DIRECTOR'S REPORT

California Agricultural Experiment Station

Prepared for Five-Year Multicampus Research Unit Review Committee

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I. HISTORY, MISSION AND STRUCTURE

History

The California Agricultural Experiment Station (AES) is part of a national system of research stations within the United States established by the Morrill Act of 1868. This legislation established the Land Grant University System by providing land grants to each state (150,000 acres to California) for the purpose of creating a college where the "leading objective be . . . to teach such branches of learning as are related to agriculture . . ." In 1870 the University of California became the first university to announce its intention to become a "station" for research. Subsequent legislation including the Hatch Act of 1887 and the McIntire Stennis Act of 1962 established a pattern of cooperation in agricultural research (including forestry) between the federal government and land-grant institutions.

In the early years, the California AES was located on the Berkeley campus, which, at that time, was the only campus of the University of California. A University Farm of 800 acres was established in 1906 at Davisville (now Davis). The Farm offered short courses for farmers and practical experience for agricultural students at Berkeley in its early years. In 1907 the University formally founded the Southern California Pathological Laboratory and Experiment Station in Riverside. This Station was reorganized in 1917 in the aftermath of a killing freeze which caused enormous damage to the region's citrus industry. The reorganized Station was initially called the Graduate School of Tropical Agriculture and subsequently became known as the Citrus Research Center. In the post-World War II years, as the University prepared to meet the enormous influx of new students, the Farm at Davis and the Citrus Research Center at Riverside became the sites of general University campuses. Davis achieved the status of an independent campus in 1959 and Riverside in 1960. (Although UCLA had agricultural programs beginning in the late 1930s, those programs were phased out and reassigned to Riverside and Davis beginning in 1958. By 1965 no agricultural programs and only a few faculty remained at UCLA.)

In the latter third of the 20th Century, the California AES settled into a three-campus structure. Some 750 Experiment Station faculty are housed in more than 50 departments located in the School of Veterinary Medicine at Davis and in three colleges of agriculture. Although all of the colleges have deep roots in agriculture, their missions have broadened over the years to include environmental and natural resource topics. The breadth of mission is reflected in the college names -- the College of Natural Resources at Berkeley; the College of Agricultural and Environmental Sciences at Davis; and the College of Natural and Agricultural Sciences at Riverside. The College at Riverside is unique in that it houses non-AES departments in the biological and physical sciences as well as the AES departments. The Director of the Agricultural Experiment Station is the Vice President for Agriculture and Natural Resources who is headquartered with the University's systemwide administration in Oakland. The college deans serve as associate directors. Campus-based facilities and activities are complemented by the facilities at ten Research and Extension Centers located throughout the state. Each Research and Extension Center has active and on-going programs of research.

Within the University of California system, the AES is formally categorized as a Multicampus Organized Research Unit (MRU). Organizationally, the California AES is located within the University's Division of Agriculture and Natural Resources (DANR). This Division, which is headed by the Vice President for Agriculture and Natural Resources, includes Cooperative Extension and the Natural Reserve System. This latter unit contains some 34 natural reserve sites around the state that are available to students and faculty of the University for research. The AES is the largest of the units within the DANR both in terms of dollars and professional personnel. It is also the largest MRU within the University of California system.

Mission

The mission of the Agricultural Experiment Station is stated in the most recently published iteration of the DANR strategic plan, *The Challenge of Change:*

> *The mission of the University of California Division of Agriculture and Natural Resources is to serve California through the creation, development and application of knowledge in agricultural, natural and human resources.*

Although DANR seeks to create a seamless web between research and outreach activities, it is understood that the primary responsibility and mission of the AES lies with the creation and development of new knowledge pursuant to the Land Grant mission. The AES mission also includes, but with lesser emphasis, the application of new knowledge.

Structure: Relations With Campuses and Departments

As noted earlier, the AES is represented on each campus by an associate director who also holds the title of dean of the respective college. Each dean/associate director is responsible to the campus chancellor for academic teaching programs and to the Director of the Agricultural Experiment Station for matters related to AES research. This dual reporting system links both AES and campus administrative responsibilities. The department administrative officer, who is the chair, has responsibilities for both teaching and research activities and reports to the dean/associate director on matters related to the department.

Each college and associated AES is composed of a number of departments whose faculty, with few exceptions, have appointments that are split between their AES and campus responsibilities. The AES fraction of the appointment is known as organized research (OR), and the campus appointment is known as instruction and research (I&R). Typically 40 percent to 80 percent of an AES faculty member's appointment (the OR portion) is in the Experiment Station which funds that portion of the faculty member's salary.

Historically, Agricultural Experiment Station faculty had 11-month appointments. Nearly 10 years ago, the colleges and School began the practice of making most new appointments on a nine-month basis, which conforms to the norm elsewhere in the University. Supplementary summer salary is available for faculty and some internal funds are available on a competitive basis to defray summer salary. These supplemental summer funds are limited to faculty members who are working directly to meet the mission of the AES. Although most older AES faculty members still have 11-month appointments, as they retire, such appointments will become a thing of the past.

Funding to support AES faculty and activities flows along two distinct pathways. Funds for faculty salaries, to support campus-based AES facilities and for most other campus-based activities are allocated by the President's Office directly to the chancellors of the respective campuses. The chancellors, in turn, have delegated authority to allocate and manage these funds to the deans of the colleges and schools. A small proportion of AES funds are under the direct control of the Vice President. These include Hatch, McIntire-Stennis and other federal formula funds, certain state funds, the funds to support AES activities at the Research and Extension Centers and a proportion of the endowment funding. This arrangements gives rise to a situation in which the Vice President, who as the Director bears responsibility for the AES, lacks control over much of the funding for AES.

Statewide Special Programs and Projects

There are a number of Statewide Special Programs and Projects (SSPPs) within the California AES. The purpose of these programs is to focus the collective energies of AES researchers on the topical area in question. Most of the SSPPs have competitive grants programs. The mission of the SSPPs is systemwide in nature and their directors/coordinators report to the Office of the Vice President. Eight of these programs are funded primarily with AES dollars.

The Agricultural Issues Center: The mission of this Center is to support University-wide applied research and analysis of issues facing California and western agriculture. International trade, the impact of national agricultural policies and fiscal policies on agriculture in the west and the effects of advances and productivity on agriculture are among its priority areas. (Budget = $300,000)

Center for Cooperatives: The mission of this Center is to provide the highest quality education, research and development assistance for cooperatives, their members and the public. Among other things, the Center supports applied research on cooperative issues. (Budget = $400,000)

The Forestry Products Laboratory: The mission of the Laboratory is to develop and transfer knowledge in forest products that will lead to improved effectiveness of utilization, improved performance of products, and environmentally sound practices for the benefit of the people of California and for users of forest products worldwide. Much of the Laboratory's research takes place on a multi-million dollar laboratory located at the Richmond Field Station of UC Berkeley. (Budget = $1.2 million)

The Genetic Resources Conservation Program: The mission of this Program is to facilitate conservation and research and provide education on all aspects of genetic resources conservation. The Program manages a small competitive grants program and has several active germplasm preservation programs. (Budget = $400,000).

The Integrated Pest Management Program (IPM): The mission of IPM is to: 1) reduce the pesticide load in the environment; 2) increase predictability and effectiveness of pest control techniques; 3) develop pest control programs that are economically, environmentally and socially acceptable; 4) marshal agencies and disciplines into integrated pest management programs; 5) increase the utilization of natural pest controls; and 6) targeted research on exotic pests and diseases in agricultural, natural and urban environments. (Budget = $2.6 million)

The Mosquito Research Program: The mission of this Program is to promote research leading to innovative methods of mosquito control, especially methods that avoid the use of broad-spectrum, conventional chemical pesticides. The program also supports research leading to improved methods of surveillance for mosquito-borne diseases such as malaria and encephalitis. (Budget = $550,000)

The Salinity and Drainage Program: The mission of this Program is to develop, interpret, and disseminate research knowledge on salinity, drainage, selenium, and other toxic element problems in the San Joaquin Valley. The Program collaborates closely with state agencies concerned with these issues. (Budget = $700,000)

The Water Resources Center: The mission of the Center is to stimulate and support water and water-related research both within and among the various academic departments and research organizations of the University. The broad research focus includes the conservation, development, management, distribution and utilization of water resources with a view to their optimum present and future use. The Center supports a large competitive grants program. The Water Resources Center is also California's designated federal Water Resources Research Institute under the terms of the Water Resources Research Act of 1984, as amended. (Budget = $1.5 million)

Three other SSPPs receive partial support with AES funds:

The Integrated Hardwood and Range Management Program: The mission of this Program is to maintain and, where possible, increase the acreage of California's hardwood range resources in order to provide wildlife habitat, recreational opportunities, wood and livestock products, high quality water supply and aesthetic values. (Budget = $750,000).

Sustainable Agriculture Research and Education Program: The mission of this program is to support the development of more economically viable, environmentally sensitive, and socially responsible agricultural practices and policies. (Budget = $1.4 million).

The Wildland Resources Center: The mission of this Center is to stimulate research and to foster extension of knowledge on conservation, management and utilization of wildland resources with a view to their optimum present and future use. (Budget = $100,000).

II. BUDGET

The annual budget of the AES, including permanent and temporary funding from all sources, is approximately $200 million. About 50 percent of the budget comes from state general funds; 45 percent from extramural (federal, state and private) grants, contracts and gifts, 3 percent from federal appropriations, and the balance from endowment income, sales, services and other sources. Additionally, the extramural contracts and grants generate approximately $15 million annually in indirect cost funding.

Following is a five-year history of funding for the AES, identifying funds by source (based on expenditure data):

FY	State General Funds	Federal Appropriations	Extramural Funds Excluding Fed Appropriations (Direct costs)	Endowments, Sales, Services and Other Sources	TOTAL
95-96	$ 82,091,000	$ 6,155,000	$ 69,834,000	$ 7,312,000	$ 165,392,000
96-97	$ 87,728,000	$ 5,449,000	$ 71,305,000	$ 7,572,000	$ 172,054,000
97-98	$ 89,456,000	$ 4,891,000	$ 73,277,000	$ 8,081,000	$ 175,705,000
98-99	$ 89,148,000	$ 5,504,000	$ 74,365,000	$ 7,789,000	$ 176,806,000
99-00	$ 97,251,000	$ 5,418,000	$ 90,294,000	$ 7,352,000	$ 200,315,000

Approximately 90 percent of AES funds are budgeted directly to the three AES campuses, in support of research programs of their respective colleges and, in the case of the Davis campus, the Division of Biological Sciences and the School of Veterinary Medicine. The remaining 10 percent of AES funds is budgeted to the Office of the Vice President, Agriculture and Natural Resources, for operation of statewide research programs and academic support units, and for administration.

About 85 percent of the state appropriations for the AES are permanently budgeted to the campuses. Of this amount, about 85 percent is committed to salaries and benefits for faculty and staff of the AES affiliated colleges/school. Most of these resources are used to fund permanent AES appointments for about 750 academics, most of who also hold professorial (I&R) appointments in their respective departments.

The AES receives federal appropriations from the U.S. Department of Agriculture authorized by the Hatch and McIntire-Stennis Acts and related legislation supporting state agricultural experiment stations operated by the land grant universities and colleges. Funds are awarded annually to the California AES based on a statutory formula for distribution among the states. Virtually all of the federal AES appropriations received by UC are allocated on a fixed percentage basis to the AES affiliated colleges/school. A small portion of the Hatch funds are distributed flexibly each year among the AES affiliated colleges/school through a collaborative statewide planning and resource allocation process.

Approximately 95 percent of the extramural funding received by the AES consists of awards made on a competitive basis to AES faculty in the affiliated campus departments; the balance is generated by researchers in statewide programs operated by the Office of the Vice President. Similarly, about 85 percent of the AES endowment income and funding from sales and other sources is generated and budgeted by the individual colleges/school, with the remainder at the statewide level.

III. EVIDENCE OF ACCOMPLISHMENT

Research

The sheer amount of research performed by California AES faculty is so enormous that it is virtually impossible to characterize it in any simple but meaningful way. The total number of Current Research Information System (CRIS) projects ranged from 1,027 in fiscal year 1996 to 1,068 in fiscal year 2000. Total research funding to support this research amounted to $165.4 million in fiscal year 1996 and grew to $200.3 million in fiscal year 2000. Rather than attempting to list and categorize the accomplishments for all of this research, evidence of accomplishment in research is presented in nine areas to illustrate both the breadth and significance of accomplishment.

Animal Diseases

Cryptosporidiosis is an important parasitic disease of animals and humans. The disease occurs throughout the U.S. each year, and livestock are thought to be the source of infection. The usual chemical for destroying bacterial contaminants in water supplies, chlorine, is not effective for killing the Cryptosporidial parasites. An evaluation of cattle for disseminating Cryptosporidia into the environment indicated that cattle rarely shed the agent. The age of greatest risk for contaminating the environment occurs within the first few weeks of life and calves are seldom in areas where watersheds would be contaminated. These research findings have made it possible to permit cattle to graze on western watersheds that are used to generate water. When cattle are allowed to graze these lands, the overgrowth of grass and associated fire danger is reduced.

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Bluetongue is a viral disease of ruminants found in tropical and temperate climates of the world. The virus is transmitted by culicoides flies, a biting fly that is the principal means of determining the distribution of Bluetongue worldwide. Bluetongue Disease causes its most serious damage to sheep but cattle appear to be the main species that are infected even though they rarely show evidence of the disease. Bluetongue is considered a List A disease by the Organization of International Epizooties (O.I.E.). The result is that severe trade restrictions are placed on countries where Bluetongue is present that plan to export ruminants to other countries where the infection is not present. Studies on cattle experimentally infected with Bluetongue virus shows that they are viremic for not longer than 50 days during which time culicoides flies can vector the disease to other animals. This research has led to the drafting of new regulatory information for consideration by the O.I.E. The research forms the scientific basis for new regulations that cut quarantine time by a third. Additional information from the research suggesting that Bluetongue is confined to different ecosystems based upon the genetic predisposition of the virus will ultimately lead to less restrictive trade rules.

Animal Sciences

The fortunes of the beef industry are tied to satisfying consumers' concerns about food safety, as exemplified by recent scares over Mad Cow Disease and Foot and Mouth Disease. Research on herd nutrition and other herd management parameters form the basis for effective management procedures for both individual animals and cow herds. AES researchers worked with the California Cattlemen's Association to implement a Beef Feedlot Quality Certification Program and a Beef Cow-Calf Quality Assurance Program. Today, over 90 percent of the feedlot cattle in California are on a quality assurance program. The quality assurance program for dairies is the first of its kind in the nation and is being used as a model system in many other states.

Environmental Sciences

Methyl tertiary butyl ether (MTBE) is a gasoline oxygenate additive that was utilized in an effort to reduce automobile exhaust emissions. Earlier air quality studies predicated that the use of MTBE would reduce auto emissions by 15 percent. Unfortunately, MTBE is a potential carcinogen and has been identified as a hazardous air pollutant in the U.S. Clean Air Act Amendments of 1990. Unlike gasoline, MTBE does not readily evaporate and is soluble in water. AES researchers showed that MTBE is leaking into thousands of water sources and has the potential to impact adversely much of the state's drinking water. AES researchers brought this information to bear through service on a Technical Review Committee of the State Water Resources Control Board. The research contributed materially to the decision of the Governor in 1999 to ban the use of MTBE as a gasoline additive. The accomplishments achieved with this research were rare in that the Technical Review Committee was able to produce a comprehensive analysis of the problem in 10 months and there was no need to call for additional research.

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AES faculty have discovered that atrazine, the world's most used herbicide, can be degraded non-biologically by manganese oxide materials through at least two different pathways. This knowledge has led to collaborative efforts to develop an optimized approach to combining microbiological and abiotic degradation of atrazine, along with microbiological production of the manganese oxide minerals in the soil. Simultaneously, AES faculty members have found that manganese-substituted iron minerals cause catalytic oxidation of arsenic (III) to a much less toxic and mobile form of arsenic (V). This conversion results in greater absorption to the minerals with resultant removal from mineral solution. This finding is important to many areas of the world where naturally occurring arsenic in drinking water supplies is a problem because it has potential as a method of decreasing arsenic toxicity.

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AES faculty members have undertaken a number of important studies on biodiversity and restoration ecology. They include:

- The first field studies to examine hybridization among transgenic plant and natural populations.

- Creation of mathematical models for the design and construction of multipurpose wetlands in southern California.

- Utilization of mycorrhizzal fungi and soil nitrogen fixation in the successful re-establishment of native coastal sage scrub communities invaded by Mediterranean grasses and invasive weeds.

- First quantitative study to describe the "foothill woodland seep springs." This work documents the impact of micro wetlands on downstream water quality and had a central and stabilizing force on the debate over the effects of grazing on rangeland water quality.

Genomics and Biotechnology

AES faculty have employed biotechnology to develop plant resistance to both biological and non-biological stresses. Accomplishments include the identification of a gene that confers chilling tolerance to cowpeas during emergence; identification of genes which are involved in providing tomato plants with resistance to aphids and nematodes; the identification of novel hybrid genes that provide citrus with resistance to *phytophtora*; and discovery of a patented protein expressed following and as a result of plant injury.

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In the general areas of transgenic organisms, AES faculty have developed and released a transgenic pink bollworm to evaluate its competitiveness as compared with natural pink bollworms. The transgenic bollworm could become significant in the development of autocidal biological control. Researchers have also transformed endosymbiotic bacteria in the pink bollworm gut to include an endotoxin protein that proved toxic to Mexican Fruit Fly larvae. In the general area of genome maps and molecular markers, AES faculty have developed 30 microsatellite markers to assist in avocado breeding and continue with on-going efforts to map the entire genomes of avocado, citrus, barley, and wheat as well as of several pathogens.

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The Center for Engineering Plants for Resistance Against Pathogens on the Davis campus is charged with researching issues that are too long-term, multidisciplinary and high risk to be conducted by a single investigator. The research that has emerged from this Center has provided a fundamental understanding of how plants respond to attacks from pests and disease. This knowledge will be critical as attempts to engineer better resistance into plants proceed. Parenthetically, it should be noted that the Center's outreach program has been instrumental in helping high school students better understand how and why crops are engineered for resistance to pests.

Natural Resource Management and Conservation

California's economy is dependent upon reliable flows of water that serve agricultural, industrial, household and environmental users throughout the state. Water is growing increasingly scarce as population grows. Water is a heavily managed resource and effective management requires the development and refinement of economic models that can assess quantitatively the consequence and social impact of various policy options. AES researchers were the first to examine the area of experimental economics as applied to water allocation. This research has elucidated the effectiveness of alternative market institutions on the efficiency and stability of markets for water and environmental values. This research has resulted in dramatic changes in the views of decision-makers toward market pricing of water and pollution rights. Market pricing is now considered a standard policy tool. In addition, this research has led the state to sponsor Drought Water Banks and implementation of water trading that brought considerable benefit to the state's economy during a prolonged drought. Models developed by AES faculty were also used to predict the economic effects of the implementation of the federal Central Valley Project Improvement Act. Currently, similar modeling studies are underway to assess the impact of Cal-Fed agreements on the division of water between agriculture, urban development and environmental uses.

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AES faculty research on coyote depredation has demonstrated that, contrary to prevailing belief, most domestic sheep are killed by territorial breeding pairs. Management strategies involving selective removal of territorial breeding pairs result in lower sheep losses and are now widely practiced.

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AES faculty have utilized long-term records collected at the Blodgett Research Forest Station to quantify the effects of management practices on vascular plant diversity. This study is the first to assess the potential for maintaining biodiversity within a framework of active management in California's timberlands.

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Over the last five decades, development in the Lake Tahoe Basin has created unintended yet severe impacts of the Lake in the form of increased nutrient and fine-sediment loading. This has resulted in steadily increasing algae growth in the lake with a progressive degradation in water clarity. Research and monitoring by a group of AES faculty was instrumental in alerting the public and resource agencies to the emerging damage to the ecosystem. The research has proved critical in the development of restoration efforts and has formed the basis for many of the existing water quality policies in the Tahoe Basin. The ongoing research into the health of Lake Tahoe has played a key role in decision-making regarding management strategies for preserving and enhancing water quality in the lake and has served as a model nationally for other ecosystems under stress.

Nutrition

AES faculty are engaged in research leading to the development of nutritional requirements of pregnant women, lactating women and the developing infant. This research is focused on identifying diets and lifestyle habits that minimize the frequency and severity of maternal complications, while optimizing the development of the infant. This research has led to the development of new growth charts for breast-fed infants. These charts are now used throughout the United States and efforts are underway to develop new international growth charts. There is evidence that the number of women who breast feed their infants is increasing. It is difficult to tell the extent to which this may be attributable to the research in question. In addition, research on breast milk composition has led to numerous improvements in the composition of infant formulas throughout the U.S. Formula-fed infants now have better, healthier diets than they did a decade ago. This helps to ensure that more children get a healthy start in life.

Pest and Disease Management

Phylloxera is an insect that feeds upon and destroys plant roots. For more than a century, grape growers in California have struggled with Phylloxera, which is an insidious pest because of its subterranean, cryptic habitat. On susceptible rootstocks it has the ability to reproduce and spread quickly, eventually destroying entire vineyards. Resistant rootstocks are the only practical means of controlling Phylloxera. AES researchers have focused continually on understanding the Phylloxera resistance mechanisms in rootstocks; discovering the mechanisms by which Phylloxera damages roots; and developing new rootstocks with improved resistance. Over the last decade new Phylloxera populations have been found that are capable of inflicting severe damage on the widely planted and moderately resistant rootstock AXR 1. As a result of this research work, rootstocks with higher levels of resistance are available to growers who must replant. There are many viticultural areas throughout California whose productive capacity has been saved because of these rootstocks.

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As a general rule, pesticide manufacturers will not seek to obtain registrations for minor crops because the cost of obtaining efficacy and residue data cannot be recovered from the small market sales. Many crops in California are classified as minor crops so that the IR-4 program, which is a federal program designed to assist in obtaining registration for minor crop pesticides, is very important. Much of the IR-4 program in California is supported by AES research which examines issues relating to the efficacy of different chemicals and the residues that remain after they are applied to the environment. It is estimated that for the period 1998-2000, $1.86 billion in minor crop savings accrued as a result of the activities of the IR-4 program. We estimate that 20% of these savings or $370 million accrued to California. A significant portion of the savings is attributable directly to the underlying AES research.

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The Glassy-Winged Sharpshooter transmits *Xylella fastidiosa* which causes Pierce's Disease in grapes, almonds, oleander and other crops. At the moment it has more potential to disrupt California agriculture than any other pest that we are aware of. AES researchers have accomplished the following in their work to develop strategies for controlling the Glassy-Winged Sharpshooter:

- Research leading to registration of the insecticide Admire for use on grapes.
- The breeding and release of a foreign parasitic wasp to control sharpshooter.
- Identification of an oleander cultivar with enhanced resistance to *X. fastidiosa.*
- Development of a dye-marking system for tracking sharpshooter populations.

Other research achievements in the area of pest and disease management include:

- Importation and release in the Imperial Valley of parasites from the Middle East to control oat bird cherry aphid and green bug, both major pests of alfalfa and grains.
- Mass release of egg parasites in southern California to control longhorned borers, snout beetles and redgum lerp psyllids, major pests of eucalyptus trees and other woody ornamentals.
- Identification of safe and effective boron compounds to control ant populations.
- Identification of improved wetland design, fish populations and water vegetation content that significantly reduce mosquito populations.

Plant Science

The research achievements of AES faculty in the general area of plant sciences are both important and many. A few are listed here:

- Release and registration of a new cowpea cultivar, which is a semi-dwarf variety with heat tolerance and enhanced resistance to root-knot nematodes and Fusarium wilt.
- Release of Gold Nugget, a late maturing mandarin orange.
- Breeding of new varieties of asparagus with greater productivity and resistance to *Phytophera*.
- Release of two patented avocado varieties with good fruit quality and tolerance to persea mites.
- Identification of five avocado rootstocks with enhanced resistance to *Phytophthora.*
- Determination that foliar applied potassium phosphate or potassium phosphite leads to higher yield in both number and size of fruit for trees receiving the same nutrients through the soil.
- Continued release of new strawberry varieties. A majority share of world strawberry production comes from varieties developed by AES faculty. These varieties are among the top royalty-earners in the UC system.

Waste Management

The traditional method of disposing of rice straw and stubble in California is by burning. State legislation adopted in the early 90s required the phase-out of rice straw burning by 2000. This required growers to adopt alternative straw management practices including incorporating the straw in the soil and baling and removing straw residue. AES researchers identified the impact of straw incorporation on potassium, nitrogen and carbon cycling and the favorable implications of theses impacts on rice fertilization requirements. Other researchers showed that shallow winter flooding and rolling of rice straw enhance the rates of straw decomposition. The shallow flooding also provides winter habitat for waterfowl. This research facilitated wildlife conservation efforts on the Pacific Flyway while simultaneously promoting sustainable agricultural practices, a lowering of fertilization requirements and reducing air pollution from the burning of rice straw.

IV. ADMINISTRATION/GOVERNANCE

Organizational Structure

The Vice President, Agriculture and Natural Resources serves as the Director of the California Agricultural Experiment Station. The deans of the three colleges of agriculture and natural resources at Berkeley, Davis and Riverside, and the School of Veterinary Medicine at Davis serve as associate directors of the AES. The Vice President and the four deans share responsibility for statewide oversight and coordination of the AES and for integration of AES programs with research and extension efforts in agriculture and natural resources conducted by UC Cooperative Extension.

Approximately 750 academics hold partial or full appointments in the AES. Virtually all are members of academic departments in the agriculture/natural resources colleges/school and the Division of Biological Sciences (Davis). About 700 of the departmental AES academics also have professorial (I&R) appointments in their respective departments; some hold partial appointments as Cooperative Extension Specialists. On average, the AES portion of faculty appointments in the affiliated campus departments is about .60 FTE. All AES academics holding departmental appointments are subject to the administrative policies and procedures of their respective college and campus, including those governing personnel, budget and grants administration.

The coordination of research and the identification of priority issues in the AES are the responsibility of the Director (Vice President of DANR) and the associate directors on the three campuses. This responsibility is extremely complex, and decisions have profound implications for agriculture, University instruction, and the economy of the state. Coordination of the Division's research and extension programs is achieved through the Program Council, composed of the associate deans from each college/school, the regional directors of Cooperative Extension, the Program Leaders for Agricultural Productivity, Human Resources, Natural Resources, Agricultural Policy and Pest Management and the Assistant Vice President for Programs. The Division's Executive Council, composed of the Associate Vice President, the Assistant Vice President for Programs, the deans of each college and the Vice President (ex-officio) is charged with providing strategic guidance to the Division leadership team in decisions regarding Division-wide policies, allocation of resources across units and articulation of long-term programmatic directions.

Many AES faculty members participate as members of Division-wide workgroups -- collaborative teams of AES and CE faculty from different locations and organizational units whose work is directed toward a common issue area. Workgroups receive year-to-year funding from the Office of the Vice President for coordinated planning and program development, in-service training, and research and extension projects. Workgroups operate under the general oversight of the four statewide Program Leaders. About 90 workgroups are presently active in the Division.

Physical Infrastructure

The Director of the California Agricultural Experiment Station (who is the Vice President, Agriculture and Natural Resources) administers no facilities other than the off-campus DANR Research and Extension Centers (RECs). All of the campus located offices, laboratories, greenhouses and other research facilities utilized for AES research are under the authority of the chancellor's office and the dean of the college/school.

The DANR RECs comprise ten centers at locations dispersed across the state. Each center is designed to accommodate field-based research in a particular climatic zone with particular commodities. Specialized facilities such as greenhouses, laboratories, livestock handling equipment, and controlled-temperature storage for fruit are available at specific centers. In the aggregate, about 12,000 acres of land and 425,000 square feet of building space are available to support the research efforts of campus and field based faculty.

Resource Allocation

Each of the agricultural colleges and the School of Veterinary Medicine allocates its AES resources through a different process.

At the College of Natural Resources (CNR) at Berkeley, the dean administers the AES budget through the Institute for Natural Resources Systems (INRS). Each year the dean allocates a portion of the AES funding not committed to academic salaries to individual faculty members on a competitive basis, guided by the recommendations of the CNR Research Committee. These recommendations are the result of a peer-review process that ranks the AES projects of each faculty member, and takes into account how the project furthers the research priorities of CNR and the AES. Additionally, each division of CNR receives an allocation of AES funds for departmental and division expenses associated with support of AES research. The distribution of these funds is based primarily on the type and size of the faculty research programs and is subject to annual adjustment. Also, the dean allocates a portion of the AES resources for centralized expenses and for CNR research facilities and services utilized by AES faculty. Faculty committees allocate research space in college-wide facilities; the INRS allocates funds for staff positions and maintenance of facilities.

At the College of Agricultural and Environmental Sciences (CAES) at Davis, a Resource Allocation Committee (RAC) formula is used to fund the infrastructure needs of departments. A portion of the College's AES resources is retained by the dean's office to fund the operational and physical infrastructure that supports AES research and to support special AES-related programs and centers. Also, the Dean of CAES allocates some funds to support the Division of Biological Sciences (DBS).

At the College of Natural and Agricultural Sciences at Riverside, almost all of the permanent AES funds are budgeted directly to departments on a permanent basis. Funds not assigned to faculty or administrative staff salaries are allocated based upon peer review of AES projects.

The projects are reviewed at both the departmental and college levels. A small portion -- about 10 percent -- is retained by the dean's office for centralized expenses, support for department chairs and discretionary use in support of AES research.

The School of Veterinary Medicine allocates the School's AES permanent funds on a flexible basis each year. The dean assigns partial AES appointments to individual faculty based on proposals for research to address particular high priority areas identified with the help of representatives from clientele groups. In addition, support funding for AES research is provided through a separate competitive grants process.

As for the portion of the AES permanent budget administered directly by the Vice President's Office, almost all of these resources are permanently committed to statewide research and academic support programs, some of which also receive Cooperative Extension funding. The largest of the AES-funded statewide research programs are the Integrated Pest Management Project, the Center for Water Resources and the Forest Products Laboratory. The AES funding for academic support programs goes toward operation of the DANR Research and Extension Centers, central administration of the Natural Reserve System, and publication of the periodical, *California Agriculture*. A small portion of the AES funds administered by the Vice President -- about one percent of the overall AES budget -- is allocated on a flexible basis each year at the Division-wide level, to address short-term needs in high priority research areas. These funds, a combination of state general funds, federal Hatch funds, and endowment income, are allocated on a temporary basis to the affiliated colleges/school, to Division-wide workgroups, and to the statewide research, academic support and administrative units. Proposals for funding are evaluated through a Division-wide review process that involves representatives of the colleges/school as well as statewide DANR program leaders and CE regional directors. The process for allocating workgroup research funding also includes evaluation of proposals by statewide peer review panels.

V. ADVISORY COMMITTEES

President's Advisory Commission (PAC): In 1998, University of California President Richard Atkinson established the President's Advisory Commission on Agriculture and Natural Resources. This Commission comprises 30 people who are leaders in the business, consumer, youth, environment and governmental communities. The Commission, which is chaired by the President, meets twice a year to identify California's needs in the agricultural, natural resources and human resources arenas and to advise the President on how the University can best meet those needs.

College Advisory Committees: The three colleges of agriculture and the School of Veterinary Medicine all have their own Advisory Committees. They are detailed below:

- **The College of Natural Resources' Advisory Board (Berkeley) -** This Board is composed of 39 people, both from within and outside the College. The Board meets twice a year and its charge is to provide counsel and support to the dean on issues related to the College's programs.

- **The School of Veterinary Medicine Advisory Council (Davis) -** This Council is made up of 14 members, one of whom is the dean and three of whom are School faculty. The remaining 10 are constituents and supporters of the School. The Council meets twice a year and its charge is to: 1) provide advice on issues relating to animal welfare; 2) advise the dean on programs and activities which fulfill the School's teaching, research and outreach function; 3) to act as advocates for the School; and 4) to assist and personally support efforts to increase funding support for the School.

- **The College of Agricultural and Environmental Sciences' Dean's Advisory Council (Davis) -** This Council is made up of 36 members who meet twice a year to provide advice and counsel to the dean on issues related to the College's programs in agriculture, natural resources and human resources. The Council membership includes a student representative and representatives from UC Berkeley, UC Riverside and the Vice President's Office.

- **The College of Natural and Agricultural Sciences' Agricultural Advisory Council (Riverside) -** This Council is made up of 42 members who meet twice a year for the purpose of ". . .[taking] an active role in investigating, studying and making recommendations to the dean and chancellor on agricultural, environmental and natural resources issues requiring University expertise, and to aid in carrying out policies and programs resulting from this advice."

Statewide Special Programs and Projects: Most of the DANR Statewide Special Programs and Projects have a technical advisory committee and a public advisory committee. The Technical Advisory Committees are made up of between 7 and 12 faculty from UC and other institutions of higher education. The charge to these committees is to provide the project director/coordinator with technical advice on programs, program direction and competitive grants programs. The technical advisory committees typically meets twice a year. The public advisory committees are typically made up of up to 25 program constituents who are not employed by the University of California. Public advisory committees typically provide advice to the project director/coordinator on broad policy and programmatic directions.

VI. PROBLEMS AND NEEDS

Facilities/Infrastructure Needs

A major area of concern for the California AES at all three campuses in the lack of adequate space and the condition of available space for carrying out modern cutting edge research. The scientists of the California AES are among the very best in the world. However, many of them must work in antiquated laboratories. Agriculture was a major activity during the formative years at Berkeley, Davis and Riverside. Most of the buildings and facilities for the colleges of agriculture were constructed during the first two-thirds of the 20th Century. Many have these facilities are still occupied by AES faculty despite the fact that they lack the infrastructure (plumbing, ventilation, electrical and computer support) for supporting modern research programs in molecular biology and plant, animal and environmental sciences.

The prospects for modernizing or replacing these facilities are not good. With sharply growing enrollments and enrollment pressures, Berkeley, Davis and Riverside, like the remainder of the UC campuses, are faced with the need for greatly increased space to accommodate more classes and additional I&R faculty. The UC capital space program is driven largely by student workload. AES appointees do not generate student workload as part of their OR appointment. Such workload is generated by the fractional I&R appointment, where it exists, but collectively those fractional appointments are so small that they fail to raise the needs of AES scientists into high priority positions in the capital budget. This is especially true for specialized animal facilities, such as vivaria, dairy barns and feed mills, and field station buildings. New facilities like the recently funded insectaries at Davis and Riverside are needed, but these require a combination of federal, state and UC funding. The Federal Government has essentially eliminated its facilities funding program and state funds are allocated almost exclusively to projects that support increasing enrollments and special initiatives. The prospects for new facilities for AES scientists in the near term are not good. The campuses will have to try and meet needs as dictated by individual hiring and retention cases on an *ad hoc* basis.

Program Support

A second major area of need relates to budgetary support for AES research. A small augmentation to the state budget two years ago failed to offset the absolute reductions, which occurred in the AES research budget in the early 90s. Except for these two events, the AES research budget has remained constant in nominal dollar terms, with the result that the real purchasing power of dollars available to the AES has declined. This decline has occurred at a time when AES dollars have to go further then they have in the past. For example, start-up costs for new faculty have increased as the cost of equipping new laboratories has risen. AES dollars are required to support skilled managers and operators to support ever more complex research equipment and research facilities. As AES scientist move into more and more sophisticated kinds of research, it will be difficult to provide the support needed for increasingly sophisticated laboratories while at the same time maintaining the critical underpinnings -- animals, trees, germplasm -- needed for AES research.

In the absence of budgetary augmentations, the inexorable reductions in purchasing power combined with the rapidly expanding need for the AES research and research support dollars will force selective elimination of some programs. AES scientists can continue to offset the loss of state and federal support dollars by increasing dependence on grants and contracts. There is a danger that such a strategy will result in AES research programs that are not focused on the AES mission and on addressing the needs of California.

Recognition of the Unique Attributes of AES Appointments

An on-going challenge for AES personnel at all three campuses is the need to develop and maintain an understanding among faculty peers and administrators that the requirements and expectation of AES appointments differ from those for I&R appointments. Those with AES appointments are expected to carry out programs that are related to the Land Grant mission and are focused on addressing the specific goals and objectives that have been identified for California within that mission. It is only logical and fair, then, that those with AES appointments should be evaluated for their accomplishments related to this mission. Yet, it is frequently the case that campus merit and promotion evaluations defer to the standards set for I&R faculty members who have almost complete independence in selecting the research that they will conduct. Campus-based faculty and administrative leadership will need to be persuaded that AES faculty should be evaluated, commensurate with the fraction of their AES appointment, on criteria that are appropriate for the AES mission rather than the general criteria that prevail for I&R faculty.

VII. COMPARISON WITH OTHER UNITS

There are a number of significant mission-oriented programs within the University of California System. These include, in addition to the Agricultural Experiment Station, the Institute for Geophysics and Interplanetary Physics, the Institute of Transportation and the Scripps Institution of Oceanography. The Agricultural Experiment Station is unique among these units because it is linked, through Cooperative Extension, with an outreach program that makes the results of AES research readily available to users throughout the state. As the University of California system seeks to develop more outreach programs, the Agricultural Experiment Station and Cooperative Extension provide both a model and a vehicle for achieving a successful outreach program.

The mission of the California AES is perhaps now more important to the welfare of California agriculture than at any time in the past. Historically, the research programs of the AES focused on maximizing agricultural productivity through improved plant and animal breeding, the development of effective water and fertilizer management regimes, the development of effective pest management strategies and the development of effective culturing, harvesting and marketing techniques. Today, the focus is no longer on maximizing productivity. Rather, consistent with public preferences, the broad objective of AES research is to help the California grower to remain profitable while farming in the most environmentally benign way possible and minimizing the use of "public" resources such as water and air (quality). To these challenges must be added the challenges of competing in a globalizing agricultural economy.

California growers face some of the highest land and labor costs found anywhere in the world. Yet to-date, they have been able to compete effectively in globalizing agricultural markets. Their ability to compete is attributable to superior entrepreneurship and the availability of superior technology (which includes arrays of cultivation and harvesting techniques.) The California AES plays a critical role in developing new agricultural techniques and technologies and getting them into the hands of growers in a timely way. It is not an exaggeration to state that the ability of California growers to compete in the global markets of the future will depend critically on the availability of new and innovative technology from the California AES.

The challenges in the natural resources sectors are every bit as daunting as those in the agricultural sector. Extractive industries such as lumbering and mining are on the decline in California, yet the pressures on the state's natural resource base continue to grow. Problems of land use and land management will need to be addressed if watershed lands are to be maintained to provide high quality water. Problems of agricultural and wildland conversion must be addressed if urban and suburban sprawl are to be contained and the agricultural land base preserved. Increasing population and incomes fuel intensifying pressures for recreational opportunities on California wildlands. The protection of species and biological diversity appears increasingly in conflict with increased development and with agriculture "as we know it." Water resources will become progressively scarce as urban demands grow in response to population growth. The preservation of air and water quality will be a continuing problem. The challenges that Californians face in managing their natural resource base are unlike any that U.S. agriculture

has faced before. The California AES will play a key role in devising new management techniques and strategies for helping to develop, preserve and enhance California's resource base.
Historically, most of the non-salary AES funds were restricted to use by those with AES appointments. As a matter of policy in recent years, AES leadership has encouraged faculty from all campuses, irrespective of whether they have AES appointments, to participate in the AES research programs. This is accomplished most easily through participation in workgroups or by participating in various statewide competitive grants programs. It is anticipated that more and more faculty members who have not been traditionally involved in AES work will become so in the future.

Thus, the California AES is a unique mission-oriented research unit within the University of California system. Today, the mission of the California AES is to help growers maintain profitability while making less use of public resources and farming in more environmentally benign ways. That mission also requires the AES to continue to develop farming technology and techniques to help California growers to remain competitive in the global economy in spite of the fact that they face very high land and labor costs. The AES mission also requires researchers to address an array of challenging problems that must be resolved if California is to preserve and maintain its natural resource base. The California AES now makes efforts to involve all UC faculty members who are interested in its work. It is anticipated that faculty from throughout the UC system who are interested and able to contribute to the AES mission will become increasingly involved in research directed at that mission. The modern challenges which Californians face with regard to sustaining their agricultural and natural resource bases make the mission and effective functioning of the California AES more crucial than ever.

VIII. PROJECTIONS – NEXT FIVE (5) YEARS

STRATEGIC DIRECTIONS

The Executive Council has considered, in some detail, potential strategic directions for the Division of Agriculture and Natural Resources (DANR). The Executive Council has identified three critical long-term strategic program areas and recommended that they be established as long-term priority areas for the Division. A fourth (Food Safety) is presently under development and a fifth (Viability of California Agriculture) is receiving study as to whether to designate it as a strategic direction. The criteria used to judge the importance of different strategic directions include: 1) importance to the State of California; 2) the existence of a significant comparative advantage for DANR in addressing the challenges in question; 3) the capacity of DANR to add value in solving the range of problems subsumed in each of the strategic areas; and 4) strategic programmatic areas are expected to remain important over the long term (more than 10 years). For the three program areas officially designated as strategic directions, the Executive Council noted that in each there are immediate problems or activities that require attention. These are identified in the description of each strategic area, which follows:

Genomics Research and Education

During the last half of the 20th Century, there has been an explosion in the amount of information available to people. Access to that information has been critical in driving an unprecedented economic expansion both in California and nationally. The information explosion has been accompanied by a transformation of the U.S. economy and culture from one that was primarily agrarian and industrial to one that is increasingly dependent on knowledge. Innovation has always depended on the acquisition of new knowledge, and today we are faced with critical decisions regarding appropriate directions to follow in seeking to acquire new knowledge. Among other things, it seems clear that significant resources will need to be invested in acquiring the knowledge that will be the cornerstone of a major transformation in the biological sciences and in educating the public broadly about the benefits and risks of agricultural biotechnology.

Clearly, research in plant, animal, and nutritional genomics will drive gains in economic productivity and economic development in agricultural, natural, and human resources throughout the 21st Century. Mendel's discoveries were the beginning of a revolution in classical genetics that allowed innovations in plant and animal breeding to contribute to unprecedented increases in agricultural productivity. Our ability to sustain and enhance those gains over the next 25-30 years, and perhaps beyond, is dependent upon the prudent investment of resources in developing the new technologies that are open to us via genomics research. Only by investing in and contributing to the development of genomic data and its utilization will we be able to maintain the preeminence in agricultural and biotechnology productivity that has been the hallmark of California and the United States. Indeed, the future prosperity of the nation can remain secure only if we maintain the capacity to feed, clothe and house our citizens.

As the population of California and the nation continues to grow, new and intensifying demands will be placed on our natural resources and the environment. The resulting pressures are likely to constrain the economic productivity of agriculture. Counter efforts to develop strategies to enhance productivity and create innovative products will depend upon obtaining the information contained in the genomes of species that we have depended upon historically as well as others that we could come to depend upon in the future. This information will inform new strategies to address the pathologies of plants, animals and humans and to guide the use of environmentally sound technologies and techniques for managing land and water and producing food. This information will also guide in developing foods and diets that are nutritionally healthy and have the potential to improve the health of individuals and populations. There is no aspect of human, natural and agricultural resources that will be unaffected by investing in genomics research.

The productivity and payoff of research in agricultural genomics and the promise of agricultural biotechnology will depend importantly on the support of a *well-informed* public. Some of the current skepticism about the benefits of genomics research is fueled by misunderstandings about the prospects and possibilities of agricultural biotechnology and its potential side effects. There is a compelling need to familiarize the public-at-large with the facts about agricultural biotechnology, about the potential benefits of employing such biotechnology and about potential unwanted side effects and how they can be managed. DANR should use its considerable outreach capabilities to mount effective and informative programs of public education in the general area of plant, animal and human genomics. That program should be informed by research on agricultural genomics. The development of the agricultural genomics research agenda should give appropriate weight to research that will help inform the education program.

For the immediate future, the Division will give high priority to the development of a new Center for Science and Innovation, which will be provisionally called, "The Institute for Plant, Animal and Nutritional Genomics." The Center will involve faculty from the College of Natural Resources (Berkeley), the College of Agricultural and Environmental Sciences (Davis), the School of Veterinary Medicine (Davis) and the College of Natural and Agricultural Sciences (Riverside). The Center will involve faculty from other schools, colleges and campuses as appropriate. The structure and operation of the Center will entail appropriate collaborative relationships with the private sector as well as appropriate state and federal research institutions.

Management of Invasive Species

A new exotic pest enters California every 60 days. This rate is likely to accelerate as market opportunities increase and the pace of international trade, tourism, and human immigration from the semitropical and tropical regions of the world accelerate. Today, exotic pests are estimated to cost California agriculture $3 billion annually. They also threaten the biological integrity of California's wild and natural ecosystems. The magnitude of this damage, together with control expenditures, will grow as the number and frequency of new invasions grows. Consequently,

over the long term, DANR will need to be positioned to respond to the need to develop and devise control and/or eradication strategies for individual pests. Simultaneously, however, more fundamental work in basic and applied science will be needed to build the foundations for managing and controlling exotic pests on something more than an episodic basis.

The biology of invasions by plants and animals is an emerging science. The nature of invasive processes, the factors that determine integration and spread and the characteristics of the successful invader are all incompletely understood. The need to develop multiple strategies of intervention, including prevention, eradication and control will require both a broader and more detailed understanding of invasion biology. Successful development of excellence in invasion biology will require broad multi-disciplinary participation from DANR faculty as well as biology faculty found elsewhere throughout the University.

For the immediate future, the Division will need to give very high priority to the development of methods of controlling and combating Pierce's Disease bacterium. Transmission of Pierce's Disease by the Glassy Winged Sharpshooter poses a clear and dangerous threat to California's grape industry. Grapes represent the second largest crop (in terms of cash receipts) in California. Ultimately, other diseases caused by the Pierce's Disease bacterium may threaten other permanent crops in California so that the potential devastation is not limited to grapes. To-date, no strategies or actions to eliminate the disease or avert its adverse effects in the short to medium run have been identified.

Ultimately, resistant stocks can be bred, but the disease may have run its course by the time this occurs. Thus, there is an urgent need for DANR research and outreach personnel to devote intensive efforts to the discovery and dissemination of knowledge related to the management and ultimate eradication or control of the disease. DANR should make a high profile commitment to finding ways of eliminating the damages caused by this disease.

Waste Management

During the first two decades of the 21st Century, California's population is expected to grow by 15 million, an increase of almost 50 percent. This population growth is likely to be accompanied by significant rates of economic growth, both of which will intensify pressures on the environment. Population and economic growth will cause increases in the quantities of waste byproducts that will have to be managed to preserve environmental quality. Intensifying human pressures on landscapes will require careful management if the capacity of California landscapes to provide environmental services and amenities is to be maintained and enhanced. As competition for scarce water supplies intensifies, as the trend of air quality degradation grows, and as the problem of finding and managing land fills become more and more difficult, agricultural and natural resource producers will have to find new methods of production, recycling and waste treatment which will minimize the impact of agricultural and natural resource impacts on the environment.

The piecemeal nature of environmental regulations and the failure of state and national legislation to envision environmental management in a holistic and integrated way has led to sub optimal practices of environmental and waste management. Thus, for example, most pollution control laws and regulations focus on a single sink -- land, air or water -- and prescribe standards and practices for protecting and enhancing the quality of one sink without recognizing that an inevitable response is to move waste products to another sink. The need for land disposal of sludge from wastewater treatment plants arises directly from national water quality protection regulations. It is also important to recognize that any activity on waterscapes or landscapes is influenced by the prevailing environmental conditions that are, in turn, influenced (and changed) by the activity in question. The ease with which crops can be cultured depends upon the environmental conditions in the field and surrounding area. The growing of crops, in turn, affects the environmental conditions in the field and surrounding area. For the future, DANR needs to cast its environmental research in an integrated, ecosystem-based fashion. Only in this way can the implications of different schemes of environmental and waste management be understood with a reasonable degree of thoroughness.

For the immediate future, the Division should accord high priority to the development of new, innovative and integrated ways of managing dairy animal waste. California is the leading producer of dairy products in the nation, and these products (milk and cream) contribute $3.6 billion to the California agricultural economy. Dairy is the largest agricultural activity in terms of cash receipts. The trend in the dairy industry is toward large intensively managed operations with herd sizes exceeding 1,000 animals. These large concentrations of cattle result in the generation of enormous volumes of waste, including manure, wash water and aerosols on relatively small parcels of land. These wastes have the potential to degrade seriously both the quality of water and air resources.

In rapidly urbanizing areas such as the Chino-Corona basin in southern California, pressure to relocate dairies is increasing. Throughout California, land use regulations are becoming more stringent, and this places new and significant constraints on the location and operation of existing as well as new dairies. There is a clear need to find new and effective ways to manage the wastes created by dairy operations and to get this information into the hands of dairy operators. DANR should make a visible commitment to finding effective ways to manage these wastes to minimize environmental degradation while maintaining the safety and high quality of California-produced dairy products.

IX. ANNUAL REPORTS

The California AES does not produce an annual report *per se*. Rather, its reporting functions are accomplished through DANR's bi-monthly publication, *California Agriculture*, and through numerous other occasional reports. Thus, for example, *The Measure of California Agriculture* is a periodic report, which summarizes the economic attributes of California agriculture, while *Valuing UC Agricultural Research and Extension* reports on periodic efforts to measure the impact of AES research and associated outreach programs. Other periodic reports include: *Extending the Bounty of Research,* a publication intended for broad public distribution which explains the impact of UC agricultural research, and the *Challenge of Change,* a published version of the DANR strategic plan. These reports and others have been included as appendices to this document.

X. ADVISORY COMMITTEE REVIEW OF DIRECTOR'S REPORT

The President's Advisory Commission will be provided with a copy of this report, and a discussion of it will be scheduled for the fall meeting of the Commission in October.

XI. APPENDIX

Reports and publications included with this report are as follows:

- *California Agriculture 2000 – Future in focus: 2000-2025 – Resources* – March-April 2000

- *The Measure of California Agriculture 2000*, Agricultural Issues Center, October 2000

- *Valuing Agricultural Research and Extension* – Agricultural Issues Center Publication No. VR-1, March 1994

- *Extending the Bounty of Research, A Report from the University of California, Division of Agriculture and Natural Resources*, May 1992

- *The Challenge of Change – A Strategic Plan for the University of California, Division of Agriculture and Natural Resources*, 1997