning.

Each of the three colleges at Berkeley, Davis and Riverside and the School of Veterinary Medicine at Davis, have external stakeholder advisory councils that meet at least annually to provide feedback on their research, extension, and teaching programs. Members of these councils represent the spectrum of clientele who use the Division's programs and who have expressed interest in providing input to the college/school planning efforts.

Several of the Statewide Special Projects and Programs have external Advisory Councils that meet at least annually to review progress and offer recommendations for future program direction.

Commodity Organizations/Marketing Order Boards

Members of these organizations provide annual input on research and extension needs for their commodities to UC ANR members through regular meetings and discussion of funding for research projects. These individual groups also come together on an annual basis to form the California Commodity Commission. This Commission met with the Vice President and offered specific recommendations on program planning and funding issues.

A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief Explanation

External stakeholders are identified through a variety of mechanisms including the activities mentioned in Section 1. At the local county level, all Cooperative Extension advisors and county directors receive feedback on external stakeholders and groups as they conduct their programs. At the statewide level, through the ANR workgroups and coordinating conferences, the CE and AES personnel identify non-ANR stakeholders to participate in program activities, including needs assessment and communicating results.

A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation

The groups described above gave their input on ANR programs and future program needs at the various meetings with ANR members. Regular 5-year program reviews are conducted of the ANR statewide programs.

During the past year, review committees included external stakeholders or gathered feedback from external stakeholders in surveys or interviews. In addition, as described above, the Division solicited input from external stakeholders through surveys, personal interviews and meetings as part of the strategic planning process that started in 2008. Stakeholders were also given the opportunity to comment on the draft Strategic Vision in February/March of 2009, before it was finalized in April 2009.

A statement of how the input was considered

- In the budget process
- To identify emerging issues
- Redirect extension programs
- Redirect research programs
- In the action plans
- To set priorities

Brief Explanation

At the individual level, the input received from stakeholders in local county and regional programs by CE advisors was used to aid in further program planning and implementation of programs at the local, regional, and statewide level. ANR workgroups and coordinating conferences identified and/or gave

feedback on priority academic positions to be filled. This information was communicated to ANR administration through four statewide program leaders and the ANR annual budget process for FY 2009. Feedback from external stakeholders compiled during the five-year program reviews of statewide programs was considered and included in the review committees' reports to ANR administration. Feedback from external stakeholders on trends and priorities for California in 2025 was considered during the strategic planning process started in 2008, resulting in the draft ANR Strategic Vision 2025 in February 2009.

Brief Explanation of what you learned from your Stakeholders

As described earlier, stakeholders provided key insights into the development and ongoing implementation of the divisionwide Strategic Vision, as well as to program planning, implementation, and evaluation of local, regional, and statewide programs.

IV. Expenditure Summary

1. Total Actual Formula dollars allocated (prepopulated from C-REEMS)	
Extension	Research
Smith-Lever 3b & 3c	Hatch
7,317,596	5,788,098

2. Total Actual Dollars Planned Programs Inputs		
	Extension	Research
	Smith-Lever 3b & 3c	Hatch
Actual Formula	7,807,610	3,986,920
Actual Matching	7,807,610	3,986,920
Actual All other	84,090,780	19,952,1582
Total Actual expanded	99,706,000	207,495,422

3. Amount of above actual formula dollars expended which comes from carryover funds from previous years		
	Extension	Research
	Smith-Lever 3b & 3c	Hatch
Carryover	1,193,322	1,886,446

V. Planned Program

Program Names:

- A. California Families, Youth and Community Development (HR)
- B. California Pest Management (Pest)
- C. Sustainability and Viability of California Agriculture (Ag)
- D. Sustaining California's Natural Resources (NR)

A) California Families, Youth and Community Development (HR)

1) HR Planned Program Knowledge Areas

Program knowledge areas and percentages

KA Code	Knowledge Area	%1862 Extension	%1862 Research
305	Animal Physiological Processes	0%	12%
311	Animal Diseases	1%	3%
501	New and improved food processing technologies	3%	6%
502	New and improved food products	1%	3%
503	Quality Maintenance in Storing and Marketing Food Products	1%	1%
605	Natural Resource and Environmental Economics	2%	3%
608	Community Resource Planning and Development	2%	3%
701	Nutrient Composition of Food	0%	4%
702	Requirements and Function of Nutrients and Other Food Components	0%	37%
703	Nutrition Education and Behavior	23%	5%
704	Nutrition and Hunger in the Population	2%	0%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	4%	1%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	6%	3%
724	Healthy Lifestyle	8%	1%
801	Individual and Family Resource Management	4%	0%
802	Human Development and Family Well-Being	5%	8%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	2%	5%
805	Community Institutions, Health, and Social Services	2%	3%
806	Youth Development	32%	1%
903	Communication, education, and information delivery	2%	1%
	Total	100%	100%

2) **HR Planned Program Inputs**

Actual amount of professional FTE/SYs expended this program

Year: 2008	Extension	Research
	1862	1862
Plan	53.5	53.8
Actual	56.4	42.5

**Actual dollars expended in this program
(includes carryover funds from previous years)**

Extension	Research
Smith-Lever 3b & 3c 1,403,786	Hatch 556,123
1862 matching 1,403,786	1862 matching 556,123
1862 all other 16,771,165	1862 all other 26,567,413

3) **HR Planned Program Activity**

Brief description of the activity

UC ANR's integrated research and extension programs conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs used PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

The target audience of some programs is underserved groups but also UC ANR reaches out to the general public, especially through its efforts to change state and local policies and create environments conducive to healthy lifestyles and positive youth development. Below is a list of our target groups:

- Adults, children, youth and families in general
- Children in general
- Low and moderate income adults, children, youth and families
- Adults and children at risk for nutrition related health problems, including individuals living in poverty, recent immigrants, and African American, Native American and Hispanic populations
- Nutrition and healthcare professionals
- Preschool, primary, and secondary school teachers and administrators
- Professional childcare providers
- Public agencies and private organizations concerned with food, nutrition, and health
- Patients with metabolic diseases
- Biomedical researchers
- Plant biologists
- Nutraceutical industry

4) **HR CSREES Defined Standard Output Measures**

FY 2008	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Plan	82,000	253,000	4	30	250	280
Report	68,531	280,674	4	29	160	189

Patents Listed:

- Isotopic labeling of collagen breakdown products in urine or blood as a metabolic biopsy to assess bone turnover and tissue fibrogenesis.
- High power density supercapacitors using electrodes of coherent carbon nanotube thin films and method of manufacturing the same.
- Another novel feline calicivirus causing a highly contagious and fatal hemorrhagic fever syndrome.

5) **HR State Defined Outputs**

FY 2008	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Plan	1,950	800	210	280	60	160	80	340
Report	1,495	335	453	20	19	119	11	39

6) **HR State Defined Outcomes**

a) **Knowledge Outcomes**

- 1,813 children and youth, participating in 4-H club, community, in-school and afterschool education programs, increased level of science, agricultural and environmental literacy.

Associated Knowledge Areas: 806 Youth Development

- 902 low-income children and youth, participating in nutrition education programs, gained knowledge of nutrition.

Associated Knowledge Areas: 703 Nutrition Education and Behavior

- 1,657 youth and adults in the general population, participating in nutrition education programs, gained knowledge of nutrition.

Associated Knowledge Areas: 703 Nutrition Education and Behavior

- 141 individuals trained as trainers, participating in food safety education programs, gained knowledge of safe food handling and preparation techniques.

Associated Knowledge Areas: 712 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

- 349 adults, participating in food safety education programs, gained knowledge of safe food handling and preparation techniques.

Associated Knowledge Areas: 712 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

- 299 parents, participating in parent education programs, gained knowledge of parenting techniques to promote child development and learning.

Associated Knowledge Areas: 802 Human Development and Family Well-Being

- 710 youth educators and child care resource specialists, participating in youth development education programs, gained knowledge of youth development practices.

Associated Knowledge Areas: 806 Youth Development

b) Attitude Changes

- 285 youth, participating in 4-H, increased readiness to pursue careers in science, engineering and/or technology.

Associated Knowledge Areas: 806 Youth Development

- 140 youth, participating in youth development programs, increased readiness to adopt leadership roles.

Associated Knowledge Areas: 806 Youth Development

- 2,018 adults and families with children, participating in the childhood obesity prevention education programs, increased readiness to adopt healthier dietary, food safety, and lifestyle practices.

Associated Knowledge Areas: 703 Nutrition Education and Behavior, 724 Healthy Lifestyle, 802 Human Development and Family Well-Being

- 154 in-home care givers and child care providers, participating in the childhood obesity prevention programs, intended to use the recommended nutrition education and life skills activities with their clientele.

Associated Knowledge Areas: 703 Nutrition Education and Behavior, 724 Healthy Lifestyle, 802 Human Development and Family Well-Being

c) Skills Changes

- 120 youth, participating in 4-H club, community and afterschool education programs, acquired leadership or civic skills.

Associated Knowledge Areas: 806 Youth Development

- 875 youth, participating in 4-H club, community and afterschool education programs, acquired planning, problem solving, teamwork, or other life skills.

Associated Knowledge Areas: 806 Youth Development

d) Behavior Changes

- African Americans and Latinos, participating in the UC Cooperative Extension healthy lifestyles goal setting program, demonstrated significant changes in attitudes and behaviors related to use of food labels, physical activity and portion control.

Issue (Who cares and Why)

The African-American and Latino communities are disproportionately affected by obesity, heart disease, diabetes, cancer and stroke. Eliminating the health disparities associated with chronic diseases requires culturally appropriate and effective interventions that address the individual's role in self-management and the community's role in supporting self-care. Goal setting has been reported to be successful because it directs an individual's attention toward a goal, encourages them to complete the goal, and forces them to alter their status quo to complete that goal.

What has been done

UC Cooperative Extension advisors, specialists, and community health program representatives designed and delivered a Healthy Rewards program among African-American and Latino populations. The African-American community in Sacramento County and Latino communities in Solano and Yolo counties were randomized in two groups. Group one received the basic nutrition education without goal setting and group two received the basic nutrition education with goal setting. All groups received some physical activity education. Participants attended four two-hour weekly sessions over the course of one month and a follow-up celebration lesson three to four weeks after the last lesson. The nutrition education lessons took place in group settings, using a learner-centered approach and adult and adult learning theory.

Results

Thirty-nine participants were enrolled in the program and 31 completed both pre- and post-evaluations. The outcomes from this community-based project show goal setting was effective to promote participant behavior change. Overall, the group reported significant changes in attitudes and behaviors related to use of food labels, physical activity and portion control. However, the group that set goals reported even greater changes, particularly in using the Nutrition Facts label to make better food choices. The potential improvement in health and well-being of the community members who participated in this project means the community as a whole wins. Community leaders have reported that participants have demonstrated a change in food choices and preparation methods toward a healthier lifestyle.

Associated Knowledge Areas: 724 Healthy Lifestyle

- Youth voice in county government policy and decision-making was formalized through Board of Supervisors' resolution to establish a youth commission.

Issue (Who cares and Why)

Research shows that engaging youth in civic activities is the most effective way to promote civic identity formation and subsequent civic engagement in adulthood. In addition, young people want to create positive change in their communities, and believe that in order to truly impact youth issues, they themselves need to be involved. Youth commissions provide a real-world setting for youth leadership and civic development. Giving young people an authentic voice in local policy and decision-making benefits both the youth and the greater community.

What has been done

In response to growing community interest in a Placer County youth commission, the Placer County 4-H Program lead the collaborative effort, working with the Placer County Department of Health and Human Services and other community partners and youth, to establish a youth commission. Twelve high school students were recruited to develop a mission statement, goals and structure for the commission. The students presented their ideas to community partners to gather input. The County Supervisor brought forth a resolution and set of bylaws developed by the youth at a subsequent Board of Supervisors' meeting.

Results

The Board of Supervisors voted unanimously to form a 15-member Placer County Youth Commission composed of youth between the ages of 14 and 21 representing each of the five supervisory districts. The passage of the resolution and establishment of a youth commission marks institutional change in the county by creating a formalized opportunity for the youth voice to influence policy and decision-making. Additionally, as a result of their participation in this process, the founding youth members reported significant increases on several indicators of civic engagement. All but one agreed or strongly agreed that they learned about local government and decision-making, and the same number affirmed that they are now more interested in local government. All of the students said they want to take action in their community and that they had opportunities to interact with adults in a meaningful way.

Associated Knowledge Areas: 806 Youth Development

- 238 parents, participating in parent education programs, adopted recommended parenting practices.

Associated Knowledge Areas: 802 Human Development and Family Well-Being

- 8942 low-income adults, youth and families, participating in nutrition education programs, adopted healthier dietary practices.

Associated Knowledge Areas: 703 Nutrition Education and Behavior

- 7537 low-income adults, youth and families, participating in nutrition education programs, adopted safe food handling and preparation techniques.

Associated Knowledge Areas: 712 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

- 8234 low-income youth, adults, and families, participating in nutrition and consumer education programs, adopted food resource management techniques.

Associated Knowledge Areas: 801 Individual and Family Resource Management

- 325 children and youth, participating in nutrition and youth development education programs, adopted healthier dietary and lifestyle practices.

Associated Knowledge Areas: 703 Nutrition Education and Behavior, 724 Healthy Lifestyle

- 598 youth, participating in 4-H clubs and other youth development programs, assume leadership roles in organizations or participate in community affairs.

Associated Knowledge Areas: 806 Youth Development

e) **Social/Health Condition Changes**

- 31 school and after school sites had teachers and youth leaders, participating in nutrition education programs, who contributed to changing their schools' culture and environment to be healthier.

Associated Knowledge Areas: 703 Nutrition Education and Behavior

7) HR Planned Program External Factors

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief explanation

As the economic situation worsened in 2009, demand continued to be strong for certain kinds of extension activities and programs, including money management skills, gardening, food preservation, and food budgeting. UC ANR has also responded by extending knowledge related to food assistance programs and strengthening community food security. Kick-off of the 4-H Science, Engineering and Technology Initiative has stimulated an increase in activities that promote science and environmental literacy in youth. Restructuring of the FSNEP program continued to pose administrative burden on county advisors; thus, possibly limiting their engagement in some other county level activities over the past year. At the same time, county-level budget problems may be limiting access to match money for FSNEP due to layoffs, although the need for this program continues to be high. Possibly due to worldwide economic recession, recent new immigrants have been arriving from highly disadvantaged, vulnerable populations, presenting with very low levels of literacy.

8) HR Planned Program Evaluation Studies and Data Collection

Evaluation studies planned

- After only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparison between locales where the program operates and sites without program intervention.

B) California Pest Management (Pest)

1) Pest Program Knowledge Areas

Program knowledge areas and percentages

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, plant, water, nutrient relationships	2%	1%
123	Management and sustainability of forest resources	1%	1%
133	Pollution prevention and mitigation	0%	1%
135	Aquatic and terrestrial wildlife	1%	3%
136	Conservation of biological diversity	1%	1%
201	Plant genome, genetics, and genetic mechanisms	0%	2%
205	Plant Management Systems	1%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	16%	17%
212	Pathogens and Nematodes Affecting Plants	22%	25%
213	Weeds Affecting Plants	15%	0%
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	1%	0%
215	Biological Control of Pests Affecting Plants	3%	13%
216	Integrated Pest Management Systems	29%	13%
311	Animal Diseases	1%	1%
312	External Parasites and Pests of Animals	1%	2%
601	Economics of Agricultural Production and Farm Management	2%	0%
721	Insects and Other Pests Affecting Humans	2%	11%
722	Zoonotic Diseases and Parasites Affecting Humans	0%	2%
723	Hazards to Human Health and Safety	0%	7%
903	Communication, Education, and Information Delivery	2%	0%
	Total	100%	100%

2) Pest Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year:	Extension	Research
2008	1862	1862
Plan	68.9	67.8
Actual	68.1	62.5

**Actual dollars expended in this program
(includes carryover funds from previous years)**

Extension	Research
Smith-Lever 3b & 3c 2,334,069	Hatch 893,599
1862 matching 2,334,069	1862 matching 893,599
1862 all other 20,265,777	1862 all other 39,115,743

3) Pest Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension programs will conduct research projects, workshops, education classes and demonstrations as well as one-on-one interventions. In addition, the programs will use PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Farmers
- Ranchers
- Rangeland owners/managers
- Landscaping professionals
- Owners/operators of allied agricultural industries
- General public
- Crop and pest consultants

4) Pest CSREES Defined Standard Output Measures

FY 2008	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Plan	47,000	0	3	130	340	470
Report	79,881	0	0	126	303	429

5) Pest State Defined Outputs

FY 2008	Classes/ Short Courses	Workshops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Plan	100	50	110	200	40	290	20	60
Report	144	37	24	16	12	273	1	5

6) Pest State Defined Outcomes

a) Knowledge Changes

- 536 farm, ranch, range and landscaping owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained knowledge of Integrated Pest Management strategies and techniques.

Associated Knowledge Areas: 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants, 216 Integrated Pest Management Systems

- 164 farm owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained knowledge of pesticide and pharmaceutical efficacy and optimal use.

Associated Knowledge Areas: 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants

- 1360 farm, forest, range, and boat owner/operators, and Pest Control Advisors and allied industry professionals, participating in invasive species programs, gained knowledge of prevention, detection and treatment practices for invasive species.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife, 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants, 216 Integrated Pest Management Systems

- 804 farm owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained knowledge on how to recognize and identify pests and diseases.

Associated Knowledge Areas: 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants

b) Attitude Changes

- 945 farm, ranch, and boat owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, were more likely to try out or adopt recommended strategies and techniques for invasive species and pest management.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife, 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants, 216 Integrated Pest Management Systems

c) Skills Changes

- 294 farm owners/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, gained skills to detect, monitor, and treat pests.

Associated Knowledge Areas: 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants, 213 Weeds Affecting Plants, 215 Biological Control of Pests Affecting Plants, 216 Integrated Pest Management Systems

- 104 boat owners, and representatives of boat owner organizations, boating businesses, and government agencies, participating in aquatic invasive species management programs, gained boat inspection skills to identify invasive species to reduce risks of transporting invasive species on boat hulls.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife

d) Behavior Changes

- 440 farm owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, adopted pesticide and pharmaceutical efficacy and optimal use practices.

Associated Knowledge Areas: 211 Insects, Mites, and Other Arthropods Affecting Plants, 212 Pathogens and Nematodes Affecting Plants

- 84 farm owner/operators and managers, and Pest Control Advisors and other allied industry professionals, participating in pest management education programs, adopted recommended integrated pest management practices.

Associated Knowledge Areas: 216 Integrated Pest Management Systems

e) Economic Condition Changes

- Cherry growers adopted recommended management practices to control and prevent Cherry Bucksin disease, which has reduced tree losses and the number of preventative sprays; thus, growers are experiencing greater economic profit

Additional qualitative outcome description:

Issue (Who cares and Why)

Cherry Bucksin disease is a devastating disease that is transmitted by leafhoppers. It is well established and has long been a serious problem in San Joaquin County cherry orchards. In infected areas, orchards require several annual sprays to control leafhoppers (and subsequent secondary pests) to prevent the spread of the disease. In addition, in neighboring Contra Costa County the disease has been found in isolated spots. This is a serious issue for small producers, organic growers, and homeowners because cherries specifically had been selected due to the fact that they rarely required any pest management sprays.

What has been done

In San Joaquin County, there has been ongoing outreach, education, and collaboration with the local Agricultural Commissioner's staff to identify and abate infected orchards. In Contra Costs County, an annual survey was conducted to identify and remove any diseased trees before the disease can spread to other orchards and become established in the county.

Results

San Joaquin County cherry growers have adopted the UCCE developed and promulgated orchard sanitation and vector control practices on close to 15,000 acres; thus, tree losses are now limited to sporadic localized outbreaks and growers are

experiencing greater orchard profit. Contra Costa County growers with 650 acres of cherries have followed the recommended removal and management practices; and thus, have reduced the number of preventative sprays. In addition, the U-pick and organic orchards that are not set up to spray have remained viable. The occurrence of this new disease has been reduced to one orchard.

Associated Knowledge Areas: 216 Integrated Pest Management Systems

7) **Planned Program External Factors**

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Avail. of grad students/others)

Brief Explanation

The past year was one of the warmest and driest on record in many parts of California. The combination of factors may have had significant detrimental impacts on plants and animals, making them more susceptible to pests. Reduced moisture availability has seriously affected wildland plant communities and may also have significant negative impacts on biological control efforts. Recovery of the plant communities will be hampered by invasive pests, particularly weed species that flourish in disturbed environments. In addition, water deliveries for irrigation in agriculture were curtailed and will be eliminated in some districts next year. Consequently, large tracts of highly productive agricultural land was left fallow, alternative crops were planted, or orchards were severely pruned to reduce water use. The result was loss of production. The combinations of drought and increasing temperatures will continue to create significant economic challenges, but will also provide important opportunities to understand how pest species and environmental conditions interact to affect community level processes. There continues to be an accelerated introduction of exotic pest species into the state (e.g., light brown apple moth and Asian citrus psyllid). The consequence of limited resources available to contain or eradicate the invasions results in decisions to abandon efforts directed against one introduction before the project has been completed to focus on the most recent discovery. The new pest species will continue to create challenges in urban, natural, and agricultural environments.

8) **Planned Program Evaluation Studies and Data Collection**

Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity
- Comparison between locales where the program operates and sites without program intervention

C) Sustainability and Viability of California Agriculture (Ag)

1) Ag Program Knowledge areas

Program knowledge areas and percentages

KA Code	Knowledge Area	%1862 Extension	%1862 Research
102	Soil, plant, water, nutrient relationships	15%	3%
111	Conservation and efficient use of water	3%	2%
201	Plant genome, genetics, and genetic mechanisms	2%	20%
202	Plant genetic resources	4%	7%
203	Plant biological efficiency and abiotic stresses affecting plants	3%	8%
204	Plant product quality and utility (preharvest)	9%	4%
205	Plant management systems	27%	4%
206	Basic plant biology	0%	18%
211	Insects, mites, and other arthropods affecting plants	2%	3%
212	Pathogens and Nematodes Affecting Plants	2%	14%
213	Weeds Affecting Plants	0%	3%
302	Nutrient Utilization in Animals	4%	1%
304	Animal Genome	0%	3%
307	Animal Management Systems	10%	0%
311	Animal Diseases	1%	2%
502	New and Improved Food Products	2%	2%
601	Economics of Agricultural Production and Farm Management	9%	1%
603	Market Economics	2%	2%
604	Marketing and Distribution Practices	3%	1%
723	Hazards to Human Health and Safety	2%	2%
	Total	100%	100%

2) Ag Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year:	Extension	Research
2008		
	1862	1862
Plan	97.8	148.7
Actual	95.6	135.7

**Actual dollars expended in this program
(includes carryover funds from previous years)**

Extension	Research
Smith-Lever 3b & 3c 2,326,312	Hatch 1,534,658
1862 matching 2,326,312	1862 matching 1,534,658
1862 all other 28,438,708	1862 all other 84,928,101

3) Ag Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension programs conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs used PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Farmers/ranchers and rangeland owners/operators/managers
- Allied agricultural industries professionals
- Landscaping professionals
- Organic farmers
- Consumers
- Food suppliers
- Food processors
- Food retailers

4) Ag CSREES Defined Standard Output Measures

FY 2008	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Plan	95,000	9000	25	100	580	680
2008	165,075	0	11	106	482	588

Patents Listed:

- Methods for controlling plant growth and seed size through expressing mutated versions of the arabidopsis aintegumenta (ant) gene in plants
- Staygreen maize
- Gallic acid inhibits production of aflatoxin by aspergillus flavus
- New strawberry cultivar, "c221"
- New strawberry cultivar 'cn222' – monterey
- New strawberry cultivar 'cn223' - san andreas
- Wheat ap1 gene promoter
- Anaerobic phased solids digester system for biogas production from organic solid wastes
- Almond variety named "sweetheart"
- Myosin binding protein c mutation in maine coon cats with familial feline hypertrophic cardiomyopathy
- UC fig selection 24-50e (proposed name sequoia), a new yellow-green skinned fruit developed for use in the fresh market

5) Ag State Defined Outputs

FY 2008	Classes/ Short Courses	Work-shops	Demonstrations/ Field Days	News-letters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Plan	280	210	150	270	90	540	15	80
Report	181	137	94	43	35	446	2	4

6) Ag State Defined Outcomes

a) Knowledge Changes

- 1653 farm and ranch owner/operators and managers, and allied industry professionals, participating in agriculture education programs, gained knowledge of cultural practices or aspects of comprehensive management systems for plant and animal production.

Associated Knowledge Areas: 203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants, 204 Plant Product Quality and Utility (Preharvest), 205 Plant Management Systems

- 230 farm owner/operators and managers, and allied industry professionals, participating in agriculture education programs, gained knowledge of irrigation and water management practices.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water

- 682 farm owner/operators and managers and allied industry professionals, participating in agriculture education programs, gained knowledge of pest and disease management for plant production.

Associated Knowledge Areas: 203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants, 212 Pathogens and Nematodes Affecting Plants

- 509 members of the public, participating in Master Gardener Programs, gained knowledge of sustainable home gardening techniques, including varietal selection, composting, water conservation and proper use of pest control, to extend to members of the public.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water, 202 Plant Genetic Resources, 205 Plant Management Systems, 206 Basic Plant Biology

- 1272 farm owner/operators and allied industry professionals, participating in agriculture education programs, gained knowledge of crop and varietal selection factors for plant production.

Associated Knowledge Areas: 202 Plant Genetic Resources, 204 Plant Product Quality and Utility (Preharvest)

b) Attitude Changes

- 249 members of the public, participating in agritourism programs and events, felt more connected to local farms and were more likely to buy local agricultural products.

Associated Knowledge Areas: 601 Economics of Agricultural Production and Farm Management

c) Skills Changes

- 66 farm and ranch owners/operators, participating in agriculture education programs, gained business management skills.

Associated Knowledge Areas: 601 Economics of Agricultural Production and Farm Management

- 453 farm and ranch owner/operators and managers, and allied industry professionals, participating in agriculture education programs, gained irrigation and water management skills.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water

d) Behavior Changes

- 266 farm owner/operators and managers, and allied industry professionals, participating in agriculture education programs, adopted recommended cultural practices or other aspects of comprehensive management systems for plant and animal production.

Associated Knowledge Areas: 203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants, 204 Plant Product Quality and Utility (Preharvest), 205 Plant Management Systems

- 443 farm, ranch and nursery owner/operator and managers, and allied industry professionals, participating in agriculture education programs, adopted recommended irrigation or other water and soil management practices.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water

- 176 farm owner/operators and managers, and allied industry professionals, participating in agriculture education programs, adopted superior varieties of crops for plant production.

Associated Knowledge Areas: 202 Plant Genetic Resources, 204 Plant Product Quality and Utility (Preharvest)

- 133 small farm and ranch owner/operators and managers, participating in agriculture education programs, utilized alternative marketing of their crops to local consumers, including farmers markets, schools, restaurants, community supported agriculture boxes.

Associated Knowledge Areas: 601 Economics of Agricultural Production and Farm Management

e) Economic Conditions Changes

- San Joaquin Valley cotton growers planted recommended resistant cotton varieties, which helps to sustain the valley's Pima cotton industry and to reduce the spread of a soil-borne fungus.

Additional qualitative outcome description:

Issue (Who cares and Why)

Fusarium oxysporum f.sp.Vasinfecum (FOV) is a widely spread soil-borne fungus that attacks cotton and other plants, causing general wilt. Previously identified

FOV races infect plants through injuries caused by root knot nematodes, which are most widely found in coarse texture soils in the San Joaquin Valley. Crop rotation or chemical applications reduce nematode populations so their damage is not significant. However, a new race of FOV, Race 4, has been identified in California. Race 4 is different because it can infect cotton plants in the absence of nematodes, causing infections in both coarse and fine textured soils. Generally, Pima cotton varieties are more susceptible than Acala or other upland varieties are to FOV Race 4.

What has been done

Researchers from the University of California and USDA Agriculture Research Service addressed the problem in several ways. They developed methods for early identification. They further described the FOV life cycle and identified methods and plant parts that could potentially spread the organism. They developed best management practices to reduce or prevent FOV spread within and between fields. They evaluated hundreds of varieties and breeding lines for resistance to FOV Race 4, and conducted field evaluations on the most promising varieties to further verify resistance. They are categorizing the genes that convey resistance and identify molecular markers for those genes. This greatly aids breeding programs that are developing more Race 4 resistant varieties.

Results

San Joaquin Valley growers shifted to plant more high quality Pima cotton, which commands a premium price. UC's identification of resistant Pima varieties enabled the continued success of the industry. Based upon our research findings, California cotton growers are able to continue growing resistant Pima cotton varieties in areas where FOV Race 4 is present. Planting resistant cotton varieties is one of the best management practices to reduce the spread of FOV. More than 95 percent of the 2007 Pima cotton crop - 832,000 bales - was purchased by overseas mills, contributing more than \$550 million to the state economy and improving the U.S. trade balance.

Associated Knowledge Areas: 212 Pathogens and Nematodes Affecting Plants

- New plantings of oil olives have economic benefit for California growers and consumers.

Additional qualitative outcome description:

Issue (Who cares and Why)

Around five hundred specialty crop growers statewide economically benefitted from producing olive oil as a new crop. Consumers also benefit because increased California production of olive oil brings real competition to the olive oil market; thus, lowering prices and improving quality. In addition, this reduces the US trade deficit.

What has been done

Research comparisons were conducted on variety suitability, irrigation effects on oil quality, and control strategies for the olive fruit fly. UCCE delivered educational outreach to producers, including classes/ workshops, individual consultations, newsletters, a website and a manual. Topics covered production efficiency (lowers cost and improves profit) and processing changes to improve oil quality for processors. In addition, UCCE offered sensory training for olive oil evaluation to train producers, processors, and consumers to enjoy the best, freshest, healthiest olive oil.

Results

In 2009, an estimated 6,000 acres of new olive orchards were planted in California; much of it is due to the huge market and good prices for California olive oil. Overall in the last five years, 20,000 acres of new olive orchards have been planted in California, which will allow the USA to now produce 1% of consumptive

demand compared to 0.5 % just 2 years ago.

Associated Knowledge Areas: 601 Economics of Agricultural Production and Farm Management

- Walnut growers adopted the recommended use of the ethylene biosynthesis inhibitor ReTain to control for pistillate flower abortion, and thus benefit from additional revenue per acre.

Additional qualitative outcome description:

Issue (Who cares and Why)

Pistillate flower abortion (PFA) is a condition prevalent in California walnut districts. It is the loss of nut-producing flowers. It is the principal factor limiting productivity in the Serr variety. It reduces yield as much as 70%.

What has been done

Since the mid-1980s various, collaborative, applied research projects, which aimed at identifying the causes and control of PFA, have been conducted. Preliminary trials in 2003 showed that the ethylene biosynthesis inhibitor ReTain can reduce PFA, increase nut set, and yields better than any mitigation practice discovered to date over the long history of PFA research. UCCE extended the results to clientele through educational presentations at grower meetings.

Results

Walnut growers of the Serr variety adopted use of the recommended practice reduced PFA losses, resulting in the economic benefit of \$300-1000 additional revenue per acre.

Associated Knowledge Areas: 205 Plant Management Systems

- Walnut growers adopted the recommended mating disruption technology to control for codling moth, resulting in their decreased reliance on environmentally sensitive pesticides, and thus benefitted from savings due to reduced pesticide application.

Additional qualitative outcome description:

Issue (Who cares and Why)

In California there are about 270,000 acres of bearing walnuts, codling moth (CM) affects virtually all of this acreage. Walnut growers spray 0 to 3 times for CM each season, using primarily organophosphate and pyrethroid insecticides. Both groups of insecticides have adverse impacts on water quality (off-site mortality of aquatic organisms) and as well, applications may trigger secondary pest outbreaks necessitating additional treatments for those pests.

What has been done

UC developed a mechanical device, called a "puffer," which releases a plume of pheromone that spreads laterally and downwind, preventing (or delaying) male codling moths from finding females. UCCE has shown that, after three to four years, it is possible to eliminate CM sprays entirely, if the technology is implemented properly.

Results

The UCCE developed pheromone mating disruption technology effectively reduces codling moth populations and damage in walnuts, and it is cost-competitive with standard insecticide programs. There was a 5% increased use of mating disruption, affecting 11,000 acres of walnuts. 70 growers are experiencing the economic benefit of 20-70% savings in pesticide applications and their related direct costs. Adoption is expected to continue increasing as more growers learn about the technology and its benefits. Growers experience increased farm sustainability and

profitability and reduced reliance on environmentally sensitive pesticides.

Associated Knowledge Areas:

7) **Ag Planned Program External Factors**

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

8) **Ag Planned Program Evaluation Studies and Data Collection**

Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity
- Comparison between locales where the program operates and sites without program intervention

D) Sustaining California's Natural Resources (NR)

1) NR Program Knowledge Areas

Program knowledge areas and percentages

KA Code	Knowledge Area	%1862 Extension	%1862 Research
101	Appraisal of soil resources	1%	9%
102	Soil, plant, water, nutrient relationships	5%	14%
103	Management of saline and sodic soils and salinity	2%	4%
111	Conservation and efficient use of water	16%	2%
112	Watershed protection and management	15%	4%
121	Management of range resources	9%	2%
122	Management and control of forest and range fires	4%	0%
123	Management and sustainability of forest resources	7%	1%
131	Alternative uses of land	2%	1%
132	Weather and climate	1%	6%
133	Pollution prevention and mitigation	15%	11%
135	Aquatic and terrestrial wildlife	11%	18%
136	Conservation of biological diversity	5%	1%
141	Air resource protection and management	3%	1%
206	Basic plant biology	0%	6%
212	Pathogens and nematodes affecting plants	0%	3%
305	Animal physiological processes	0%	3%
311	Animal diseases	0%	4%
605	Natural Resource and Environmental Economics	4%	7%
901	Program and Project Design, and Statistics	0%	3%
	Total	100%	100%

2) NR Planned Program Inputs

Actual amount of professional FTE/SYs expended this program

Year:	Extension	Research
2008	1862	1862
Plan	64.2	72.0
Actual	62.6	78.2

**Actual dollars expended in this program
(includes carryover funds from previous years)**

Extension	Research
Smith-Lever 3b & 3c 1,743,443	Hatch 1,002,540
1862 matching 1,743,443	1862 matching 1,002,540
1862 all other 18,615,130	1862 all other 48,910,325

3) NR Planned Program Activity

Brief description of the activity

UC ANR's integrated research and extension programs conducted research projects, workshops, education classes and demonstrations, as well as one-on-one interventions. In addition, the programs used PSAs, newsletters, mass media, web sites and collaborations with other agencies and organizations to create and deliver programs.

Brief description of the target audience

- Farmers
- Ranchers
- Marine industry owners/operators
- Governmental agencies
- Agricultural and fishing organizations
- Owners/managers of private and public rangeland, forest and wildlands
- Community organizations
- Resource managers

4) NR CSREES Defined Standard Output Measures

FY 2008	Direct Contacts Adults	Direct Contacts Youth	Patents	Extension Peer Reviewed Publications	Research Peer Reviewed Publications	Total Publications
Plan	114,000	0	3	70	470	540
2008	87,998	0	1	64	332	396

Patents Listed:

- Invert emulsion formulation for improved storage and delivery of microbial biological control agents

5) NR State Defined Outputs

FY 2008	Classes/ Short Courses	Workshops	Demonstrations/ Field Days	Newsletters	Web Sites	Research projects	Videos, slide sets, other A/V or Digital Media	Manuals, other print materials
Plan	90	160	120	70	30	240	40	70
Report	87	133	52	6	16	230	0	6

6) NR State Defined Outcomes

a) Knowledge Changes

- 1570 farm, ranch, rangeland, and marine industry owner/operators and managers, allied industry professionals, public agency representatives, and members of the public, participating in water quality education programs, gained knowledge of best management practices for preserving water quality.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water, 112 Watershed Protection and Management

- 563 resource managers and other stakeholders in fishery management issues, participating in sustainable use of fisheries education programs, gained knowledge of strategies and techniques for sustainable use of marine and inland fishery resources.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife

- 120 owners/managers of private and public rangeland, forest and wildlands, participating in sustainable use of natural resources education programs, gained knowledge of strategies and techniques for sustainable use of range, forest and wildland resources.

Associated Knowledge Areas: 121 Management of Range Resources, 123 Management and Sustainability of Forest Resources, 135 Aquatic and Terrestrial Wildlife, 136 Conservation of Biological Diversity

- 158 fire protection and land management agencies, land and home owners, community organizations, and landscape professionals, participating in wildland fire education programs, gained knowledge on how to increase the fire resistance of homes and landscaping.

Associated Knowledge Areas: 122 Management and Control of Forest and Range Fires

b) Attitude Changes

- 104 farm, nursery, ranch and rangeland, and marine industry owner/operators and managers, allied industry professionals, public agency representatives, and members of the public, participating in water quality education programs, intended to use best management practices for preserving water quality.

Associated Knowledge Areas: 111 Conservation and Efficient Use of Water, 112 Watershed Protection and Management, 133 Pollution Prevention and Mitigation

c) Behavior Changes

- Standardized marine stewardship protocols were developed and applied to monitor the effectiveness of marine protected areas (MPAs) along the California coast.

Additional qualitative outcome description:

Issue (Who cares and Why)

The State of California is responsible for managing nearshore fish populations. Currently, the data to manage fisheries are collected across large areas, but the local abundance of many species varies greatly. The lack of information specific to local areas means that some species are overfished and some are underutilized. Also, California is establishing marine protected areas (MPAs) as a resource conservation and

management tool; these areas are closed to some form of human use, such as fishing. Resource managers have found that the effectiveness of marine protected areas (MPAs) has varied around the world, and is dependent upon the level of societal acceptance. As a policy tool, MPAs have been most successful in regions that have included stakeholders in the evaluation process.

What has been done

UCCE teamed up with California Polytechnic State University, and members of the fishing community to form a Collaborative Fisheries Research Program. The program's purpose is to implement collaborative research and facilitate the co-management of marine resources. Workshops with stakeholders were conducted to develop standardized protocols for gathering data using commercial and recreational fishing vessels and gear. These protocols were used to conduct baseline surveys of MPAs and corresponding reference sites. Nearly 20,000 fishes were caught, identified to species, measured, tagged, and released. Scientific information obtained from this project included species and size composition, and catch rates. Information about fishes movements will come from recaptures of tagged fish.

Results

As a result of this project, standardized monitoring protocols were created, implemented, reviewed, and endorsed by California fishing communities, academic scientists, resource managers, and members of non-governmental organizations. The protocols are sufficiently rigorous to enable the development of collaborative studies that can be used to estimate population trends along smaller sections of coastline than were previously possible, and to monitor MPAs across the state. In addition, this project demonstrated that fishermen and scientists can successfully collaborate to provide resource managers with accurate information, thus allowing members of industry to play an active role in the evaluation of marine policy.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife

- 160 forest and home owners and fire fighting agencies, participating in wildland fire education programs, adopted recommended wildland fire prevention and control practices.

Associated Knowledge Areas: 122 Management and Control of Forest and Range Fires

d) Environmental Condition Changes

- Coho salmon are recovering from near extinction in California's Russian River.

Additional qualitative outcome description:

Issue (Who cares and Why)

Once numbering in the thousands, today Coho salmon in the Russian River and its tributaries are on the verge of local extinction. In 2001, to prevent this from happening, Sonoma County UCCE and the California Sea Grant Extension Program teamed up with the California Department of Fish and Game (DFG), NOAA Fisheries, the Army Corp of Engineers, the Sonoma County Water Agency to create the Russian River Coho Salmon Captive Broodstock Program. The program's goal is to restore self-sustaining runs of Coho salmon to multiple tributaries of the Russian River, and in doing so, create a balance where the river's water can sustain both the Coho salmon and the residential and agricultural uses that rely on it.

What has been done

Under this program, juvenile Coho were collected from streams within the Russian River watershed by DFG, and subsequently raised to maturity and spawned. In 2004,

DFG began releasing the offspring of these captive-bred wild fish into Russian River tributaries that historically held runs of Coho salmon. UCCE documented the growth and survival of released fish and measured fish populations in the stream, as they migrate to the ocean, and when they ultimately return to their natal streams to spawn. The results are used to inform future program decisions about fish releases and habitat restoration, which increases the likelihood of salmon recovery in the Russian River.

Results

Once on the brink of localized extinction, adult returns from the ocean and successful spawning have been documented every year since 2006. Recovery of this endangered species is critically important both for the fish, and for the people in the watershed who also rely on the river's water. As release numbers increase, a corresponding increase in returns is anticipated, especially with the good ocean conditions for smolt survival observed in recent years. Data are being used to refine stocking protocols, and incorporate the release of acclimated Coho smolts as part of the program. The program is on track to accomplish its goal to see these fish return in sufficient numbers to establish self-sustaining runs in the historic habitat.

Associated Knowledge Areas: 135 Aquatic and Terrestrial Wildlife

- Rangeland on California's Central Coast environmentally benefitted from improved grazing management practices, which conserve biological resources, including wildlife habitat and water quality.

Additional qualitative outcome description:

Issue (Who cares and Why)

Grazing livestock on rangeland is a significant use and land management tool across much of the public and private open space lands along the Central Coast of California. Proper grazing management can enhance wildlife habitat and protect water quality from sediment and pathogens. In addition, livestock grazing on rangelands provides an economic benefit to coastal communities.

What has been done

For the past three years, UCCE has worked with the Central Coast Rangeland Coalition to develop and test a rangeland health assessment tool. The Central Coast Rangeland Coalition is a community of ranchers, conservationists and government agencies committed to sustainable rangeland stewardship. The coalition includes approximately 50 participants representing about 200,000 acres of private and public rangeland from San Francisco Bay to Morro Bay. Initial efforts demonstrated that all the rangeland sites being monitored (250,000 acres +) are in excellent condition with few significant resource concerns.

Results

The 17 ranchers/land managers participating in this project understand how their management may impact rangeland health including water quality. The assessment information has lead at least two ranchers, managing 13,000 acres, adopting the recommended, improved grazing management practices, e.g. using appropriate stocking rates and controlling livestock with additional fencing.

Associated Knowledge Areas: 121 Management of Range Resources

e) Economic Condition Changes

- UCCE natural resource management programs in California's Sierra Foothills contributed the design of and fund development for a fuel break that stopped the Yuba fire from damaging forest landowners and the communities of Dobbins and Brownsville; thus, protecting

livelihood of around 3,000 people.

Additional qualitative outcome description:

Issue (Who cares and Why)

The absence of fire from natural foothill ecosystems has increased potential for catastrophic fire. In addition, the Sierra Foothills have experienced population growth, which has correspondingly increased the potential for ignition of fire. People that move into the foothills are interested in having a visual screen on their property and are not aware of the potential fire danger that this may incur.

What has been done

UCCE conducted educational outreach to change community attitudes and behavior toward fuels management around homes and in the forest ecosystem. Educational information about fire prevention was delivered to the community through the Fire Safe Councils, which exist through the combined efforts of county staff, UCCE, the area federal, state, and local fire departments, local timber farming companies, professional foresters, and environmental groups. UCCE led the effort to fund and construct the Middlebrook fuel break. The design of the vegetation incorporated research information to maximize effectiveness.

Results

The fuel break stopped the run of the Yuba fire up the canyon and held the fire line in that area. The fuel break cost \$56,000 as compared to the estimated \$ 5 million cost to suppress the Yuba Fire. This work demonstrates that use of the proper fire science and fuel breaks can be effective tools to protect communities and watersheds, while saving taxpayer money.

Associated Knowledge Areas: 122 Management and Control of Forest and Range Fires

7) NR Planned Program External Factors

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Fiscal year 2009 continued the trend experienced in the previous several years as having below average rainfall amounts, resulting in several significant impacts across the state. There is increasing competition for our scarce water resources among the agricultural, urban, and environmental sectors. In conjunction with a number of recent decisions regarding allocations of water from the Colorado River and the Bay Delta, the drought exacerbated that competition. The inextricable link between water quantity and water quality has come into sharper focus as a result of water scarcity. There is an increased focus on finding appropriate, safe uses for reclaimed municipal wastewater for agricultural, urban, and environmental uses. Increased attention is being paid to protecting groundwater sources of potable water from surface contamination. In some areas of the state, agricultural lands are being fallowed as water previously used for irrigation is being sold for urban use. Water scarcity is also resulting in closer scrutiny regarding the water needs of new developments proposed in some urban areas. The continuing below average rainfalls also contributed to the numerous severe wildfires across the state. Some of the impacts were immediate, including the destruction of thousands of acres of forests, wildlands, and urban areas; air quality impacts on human health, wildlife, etc., as well as the significant economic impacts. Other impacts will take longer to occur. These include the potential for erosion

during heavy rainfall events in the burn areas, which will cause increased sediment loads to surface water bodies, which can impact the aquatic ecosystem; recovery of plant and animal species in the burn areas, and economic recovery.

8) **NR Planned Program Evaluation Studies and Data Collection**

Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity
- Comparison between locales where the program operates and sites without program intervention