



**University of California  
Agriculture and Natural Resources**

**Core Issues and Target Opportunities  
2005**

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## ***FOCUSING ANR'S PROGRAMS AND DIRECTION***

The Division of Agriculture and Natural Resources (ANR) plays a vital role in fulfilling the University of California's fundamental land-grant mission of teaching, research and public service to benefit all Californians. This poses many challenges for the Division, including the need to focus ANR's mission and direction. This need for focus was a major theme expressed at stakeholder Listening Sessions in 2004, one of many themes heard and carefully considered by ANR leadership. The ANR Vice President and Executive Council charged the Program Council to develop recommendations to help focus ANR's mission and high-priority research and extension programs in areas that maximize the public good. In response to this charge, Program Council adopted the guiding principle that ***ANR research and extension programs serve the public good of California through the creation, development and application of knowledge addressing critical issues in agricultural, natural and related human resources, through a system of community-driven research and outreach programs with CE advisors supported by CE specialists and AES scientists.***

The Program Council developed a framework for identifying and ranking core issues for ANR to fulfill the charge from the Executive Council (See Figure 1). Following the identification of issues of possible interest and appropriateness to ANR, the Program Council worked to select and rank core issues for ANR. The results of the Program Council's core issue analysis and assessment are given in this document. The expectation is that the results of this exercise will be used by ANR leaders as a basis for decisions related to allocation of ANR resources over the next 3 to 5 years.

### ***Defining ANR Core Issues and Program Components***

Starting with the 40 Critical Issues identified in 2003 by the Program Planning Advisory Committees (PPACs), the Program Council identified issue gaps and refined the PPAC list to identify 21 possible ("core") issues of greatest relevance and importance to California and appropriate for ANR's mission. These 21 core issues are considered to be at the same relative level of scale, and therefore comparable within and across the ANR program areas of Agricultural Policy and Pest Management, Agricultural Productivity, Human Resources, and Natural Resources and Animal Agriculture.

The Program Council identified specific research and extension program components within each core issue that either existed or may need to be developed within ANR to effectively address each issue. The program components in each core issue area referred to researchable or extendable programmatic areas (or foci) and/or activities related to the issue in terms of:

- Understanding the nature of the issue;
- Economics and social components of the issue;
- Environmental/social consequences of the issue;
- Policy impacts related to the issue; and
- Management approaches for addressing the issue.

Identification of possible core issues completed Phase A shown in Figure 1.

Program Council members then conducted an evaluation of each core issue and program component using the following criteria:

- 1) alignment with the overall guiding principle (see above),
- 2) current and/or future significance of the issue,
- 3) potential impact of ANR programs on the issue's solution,
- 4) maximization of public good,
- 5) alignment with revised ANR core values (see below),
- 6) strength of the research/extension outreach continuum,
- 7) ANR capacity, and
- 8) ANR's comparative advantage.

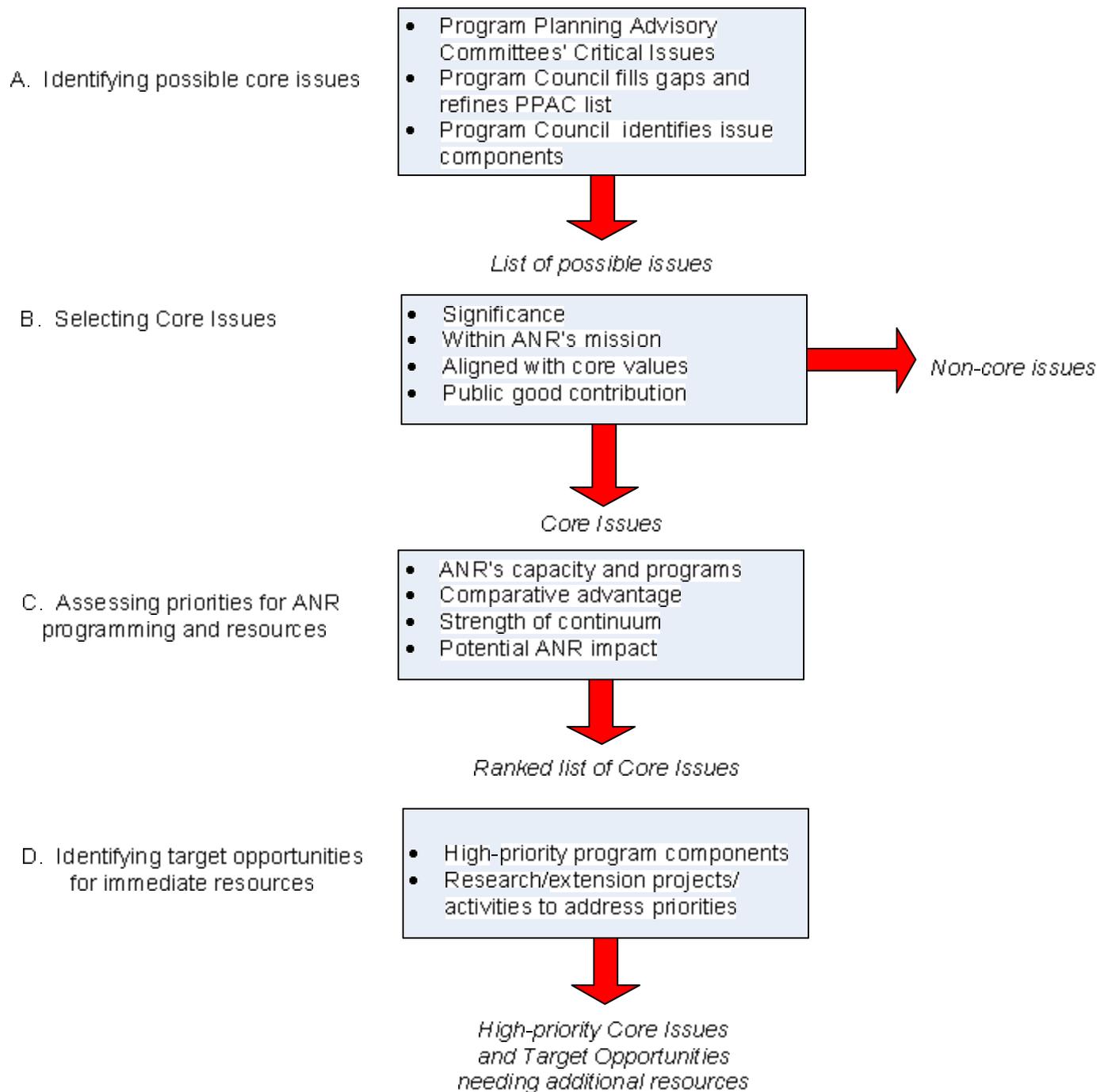
This evaluation process, completed Phase B and C in Figure 1, and led to Program Council's ranking of the 21 issues.

#### ***ANR Core Values***

The Program Council reconfirmed ANR's Core Values for guiding action and decisions at all levels of the Division and added reference to ANR's land grant mission in the last core value as follows:

- *The highest standards of ethical behavior, honesty and integrity, with the recognition that the trust and confidence of the public is absolutely essential to our success.*
- *Academic excellence and maintaining credibility as an objective source of knowledge.*
- *Scientifically valid research as a foundation for anticipating problems and developing practical solutions.*
- *Responsiveness to state and local needs in California, and consideration of the global context that shapes these needs.*
- *Diversity within our organization, equal access to knowledge by all people and equal opportunity for self-reliance through education.*
- *Collaboration, teamwork and mutual respect among ourselves, in partnership with other organizations, and in interaction with our clientele.*
- *Academic freedom, with the recognition that individual freedom goes hand in hand with a high standard of professional responsibility and personal accountability to ANR's land grant mission.*

Figure 1: Process for Defining ANR Core Issues and Priorities



### Ranked ANR Core Issues

As a result of the Program Council ranking process, the 21 issues were placed in three groups identified as “High”, “Medium”, and “Low” priority for ANR in the short term.

<b>Issue Priority</b>	<b>Agricultural Policy and Pest Management</b>	<b>Agricultural Productivity</b>	<b>Human Resources</b>	<b>Natural Resources and Animal Agriculture</b>
<b>High</b>	<ul style="list-style-type: none"> <li>○ Invasive Species</li> <li>○ Pest Management</li> </ul>	<ul style="list-style-type: none"> <li>○ Food Safety</li> <li>○ Sustainability and Viability of Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>○ Youth Development</li> </ul>	<ul style="list-style-type: none"> <li>○ Water Quality</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>○ Biosecurity</li> </ul>	<ul style="list-style-type: none"> <li>○ Organic Production</li> <li>○ Soil Quality</li> <li>○ Waste Management</li> </ul>	<ul style="list-style-type: none"> <li>○ Childhood Obesity</li> <li>○ Human Nutritional Status</li> </ul>	<ul style="list-style-type: none"> <li>○ Air Quality</li> <li>○ Land Use</li> <li>○ Sustainable Use of Natural Resources</li> <li>○ Water Supply and Allocation</li> <li>○ Wildland Fire</li> </ul>

The lowest priority core issues, although recognized as representing critical needs for California and important fields of endeavor for ANR, are areas where, in most cases, investments of ANR resources are not likely in the near future.

<b>Low</b>	<ul style="list-style-type: none"> <li>○ Agricultural Labor</li> </ul>		<ul style="list-style-type: none"> <li>○ Community Development</li> <li>○ Family and Consumer Well Being</li> <li>○ Food Security</li> </ul>	
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The 21 core issues and important program components of each are discussed in the remainder of this document. For each issue, the overall importance or significance of the issue to California is described together with a general description of the issue and a listing of program components ranked as some of the most important components of the issue for attention by ANR research/extension programs. To complete Phase D in Figure 1, two specific target opportunity areas within the six high-priority core issues and four of the medium-priority issues – Air Quality, Biosecurity, Childhood Obesity and Sustainable Use of Natural Resources – have been identified as the focus for the FY 2006-2007 ANR Core Issue Grants.

## AGRICULTURAL POLICY AND PEST MANAGEMENT PROGRAM AREA

### High-Priority Core Issues

#### Invasive Species

**The significant issue for California:** The negative impact of invasive species on agricultural, natural, and urban systems.

A new potential pest (insect, weed, disease, nematode, marine organism, etc.) is introduced into California on a regular basis (e.g. a new insect is introduced every 60 days). Many of these “exotic” pests and diseases or invasive species become established and cause billions of dollars in damage to California’s agricultural, natural, and urban environments. Some species invade and spread rapidly – often referred to as “established pests,” rather than “invasive pests,” 15 years after their initial introduction into California; other species spread more slowly and might be considered to be “invasive” into new areas of California beyond this time. Invasive species will continue to enter the state, probably at an accelerated rate, because of increased international air transport, growing tourism, human immigration from semitropical and tropical regions where many of California’s crops originate, and recent international trade agreements (NAFTA, GATT, etc.) which are leading to increased movement of infested agricultural products into the state.

**ANR’s role:** Research and education related to increasing the understanding of invasive species, modes of entry into the state, assisting in the eradication or reducing the spread of newly introduced species, and developing methods of effectively dealing with recent introductions.

The priority components of invasive species that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Basic biology of invasive species
- b. Genetics and systematics (origin, diversity)
- c. Epidemiology and modeling invasion biology
- d. Prediction of social/economic consequences
- e. Biological control of invasive species
- f. Cultural control of invasive species
- g. Prediction, early detection, and prevention of invasion

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Development or refinement of risk assessments for various invasive species and their impacts and action plans to include applied research and extension components.

- Development of a more proactive California approach to deal with potential invasive species including the development and implementation of methods of preventing entry of such species into the state.
- Cooperation among California Department of Food and Agriculture, U.S. Department of Agriculture-Agricultural Research Service, UC ANR, and other agencies when newly invasive species are detected to deal with these species through coordinated local eradication, expanded monitoring, suppression, and/or management and by focusing and coordinating research and extension efforts.
- Better and more accurate quantification and communication of the economic and sociological consequences of invasive species for both past and potential introductions.
- A coordinated and integrated approach by UC to deal with invasive species negatively impacting the state.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Potential invasive species are denied or delayed entry into the state preventing infestations of California's agricultural, natural and urban systems.
- Species which are introduced are eradicated or controlled before they can spread and spread is reduced either over space or time.
- Management strategies are implemented which mitigate the economic or sociological impacts.

**Target Opportunities for 2006-2007:**

- Improving understanding of the basic biology or economic impact of invasive species affecting California.
- Developing and/or evaluating strategies to mitigate the impact and/or control the spread of invasive species.

**Pest Management**

**The significant issue for California:** The negative impact of key pest species on plant and animals systems in agricultural, natural, and urban environments.

The management of key pests in California's diverse agricultural ecosystems is an on going effort. The same environment that allows a tremendous plant, crop, and animal diversity also provides limitless niches for various pest organisms, including weeds, insects, plant diseases, nematodes, mites, and vertebrate pest and disease causing organisms. Integrated pest management utilizes a wide range of biological, cultural and physical controls with chemical control restricted to an as-needed basis when monitoring indicates economic thresholds have been exceeded. Pest management is an important production concern to California farmers because it affects profitability from two sides: costs of production and loss of yield/income. Programs developed to manage pests require constant maintenance and adjustment as new pests are introduced, new crops are brought into production, new crop protection products are

introduced or removed, and new technologies are introduced (advances in weather monitoring, pest modeling, site specific agriculture, GIS applications, etc.).

**ANR's role:** Developing and delivering science-based information to quantify pest situations and help guide pest control decision-making.

The priority components of pest management that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Management of weeds
- b. Basic biology of pest species
- c. Alternatives to chemical pesticides
- d. Biological control
- e. Cultural controls

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Increased utilization of effective pest monitoring and use of economic thresholds to make treatment decisions.
- Increased awareness, broad adoption and use of new and improved pest management practices and products, including greater use of pesticide resistance management practices, increased use of less toxic and more environmentally safe pesticides and greater reliance on alternative methods of control such as resistant varieties, biological controls, and/or cultural controls.
- Improved understanding of the complexity of pest management through demonstration of knowledge of systems and interaction of biological, climatological, ecological and other factors in managing pests.
- Increased professionalism of crop and pest consultants through improved PCA certification programs.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- More reliable, effective and economic management of important pest species by pest control advisors, growers and other horticulturalists.
- Reduced use of environmentally significant or toxic pesticides.
- Sustained profitability of California agriculture through more effective and reliable pest management practices.

***Target Opportunities for 2006-2007:***

- Developing and/or evaluating sustainable management strategies for weed species in agricultural, natural and urban environments.
- Developing and/or evaluating biological and cultural management strategies for a variety of pest species to contribute to integrated and sustainable pest management.

## **Medium-Priority Core Issues**

### **Biosecurity**

***The significant issue for California:*** Agriculture in California, including all food production, distribution, and marketing systems, is extremely vulnerable to accidental or intentional invasions of pathogens, pests, and toxins.

A successful invasion of these pathogens, pests, or toxins can permanently disrupt production of any agricultural commodities and products including food crops, livestock, and poultry ultimately impacting California's economy. Historically, chemical agents and microbial pathogens have been used to successfully attack people, animals, and food supplies throughout the world. Today our state's vulnerability to invasions of pathogens, pests or toxins is extremely high, in part due to the eradication of many of the most threatening agents, leaving our domestic species lacking resistance to these disease agents and highly vulnerable. To ensure optimal biosecurity, preparation and education plans are vital to protect consumers and the agricultural viability of the state.

***ANR's role:*** ANR has the multidisciplinary capacity and strategic position statewide to design and deliver educational programs for the agricultural sectors to ensure maximum biosecurity, prevent catastrophic losses, develop early diagnostic and effective therapeutic products in responding to an invasion, and assist in the recovery from a biological event. ANR research and extension programs address the areas of biosecurity in agricultural sectors, including prevention, detection, response, and recovery from invasions. Both domestic and foreign threats to biosecurity include common and emerging food-borne pathogens, pests, or toxins. Foods produced from the agricultural sectors of livestock, poultry, fruits and vegetables, nuts, and other crops are considered the primary risk areas.

The priority components of this issue that ANR research and extension programs should consider for additional resources in the next 3 to 5 years include:

- a. On-farm biosecurity risks (including imported feed, water, air and other contaminants).
- b. Biosecurity risks during transportation and marketing of crops, livestock and poultry.
- c. Biosecurity risks during processing of crops and animals, including slaughter of livestock and poultry.
- d. Biosecurity risks on the retail and consumer components of the food production system.

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Implementation of biosecurity plans for California plant and livestock production systems.
- Efficient management of new pest or disease outbreaks with minimal economic impact.
- More aware and better trained first detectors of plant or animal pests and diseases who are well integrated into the National Plant Diagnostics Network and National Animal Health Laboratory Network.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- California's plant and animal agricultural production systems are better protected against intentional or unintentional introduction and spread of pests and diseases.
- Introduced pathogens, pests or toxins are rapidly managed to minimize health and economic impacts.

**Target Opportunities for 2006-2007:**

- Developing risk-based methods of prevention, detection, response, and recovery from intentional or accidental invasion of pathogens, pests, or toxins in the food production systems at the farm level, during transportation, marketing, processing, and at the retail and consumer levels.
- Delivering effective extension education to targeted sectors of agriculture on prevention, detection, response, and recovery from biological invasion of food systems.

## **Low-Priority Core Issues**

### **Agricultural Labor**

**The significant issue for California:** Agriculture's unsustainable reliance on inexpensive labor and the impacts of agricultural occupations on worker health and safety.

California agriculture operates in a highly competitive global environment. Without the less expensive and readily available agricultural labor entering California from less-developed countries, this industry would find it difficult, if not impossible, to continue to compete internationally. Economic, social and regulatory facets of agricultural labor affect all the citizens of the state. In addition, agricultural workers are also exposed to a wide range of occupational risk factors, including estimated costs of occupational musculoskeletal disorders to California agricultural alone at \$450 million per year. Agricultural ergonomics and safety is therefore an important additional component of the agricultural labor issue for California.

**ANR's role:** ANR research and extension programs address ergonomic, sociological and toxicological issues in the agricultural workplace, and conduct education programs to improve worker health and safety.

No components of the agricultural labor issue were identified as areas for allocation of additional resources in the next 3 to 5 years.

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Increased knowledge of ergonomic injuries and implementation of injury prevention methods.
- Improved knowledge of employers and workers and adoption of more ergonomic and safer tools and practices behaviors in daily work.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- California agriculture remains a significant part of the economy contributing to employment, income, and taxes.
- Reductions in health costs, lost work time and suffering associated with musculoskeletal disorders and other occupational injuries in targeted agricultural labor forces.

## AGRICULTURAL PRODUCTIVITY PROGRAM AREA

### High-Priority Core Issues

#### Food Safety

**The significant issue for California:** Ensuring the safety of the food supply, as food-borne illnesses can result in lost productivity, increased medical expenses and death.

Consumer health and agricultural sustainability require a food supply that is produced, processed, distributed, and prepared in a manner that prevents or minimizes contaminants such as bacteria, viruses and prions, or chemicals, including natural toxins and added products. Loss of prime farmland through urbanization and parcelization will gradually increase America's dependence on foreign sources of certain foods. While the U.S. historically has been a net agricultural exporter, 2004 was the first year that the nation had a net agricultural trade deficit. Domestic food is considered the safest in the world and safer than some sources that do not have pesticide and food safety standards comparable to those in California. The global food supply provides consumers with products originating from plant and animal sources around the world, increasing the risk of food borne illnesses. A wide range of policies impact every aspect of food production and quality control. Public health, agricultural market share, environmental and ecological impacts are associated with these production practices. The health of livestock and poultry is a pivotal control point in assuring food safety for consumers.

**ANR's role:** ANR conducts research and extension work critical to ensuring consumer food safety in all phases of the food chain, from "farm to fork."

The essential priority components of food safety that ANR research and extension programs should address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Consumer education including safe in-home food preparation.
- b. Food handler and preparer practices and education.
- c. Development of on-farm production practices to control contamination of pre harvest foods from microbes, toxins, and chemicals.
- d. Development of effective approaches to destroy or control food-borne pathogens on-farm.
- e. Development of systems to control vectors on-farm, including understanding the biology of the vectors.

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Improved food safety knowledge and practices for food suppliers, processors, retailers and consumers.
- Improved food handling behaviors throughout the food production, processing, storage and consumption system.

- Adoption of new detection techniques and countermeasure practices for food contaminants.
- Increased producer, handler and consumer knowledge and improved skills in appropriate use and management of new food technologies, additives and contaminants.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Decrease in the number of Californians who suffer from food-borne illness each year.
- Reduction in the cost of medical care, lost work hours and deaths due to food-borne illness.

**Target Opportunities for 2006-2007:**

- Developing and/or evaluating effective pre harvest and at-harvest production/processing practices to ensure a safe food supply.
- Developing effective approaches to control/destroy food-borne pathogens on-farm.

**Sustainability and Viability of Agriculture**

**The significant issue for California:** Maintaining an environmentally and economically sustainable system for production of food, fiber, and ornamentals.

Agriculture is a large and highly valued component of California's economy. The profitability of California farms has been diminished by sharply rising production costs, depressed value of some crops due to overproduction, increased competition for water, increased diversity and availability of imported crops, and trade restrictions that limit export markets. Organic production of plants and animals is a rapidly growing sector of agriculture that will help shape economically and environmentally sustainable agricultural systems. California agriculture is at a critical point in its evolution. To remain economically viable, California producers must continue to improve the efficiency and quality of agricultural production in an ecologically and environmentally sound manner.

**ANR's role:** ANR carries out research and educational programs that address the ecological sustainability and economic viability of agriculture and the environmental and social issues that impact upon or that are impacted by agricultural production systems. ANR very effectively develops and transfers technologies and reduced input systems that contribute to long-term sustainability.

The priority components of sustainability and viability of agriculture that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Introduction of new crops/breeds
- b. Application of biotechnology

- c. Organic production strategies
- d. Economic and marketing analysis
- e. Social/biological impacts of agriculture and agricultural lands

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Development and adoption of new crops and breeds that improve the competitive position of California producers.
- Adoption of new technologies and improved cultural, water, and nutritional systems by California producers that lead to more efficient and less costly production, with less detrimental impacts on the environment.
- Adoption of improved management information, forecasting and decision-making systems by California producers that improve competitive advantage and profitability.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- California agriculture remains economically viable, maximizing its opportunities in markets where it has a competitive advantage.
- California commodities are produced with minimal or no detrimental impact on the state's natural resources and environment.

**Target Opportunities for 2006-2007:**

- Developing and/or evaluating effective strategies to ensure the ecological sustainability of California agriculture that focus on the opportunities and challenges associated with:
  - Transition to organic production techniques,
  - New crops and breeds, and
  - Biotechnology.
- Developing and/or evaluating effective management and marketing systems to ensure the economic viability of California agriculture.

## **Medium-Priority Core Issues**

### **Organic Production**

**The significant issue for California:** Lack of economically sustainable production, processing and distribution strategies of certified organic food, fiber, and ornamentals for California producers and consumers.

Organic production of plants and animals is a rapidly increasing sector of agriculture with significant implications in terms of food quality, human nutrition, health and food safety. Farmers are seeking research-based solutions to the problem of controlling pests, diseases and

weeds in organic production systems due to widespread interest in organic production techniques spurred by consumer demand, and the promulgation of a national standard for organic products. Opportunities for new management strategies include innovative techniques for controlling pests and diseases, especially biological control, novel cultural practices, and development of resistant varieties.

**ANR's role:** ANR's role is to develop and deliver novel technologies that will allow environmentally and economically viable production of organic products, in particular providing strategies for plant nutrition and control of diseases, insects, nematodes and weeds. ANR develops fundamental information leading to solutions in crop ecology and organic production technology. Examination of the relationship between organic production and environmental quality includes work on soil and water quality, and on the effects of cultural practices, weather and climate. Socio-economic evaluations are required to foster the development of organic agriculture including consumer and marketing studies, examination of the trade-offs between production efficiency and social values, the impacts of GMOs, land use policy, regulations, value/profitability, and global cost/benefit analysis.

The priority components of organic production that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Effective and efficient production systems
- b. Biological controls
- c. Cultural practices and management

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Increased adoption of organic production practices and systems by California growers.
- Increased compliance with federal and state organic standards for California organic growers.
- Increased numbers of California producers who will be able to effectively respond to growing U.S. and foreign markets for organic products.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Growing number of successful organic growers and marketers in California with increased efficiency, productivity and decreased risk of financial failure.
- Increased availability of economical, healthy and appealing organically grown food and fiber for diverse consumer needs and tastes.

## **Soil Quality**

***The significant issue for California:*** Sustaining the availability and quality of the soils in the State's agricultural, natural and urban systems and mitigating the threats of salinity and erosion, deterioration of soil in urban settings and environmental impacts of tillage.

Maintaining or improving soil quality is important to long-term agricultural productivity, to water quality, and to the sustainability of agricultural, natural and urban systems in California. Soil quality plays a role in the complex interactions of microbial communities, which influence nutrient cycling and disease suppression, but these interactions, and their relationships to plant establishment need to be better understood.

***ANR's role:*** ANR research and extension work addresses all aspects of soil analysis, management and quality assessment, as well as the understanding of the parameters influencing soil quality and the development of sustainable soil-management practices to support agricultural productivity, as well as organisms and systems in diverse natural and human-made settings.

The priority components of soil quality that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Soil biology
- b. Organic material/carbon sequestration
- c. Nutrient accumulation and cycling
- d. Soil texture/structure/aggregation
- e. Toxicity/salinization
- f. Erosion, water holding, leaching, run-off dynamics

***Outcomes:*** ANR research and extension activities in this issue will lead to:

- Development and use of management guidelines to improve soils on farms, urban landscapes, watersheds, and natural areas.
- Improved knowledge and understanding of the relationships between alternative soil management practices, soil quality, soil productivity and environmental quality.

***Impacts:*** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Improved soil quality within natural or managed ecosystems to better sustain plant and animal productivity, maintain and enhance water and air quality, protect wildlife habitat and natural systems and support human health and habitation.
- Improved soil-management practices leading to improved quality benefiting cropland, rangeland and woodland productivity.
- Reduced soil degradation.

## **Waste Management**

***The significant issue for California:*** Mitigating and/or preventing negative impacts of urban and agricultural wastes on the environment due to increased population growth and concurrent increases in waste products.

California's population is expected to grow by 15 million by 2020, an increase of almost 50%. This population growth will be accompanied by economic growth, intensifying pressures on the environment and increases in the quantities of waste byproducts that will have to be managed to preserve environmental quality. Problems of finding and managing landfills continue to intensify. Urban constituents and agricultural and natural resource producers must find new ways to reduce waste and methods of production, recycling and waste treatment that minimizes the impact on the environment. Specific issues include waste from livestock/dairy operations, green waste issues (both agricultural and urban), and solid waste reduction. There is also the need for an integrated ecosystem approach to waste management for long-term sustainability.

California is the leading producer of dairy products in the nation, and these products (milk and cream) contribute \$3.6 billion to the California economy. The trend in the dairy industry is large, intensively managed operations with herd size exceeding 1,000 animals. These large concentrations of cattle result in the generation of enormous volumes of waste that include manures, wash water and aerosols on relatively small parcels of land. These wastes have the potential to degrade both air and water quality. There is a clear need to find new and effective ways to manage the wastes created by dairy operations to minimize environmental degradation and maintain the safety and high quality of California dairy products.

The trend is similar for all agricultural based industries. There is increasing regulation of disposal of waste products and there is a need to find methods that reduce, reuse and recycle all components of the waste stream. Within the urban context, there is a need to develop new uses for urban and plant wastes, composts and sludge.

***ANR's role:*** ANR develops and extends knowledge and information on waste management strategies, addressing such disparate issues as disposal of urban green waste and recycling of dairy manure and waste water. ANR research covers the sources and nature of agricultural and urban waste, and the dynamics of movement and degradation of wastes and pollutants. ANR contributes to waste management strategies by studying recycling opportunities, waste containment, waste abatement and potential use of waste materials.

The priority components of waste management that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Livestock production practices
- b. Strategies for recycling urban green waste

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Implementation and coordination of dairy producer manure and nutrient management plans.
- Adoption and use of models for cooperative agreements and relationships all along the waste stream to improve waste management practices and systems.
- Improved communication between regulators and producers leading to development and utilization of environmental quality assurance programs.
- Development and adoption of new uses for waste products.
- Increased use of green waste products from and in agriculture/urban systems.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Reduced contamination of the environment from waste materials.
- Significant reduction in waste production in all agricultural and urban systems leading to reduction in waste stream.
- Increased use of waste products.
- Increased economic opportunities and profitability from waste-related products and services.

## **HUMAN RESOURCES PROGRAM AREA**

### **High-Priority Core Issues**

#### **Youth Development**

*The significant issue for California:* California youth need support systems and opportunities to be prepared to provide leadership and participate effectively in an increasingly complex society.

California has a large stake in the healthy development, productivity and leadership capacity of its next generation to build strong communities and to address the many challenges facing the state. The skills needed by our youth to develop their communities and to take advantage of opportunities for personal success include leadership, planning, decision-making, problem solving, critical thinking, and valuing diversity. Research indicates that youth learn from both formal and non-formal forms of education and that peers and environments have a great influence on the educational and extra curricular activities they choose to engage in. It is known that youth learn best through “hands-on” activities and interaction. Youth need opportunities to discover and expand the range of their assets and capacities, and to practice and demonstrate their value to the community.

*ANR’s role:* ANR research and extension programs provide knowledge and information in non-formal and out-of-school positive youth development activities in the areas of citizenship, leadership and life skills development with broad expertise in agricultural and natural resources sciences. Cooperative Extension’s county-based structure throughout California provides local delivery of youth development programs through the 4-H youth development program.

The priority components of the youth development issue that ANR research and extension programs need to address and should be considered for additional resources in the next 3 to 5 years include:

- a. Understanding positive youth development and the influence of their peers.
- b. Improving agricultural literacy.
- c. Improving science and environmental literacy.
- d. Promoting citizenship, leadership, and life skills development in youth.

*Outcomes:* ANR research and extension activities in this issue will lead to:

- Improved citizenship, leadership and life skills in youth.
- Increased engagement in community activities and assumption of leadership responsibilities by youth.
- Increased understanding of a wide variety of scientific, technological and agricultural topics in youth.

- Increased numbers of youth engaged in healthy non-formal and/or out-of-school activities that result in positive youth development.
- New contributions in the field of youth development regarding effective practices.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- California youth are better prepared to participate in their communities.
- California youth assume critical leadership and citizenship roles.

**Target Opportunities for 2006-2007:**

- Developing and evaluating effective practices to improve citizenship, leadership, and life skills development of California youth.
- Developing and/or evaluating effective practices to improve agricultural, environmental and/or science literacy of California youth.

## **Medium-Priority Core Issues**

### **Childhood Obesity**

**The significant issue for California:** The number of overweight children has almost tripled since 1970 in California; the development of associated serious, life-long health, economic and social problems are significantly increasing with this epidemic.

Thirty percent of children and adolescents are overweight or at risk of becoming overweight. At the same time, health problems associated with this condition (e.g. - type 2 diabetes, asthma, and sleep apnea), poor self esteem, and social isolation have become more prevalent. Physicians across the state have expressed alarm at the deteriorating health of children due to poor dietary intake and sedentary lifestyle. Parents and professionals concerned about the health of children need guidance as to how to address this problem without increasing body dissatisfaction, low self-esteem, stigmatization of obesity, and eating disorders. Children of minority populations (Native Americans, Hispanics, and African Americans) and disadvantaged families (families in poverty) are at especially high risk of becoming obese, contributing to health disparities across different racial groups.

**ANR's role:** Through research and extension, ANR is guiding the design, implementation, and evaluation of multifaceted and integrated actions that can reduce the prevalence of childhood obesity.

The priority components of the obesity issue that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Understanding food choices and their impact on childhood obesity.

- b. Effectively promoting behavioral change relative to healthy diets and exercise

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Decreased youth consumption of soft drinks and foods of low nutrient value and increased consumption of fruits and vegetables at home and in schools.
- High-risk families consuming healthier diets and becoming more physically active.
- Adoption by health professionals of “health at every size” approaches focused on lifestyle changes rather than solely on weight when working with children.
- Decreased disparity among ethnic groups with respect to health concerns.

**Impacts:** ANR’s research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Fewer obese children.
- Improved overall health and wellness of children due to decrease in obesity associated health problems.
- Decreased health care costs.

**Target Opportunities for 2006-2007:**

- Understanding food choices and their impact on childhood obesity.
- Developing and/or evaluating techniques for effectively promoting behavior change to reduce childhood obesity.

## **Human Nutritional Status**

**The significant issue for California:** Nutritional status of citizens is critical with five of the top ten fatal diseases (heart disease, cancer, stroke, diabetes, and liver disease) directly related to poor diet, inactivity and obesity.

Poor food choices and feeding practices impact maternal and child health and contribute to undesirable birth outcomes, nutritional deficiencies, slowed child growth, increased infections, and childhood anemia and obesity. At long-term follow-up, individuals with very low birth weight tend to lag behind academically, with fewer graduating from high school and college. Research also demonstrates that poor nutrition during pregnancy predisposes the infant to chronic health problems later in life. Research has shown that children do not eat enough fruits and vegetables, and most of the servings they do eat come from either fruit juices or fried potato products. Only 2 percent of youth meet all the recommendations of the USDA and 16 percent do not meet any of the USDA dietary recommendations. More than 60 percent of the U.S. adult population is now overweight and about one-third is obese. Obesity increases the risk of chronic diseases, including type 2 diabetes, cardiovascular disease, and other health problems. Lifestyle changes can prevent or delay the onset of these problems in high-risk populations. Developing and maintaining a healthy lifestyle that includes the consumption of fruits and vegetables can be started early in life to help reduce the risk of chronic disease.

**ANR's role:** ANR research and extension education programs focus on factors related to nutritional make up of food, food consumption patterns in different ethnic and socio-economic groups and farm-to-fork food related topics. Nutritional status problems can be addressed with appropriate education and other community interventions. Educational interventions that modify lifestyle factors are cost-effective approaches that ANR has pioneered with various groups.

The priority components of human nutritional status that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Understanding the biological and socio-economic aspects of nutrition for children
- b. Developing management plans for specific categories of at-risk populations that will promote behavior change for chronic-disease prevention.
- c. Understanding the impact of food choices on nutrition and health

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Increased knowledge and understanding among health professionals and paraprofessionals of the factors associated with poor nutritional status and its consequences.
- Increased breastfeeding and healthier children, with California mothers meeting the U. S. Department of Health Services goal for the year 2010 with respect to breastfeeding: i.e. 75% of mothers initiate breastfeeding, 50% breastfeed for at least 6 months and 25% still breastfeeding at one year.
- Increased intake of fruits and vegetables by children.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Projected cost savings to public and food assistance programs ranging from \$3,442 to \$4,944 per family as a result of increasing duration of breastfeeding to at least six months in low-income Southeast Asian women.
- Reduced maternal and infant morbidity and mortality among all segments of the population.
- Delayed or reduced onset of chronic health problems related to poor nutritional status in the adult population.
- Reduced nutrition-related health disparities among different ethnic groups.

## Low-Priority Core Issues

### Community Development

**The significant issue for California:** Communities, large and small, are struggling to remain solvent and maintain the quality of life for their residents.

There is a continuing need to promote self-sustaining, long-term economic and community development in rural and other areas throughout California. It is important to demonstrate how communities can achieve self-sufficiency through innovative and comprehensive strategic plans developed and implemented at a grassroots level by empowered citizens. Continued local involvement and decision making supported by partnerships among private, public and nonprofit entities contribute to vital communities. Youth need the opportunity to become involved in the activities of their communities and communities need the perspective of youth in their community decision-making processes. The participation of community residents cannot be taken for granted, especially if individual families do not have a tradition of involvement or residents come from countries or communities where full participation was not allowed. The development of civic engagement skills and an ethic of service need to be deliberately nurtured among the youth of California if strong self-governing communities are to be maintained.

The ability of communities to respond to critical economic and social issues is complicated by growing populations, greater demands on schools, limited resources, lack of health services, utility systems, a growing shortage of affordable housing, and concerns for resource use and allocation. The ability to respond to these challenges depends upon active cooperation between community businesses and government, the nonprofit sector, agriculture, researchers, educators and community members.

**ANR's role:** There are aspects of community development that will continue to be important to ANR programmatically. These important research and extension areas of community development include the socioeconomic aspects of rural development.

No components of the community development issue were identified as areas for allocation of additional resources in the next 3 to 5 years.

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Community-based organizations in which youth take an active role in determining the goals and actions of the organizations and have the opportunity to practice both the rights and responsibilities of membership.
- Strengthened links between community engagement and academic learning as demonstrated by service learning efforts.
- Heightened awareness within communities of the value of youth and the important contributions they can make in public life.
- Greater importance placed on the value of civic engagement by youth.

**Impact:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Greater and more diverse numbers of youth participating in civic life such as providing leadership for and/or active membership in formal and non-formal organizations, holding elected and appointed offices and providing service to others in their communities.
- Communities in which all segments of the population are represented in participatory decision-making, therefore leading to strong and healthy communities.

### **Family and Consumer Well-Being**

**The significant issue for California:** Many individuals and families are experiencing financial crisis due to low income, inadequate money management skills, limited savings, too much debt, and poor planning for potential major life events.

California has the largest general population and welfare population of any state in the nation. Additionally, there is a high number of immigrants from many different cultures who speak little or no English. The overall well-being of many individuals in the state is of concern as support programs are reduced or eliminated. More than half of Americans report living paycheck to paycheck. The average household carries about \$8,000 in credit card debt—up two-thirds compared to a decade ago. During the past decade, the rate of personal bankruptcy in the U.S. rose by 69 percent. There is a need for additional knowledge, skills, and motivation to build financial security and to strengthen the capacity of families and individuals to create and maintain self-sufficiency.

**ANR's role:** ANR extension programs target youth, financially vulnerable populations, and consumers making financial decisions through their lifetime. Programs focus on behavioral change, starting with achieving financial self-sufficiency. The ultimate goal, financial self-sufficiency and improved family and consumer well-being, is the cornerstone of prosperous communities, nurturing neighborhoods, and strong families. Important research and extension areas of family and consumer well-being include developing and extending management solutions to improve literacy in agriculture, environmental science, and resource management.

No components of the family and community well-being issue were identified as areas for allocation of additional resources in the next 3 to 5 years.

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Improved attitudes, understanding and skills in financial self-sufficiency.
- Increased number of Individual Development Accounts opened.
- Higher credit scores.
- Increased number of checking, savings, and IRA accounts opened.
- Increased adoption of improved resource management practices and improved utilization of the food dollar by low-income and underserved populations.

**Impacts:** ANR’s research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Increased number of financially literate, self-supporting consumers.
- Decreased time spent resolving credit and related financial issues.

## **Food Security**

**The significant issue for California:** Ensuring access to affordable, nutritious, and culturally appropriate food for all people of California.

A fundamental indicator of a society’s health is secure access to nutritious food. All adults should be secure in their ability to feed themselves and their children. If food security is a measure of a healthy community, the presence of food insecurity reflects failure in meeting this most basic need. Lack of assured access to enough food through socially acceptable means, is technically termed “food insecurity” by the U.S. Department of Agriculture. In its extreme form, food insecurity results in hunger—going without food. Those who are food insecure yet not experiencing hunger are considered to be at risk for hunger. In Los Angeles County alone, the state’s most populous county, almost one out of three low-income adults (29.8%) frequently cannot afford to put food on the table. This means that about 775,000 are classified as “food insecure” in just one county in the state—this number includes 160,000 children.

**ANR’s role:** Important research and extension areas of food security include the legislative, regulatory, and policy related issues.

No components of the food security issue were identified as areas for allocation of additional resources in the next 3 to 5 years.

**Outcomes:** ANR research and extension activities in this issue are expected to lead to:

- Improved access to nutritious, economical, safe, high quality food for all families so hunger will be reduced.
- Reduced obesity as access to healthful food is increased.

**Impact:** ANR’s research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Increased access and consumption of affordable and nutritious food resulting in improved health for all, especially families with limited resources

## NATURAL RESOURCES AND ANIMAL AGRICULTURE PROGRAM AREA

### High-Priority Core Issues

#### Water Quality

**The significant issue for California:** The availability of high-quality water for all beneficial uses.

California has 685 water bodies listed as impaired under the federal Clean Water Act of 1972 based on the 2002 Section 303(d) list. This represents 456,338 acres of bays and harbors, 119 miles of coastal shorelines, 99,857 acres of estuaries, 255,465 acres of lakes and rivers, 26,545 miles of rivers and streams, 291,761 acres of saline lakes, 66,672 acres of tidal wetlands and 73,598 acres of freshwater wetlands. Contaminants that impair water quality and potentially threaten human health identified in these water bodies include nutrients, pesticides, sediment, and bacteria. Temperature and sediment threaten spawning and rearing habitat for salmon and other aquatic species, and degradation of riparian habitat compound these impairments to beneficial uses derived from clean water. Beneficial uses include water for drinking, bathing and recreation, wildlife and fisheries habitat, agricultural uses include allocation to crops and consumption by domestic animals.

**ANR's role:** Research and extension education on biological and physical aspects of water quality, the economic and social activities that affect water quality and solutions to prevent or mitigate water quality problems.

The priority components of water quality that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Microbes and pathogens
- b. Sediment
- c. Pesticides
- d. Nutrients
- e. Agriculture production practices
- f. Timber production practices
- g. Livestock production practices

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Improved water quality knowledge and management techniques for agricultural and natural resource managers, as well as response and compliance approaches for municipalities to cope with waste-water discharge requirements.

- Improved monitoring procedures and systems to record and document water-quality trends over time.
- Increased systems approaches and collaborative interaction among water stakeholders in maintaining water quality at the watershed level.
- Reduced water conflicts that escalate and require court intervention.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Increased clean water, environmental health and high functioning aquatic, coastal marine and riparian habitats.
- Reduction in the number of impaired water bodies throughout California.

**Target Opportunities for 2006-2007:**

- Developing and evaluating management practices for reducing microbes, pathogens, sediment, pesticides and nutrients from irrigated agriculture and dairies.
- Developing and evaluating accurate and economically feasible water-quality monitoring technologies.

## **Medium-Priority Core Issues**

### **Air Quality**

**The significant issue for California:** The negative impacts of air pollutants on humans, plants and animals.

The negative impacts of air pollution include crop injury, global warming, plant and animal biodiversity shifts, human health impairment and others. Generation of particulate matter (PM) and photooxidant gases from farming and livestock operations can be significant contributors to air pollution including ozone generation, reducing crop yields, impairing human health and contributing to other environmental impacts.

**ANR's role:** Research and extension education related to increasing the understanding of the biological and physical aspects of air quality, including sources, characteristics, movement and mitigation or prevention of air quality problems.

The priority components of air quality that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Air pollutants generated from animal production
- b. Air pollutants generated from crop production

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Improved, research-based pollution control practices incorporated into air quality regulations.
- Increased knowledge and use of pollution control/prevention practices among growers, producers and related agricultural industry members.
- Accurate, research-based inventory of agricultural elements affecting air quality and pollution developed by the California Air Resources Board.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Significant and measurable improved air quality in California.
- Improved health of Californians suffering from air quality-related health problems.
- Economic benefit due to reduction in the cost of medical care, lost work hours and deaths due to air quality-related illness and disease.
- Improved agricultural productivity.

**Target Opportunities for 2006-2007:**

- Developing and/or evaluating management practices for reducing air quality impacts from agriculture.
- Developing and/or evaluating accurate and economically feasible air quality monitoring technologies.

## **Land Use**

**The significant issue for California:** Land use decisions that serve the long-term welfare of citizens, consumers and communities.

California is the most diverse, populous and rapidly growing state, leads the nation in the value and diversity of agriculture, and contains an enormous diversity of ecosystems. As a result, land use conflicts are frequent throughout the state. Land use decisions can and have resulted in loss of plant and animal species, open space and wildlife, deterioration of water quality, increased dispersal of invasive species, and habitat fragmentation.

**ANR's role:** Research and extension education related to increasing the understanding of the biological, economic, social and physical aspects of land use, including urban and rural uses and trends, characteristics of land use planning and policy approaches and issues, mitigation or prevention of land-use related problems.

The priority components of land use that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Invasive species
- b. Viability and sustainability of agriculture
- c. Urban/rural interface
- d. Habitat fragmentation

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Reduced incursions of invasive species in urban and rural settings.
- Increased knowledge of land managers and decision-makers about negative effects and long-term implications of habitat fragmentation and poor land-use practices.
- Increased knowledge and use of research-based guidelines for improved and ecologically sustainable land management on farms, urban landscapes, watersheds, natural areas and urban/rural interface locales.
- Reduced conflicts and costs associated with urban/rural interface issues.
- Increased use of agricultural and natural buffers by landowners, land managers and land-use planning officials.
- Increased planning and implementation of habitat restoration projects.
- Increased implementation of habitat conservation plans by land managers, planning officials and developers.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Increased biodiversity.
- Cleaner air, soil and water associated with improved land use practices.
- Sustainable open space and natural habitat for the environment, recreation and wildlife.
- Sustainable agricultural, natural and urban systems in California.

## **Sustainable Use of Natural Resources**

**The significant issue for California:** The sustainability of ecosystems that provide products, recreation and habitat.

Sustainable use of natural resources incorporates management approaches that maintain critical ecosystem conditions on a landscape scale over the long term. Sustainability implies the use of resources that will allow the indefinite survival of ecosystems and associated plants and animals. Implicit in the persistence of ecosystems is the concept that species will not be driven to extinction, the balance of individual populations will be maintained, and natural resources will be managed so they will not be exhausted.

**ANR's role:** Research and extension education related to increasing the understanding of the biological, economic, social and physical aspects of the sustainability of natural resources in California, including management practices that promote ecological sustainability along with

economic opportunity on a landscape scale, characteristics of natural resources-use planning policy approaches and issues, mitigation or prevention of natural resource use related problems.

The priority components of the sustainability of natural resources that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Plant physiology and ecology effects on natural resource sustainability
- b. Ecologically sustainable natural-resource management practices
- c. Landscape-scale planning and management practices
- d. Economic opportunities and sustainable natural resources production

**Outcomes:** ANR research and extension activities in this issue will lead to:

- Improved knowledge and use of ecologically sustainable natural resources practices by land managers, decision-makers, industry members and consumers.
- Broader awareness of effects and implications of loss of habitat, sensitive species, disruption of nutrient cycles, and overall ecological systems on natural and human systems.
- Increased knowledge and use of research-based guidelines for improved and ecologically sustainable land management on farms, urban landscapes, watersheds, natural areas and urban/rural interface locales.
- Increased knowledge and adoption of ecologically sustainable production practices resulting in economic growth and profit for natural resources industries.
- Reduced conflicts and costs associated with natural resources use issues.

**Impacts:** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Increased biodiversity.
- Improved economic growth and productivity of the natural resources industry in California.
- Reduced natural resource system failure and related economic, environmental and social losses.
- Cleaner air, soil and water associated with improved natural resources use practices.
- Sustainable open space and natural habitat for the environment, recreation and wildlife.
- Sustainable agricultural, natural and human systems in California.

**Target Opportunities for 2006-2007:**

- Developing and/or evaluating the effectiveness of management practices that promote ecological sustainability.
- Developing and/or evaluating the effects of management practices that promote economic opportunity in sustainable natural resource production.

## **Water Supply and Allocation**

***The significant issue for California:*** Providing the necessary quantity and timing of water distribution to benefit human, agricultural and ecosystem uses.

California's future prosperity is tied to effective management of available water for the values and benefits held by its citizenry. Proposed development, population growth, agricultural production, and ecosystem sustainability in California are dependent on reliable sources of high quality water. Water supply reflects the amount of water available for human, agriculture and ecosystem uses over time, and water allocation represents the timing and distribution of water.

***ANR's role:*** Research and extension education on the biological and physical aspects of water supply and allocation and the economic, political and social activities that affect water supply and allocation and solutions to water supply and allocation problems.

The priority components of water supply and allocation that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Water quality throughout water distribution systems
- b. Water use efficiency and conservation practices

***Outcomes:*** ANR research and extension activities in this issue will lead to:

- Improved public awareness of value and importance of efficient water-use technologies, ecosystem water requirements and efficiency in collection, storage and transport of water.
- Increased adoption of efficient water-use technologies.
- Development of water markets that sustain agriculture, domestic, commercial and environmental functions/services.
- Development of criteria for guiding water allocation and use policies that enable increased recycling and efficiency of water use.
- Timelier and less conflictive resolution of water allocation decisions based on research-based information and better informed and engaged stakeholders.

***Impacts:*** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Sufficient water supplies for sustainability of California's growing urban population, agricultural viability and ecosystem needs.
- Reduction in failure of water supply and allocation systems and related economic, environmental and social costs.

## **Wildland Fire**

***The significant issue for California:*** The human, environmental and economic impacts of fire.

Fire management systems require several approaches based on a greater understanding of fire behavior, the ecological role of fire in natural systems, ecosystem health, and fire suppression strategies. Fire and fuels management directly affect water and air quality, and have impacts on habitat, invasive species expansion, and other areas.

***ANR's role:*** Research and extension education on biological, ecological and physical aspects of wildland fire and the economic, political and social activities that affect wildland fire and solutions to wildland fire problems.

The priority components of wildland fire that ANR research and extension programs need to address and which should be considered for additional resources in the next 3 to 5 years include the following:

- a. Water quality
- b. Air quality
- c. Fuel management strategies
- d. Ecology and role of wildland fire
- e. Wildland fire risks and safety

***Outcomes:*** ANR research and extension activities in this issue will lead to:

- Improved knowledge and adoption of innovative fuel-management practices to reduce the cost of fire suppression and rehabilitation.
- Improved public understanding and implementation of science-based fuel management policies.
- Improved public understanding of risks associated with wildland fire and adoption of related prevention/safety practices.

***Impacts:*** ANR's research and extension activities in this issue area will contribute to the following payoffs and benefits to society:

- Decrease in the number of acres burned by wildfires.
- Decreased wildfire suppression costs, lower fire insurance premiums.
- Improved wildlife habitat, air and water quality.
- Improved public safety and decrease in death, injury and losses related to wildland fire.