

Healthy Families & Communities Strategic Plan: 2016 Update

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Introduction

In 2009, the UC Division of Agriculture and Natural Resource finalized the Strategic Vision: 2025, after an extensive period of consultation with stakeholders and citizens throughout the state. The document articulated the broad, long-term goal of working with our partners to help California ensure a safe nutritious food supply, conserve natural resources, promote health, and enhance economic prosperity. Nine multidisciplinary, integrated strategic initiatives were identified, five of which have been selected for ongoing activity to date. These initiatives reflect the division's considerable infrastructure and expertise along with the opportunity to pursue new ways of partnering within and outside UC to find solutions and realize opportunities for California communities.

Healthy Families and Communities (HFC) is one of the five Strategic Initiatives currently operational, drawing on the diverse strengths of the division in programs serving youth, families, and communities. The initial strategic plan for the HFC initiative was adopted in fall 2010, after a year-long planning process. This updated strategic plan represents the first opportunity to revise the original plan since that time. It draws on input received at the ANR statewide conference in fall 2015, which gathered information about the perceived strengths and limitations of the earlier plan. The HFC panel subsequently drafted a revised strategic plan and received feedback at a Strategic Initiative meeting in fall 2016.

For reference, the original HFC strategic plan which includes a list of academic books and articles that supports the HFC initiative priorities and be found at <http://ucanr.edu/sites/StrategicInitiatives/files/202847.pdf> . For a partial list of ANR publications and resources related to the HFC initiative, see <http://ucanr.edu/sites/californiaagriculture/files/157861.pdf>

Four Initiative Priorities

The revised plan reaffirms the original three HFC initiative priorities, with key modifications, while also adding a fourth integrative priority in the area of community development and public policy. The new plan thus encompasses four intertwined areas of emphasis under our broad mandate to promote health and well-being at multiple scales (individual, family, community, region, state) and across all racial, ethnic and socio-economic groups:

- Community Development and Public Policy (its own area of emphasis, but also woven throughout the other three)
- Food Literacy and Healthy Lifestyles
- Positive Youth Development
- Scientific Literacy (youth and adult)

In pursuing this work, the panel is committed to address cutting edge public priorities by integrating work across all four HFC priorities. Recognizing that healthy communities do not exist in isolation of healthy natural environments and thriving local and regional economies, we also are committed to working with the other four ANR strategic initiatives (e.g. water, sustainable food systems, sustainable natural ecosystems, and endemic and invasive pests and diseases), as well as with our partners throughout California and beyond. Systems thinking and a holistic perspective on problems and solutions should undergird all aspects of our work, which is located at the critical nexus of agriculture, environment, food, health, and the economy. The best thinking from all these areas must inform our applied research and community extension activities.

The four areas of programmatic focus were thoughtfully chosen using the following criteria:

- Builds on existing ANR strengths and resources;
- Creates visible, tangible public value;
- Is multidisciplinary with coordinated outcomes;
- Uses integrative approaches to connect with the other four strategic initiatives;
- Draws on existing research and best practices;
- Can attract increased outside funding; and
- Supports engaged scholarship to inform decision-making and public policy

We anticipate our implementation of this plan will lead to the following outcomes:

- Facilitating strong connections, thoughtful and innovative problem-solving among internal and external stakeholders;
- Creating public value with tangible impacts;
- Eliciting the enthusiastic participation of ANR personnel and partners, including new and cross-disciplinary relationships;
- Attracting outside funding to support work of the division and its many state and community partners; and
- Forging effective partnerships that lead to the development of science-based decision- and policy-making

The following sections provide a more detailed description of work within and across each of the four integrated priority areas.

Community Development and Public Policy

Cooperative Extension's historic mission is to promote democratic participation in civic life, helping local residents gain the power and means to shape their lives, families, and communities. In contemporary communities, democratic engagement is critical to pursuing the health and well-being of families and individuals. Community development and public policy work in extension has two faces: 1) it is an integrative dimension of *all* extension programs, which evolve in response to community needs or goals and are shaped by public policy priorities, conflicts, and processes; and 2) it is a particular area of extension focus and expertise, to which a smaller number of specialized extension professionals devote their full programs.

Whatever their particular area of expertise, Cooperative Extension Advisors and Specialists create public value by catalyzing innovation and community change—building strategic partnerships, developing long-term relationships, facilitating networks, informing public policy, and providing focus and direction for community coalitions. This requires that extension advisors have a seat at the table in local, regional, or state planning processes and are actively building relationships with elected officials, department heads, staff in both public and nonprofit agencies, as well as with industry and private businesses. This “relational work” and community leadership is a key historic strength of Cooperative Extension and must be valued and supported throughout our organization, particularly in merit and promotion processes.

The intertwined initiatives in our Healthy Families and Communities initiative are designed to provide sound technical knowledge and a research-base to support innovation, while respecting the autonomy of local communities and the particular nature of their historical, social and political context. A key underlying strategy for our work is community capacity building, not only with geographic communities but particularly with underrepresented groups, new cultural audiences, or other communities of identity or interest.

Areas of Inquiry and Applied Work

Research and education aimed at changing individual behaviors must be complemented by a deliberate focus on the community structures and policy choices, which facilitate or impede needed changes. For example, nutrition education work must be joined with efforts to improve access to healthy foods or to providing parks, gardens and other amenities that promote physical activity and fitness. Youth must be seen not just as objects of programs but as contributors whose voices can help cities design parks, adjust public transit schedules, or make decisions about school food and environmental policies, for example. Family programs and services, such as housing or child care, must not only be present but fully accessible given transportation options and other aspects of the local infrastructure.

Within the community development area, specialists and advisor programs include (among many other possibilities):

- supporting community economic development and workforce development;
- informing and integrating local and regional food systems;
- promoting civic engagement by youth and adults;
- facilitating child care coalitions and other family support initiatives;
- expanding family and community financial literacy and security; and
- catalyzing community coalitions, helping them with both content information on particular policies but also with knowledge about coalition building practices and civic engagement processes.

In the realm of public policy, particular extension roles include:

- equipping communities and individuals with the data they need to advocate for sound, equitable public policy;
- convening and/or facilitating discussion of public issues;
- helping forge constructive debate and community consensus;
- informing the policy making process at a number of entry points, ranging from agenda setting, to

policy formation, to implementation, all the way through to evaluation, for example by;

- providing research to identify and highlight priority issues for policy-making,
- informing options about the best strategies to implement new programs, and
- providing evidence as to how or why existing policies should be continued, revised or terminated.

Community development and public policy activities can integrate with the other priorities in the Healthy Families and Communities initiative: food literacy and healthy lifestyles, positive youth development, and scientific literacy. In each of these domains, local governments and communities face challenges of inclusion, equity, and responsiveness. Extension personnel help in a wide variety of specific ways, providing information or connections to support community priorities. Among many other examples, this can include:

- 4-H Youth Development Advisors facilitating the work of a local Youth Commission or building the capacity of parents to be active and informed community volunteers;
- Family, Nutrition, and Consumer Science Advisors promoting youth financial literacy, informing school wellness policies, or catalyzing community strategies to curb obesity or improve community food literacy and security;
- Master Gardeners and advisors supporting community or school gardens and related learning opportunities.
- County Directors responding in a timely fashion to requests from the Board of Supervisors for information or access to experts on a particular issue.

Anticipated outcomes and impacts

The desired outcome of this priority is much the same as the overall outcome of the Healthy Families and Communities initiative: to improve the health and well-being of individuals, families, and communities throughout California. As such, desired community development and public policy outcomes intersect with desired outcomes in our other three HFC priority areas, as described in later sections of this document. Among many other potential outcomes, our work in this area should result in many of the following:

For Individuals:

- Youth and adults will increase their level of participation in civic affairs and public life, including participation in the political process at all levels.
- Youth will be prepared to enter the workforce, reducing the number of young adults who are out-of-school and out-of-work.
- Volunteers in youth, nutrition, and Master Gardener programs will build their leadership capacity, taking ownership of community programs and feeling empowered to make other civic contributions.
- Youth will gain tools to engage in action research that informs the work of youth-serving institutions.

For Families

- Families will have the tools to access and navigate the system of social supports in their community.
- Families will have equitable access to food, to positive youth development programs, to science-based information, and to healthy living opportunities.

For Communities:

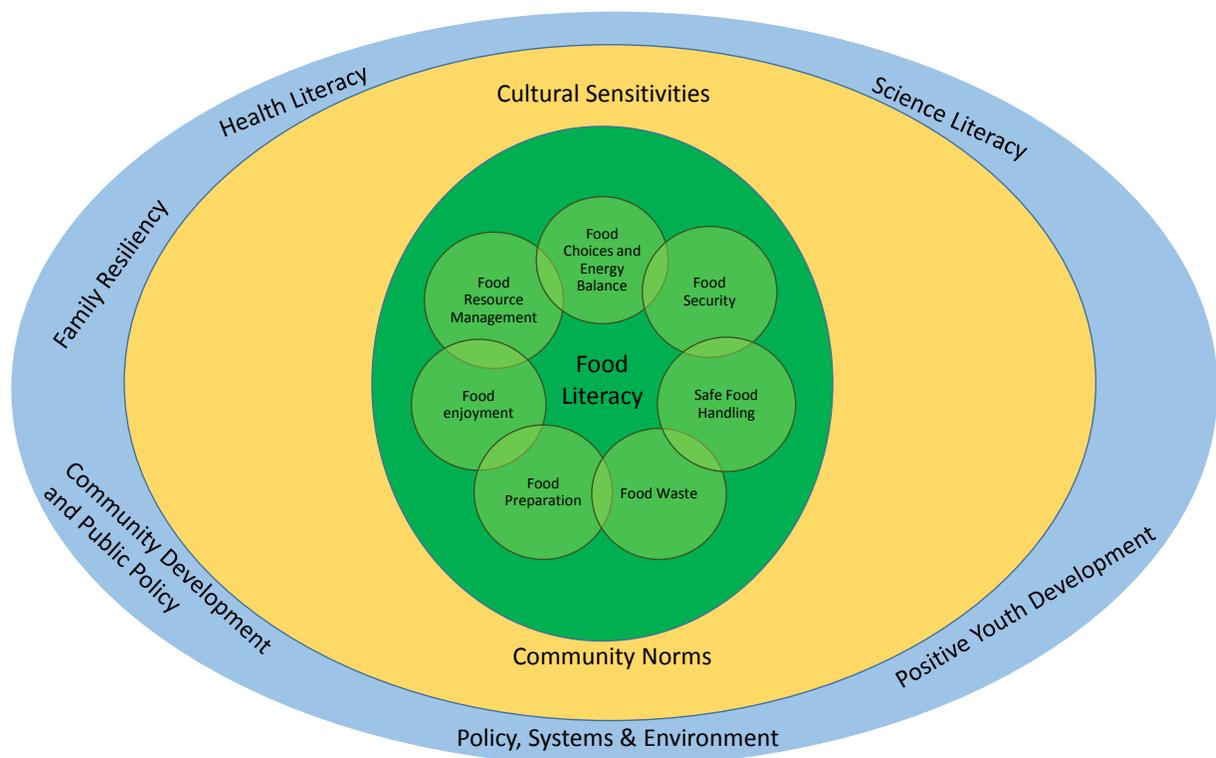
- School and community policies will have been put in place to sustain healthy food and activity environments.
- Community planning processes will incorporate healthy living, food access, scientific knowledge, and youth engagement as key priorities.
- The number, sophistication, and policy impact of civic bodies like Food Policy Councils in California will increase, or there will be other signs that local coordination of resources is being enhanced.
- Rural communities will have increased access to university resources as they pursue community economic development strategies, particularly resource-related strategies that can draw on ANR expertise in agriculture and natural resources.
- Urban communities will look to ANR as a conduit to science-based information on the state's agriculture, natural, and human resources in order to move ideas and plans into action.

For ANR and the Cooperative Extension System:

- ANR personnel will increase their degree of familiarity with the public policy process so that their research is more likely to be used and have impact.
- All community groups will recognize Cooperative Extension as a critical community resource as they attempt to organize, convene, and deliberate over various issues and opportunities.
- Local government support for UCCE offices and programs will increase.
- Local Cooperative Extension Advisors will be even more integrally involved in local coalitions to improve systems or coordinate services, often in leadership roles.
- The Cooperative Extension System will maintain and enhance its strong legacy as a partner with local communities and their leaders, adapting to new program areas as warranted.

Community development and public policy themes connect with each of the other three priorities in our revised HFC strategic plan, as articulated in the sections below.

Food Literacy and Healthy Lifestyles



Cooperative Extension’s mission has from its very beginnings sought the betterment of farm, home, and community life. Indeed, while times have changed significantly, many early extension efforts such as those to promote family or community gardens and to build skills in canning and food preservation are undergoing a remarkable revival in interest. Interest in nutrition education has been a common thread throughout the past century of extension work, though the content and forms of delivery of science-based nutrition information is continually evolving.

The 2010 HFC strategic initiative plan selected as a priority the development of strategies to promote healthy behaviors for childhood obesity prevention. Subsequently, the UC Division of Agriculture and Natural Resources Competitive Grants Program funded a number of projects addressing this priority, including a major, multi-year grant addressing the question: To what degree does a multifaceted, multi-

level, school-centered environmental intervention targeting culturally diverse children promote healthful dietary and activity habits, reduce obesity and support more regional agriculture? Follow-up evaluations of the grant funded projects found substantial, beneficial impacts, including measurable reductions in childhood obesity. Further, the evidence shows that the projects have begun to impact public policy. One example is by helping schools implement existing school wellness policies or by providing evidence to support the expansion and further development of farm-to-school activities or community nutrition efforts.

While childhood obesity is still of great concern, this revised strategic plan seeks to promote a broader culture of health and food literacy across the developmental spectrum, for young children to aging adults. In part, this shift reflects what we have learned to date about the interrelated nature of making changes in this area, for example the need to involve parents and families in programs focused on childhood obesity. In part, it also reflects the reality that a range of food and lifestyle choices and related environmental conditions are among the leading causes of chronic diseases, such as diabetes, hypertension, heart disease and cancer, which for the first time in history exceed communicable disease at the forefront of global health concerns. Estimates suggest that nutrition and lifestyle-related conditions are responsible for 75% of all health care costs and threaten quality of life, function and emotional well-being.

They are also highly modifiable with lifestyle improvement addressing nutrition and physical activity. It is imperative that science-based programs and messages are delivered to county clientele and the general public to promote comprehension of tested recommendations and realistic strategies for improvement in nutrition, physical activity, health and quality of life. The health of individuals and communities improves when chronic disease is prevented in the first place, and can be modified with behavioral health interventions when chronic conditions occur. The opportunities for effective interventions are extensive, building on and expanding our existing capacity to comprehensively address the issues in partnership with government, nonprofit, and private stakeholders. While low-income populations are at greatest risk of poor nutrition and associated health consequences, all segments of the population are affected and should be considered as part of UCCE programs. Greater capacity is needed to comprehensively address these issues across the state and communicate with external stakeholders. Without substantial progress in these areas social and economic costs related to obesity, diabetes, heart disease and other nutrition related-chronic health problems continue to be projected for California's future.

Areas of Inquiry and Applied Work

To focus our efforts on this priority, we have chosen the integrating concept of food literacy. As stated in the Cooperative Extension's National Framework for Health and Wellness, "Improving the health of the nation requires working across systems. For example, efforts to promote healthy eating are not likely to be successful without considering the process by which food is produced, distributed, and marketed" (Braun et al., 2014). *The concept of **food literacy** incorporates a multitude of factors that build upon each other and interact to promote an understanding of food, nutrition, and health. While there are several definitions of food literacy, we are using the definition of food literacy as the platform that empowers individuals, households, communities or nations to protect diet quality*

through change and to strengthen dietary resilience over time. Each component is an important piece, which strengthens one's relationship with food leading to greater overall resilience. It is composed of a collection of inter-related knowledge, skills, and behaviors required to plan, manage, select, prepare and eat food that is founded on evidence-based recommendations for healthy diets for individuals throughout the lifecycle. This will include food resource management, safe food handling practices, with a goal of reducing food waste and increasing food security. (Vidgen, H. and Gallegos, D., 2014). Food literacy informs food choices that take into account a wide range of factors, from personal health, to environmental impacts, to economic arrangements.

Evidence-based interventions facilitated and delivered in a way that considers community, family and individual norms and beliefs are the hallmark of Cooperative Extension programs (Braun et. al., 2014). UC ANR has been conducting research, outreach and education to support these principles of food literacy for years.

Moving forward, UC ANR will play a leadership role in:

- Formulating concrete recommendations for improving food literacy and physical activity opportunities in counties across California, working with youth and their families, schools, youth-serving organizations, recreation departments, and other community partners;
- Creating and evaluating comprehensive school and community interventions in counties across California;
- Collaborating with local planners and policy makers to provide science-based assistance to inform strategic policy decisions benefiting all Californians;
- Conducting policy relevant research involving chronic disease prevention, nutrition for high risk populations (maternal health and senior health), and community food security.

The complex issues surrounding food literacy and healthy lifestyles issues require working across disciplines using systems thinking. Among the strategies we will use to accomplish this are:

- Integrating nutrition, agriculture, youth development, parenting, and community development through linking all parts of the ANR network at the campus and community levels;
- Nurturing collaborative efforts among colleagues in nutrition, community and child development, sustainable food systems, medicine, nursing, education and science literacy to successfully address issues that directly impact the nutrition and health status of California's population;
- Connecting food literacy and healthy lifestyle themes with each of the other three priorities in the revised HFC strategic plan;
- Engaging in the efforts of the Sustainable Food Systems Initiative, specifically with small and mid-size farms and supporting greater consumption of Californian grown foods.

Essential to all UC ANR strategic initiatives is coalition building, community decision-making and organizational and policy development areas in which ANR academics can share expertise and learn from the public.

Targeted Outcomes and Impacts

Evidence-based strategies for change at both the individual and family behavioral, organizational, community, and policy levels should be documented, to derive intervention models tested for effectiveness and with clear definitions of success. Food security, chronic disease prevention and management, food safety, family resource management and family resiliency outcomes and impacts will be evaluated through individual, organizational, and community surveys and documentation of policies implemented. Dissemination of successes and translation of research to operational extension programs will be a high priority at all levels as described below:

Individual Change:

Youth, adults, and seniors will:

- Increase their food literacy knowledge, skills, and behaviors including their ability to identify healthy food and beverage choices and food systems;
- Follow recommended dietary guidelines to improve diet quality;
- Manage resources and stretch their food dollars or purchase healthy and nutritious foods on a restricted budget;
- Prepare healthy meals;
- Follow basic food safety practices;
- Reduce food waste; and
- Identify and modify behaviors and personal barriers and motivators for positive nutrition, health, and fitness outcomes.

Families will:

- Model appropriate child feeding practices;
- Increase family participation in nutrition-related activities (e.g. planning meals and food budgets, shopping for food, gardening, eating meals together);
- Experience food secure households;
- Participate in physical activities as a family; and
- Practice healthy behaviors and habits (e.g. wellness, community engagement, etc.).

Organizational and Institutional Change:

- Children, adults and seniors will have access to healthy foods and food systems through retail stores, farmer's markets and farm stands, schools; and community gardens;
- Schools will adopt methods to increase student participation in consuming healthy school meals;
- Schools will offer opportunities for daily physical activity and physical fitness scores will improve;
- Communities will have increased opportunities for physical activity at educational institutions and public facilities;

- Rural and urban population's concept of health will move beyond the facts and guidelines into the thoughtful practices of healthy behaviors to prevent and manage obesity and chronic disease.

Systems Change:

- School and community policies will be implemented and monitored to sustain healthy food systems and physical activity environments to prevent and manage obesity and chronic disease;
- Community planning processes will incorporate healthy living and food literacy goals and objectives;
- Professional development for UCCE staff and volunteers (4-H, Master Gardeners, and Master Food Preservers) will include food safety education, testing, and monitoring to prevent foodborne illnesses in extension programs;
- The Cooperative Extension System will become a recognized asset in helping communities achieve healthy living objectives.

Promoting Positive Youth Development

For over 100 years Cooperative Extension 4-H Youth Development programs have sought to promote civic engagement and leadership skills, learning how to learn, and the ability to cope with change, while providing a wide range of training opportunities. While many people associate this work with the 4-H Youth Development Program remains vital and important in California and the 4-H Youth Development Program is a model for positive youth development that is extended in our work with in-school and out of school time programs and through our influences on the curricula and programs of other youth-serving organizations.

A unifying goal for any state is to nurture all youth who enter adulthood prepared to thrive and to contribute to society through work, civic engagement, and nurture of others. Far too many California youth currently fail to reach their full potential. Each year, approximately 11% of California's youth do not graduate high school. The rate is 19% among African-American youth (Tolakson, 2016). Only 38% of the total population hold a bachelor degree or higher (US Department of Education, 2012); and 15.3% of Californians the people live in poverty (US Census, 2015). Approximately one of every six 16-24 year olds in the state is out of school and out of work. California has some of the biggest disparities in youth outcomes among any state and needs effective strategies that promote the developmental assets that support youth development and are associated with decreased risky behaviors. Promoting healthy pathways to college and work are urgent concerns, not only for the individual youth and their immediate families and communities, but for the state as it seeks to replace an aging workforce and remain economically competitive in the global economy.

Positive youth development is an intentional, pro-social approach that engages youth within their communities, schools, organizations, peer groups, and families in a manner that is productive and constructive; recognizes, utilizes, and enhances youths' strengths; and promotes positive outcomes for young people by providing opportunities, fostering positive relationships, and furnishing the support needed

to build on their leadership strengths. (Federal Interagency Working Group on Youth Programs, 2014)
In addition, youth development prepares youth to live in a diverse environment where cultural differences are valued and respected.

Cooperative Extension's 4-H Youth Development programs help youth by preparing them for college, work, and life. The program also provides a research laboratory to establish, refine and share effective youth development practices and to inform both policy and program implementation. UC 4-H Youth Development Advisors, Youth Families and Communities Advisors and 4-H Program Representatives establish, facilitate and participate in community networks and coalitions that promote education, training, coordination of resources, and policy improvements rooted in positive youth development theory. They provide access and entry to varied and diverse youth populations across California, helping anticipate demographic and social changes and challenges facing the state and nation.

Areas of Inquiry and Applied Work

Our commitment is to transform risk and uncertainty into positive youth development supported by thriving, resilient, adaptive communities. This revised plan seeks to continue and expand on work done over the past few years. Key issues we are addressing include: college readiness; work force preparedness; diversity, equity and inclusion; civic engagement (activism); health and wellness; authentic youth leadership (i.e., peer mentoring, conflict mediation); supportive relationships (youth and adult); and food systems (i.e., food security).

Research, education, and extension addressing the above issues and topics will take many forms, including the following:

- Develop innovative 4-H Youth Development Programs to serve all the youth population in the state, respecting and appreciating different cultural perspectives and heritage;
- Direct delivery of high quality positive of 4-H Youth Development program in diverse communities. Partnerships to support the delivery of high quality of 4-H Youth Development programs in diverse communities;
- 4-H Volunteer Development and management
- State and County program evaluations on effective implementation strategies, to secure informative and research based policy and budget decisions based on program level or community surveys capturing individual, family, and organizational changes;
- Manuscripts for publication in a peer-reviewed scientific journals and summarizing findings from new programs, processes and outcome evaluations;
- Be a national leader in 4-H Youth Development Programs.
- GIS maps comparing communities using the Center for Regional Change's Healthy Youth/Healthy Regions index of youth vulnerability/success;
- Document the science positive youth development and draw on the above products to capture key policy relevant findings for use at community, county, and state level decision-making; agenda setting, legitimation and evaluation.

The positive youth development approach can complement each of the proposed UC ANR strategic initiatives, both within and beyond the Healthy Families and Communities area. A few of the many possible

connections that hold the promise of forging tighter connections among agricultural, natural resources, and human resources advisors and specialist are:

- Collaborative projects that promote healthy behaviors and lifestyles, combining efforts to ensure that youth have access to quality food and to environments that promote physical fitness and activity with educational content around health, nutrition and fitness.
- Through a combination of relevant programmatic content with positive youth development practices, youth and young adults can be key contributors to UC ANR efforts related to environmental restoration and education, wildlife preservation, school and community gardens, local food systems, and small farm viability.
- Calling upon agricultural and natural resource advisors to introduce youth to scientific topics and ways of thinking as they are embodied in UC ANR initiatives related to climate change, land use, natural resources, food quality, animal health, etc.

Targeted Outcomes and Impacts

Our positive youth development work can be evaluated by tracking measurable changes in individuals, families, youth-serving organizations, and communities. We expect youth to increase their competence, connection, character, caring, confidence, contribution and resiliency. ***A key overarching outcome underlying all our work is the goal of reducing disparities so that all California youth have an equal opportunity to succeed.***

Individual change:

Using administrative data, program evaluations, and related research, we will determine if youth reached through 4-H:

- respecting diversity and culture differences
- reflect and take the actions required to welcome all ethnic, racial, socio-economic and cultural demographics groups of the state and the counties where we work;
- engage in school, improving their grades, and graduating at higher rates;
- develop leadership skills including public speaking and community engagement
- develop non-cognitive skills associated with increased college readiness and workforce preparedness;
- identify one or more personal interests, skills, and passions and connecting these to future work or civic engagement opportunities;
- face challenges with persistence;
- experience less conflict in their peer relationships (e.g., reduction in bullying, less loneliness);
- experience positive inter-group relationships (e.g., less stereotypical language, better race relations);
- become more emotionally stable (e.g., lower rates of depression, lower rates of chronic stress);
- develop a sense of agency;
- enjoy improved physical health (i.e., greater social support leads to lower chronic stress which leads to better physical health);

- possess a sense of purpose;
- participate actively in civic affairs.

Family and Organizational Change:

- more parents, caretakers, and staff/volunteers, from all the ethnic and racial backgrounds in youth serving organizations are trained in how to mentor and support thriving youth;
- school systems embrace positive youth development concepts and principles;
- decisions made by families, schools, and other youth-serving organizations put youth at the center of the conversation;
- 4-H is recognized as a leader and program model for positive youth development with UC and outside

Community Change:

Over time, and as a result of collective efforts, the achievement of positive youth development should result in an increase in the number of youth finding healthy pathways to adulthood and a corresponding decrease in the number of marginalized youth lacking access to important institutional supports. In partnership with researchers at the Center for Regional Change at UC Davis, we can now track and compare a number of key research-based indicators across place and time, including rates of:

- high school and college graduation;
- reduced poverty levels
- reduced income disparities
- youth of color graduating high school and pursuing higher education;
- youth engaged in (and leading) community service projects;
- young adults' gainful employment
- civic involvement (e.g., community service agents of community change, voting)
- emergence of representative resident leaders;
- voting;
- reduced racial/ethnic inequalities.

Scientific Literacy

Introduction/Background

Twenty-first century life offers a globalized world that is highly dependent on science and technology, and related political and economic decisions require sound choices made by an informed, population (Miller, 2006; NAS, 2007; Turiman, Omar, Daud, & Osman, 2011). Additionally, advancing the understanding of, attitudes toward, and perceptions of science are imperative for those individuals who endeavor to pursue careers in science and related fields (NAS, 2007). Furthermore, science is an essential tool for the future of human, ecosystem, and planetary health and wellness. Improved scientific literacy is critical to understand and mitigate threats to these systems.

Scientific literacy is an important individual, community, and societal goal (e.g., National Academies of Science, Engineering, and Medicine, 2016), and can be advanced through formal (e.g., school) and nonformal education programs (e.g., 4-H; afterschool programs; summer camps) (National Research Council, 2009). Furthermore, scientific literacy goes beyond knowing basic facts about science; current definitions of scientific literacy include understanding and using the processes and practices of science, interest in and attitudes toward science, and an ability to apply science in authentic ways, including civic engagement (National Academies of Sciences, Engineering, and Medicine, 2016; Smith et al., 2015).

For adults, most measurements of scientific literacy come from large public opinion surveys; when looking at these measures, it can be said that U.S. adults have positive attitudes toward science, perceive societal benefits created by science, and support scientific research (National Academies of Science, Engineering, and Medicine, 2016). Furthermore, these trends have remained consistent over several years. However, disparities related to scientific literacy exist among U.S. adults, with data revealing that White adults scored higher on science knowledge surveys than Latino and African American adults (Pew Research Center, 2015). These disparities are associated, in part, with the distribution of income and access to high-quality schooling, as well as foundational literacy (fluent use of words, language, numbers, and mathematics) (National Academies of Science, Engineering, and Medicine, 2016).

Among K-12 youth, low achievement has been found on large-scale assessments in science over many years (e.g., Baldi, Jin, Skemer, Greene, Herget, & Xie, 2007; Grigg, Lauko, & Brockway, 2006; Guzmán et al., 2004; NCES, 2012) and has prompted concerns over the future of the nation's economic and political security (NAS, 2007). From an international perspective, the U.S. ranked 19th in youth science performance out of 35 Organisation for Economic Co-operation and Development (OECD) countries in the 2015 Program for International Student Assessment (PISA) (OECD, 2016). Nationally, science scores from the 2015 National Assessment of Educational Progress (NAEP), the largest nationally representative and continuing assessment of U.S. students, revealed that youth from all grade levels measured (4th, 8th, and 12th) were at unacceptably low levels (NAEP, 2016). Furthermore, science achievement among youth from underrepresented audiences – African American and Latino – were shown to be markedly lower than White youth at corresponding grade levels; males outperformed females; and youth from high income families outscored low income youth (NAEP, 2016). In a state-by-state comparison of NAEP science scores, California 4th graders were tied for lowest performing among all states, and California 8th graders tied for 47th.

Land-grant universities are primed to help address the challenge of improving scientific literacy by engaging and empowering youth, families, and communities in developing practical, applied, and sustainable science-based solutions to local and global issues (e.g. climate change; water quality, quantity, and security; agricultural innovations; income inequality, food safety and security; environmental sustainability; environmental justice). The State of California's social, political, environmental, and economic landscapes provide a frontline context to 21st Century issues that require science and technology as a means to identify and implement constructive, sustainable solutions. People increasingly rely on digital communications to provide information rapidly to inform the solution-making process; however, the public's ability to navigate relevant science-based information, make sense of it and put it to use is deficient; therefore, helping to develop scientific knowledge and skills to use science in our everyday lives is critical. Additionally, science reasoning and process skills are essential for finding information, learning knowledge, and effectively communicating it in such a way that everyone can access what they need when they need it.

Work from UC ANR's Strategic Initiatives has been leveraged to help develop new and strengthen existing educational efforts to advance scientific literacy among youth and adults in California. Within UC ANR, scientific literacy is defined from the citizen's perspective, an approach that focuses on real-world issues and is defined around four anchor points: science content knowledge; scientific reasoning skills; interest in and attitudes toward science; and contributions through applied participation (Smith, Worker, Ambrose, & Schmitt-McQuitty, 2015). The four anchor points provide a consistent framework for developing educational programming and, with their focus on real-world situations, help center science education on issues of concern to citizens of California.

For youth audiences, efforts to improve STEM learning through California 4-H have advanced consistently since the introduction of the 2007 National 4-H Science Mission Mandate. Specifically, efforts have been made to expand STEM programming through California 4-H that is grounded in a positive youth development framework and utilizes hands-on, inquiry-based strategies that include opportunities for real-world applications. These experiences are guided by adults who have passion, interest and knowledge about science and act as volunteers, leaders, coaches, and mentors to provide opportunities for youth to explore and engage in science to further develop their interests, skills, and abilities. Furthermore, efforts in California 4-H that focus on healthy living, college, and career readiness, and expanding programming to reach culturally and ethnically diverse audiences complement and help enhance science education opportunities.

For adult audiences, scientific literacy is advanced through UC ANR efforts such as the California Naturalist Program, the Master Gardener Program, Project Learning Tree, and others. Specifically, the California Naturalist Program helps foster a diverse community of naturalists by engaging the public in the study and stewardship of California's natural communities. The Master Gardener Program serves to extend research-based information about home horticulture and pest management by training volunteers who conduct outreach to the general public throughout California. Project Learning Tree, a nationally-recognized program, engages adults to teach youth about trees and forests as a way of increasing student understanding of the environment and actions they can take to conserve it.

Framing Scientific Literacy within UC ANR

Traditionally, scientific literacy was thought of as an individual manifestation; however, it must be recognized that individuals are nested within communities, which are further nested inside societies, and therefore scientific literacy can be expressed collectively. The National Academies of Science, Engineering, and Medicine (2016) advances the concept that scientific literacy is developed at three levels – the individual, the community, and society. Thus, using the four anchor points described earlier, advancing scientific literacy in UC ANR will be framed and explored at these three levels.

- **Individual-Level Scientific Literacy:** Investigating the effects of UC ANR education and outreach programs on the science content knowledge, scientific reasoning skills, interest in and attitudes toward science, and contributions through applied participation on individuals.
- **Community-Level Scientific Literacy:** Investigating the effects of UC ANR education and outreach programs on the collective contributions by individuals (human capital) and shared resources within communities to addresses issues that contribute to a community’s overall well-being.
- **Society-Level Scientific Literacy:** Investigating the effects of UC ANR education and outreach programs on public policies, resources, and institutions, including disparities in scientific literacy with respect to diverse and underserved populations.

Areas of Inquiry and Applied Work

Since the 2010 Strategic Initiative Plan, a multitude of new STEM programs, peer-reviewed curricula, and learning opportunities were developed by UC ANR and made available for youth and adults to enhance and expand their participation in community-based science education efforts in California. Furthermore, research by UC ANR academics advanced STEM education through efforts such as the articulation of the meaning of scientific literacy within UC ANR (Smith, Worker, Ambrose, & Schmitt-McQuitty, 2015), the advancement of professional development research for science educators (Smith, 2013; Smith & Schmitt-McQuitty, 2013), and the investigation of science interest among elementary and high school students (Heck, Carlos, Barnett, & Smith, 2012). There are further areas of inquiry important to advance applied research, education, and extension as it pertains to advancing scientific literacy in individuals, communities, and society. These include:

- **Professional Development for Science Educators**

Traditional professional development opportunities for science educators are considered to be ineffective (Penuel, Fishman, Barry, Yamaguchi, Gallagher, & Lawrence, 2007). They are episodic in nature – mainly one-time events; they occur out of context to the educator and educational setting; and they involve passive learning, facilitated through direct instruction by experts external to the program and intended audiences (Fleischer & Fox, 2003; Penuel, et al., 2007; Smith & Schmitt-McQuitty, 2013). *Reform-based* professional development models for science educators need to be explored and extended further by UC ANR researchers (Smith, 2013; Smith & Schmitt-McQuitty, 2013). These strategies occur over extended periods of time, involve active learning, address contextualized issues or concerns related directly to educators’ practice, and are data driven, and connect to broader organizational and systemic efforts (Garet et al., 2001; Smith & Schmitt-McQuitty, 2013).

- Environmental and Health Science Education Research and Extension

As human populations grow and expand into new areas, disruption and change in environmental conditions and increased human-animal interactions is bringing about multidisciplinary efforts for One Health for the benefit of our planet, mankind, and animals (Dhama et. al. 2013).

Recognizing that the health of humans is connected to the health and welfare of animals and the environment provide a more comprehensive and ecological approach to the nexus of healthy living, agriculture, and the environment. Programs that bring together policy, system, and environmental aspects to investigate and innovate around the issues of our time – climate change adaptation; food safety and security; water quality, quantity, and security; natural ecosystem sustainability; and endemic and invasive pests and diseases – are needed at the local, national, and global levels. Regardless of the UC ANR program, however, there is a need to help develop stronger linkages and deeper understanding among youth and adults of a ‘healthy approach’ to managing the state’s shared agricultural and natural resources.

- Science Program Adaptation and Development for Diverse Audiences

There are defined discrepancies in scientific literacy along racial, ethnic, and gender lines for both youth and adults (National Academies of Science, Engineering, and Medicine, 2016; NAEP, 2016). As the demographics in California continue to expand, it will be incumbent that UC ANR keeps pace in offering culturally and ethnically relevant science learning opportunities for youth and adults. In doing so our science education programs need to be tailored to diverse cultures, histories, experiences, challenges, resources, needs and interests. Science learning opportunities for traditionally underserved audiences must be conducted in safe environments that are inclusive of community members and families, bridge cultural differences while recognizing, celebrating and reinforcing individual cultural practices; furthermore, science programming must utilize curricula that support ethnic/racial identity development, leadership and empowerment (Mansour & Wegerif, 2013).

Targeted Outcomes and Impacts

Individual Change:

- Improved capacity among science educators (both professional and volunteer) to implement effective science programming.
- Increased enrollment in science education programs among underrepresented audiences, females, and individuals from low-income families.
- Improved youth and adult scientific literacy with respect to agriculture, human, and natural resources.

Community Change:

- Increased human capital within communities to address community-based issues collectively.
- Engaging communities in action to address local/regional/national issues.
- Communities make contributions to new science knowledge.

Systems (Societal) Change:

- Improved scientific achievement among U.S. youth based on national measures.
- Improved scientific achievement among U.S. adults based on national measures.
- Improved interest among youth and adults with respect to the pursuit of STEM-related careers.

Organizational (UC ANR) Change:

- More programs, curricula, and learning opportunities available for youth and adults to enhance and expand their participation in community-based science education programs.
- Enrollment of youth and families in science-based programs that reflects the demographics of California.
- Increased capacity among UC ANR staff and volunteers to extend, support, and deliver non-formal science learning opportunities.
- Increased efforts and programmatic support to help prepare individuals' for STEM-related careers.
- Collaborations between UC ANR scientists, educators, and community-based programs bring advancements to Integrated Environmental and Health Science Education Research and Extension
- Enhanced cross-initiative programming and participation rooted at UC ANR research and education facilities.
- Enhanced policy-directed efforts that build from applied research by UC ANR academics.

Scientific literacy is an important educational and societal goal (e.g., NAS, 2007); which, according to Nelson (1999), is not optional in today's world. Twenty-first century life offers a borderless, globalized world that is highly dependent on science and technology, and related political and economic decisions require sound choices made by an informed, scientifically literate population (Miller, 2006; NAS, 2007; Turiman, Omar, Daud, & Osman, 2011). Furthermore, advancing scientific literacy is imperative for those individuals who endeavor to pursue careers in science and related fields (NAS, 2007). Science is an essential tool for the future of our planet's health and wellness; our ability to understand threats to our ecosystems and the choices we make to mitigate those threats is critical.

Citizens of the United States – adults and youth – are not well informed about science. For example, Miller (2006) indicates that only 28% of the adults in the United States can be considered scientifically literate. Furthermore, on average, White adults scored higher on science knowledge surveys than Latino and African American adults, which may be due, in part, to the underrepresentation of these groups in the STEM workforce (Pew Research Center, 2015). Among K-12 youth, low achievement on large-scale assessments in science over many years (e.g., Baldi, Jin, Skemer, Greene, Herget, & Xie, 2007; Grigg, Lauko, & Brockway, 2006; Guzmán, Partelow, Pahlke, Jocelyn, Kastberg, Williams, & Gonzales, 2004; NCES, 2012) has prompted concerns over the future of the nation's economic and political security (NAS, 2007). Furthermore, although scores across all youth groups are considered to be at unacceptable levels, science achievement among youth from underrepresented audiences – African American and Latino – has been shown to be markedly lower than White youth at corresponding grade levels; males have outperformed females; and youth from high income families have outscored low income youth (NCES, 2012). From a state perspective, California public school students have performed poorly in science when compared with students from other states and the District of Columbia (NCES, 2012). With an average score of 151 nationally, only students from the District of Columbia (112) and Mississippi (137) had a lower average science score on the 2011 National Assessment of Education Progress at Grade 8 than California, which tied with Alabama at an average score of 140.

Land-grant universities are primed to address the challenge of improving scientific literacy by engaging and empowering youth, families, and communities in developing practical, applied and sustainable science-based solutions to the local and global issues of our time (e.g. climate change; water quality, quantity, and

security; agricultural innovations; income inequality, food safety and security; environmental sustainability; environmental justice). The State of California's social, political, environmental, and economical landscape provides a frontline context to a dynamic world of 21st Century issues that require science and technology as means for constructive, sustainable solutions. People increasingly rely on digital communications to rapidly provide information to inform the solution-making process; however, the public's ability to navigate relevant, science-based knowledge is critical. Science reasoning and process skills are essential for finding information, learning knowledge, and effectively communicating it in such a way that everyone can be able to access what they need when they need it.

Work from all UC ANR's Strategic Initiative areas has been leveraged to help develop new and strengthen existing educational efforts to advance scientific literacy among youth and adults in California. For youth audiences, efforts to improve STEM learning through California 4-H have advanced consistently since the introduction of the 2007 National 4-H Science Mission Mandate. Specifically, efforts have been made to expand STEM programming through California 4-H that is grounded in a positive youth development framework and utilizes hands-on, inquiry-based strategies that include opportunities for real-world applications. Furthermore, efforts in California 4-H that focus on healthy living, college and career readiness, and expanding programming to reach culturally and ethnically diverse audiences complement and help enhance science education opportunities through California 4-H.

For adult audiences, scientific literacy is advanced through UC ANR efforts such as the California Naturalist and Master Gardener Programs that extend research-based information to the public. Specifically, the California Naturalist Program engages the public in the study and stewardship of California's natural communities. The program helps to foster a diverse community of naturalists that advocate for the stewardship of California's rich natural resources through citizen science and community service. The Master Gardener Program serves to extend research-based information about home horticulture and pest management. Through a partnership with county offices, the program trains volunteers who donate thousands of hours annually by conducting outreach to the general public throughout California.

Areas of Inquiry and Applied Work

Since the 2010 Strategic Initiative Plan, a multitude of new STEM programs, peer-reviewed curricula, and learning opportunities were developed by UC ANR and made available for youth and adults to enhance and expand their participation in community-based science education efforts in California. Furthermore, research by UC ANR academics advanced STEM education through efforts such as the articulation of the meaning of scientific literacy within UC ANR (Smith, Worker, Ambrose, & Schmitt-McQuitty, 2015), the advancement of professional development research for science educators (Smith, 2013; Smith & Schmitt-McQuitty, 2013), and the investigation of science interest among elementary and high school students (Heck, Carlos, Barnett, & Smith, 2012). Additionally, other research revealed areas of need relative to future applied research, education, and extension as it pertains to advancing scientific literacy among youth and adults. These include:

- Professional Development for Science Educators

Traditional professional development opportunities for science educators are considered to be ineffective (Penuel, Fishman, Barry, Yamaguchi, Gallagher, & Lawrence, 2007). They are episodic in nature – mainly one-time events; they occur out of context to the educator and educational setting; and they involve passive learning, facilitated through direct instruction by experts external to the program and intended audiences (Fleischer & Fox, 2003; Penuel, et al., 2007; Smith & Schmitt-McQuitty, 2013). *Reform-based* professional development models for science educators need to be explored and extended further by UC ANR researchers (Smith, 2013; Smith & Schmitt-McQuitty, 2013). These strategies occur over extended periods of time, involve active learning, address contextualized issues or concerns related directly to educators’ practice, and are data driven, and connect to broader organizational and systemic efforts (Garet et al., 2001; Smith & Schmitt-McQuitty, 2013).

- Integrated Environmental and Health Science Education Research and Extension

As human populations grow and expand into new areas, disruption and change in environmental conditions and increased human-animal interactions is bringing about multidisciplinary efforts for One Health for the benefit of our planet, mankind, and animals (Dhama et. al. 2013). Recognizing that the health of humans is connected to the health and welfare of animals and the environment provide a more comprehensive and ecological approach to the nexus of healthy living, agriculture, and the environment. Programs that bring together policy, system, and environmental aspects to investigate and innovate around the issues of our time – climate change adaptation; food safety and security; water quality, quantity, and security; natural ecosystem sustainability; and endemic and invasive pests and diseases – are needed at the local, national, and global levels. Examples of such programs and program opportunities include: California’s expansive school garden infrastructure coupled with UC ANR’s Cross-Initiative expertise in human, agriculture, and natural resource sciences could provide needed community leadership, sustainable strategies, and community-based research into these integrated concepts; additionally, the use of UC ANR research and education facilities (e.g., Elkus Ranch; RECs) and UC ANR scientists for environmental education programs and community service opportunities related to agriculture and natural resources. Beyond specific programming, however, is the need to help develop stronger linkages and deeper understanding among youth and adults of a ‘healthy approach’ to managing the state’s shared agricultural and natural resources.

- Science Program Adaptation and Development for Diverse Audiences

As the demographics in California continue to expand, it will be incumbent that Science Literacy keep pace in offering culturally and ethnically relevant science learning opportunities for youth and adults. In doing so our science education programs need to be tailored to diverse cultures, histories, experiences, challenges, resources, needs and interests. Science learning opportunities for traditionally underserved audiences must be conducted in safe environments that are inclusive of community members and families, bridge cultural differences while recognizing, celebrating and reinforcing individual cultural practices and utilize curricula that support ethnic/racial identity development, leadership and empowerment. (University of California, Agriculture and Natural Resources, 2016). Adults with similar cultural and ethnic backgrounds as youth participants will play a key role in the successful delivery, expansion and sustainability of science education programs such that youth can see themselves in the adult participants which may instill educational and career pursuits.

Strategies to Accomplish Future Work through UC ANR

Research, education, and extension addressing the above issues and topics will take many forms, including, but not limited to:

- Collaborations within UC and ANR partners as well as with public and private entities;
- Manuscripts for publication in peer-reviewed journals and proceedings that summarize findings from process and outcome evaluations;
- Presentations to relevant state professional and policymaking organizations at conferences and other key events;
- Presentations to stakeholders;
- Program evaluations on effective implementation strategies;
- Published results of community level program surveys capturing individual, family, and organizational change;
- Statewide programs implemented at the local level;
- Theoretical and applied research.

Targeted Outcomes and Impacts

Individual Change:

- Improved capacity among science educators (both professional and volunteer) to implement effective science programming.
- Increased enrollment in science education programs among underrepresented audiences, females, and individuals from low-income families.
- Improved youth and adult scientific literacy with respect to agriculture, human, and natural resources.

Organizational and Institutional Change:

- More programs, curricula, and learning opportunities available for youth and adults to enhance and expand their participation in community-based science education programs.
- Enrollment of youth and families in science-based programs that reflects the demographics of California.
- Increased capacity among UC ANR staff and volunteers to extend, support, and deliver non-formal science learning opportunities.
- Increased efforts and programmatic support to help prepare individuals' for STEM-related careers.
- Collaborations between UC ANR scientists, educators, and community-based programs bring advancements to Integrated Environmental and Health Science Education Research and Extension
- Enhanced cross-initiative programming and participation rooted at UC ANR research and education facilities.

Systems Change:

- Improved science achievement among youth adults based on national measures.
- Improved interest among youth and adults with respect to the pursuit of STEM-related careers.

UC ANR Resources to Support Implementation of this Revised HFC Plan

UC ANR advisors, specialists and related faculty in the Agricultural Experiment Station, drawing on institutional connections throughout the land grant system, create an adaptive network supporting engaged scholarship that benefits communities. Here we list a few of the many research and extension centers and institutes whose work informs and supports the priorities in this plan.

The Youth, Families and Communities Statewide Program: A statewide program of the University of California Division of Agriculture and Natural Resources, administers youth, nutrition, family, and community programs in California, including the following:

- **4-H Youth Development Program** - This statewide program offered in 57 counties focuses on providing experiential learning experiences that develop leadership, citizenship, life skills, and supportive environments in which culturally diverse youth and adults are engaged to reach their fullest potential while advancing the field of youth development. These programs conduct and promote collaborations in programming, research and evaluation between UC county cooperative extension and UC campus-based scientists to expand the understanding of youth development in the contexts of family and community.
- **Expanded Food and Nutrition Education Program (EFNEP):** This nutrition education program, available in 24 counties, assists low-income families with young children to acquire knowledge, skills, attitudes, and behavior change necessary to make nutritionally sound diet choices, improve their food security, and become more physically active as a family.

UC ANR Nutrition Policy Institute (NPI): The Nutrition Policy Institute (NPI) conducts and evaluates research related to the impact of nutrition and physical activity on public health. NPI prizes research that provides a strong basis for public policies that can eliminate health disparities, especially those stemming from lack of access to healthy foods and opportunities for physical activity.

UC Master Gardener Program: Master Gardeners teach the public how to grow a wide variety of fruits and vegetables with sustainable practices, and link closely with UC county programs to promote safe food production, increased fruit and vegetable consumption, and encourage families to use gardening as a form of healthy recreation and exercise.

UC Master Food Preserver Program: The UC Master Food Preserver program extends research-based information about safe home food preservation to the public. In exchange for training from the University, UC Master Food Preservers offer volunteer services and outreach to the general public in safe home food preservation in turn, promoting food waste reduction, food resource management techniques, food safety and increased fruit and vegetable consumption.

UC California Naturalist: The California Naturalist program uses a science curriculum, hands-on learning, problem-solving, citizen science, and community service to instill a deep appreciation for the natural communities of the state and to inspire individuals to become stewards of their local resources.

UC ANR Research and Extension Centers (RECs): The REC system links research and education programs of UC academics to enable the delivery of the highest quality science to promote healthy citizens and thriving communities.

Elkus Ranch: A 126-acre coastal ranch which is an outdoor laboratory where people can experience a working farm, investigate the natural world, and where scientists and citizens of ALL AGES work collaboratively in the spirit of cooperation to develop innovative and practical solutions to agricultural and environmental challenges.

Project Learning Tree: Part of the UC ANR family, Project Learning Tree is a national environmental education program that includes instructional materials for early childhood through grade 12 for use with youth in formal and nonformal education settings. Hands-on activities connect youth to nature, engage them in learning, and grow 21st century skills – including the ability to think critically and solve problems.

The UC CalFresh Nutrition Education Program, also known as SNAP-Ed: Nutrition educators empower SNAP eligible low-income participants to adopt healthy lifestyle practices. The goals include utilizing comprehensive programming to change behaviors and practices related to nutrition food choices, safe food handling and food budgeting practices.

UC Davis Department of Nutrition Center for Nutrition in Schools: The Center supports the school community by ensuring that nutrition and health policies and practices in school communities are based on scientific evidence.

UC Davis Center for Regional Change: The CRC is a catalyst for innovative, collaborative, and action-oriented research. It brings together faculty and students from different disciplines, and builds bridges between university, policy, advocacy, business, philanthropy and other sectors. The CRC's goal is to support the building of healthy, equitable, prosperous, and sustainable regions in California and beyond.

UC Agricultural Sustainability Institute (ASI) and UC Sustainable Agriculture Research and Education Program (SAREP): ASI and SAREP provide a hub to link initiatives and education in sustainable agriculture and food systems across all UC campus and county agricultural divisions with other partners across the State of California.

The Student Farm at UC Davis: The program supports the development and use of instructional school gardens through training, resources and networking opportunities. The program focuses on sustainable agriculture and food systems; emphasizes in-field experiential learning and supports student exploration, creativity, initiative, and leadership.

UC Davis Betty Irene Moore School of Nursing: The school practices interdisciplinary health research and community engagement with local residents and community leaders.

UC Davis School of Medicine: The school integrates educational practice with research and medical delivery in student-run community clinics.

UC Davis Center for Poverty Research: The Center for Poverty Research at UC Davis is one of three federally designated centers whose mission is to facilitate non-partisan academic research on poverty in the U.S., disseminate this research, and train the next generation of poverty scholars.

UC Davis World Food Center: The World Food Center is bridging the gap between farm and health.

UC Davis and UC Berkeley's School of Education: These schools emphasize interdisciplinary collaboration with practitioners and community partners integrating research and practice.

Berkeley Food Institute: BFI informs policymakers and reporters about important research from UC Berkeley; enables researchers to become more aware of important developments among agricultural producers; facilitates exchange of knowledge and information between social movements and scientists; and collaborates with efforts to ensure accountability and social responsibility among agri-food corporations.

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