



College of Agricultural and Environmental Sciences

Academic and Strategic Plan 2015

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CA&ES Consultations:

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Meeting the Challenges of 21st Century Global Change

EXECUTIVE SUMMARY

The Academic and Strategic Planning Committee (ASP) was convened in October 2015 and met weekly throughout the fall quarter. The charge was to articulate a small set of inclusive, innovative, and forward-thinking college priorities that build on both the 2013 Visioning Committee Report and the 2015 Academic and Strategic Planning Survey. Further, the committee was to generate implementation strategies and areas of strategic emphasis so that follow-up workgroups could be formed to continue making progress on these priorities.

The College of Agricultural and Environmental Sciences (CA&ES) has a pivotal role in creating substantive solutions to the key challenges that face humanity, both within California and the broader world. It is the responsibility of the college to use its scientific expertise and leadership to address the complex problems of the 21st Century through our land-grant mission of research, teaching, extension, and outreach. The college is uniquely positioned as a global leader to be responsive to a rapidly changing world and to maintain our excellence and preeminent standing in traditional strengths. A key principle guiding our continuing excellence is that the college must capitalize upon and grow the existing and potential synergies within CA&ES.

The overarching **Global Mission** for CA&ES is enthusiastically supported by the committee:

The mission of the College of Agricultural & Environmental Sciences is to promote agricultural, environmental, and social sustainability through research, teaching, and public engagement to meet the challenges of global change in the 21st century.

To accomplish this mission, we identified **four core priority themes** for growth and integration within the college in the future. Importantly, these themes are deeply intertwined. Defining the interrelationship of the college in this way represents a new vision that highlights the significant opportunities that will propel the college forward.

- **Sustainable Agriculture and Food Systems**
- **Equitable, Healthy Communities**
- **Ecosystem Viability & Functionality**
- **Meeting the Challenges of Climate Change**

The college expertise lies at the nexus of these most pressing and critical crosscutting issues facing society. Global challenges of food, health, ecosystems, and human communities require concerted coordinated efforts to effect innovative and transformative solutions. Together these four themes illuminate how the college is uniquely positioned to approach these critical transdisciplinary issues. The themes and their underlying focal topical areas articulate a coordinated crosscutting structure as a college objective.

This plan frames the CA&ES efforts in an integrated fashion, which will energize our mission and build upon our excellence moving forward. The ASP committee recognized that these themes are inextricably interrelated, and that they combine core strengths as well as newer areas requiring investment, particularly in the promotion of interdepartmental/interdisciplinary connections.

The committee further proposed **integrated areas for potential development** through the hiring process, enhancement of facilities, innovative teaching at the undergraduate and graduate levels, outreach approaches, and pursuit of endowment funding to provide seed research funding and promote achievement of bold and far-reaching big ideas. The crosscutting areas for investment reflect the

interrelationships within the four priority themes and associated focal areas and include (in no priority order):

- **Sustainable global food security and adaptation to global change**
- **Sustainable development for healthy communities**
- **Climate change science and policy**
- **Integrated water science**
- **Informatics, remote sensing and spatial modeling**
- **Integrated social and environmental policy**
- **Disease dynamics and mitigation in a changing world**

The committee proposes the following implementation steps. Following the consultative process, workgroups should be convened to further develop the high priority concepts and outline actions to implement the ideas.

Suggested workgroups:

1. Workgroup to explore and prioritize college needs with regard to enhancing facilities.
2. Workgroup to develop strategies for college hiring priorities, to balance core FTE needs with new opportunities for growth and integration; with special consideration of crosscutting areas of academic investment.
3. Workgroup to identify existing crosscutting, integrative minors and explore ways to invigorate those with potential development of new integrative minors that cross departments.
4. Workgroup to explore alternative and new models of pedagogy that are applicable to many class sizes, and support for small class undergraduate experiential learning and for graduate education strategies.
5. Workgroup to explore seed funding procedures that could be supported by endowments and fundraising, not redirection of core funding.
6. Workgroup to discuss the relationship with ANR, as this relationship contributes to the UC CA&ES mission.
7. Workgroup to fully develop and explore the bold, big ideas that will showcase the full spectrum of CA&ES impacts.

Final Committee Recommendations

1. Focus college investments in four core themes, with strategic emphasis on integrated and transdisciplinary areas for future development.
2. Pursue future hires to maintain existing core departmental strengths and build integrative capacity in emerging fields.
3. Develop seed funding (through endowments) to support crosscutting, interdisciplinary research efforts.
4. Promote crosscutting educational experiences for undergraduates and graduate students.
5. Develop bold and integrative outreach, teaching, and educational platforms that build and maintain the strength of the college.

I. Introduction

Our Charge:

The Academic and Strategic Planning (ASP) committee was charged to develop a streamlined Academic and Strategic Planning Report with an Executive Summary by December 31, 2015. The specifics of the charge (full text in Appendix 1) were to:

- 1) Articulate 2-3 key college priorities that are inclusive, innovative, and forward-thinking and that build on both the 2013 Visioning Committee Report and the 2015 Academic and Strategic Planning Survey. The priorities should serve as strategic umbrella concepts to guide our continuing excellence. They should address our college and Agricultural Experiment Station missions of teaching, research, extension, and outreach;
- 2) Generate a listing of implementation strategies that the college can pursue to meet its interdisciplinary objectives employing an integrated approach to solving major issues of the state, nation, and world in keeping with our mission;
- 3) Identify areas of strategic emphasis, so that follow-up workgroups can be formed to help implement the priorities and address strategy details.

Our Context:

The College of Agricultural and Environmental Sciences (CA&ES, or the college) is the top college in the world for teaching and research in the agriculture and forestry category of the QS world ranking, 2013-15. As the global leader, we strive to be responsive to a rapidly changing world yet maintain excellence in our areas of traditional strength, which range broadly across the agricultural, environmental, and human sciences.

Global population growth has placed a premium on safe and secure food sources, while simultaneously imposing greater stress on our natural ecosystems, and on biodiversity and the environment. Increased urbanization, reliance on fossil fuels, and impacts of climate change pose growing challenges for agricultural, environmental, and human sustainability. Human health and nutrition require much greater focus as our population grows and ages, and we must provide for equitable and healthy lifestyles for all. Ensuring the availability of safe, clean water to meet human, agricultural, and environmental needs is a global concern that will only continue to intensify. CA&ES is uniquely positioned to build capacity to confront these growing challenges. In doing so, CA&ES will continue to provide leadership in the region, in California, and in the world, and our college will be pivotal within other ongoing efforts at UC Davis and within the University of California system.

Over the past decade, CA&ES has undertaken a number of comprehensive and inclusive planning efforts. These include:

- CA&ES Academic and Strategic Plan (ASP) 2007 (Chair: Harrison)
- Academic Prioritization Committee (APC) 2009 (Chair: Greenwood)
- College Planning Committee 2010 (CPC) (Co-chairs: Delany, Hopmans)
- College Visioning Committee 2013 (CVC) (Co-chairs: Block, Schwartz)
- College Survey 2015 (Led by Campbell, CA&ES Associate Deans)

These plans provide a rich resource involving much thought and college-wide consultation. Accordingly, the goal of our committee was not to re-create any of these efforts. Rather, we sought to distill the

vision provided by these previous reports so as to arrive at a small number of key priorities for the college and develop a list of implementation strategies and recommendations.

Two of these reports figure prominently. The report from the College Visioning Committee (CVC) in 2013 identified eight multidisciplinary opportunities to address critical global problems (Food Security and Safety; Healthy Diets, Healthy Living; Sustainable Agricultural Growth and Economies; Water Quality and Quantity; Balanced Land Use; Environmental Stewardship; Sustainable Energy). The ASP committee utilized the breadth of ideas delineated in the CVC report; however, the committee felt that the key themes lacked sufficient specificity to meet the committee's charge. Most recently, CA&ES conducted a College Survey in 2015 to evaluate support for two overarching themes: "Adapting to Climate Change" and "Vibrant Healthy Communities." Both themes resonated well with the college faculty, and the survey findings underscored the desire to integrate and connect the core pillars of the college and create interdisciplinary approaches, blending social, biological, and technological science. However, members of the ASP (and comments on the survey from the faculty at large) suggested that these two themes did not fully capture all areas of strength and opportunity within CA&ES. Accordingly, our approach struck a middle ground between the perceived breadth of the CVC report and the perceived confines of the College Survey.

Our Approach:

A detailed description of the membership and mechanics of the committee is provided in Appendix 2. Briefly, the committee comprised one representative from each department and three co-chairs, chosen by the Dean's Office. Four Associate Deans of CA&ES participated as ex-officio participants. The committee met weekly from September 29 to December 15, 2015.

The committee distilled the available ideas and information from previous CA&ES planning documents into a smaller number of key priority themes. Through extensive discussions as a group and in small teams, an overall CA&ES mission emerged as a guiding vision, and a small number of core themes coalesced, resulting in **four key, highly interrelated priority themes**. These themes define priority areas of existing strengths and future growth that will maximize the impact of CA&ES regionally, nationally, and globally. Topical areas of focus *within* each of the four priority themes were articulated based upon past plans and the departmental programmatic thrusts, and implementation strategies were developed. The integrative nature of the constituent components underpinning each priority theme demonstrate how the classical CA&ES divisions work together through research, teaching, and outreach to address the pressing challenges of global change facing society in the 21st century.

II. A Global Mission for the College

The Academic and Strategic Planning Committee enthusiastically supports the following mission statement to guide college planning:

General mission (overarching)

The mission of the College of Agricultural & Environmental Sciences is to promote agricultural, environmental, and social sustainability through research, teaching, and public engagement to meet the challenges of global change in the 21st century.

Four Core Priority Themes

To accomplish this mission, we identified four core priority themes for growth and integration within the college in the future. Importantly, these themes are deeply intertwined. Defining the interrelationship of the college in this way represents a new vision that highlights the significant opportunities that will propel the college forward.

I. Sustainable Agriculture and Food Systems

In the broadest sense, sustainable agriculture and food systems ensure secure, safe, and high quality healthful food for the world's population without negative social and environmental impacts. Fibers and biofuels are also important products of sustainable agricultural systems. Our college has undeniable excellence to provide the leadership necessary to confront the challenges of balancing production with social responsibility. Effective and coordinated efforts of existing and expanded biologic, social, and technologic strengths can be transformative in the production of food without compromising environmental and social goals. Key research challenges to ensure sustainability of agriculture and food systems include efficient and responsible resource utilization, mitigation of agriculturally related emissions, adaptation to a changing climate, addressing water management, mitigate a declining labor force, and developing innovative approaches for bio-based materials, pathogen management, and healthy food production. Novel approaches must be adopted to address these research areas and include collection and analysis of big data, high throughput phenotyping, improved understanding of the ecology of agricultural systems, and quantifying tradeoffs. Sustainable agriculture and food systems are fundamental to all aspects of human existence, requiring significant investment in existing strengths and integrated growth opportunities.

II. Equitable, Healthy Communities

Healthy, equitable, and vibrant communities are essential for a sustainable future. Multiple opportunities for global leadership lie at the nexus of food, health, environment, and society. Our college has a unique concentration of biological, environmental, developmental and applied social scientists to address the human dimensions of complex food and community systems. CA&ES should continue to build upon existing strengths to meet this increasingly complex interplay of factors. Integrative effects of foods and food systems on nutrition and health have physiological, social, economic, and policy implications for individuals and populations. Challenges to optimal human development exist that are related to youth, a growing elderly population, epidemic proportions of obesity and chronic disease, and issues of class, race, and gender. Social equity is a growing problem that demands attention — particularly in agricultural communities and inner cities. Urban resource use and the urban–agricultural interface generate additional challenges and offer opportunities for the college to take leadership in innovative solutions for effective, sustainable, and environmentally sensitive communities, urban greening, and human health and well-being. By emphasizing integrated approaches linking social and biologic dimensions, we can create the transformative ideas needed to inform sustainable development, vibrant communities, and provide solutions for equitable access to food and nutrition at the individual, community, societal, and global scales.

III. Ecosystem Viability & Functionality

Biological diversity in natural and human-dominated ecosystems is essential to human well-being and global sustainability. Ecosystem services, such as the provision of clean air and water, fisheries and forest products, carbon sequestration and climate regulation, are widely recognized to depend on the maintenance of biological diversity. In turn, biodiversity and the services it provides are threatened by climate change, disease, contaminants, habitat loss, and the many other interacting stresses that are

forecast to intensify greatly during the 21st century. Our college plays a critical role in identifying, understanding, and developing scientific and policy tools to mitigate these threats, as well as in educating the next generation of environmental leaders and environmentally aware citizens. While UC Davis enjoys one of the world's top-ranked environmental programs, we face many critical gaps, both in rapidly emerging areas such as climate change science, and in maintaining our critical base strengths. Also, we have not yet solved the long-recognized problem of achieving better integration within the college and improving visibility for our environmental research, teaching, and outreach.

IV. Meeting the Challenges of Climate Change

Climate change is a leading sustainability challenge of our time running through the other three themes. CA&ES can build its strength in climate science and policy, mitigation and adaptation, as well as expand educational offerings on this topic. As a thematic priority, climate change represents enormous opportunity for UC Davis and CA&ES to take global leadership — given our proximity to state leadership in Sacramento and our college faculty who are global leaders in climate science research, policy, and education. The impacts of climate change on agriculture will significantly impact the world's ability to feed itself. The impact of climate change on water resources cannot be overstated, as water management weaves through all themes. Particular research opportunities exist around climate mitigation policy and planning, energy policy, urban greening strategies for climate change adaptation, bio-resources for materials and energy, and behavior change strategies. CA&ES, with its outreach responsibility, can also engage California communities — at state, regional, and local scales — in ways that connect climate research to policy and action. Outcomes at the state level can be modeled for national and international implementation.

Together these four themes illuminate how the college is uniquely positioned to approach the transdisciplinary issues that face humanity in the 21st century. These themes resonate strongly throughout every one of our recent college planning efforts. Cooperative CA&ES efforts across disciplines are essential to address the emerging challenges of global change. This report, although a departure from previous plans, is the first to articulate coordinated crosscutting structure as a college objective, and acknowledges that the college components need to cooperatively coordinate efforts if we are to remain preeminent leaders in the global arena. This plan frames the CA&ES efforts in an integrated fashion, which will reenergize our mission and build upon our excellence moving forward. The ASP committee recognized that these themes are inextricably interrelated and that they combine core strengths as well as areas requiring investment, particularly in the promotion of interdepartmental/interdisciplinary connections. These priority themes address challenges that are relevant to the California landscape as well as other communities throughout the world.

Focal Topical Areas under the Themes

The four priority themes provide a framework for future college growth. To be successful, however, we will need more than thematic priorities — we need strategic actions that can be implemented by the college over the next decade. A second goal of the ASP was to delve into each theme to provide this guidance. To do so, we identified topical areas of research, education, and outreach for each theme that represent existing strengths and growth opportunities for CA&ES. We recognize that these topical areas must be evaluated further to assess the areas of strategic emphasis that will be needed to achieve the two-pronged goal of investments in core strengths of the college to maintain excellence and investments in new focal areas to advance the mission of the college to meet the local and global challenges.

I. Sustainable Agriculture and Food Systems

- Ensuring food security (quantifying global challenges to food security, adaptation to climate change, sustained productivity, accommodating changing diets, breeding and biotechnology, environmentally adaptive, agroecological approaches with reduced environmental costs, accessibility, transport/adjacency to demand)
- Food quality and safety (flavor, bioactives, healthful attributes and biofortification, acceptability, pathogen and pest control, analysis of policies and regulations)
- Resource-efficient production and supply chain (resource use, sustainable processing, resource utilization efficiency, water, transportation, post-harvest elements, byproduct utilization, efficiency including protecting resources such as water, reduction of energetic inputs, economic impacts of each step of supply chain, mitigation of greenhouse gases)
- Traditional and novel approaches to agricultural production and improvement (big data, genomics and phenomics, selection, proteomics, remote sensing, biotechnology, appropriate technology and scale, and use of agroecological approaches; compatibility with biodiversity)
- Disease and pathogen management and mitigation (enhance early detection technologies, environmentally sound and cost effective pest control, environmentally sound management of plant animal and vector-borne diseases, reduction of disease in face of abiotic stress)
- Labor force (improving the welfare of the labor force through fair wages, race relations, healthy working conditions, housing, health care; developing alternatives to a declining labor force)

II. Equitable, Healthy Communities

- Human development, health and nutrition (biomarkers of health and disease, nutrient metabolism, nutritional and community impacts on health and development through the lifecycle, microbiome and microbial community interrelationships to food and health, communicable and non-communicable disease risks , prevention and mitigation)
- Sustainable economic and spatial development (ag/urban interface, urbanization, threats to land used in production agriculture by urban sprawl, bio-economic optimization of intervention programs)
- Social equity (affordable housing, built environment to promote health, ethnic diversity, human labor resources/labor systems, chemical impacts of products and treatments, worker safety)
- Ecological restoration and urban greening (green cities, incorporating environment with housing; linking natural systems and communities for human benefit, human/wildlife conflicts and ecosystem management)
- Carbon neutral communities (green building, energy systems, transportation)
- Community food systems (food safety, food justice, accessibility and food security, safe and available water)

III. Ecosystem Viability and Functionality

- Conservation of biodiversity and minimizing anthropogenic impacts on natural and human-dominated ecosystems in the face of global stresses (climate change, human population growth, habitat loss, declining water quality and availability, emerging and known contaminants, disease management)
- Sustainable management of the ecosystem services and economic resources provided by the natural environment (forests, wildlife, soil, air, fresh water, marine and coastal ecosystems)

- Development of effective solutions to environmental challenges through the integration of natural sciences with the social sciences (economics, policy, planning, design, community development and related implementation strategies)
- Employ reconciliation ecological approaches (manage agricultural, urban, rural, and wild lands in ways that promote wildlife and enhance biodiversity in the landscapes in which humans work, live, produce food, and recreate)

IV. Meeting the Challenges of Climate Change

- Mitigation strategies (climate action planning and policy across governmental scales; energy conservation; renewable energy; water management; greenhouse gas-reducing agricultural strategies)
- Adaptation strategies for agriculture, the environment, and human communities (recharging ground water, water efficiency, agroecology, urban greening, green building, preparation for intensified storms, food security)
- Maintaining agricultural productivity in the face of biotic and abiotic stresses (emerging disease management and mitigation, vector management, enhancing food production on marginal lands)
- Climate science (characteristics and impacts of a changing climate on all ecological landscapes both human-dominated and natural)

As is readily apparent, many topical areas are common across the themes illustrating the interrelated nature of the CA&ES expertise and vision. For example, food security, food safety, and disease management are a feature of more than one priority theme. The same holds true for ecosystem management, resource management, and water management. Another example is pest control on human and community well-being — food safety, quality, and ecosystem impacts. Appreciation for these commonalities led to a conceptual framework that helped to clarify a central observation of this committee — future efforts of CA&ES will need to be interdisciplinary, integrative, and will cut across many of the traditional college pillars.

This concept was best captured in a Venn diagram that illustrates the coordinated efforts necessary to tackle these topical areas. The centrality of the theme “Meeting the Challenges of Climate Change” is evident by the positioning of the topical areas that overlap the other three priority themes. The overarching theme for the entire plan is to meet the challenges of global change (represented by a circle encompassing all of our priority themes; Figure 1).

The Venn diagram is meant to represent visually the interrelated aspects of the topical areas identified under each of the four priority themes. The college expertise lies at the nexus of these most pressing and critical crosscutting issues facing society. Global challenges of food, health, ecosystems, and human communities require concerted coordinated efforts to effect innovative and transformative solutions.

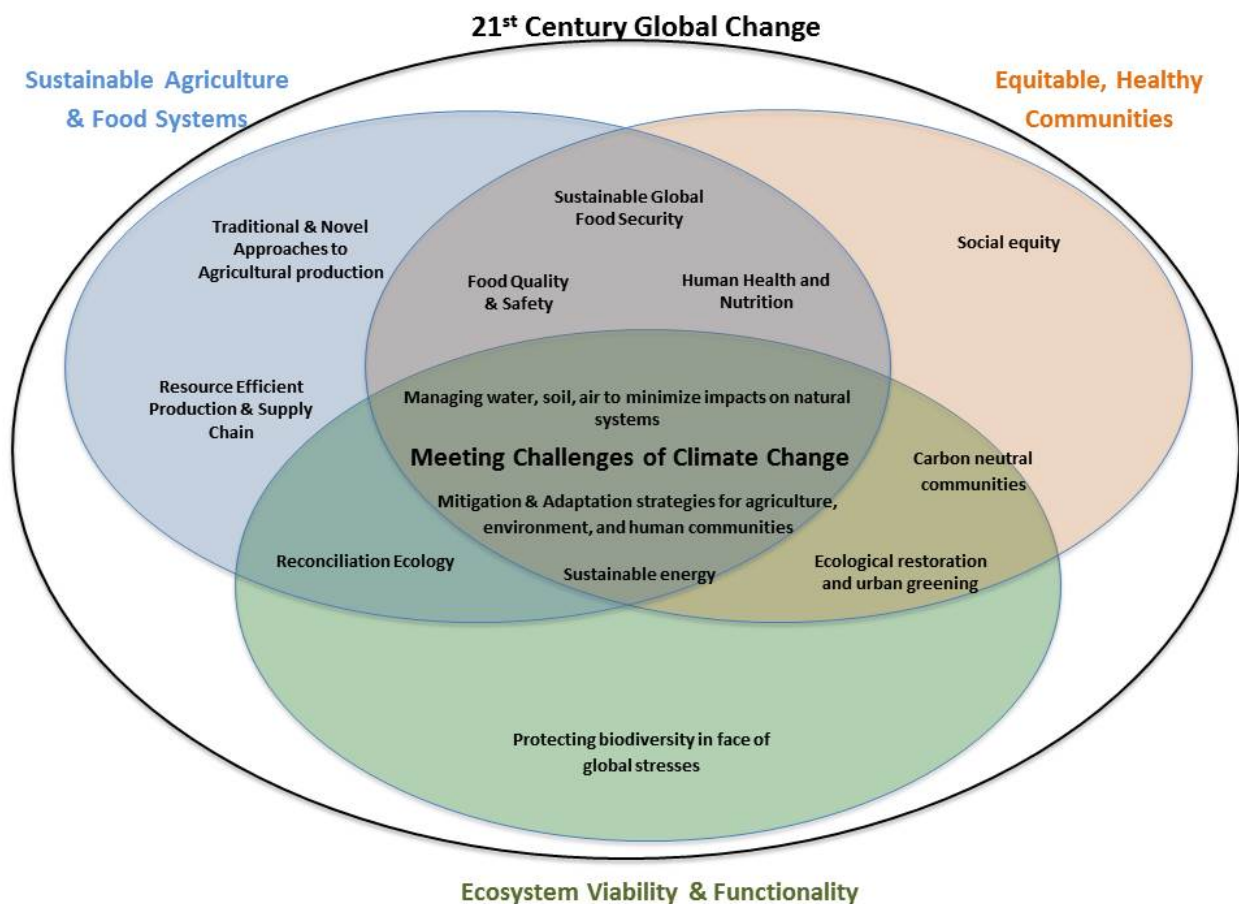


Figure 1. A Venn diagram to illustrate the interdisciplinary and overlapping nature of the topical areas of expertise that lie within the four priority themes proposed for the CA&ES.

III. Implementation Strategies

The challenges that face the university today and in the near future require bold, integrative, and transdisciplinary approaches. CA&ES is in a unique position to provide global leadership — there is simply no other college in the nation or the world with comparable depth or breadth of expertise. To meet these challenges, implementation strategies should focus on two goals:

- (1) maintain and grow excellence in our traditional areas of strength
- (2) explore and embrace new emerging fields and big ideas that integrate broadly across multiple disciplines.

1. Hires in Agricultural, Environmental, and Societal Sustainability for the 21st Century

We recommend that hiring initiatives in CA&ES follow a thematically-driven process wherein the four priority themes outlined in this academic plan serve as the focus. These themes allow the college to maintain and build upon our existing strengths while facilitating interdisciplinary collaborations. The hiring of new faculty will be crucial in order to achieve the goals of the academic plan.

Maintain and grow excellence in our traditional areas of strength:

We must ensure that the CA&ES does not lose critical research, teaching, and extension capacity in agricultural, environmental, and human sciences. Hence, fulfilling critical department needs should be a top priority. Key disciplinary needs in teaching, research, and outreach should align with the themes and subtopics, and CA&ES departments should be expected to articulate their needs through justifications within the themes.

Continuing consideration should be given to hiring Lecturers with Security of Employment (LSOE) for delivery of high capacity lower division service courses and expertise to focus on innovative pedagogy. We will also need to consider how to balance the delivery of the didactic curriculum with research and outreach activities, within the constraints of the new nine-month appointments. To allow our new faculty to flourish and drive us forward, we must consider how we might mitigate the potential lack of the additional two months summer salary and resulting productivity. Furthermore, departmental IR/OR FTE targets must be readjusted upward to provide the capacity to meet the educational needs of the increasing student population and still provide leadership and exceptional cutting-edge research and outreach to meet California's and global challenges in the 21st century.

Embrace new emerging fields and big ideas that integrate broadly across multiple disciplines

To complement the core departmental strengths and foster innovative collaborations, focused hires in the four priority areas, seeking leaders with a comprehensive view of these topic areas, could provide a mechanism to energize growth and promote greater integration among areas of traditional strength. Coordinated efforts should also be made to bring existing faculty together to work on the priority areas; doing so may further reveal unanticipated FTE gaps that, when filled, would significantly advance the work of the cluster. These FTEs could be individual hires or clusters of positions specifically targeting research, education, and extension through an integrated approach to each of the four themes. Some of these positions should be of more senior standing to coalesce and lead the core efforts. Focused or cluster hires could be accomplished through the regular FTE call, or by continuing the CIRE initiative and the campus-wide HIP program.

Our college is at the forefront of several emerging fields, offering considerable opportunity for growth. Some represent novel programs; others build on existing strengths to enhance interdisciplinary initiatives. Our committee did not attempt to explore each of these opportunities in depth, and this remains an important task for a follow-up workgroup. Several ideas were considered by the committee, and these are compiled in Table 1 and described in Appendix 3. We caution that this is a preliminary list representing the suggestions of the ASP committee; a broader consultation would be valuable.

2. Seed Funding

Meeting the combined challenges of agricultural, environmental, and societal sustainability for the 21st century requires creative endeavors at the intersection of multiple disciplines. Our college is rich in the talents and many of the resources needed to meet these challenges. However, seed money to catalyze high-risk, high-reward endeavors has been identified by our faculty as a critical need.

We propose, as a top fundraising priority, the building of an endowment to provide seed grants to our college faculty. It could be modeled approximately after the (former) Kearney Foundation grants, which awarded smaller grants to single investigator/single discipline projects, and larger ones to multidisciplinary projects. Key elements of a successful proposal would be that (1) it addresses one or more of the priority themes; (2) and that it offers a clear plan for building a longer-term research and outreach program based on the success of the seed grant. Inclusion of faculty summer salary support should be encouraged to ensure that our ability to conduct research relevant to the AES mission remains a high priority. These grant programs should emphasize research that holds potential for broad progress

within the priority area (for example, areas defined in Table 1), rather than exploring highly specialized niches within it, and research that connects findings to policy and potential action by stakeholders.

3. Facilities

Maintaining the college standing depends on attracting excellent entry level and mid-career scientists. These individuals require state-of-the-art facilities to conduct their research and publish in high impact journals. Several of the college's facilities were constructed in the 1950's and are not adequate for the type of work that is required now and in the future. We need to update the facilities looking into the next 50 years. Usually new equipment is more easily obtained through grants, but upgrading the infrastructure remains a significant challenge.

This is a stand-alone undertaking, and our committee did not have sufficient time to explore these needs. We recommend a follow-up workgroup be developed to focus on this task to catalog existing facilities, evaluate current conditions, identify existing and projected needs, and prioritize those facilities needing most urgent attention. The campus Big Ideas initiative offers one mechanism by which facility improvement and development could be integrated into a larger fundraising initiative. (A short, non-exhaustive list of some facility needs identified by the committee is provided at the end of Appendix 3.)

4. Undergraduate Education

With expanding undergraduate student populations, we have a growing opportunity and responsibility to educate and train the future leaders who will have the capacity to address the complex societal issues to be faced. This training requires fundamental disciplinary knowledge coupled with skills to address transdisciplinary challenges to ensure student success in their future workplace and an informed and scientifically literate populace.

Experiential learning:

We must ensure that our students engage in active, experiential learning at top-notch facilities that reflects modern, forward-thinking approaches — such hands-on training is absolutely essential for the intellectual development of solution-oriented, and critically thinking leaders. Our college risks the erosion of our ability to provide experiential learning through field courses, lab courses, opportunities at our Natural Reserves and field stations, and relatively small and specialized courses. We advocate strong and continued support for these key, life-changing learning opportunities. Teaching facilities (labs, field sites), TA support, and resources to provide for hands-on experiential training must be a priority for the college.

New models of pedagogy:

The college also needs to develop and support new models of pedagogy that promote active learning to classes of all sizes. Active learning strategies are possible even within large classes, and modules on topics such as climate change, agricultural sustainability, ecosystem viability, and healthy human communities can be added to courses all over campus. New learning technologies and hybrid classes should be discussed by such a follow-up workgroup. Scientific literacy and competence across disciplines will be required of our students as they enter the workforce. Combined, experiential and active learning and interdisciplinary science literacy will position our undergraduates for success in a multitude of careers.

Scientific, Cultural & Environmental literacy:

Studies consistently show that the vast majority of U.S. citizens have significant gaps in science and environmental literacy, and do not understand how to apply that knowledge to policy and social change; this gap appears to be increasing. Sustainability education requires not just science literacy, but an all-

around understanding of how to weave together different types of information and ways of understanding the world and then connect them to action so as to solve problems. A fundamental role of the university must be to ensure that the public is well educated, and we believe that CA&ES is poised to play a leadership role, campus-wide, in remedying that deficiency. We suggest the development of a series of GE courses that would improve science and social literacy (perhaps weaving in English composition?) with Lecturer SOEs to instruct with research into the pedagogy of science literacy education.

Additional Support in Priority Areas:

Special support may be needed for education in several of the priority areas where we lack current expertise. This could include new faculty who can teach integrative courses on these topics, course buyouts for existing faculty who could teach such courses, or hiring Lecturer SOEs who specialize in integrating subject matter across disciplinary fields.

5. Graduate Education

A significant risk posed by the steady growth in undergraduate and graduate enrollments is our ability to continue to deliver educational excellence at the graduate level. While many of our graduate groups are rated the best in the world in their fields, this prestige may be lost unless we maintain strong support for graduate groups and students. Funds to provide TAs (a primary source of support for graduate students) for lab/field courses remain limited, despite growing numbers of undergraduates seeking such classes. This may require campus wide resolution, but we risk significant erosion of our ability to attract and support the top-tier of graduate students without a clear plan and commitment to enhance graduate student support. The college needs to develop or facilitate targeted support for graduate research in the priority areas, possibly following an Integrative Graduate Education and Research Traineeship (IGERT) model. A second challenge will be to ensure that faculty has time and ability to deliver essential graduate coursework. With growing undergraduate teaching loads and a campus budget model tipped towards undergraduate SCH's, the college (and campus) will need to provide incentives for our departments and faculty to provide graduate-level coursework and research training.

6. Cooperative Extension

Achieving our college's AES mission in the environmental sustainability area requires the same dedication to outreach and extension as we dedicate to our agricultural mission. Our environmental stakeholders are the Californian public and the federal, state, and regional agencies that manage our natural resources. The number of CE specialists has eroded over time, reducing the efficacy of the program at all levels. We advocate a vigorous expansion of the ANR continuum affiliated with UC Davis — including development of the environmental component of Cooperative Extension, with specialists in fields such as wetlands and wildlife management, air and water quality, greenhouse gas emissions reduction, and the use of knowledge networks and systems in environmental decision-making. Expansion will enable the college to effectively address those emerging areas outlined in Table 1. The ASP committee continues the recommendation of joint IR/CE appointments.

7. Bold integrative “Big Ideas”

As of this writing, the UC Davis campus has embarked on a new campaign embracing the concept of “Big Ideas.” The college should embrace this concept and push aggressively to develop a number of new initiatives under this umbrella. Unlike any other college, we are poised with the interdisciplinary strength and crosscutting technology and research to facilitate broad thinking and the development of

overarching concepts that link multiple departments and programs (and perhaps colleges). Numerous ideas are currently being developed (see Appendix 3 for an example).

Table 1 captures the crosscutting areas that the ASP committee considered as having great potential to confront the challenges being faced at the local, state, national, and international level. There was excitement and anticipation that investment in these areas would promote and build the interrelationships within the four priority themes and the associated focal areas. More important, investing in these areas with faculty, facilities, education, and outreach will ensure the college retains its preeminent role as THE leader that informs policy and practice around the globe.

TABLE 1. Emerging integrative areas that present opportunities for new investment in CA&ES. These are not listed in any order or priority.

Area	Integrative Components
Sustainable Food Security and Adaptation to Global Change	Food security, safety, and quality using both traditional and novel approaches to meet the challenges of global change (economic, social, environmental) on production, processing, storage, marketability, and sustainability of food (crop and livestock) and fiber production systems, plant diseases in a changing climate, livestock health and welfare, aquaculture and mariculture
Sustainable Development for Healthy Communities	Rural-urban dynamics, urban greening & carbon-neutral sustainable development, water use optimization, urban farming solutions, sustainable waste management solutions, issues of equity & justice, economic development & viability, food systems & security, personal & public nutrition and health
Climate Change Science and Policy	Macro scale modeling and forecasting, big data, policy, mitigations, alternative energy, adaptations and solutions for agricultural & the natural biota, urban planning, social marketing, and behavior change
Integrated Water Sciences	Water use/efficiency/quality, resource preservation and reconciliation, drought adaptation strategies, sustainable marine and coastal systems, impact of water use on natural ecosystems, ensuring an adequate and safe water supply for agriculture, wildlife and communities
Informatics, Remote Sensing and Spatial Modeling	Implementation of sensor technologies into food and industrial production systems to optimize input management, quality control, and product traceability. Use of airborne sensors to improve understanding and management of urban, agricultural and natural systems. Geospatial methods and spatial analytical techniques applied to agriculture and environmental management. Capacity to handle massive data sets that modern technologies generate.
Integration of Social and Environmental Science and Policy	Policy and decision-making, integration of science into policy, social impacts of environmental issues, anthropogenic impacts on society and policy
Disease Dynamics in a Changing World	Disease dynamics and mitigation in agricultural, environmental, and urban settings, microbiome and microbial communities of plants, animals and humans, integrated social, behavioral and biologic inputs to health

IV. Suggested follow-up workgroups

The information and recommendations in this report will be reviewed by the dean, shared with the college and stakeholders for consultation, and accepted or amended as appropriate. Following the consultative process, the next steps toward making the ideas actionable will be workgroups to further develop the high-priority concepts. Suggested workgroup ideas are provided below:

1. Workgroup to explore and prioritize needs for college facilities —survey, review, prioritization, and development opportunities on an integrative, college level
2. Workgroup to develop a consistent and coordinated strategy for college hiring priorities, to balance core departmental FTE needs with new opportunities for growth and integrations. Further in-depth strategic planning should focus on development of the emerging crosscutting opportunities for academic investment. Integrative FTE hiring initiatives — review and revise (if necessary) procedures and priorities, including CIRE and LSOEs, to meet departmental and college needs for research, outreach, and educational delivery of integrative concepts. The workgroup should evaluate the overall success of the collaborative efforts of previous cluster hires. Consideration is needed to prioritize/facilitate HIP proposals in a college-wide coordinated fashion to grow strategically.
3. Workgroup to identify existing crosscutting, integrative minors and explore ways to invigorate those and explore development of new integrative minors that cross departments.
4. Workgroup to explore alternative models and support for small class experiential learning (lab, field courses) and alternative models of pedagogy to incorporate active learning into classes of all sizes; this workgroup could also explore support for graduate education, TAs, readerships, since this is tied directly into growing undergraduate numbers but limited graduate support
5. Workgroup to explore seed funding procedures that should be supported by endowments/fundraising etc., not redirection of core funding. Seed funding should be supported by new funds, as opposed to a redirection of base funds.
6. Workgroup to discuss the relationship with ANR, as this relationship contributes to the UC CA&ES mission. This includes specialist hires with a joint I&R/CE appointment but other items as well, such as campus affiliation, funding, etc.
7. A workgroup to fully develop and explore the bold, big ideas that will showcase the full spectrum of CA&ES impacts and exemplify the priorities presented in this planning document.

V. Recommendations

1. Focus college investments in four key priority theme areas (that address regional, state, national, and global concerns), with strategic emphasis on integrated and transdisciplinary areas.
2. Pursue future hires to maintain existing core departmental strengths and build integrative capacity in emerging fields. We advocate a thematically-driven initiative process, wherein the four priority areas outlined in this academic plan serve as the guide for both regular departmental FTE calls and CIREs.
3. Develop seed funding (through endowments) to support interdisciplinary research efforts.
4. Promote crosscutting educational experiences including minors, internships, small group learning opportunities, international exposure, and improved education abroad opportunities.

5. Develop bold, integrative outreach, teaching, and educational platforms that build and maintain the strength of the college (e.g, “Big Ideas” of demonstration farms, communities, and/or ecosystems that fit the broad contextual concepts of the priority themes, facilitate experiential learning, and serve as a research model — yielding results that can be translated to address state, national, and international problems. Appendix 3).

Appendix 1. Charge letter

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~~September 28, 2015~~
Updated: October 15, 2015

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DAVE CAMPBELL, Associate Dean, CA&ES Dean's Office, *ex officio*
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MATT WOOD, Associate Professor, Environmental Toxicology

Dear Colleagues,

It is with excitement on behalf of the college that I write to you outlining the details of the 2015 College of Agricultural and Environmental Sciences Academic and Strategic Planning Committee ("2015 ASP"). But first, let me express my sincere thanks for your expressed willingness to serve on this committee during the Fall 2015 quarter. I am aware that your dedication to this effort may well mean there is another priority that must take a back seat, so please know how much I appreciate your individual and collective service on behalf of the entire college.

I would also like to acknowledge the three co-chairs for this committee, Professors and Chairs Anita Oberbauer, Francene Steinberg and John Eadie. Their programmatic expertise, organizational skills, and dedicated approach to research, teaching, service and outreach activities offer a great blend of leadership and collaborative skills to guide this committee.

The committee work will be fast paced and I look forward to hearing about your work during the quarter from the *ex officio* members of the ASP, Associate Deans Dave Campbell, Sue Ebeler, Ed Lewis and Ron Tjeerdema. College staff member Brenda Nakamoto will provide staff support as she has done in an exemplary manner for other college committee efforts.

2015 ASP
October 15, 2015
Page 2

Herein I outline the ASP charge:

- Work together to develop a streamlined Academic and Strategic Planning Report with an Executive Summary by December 31, 2015.
- The report should include:
 - Articulation of 2-3 key college priorities that are inclusive, innovative and forward-thinking and which build on both the 2013 Visioning Committee Report and the 2015 Academic and Strategic Planning Survey.
 - The priorities should serve as strategic umbrella concepts to guide our continuing excellence and that address our College and Agricultural Experiment Station missions of teaching, research, extension and outreach.
 - Generate a listing of implementation strategies that the college can pursue to meet its interdisciplinary objectives employing an integrated approach to solving major issues of the state, nation and world in keeping with our mission.
 - Identify areas of strategic emphasis wherein follow-up workgroups might be formed to help implement the priorities and address strategy details.

Warm regards and thank you for your service,



Helene R. Dillard, Ph.D.
Dean and Professor

cc: Mary Delany, CA&ES Dean's Office
Julie Fritz-Rubert, CA&ES Dean's Office
Alan Hastings, CA&ES Faculty Executive Committee Chair
Jan Hopmans, CA&ES Dean's Office
Tom Kaiser, CA&ES Dean's Office
Christine Schmidt, CA&ES Dean's Office

Attachments: Executive summaries-Background of prior planning committees
2015 Academic and Strategic Planning Survey Report

Appendix 2. Committee Mechanics

The committee membership included faculty from each department. Each member was specifically charged with representing the breadth of their home department and asked to report to and solicit feedback from their home department. The committee also comprised three co-chairs and four Associate Deans (ex officio).

The ASP committee members met 12 times (1.5 hours each) during Fall 2015 quarter, from September 29, 2015 to December 15, 2015. The committee heard presentations from Dave Block who summarized the CVC and Dave Campbell who reported on the college survey results. The committee followed these presentations with discussions and general consensus that the CVC report was an important visioning exercise yet yielded too many disparate themes that lacked the specificity required to yield implementation strategies whereas the college survey was too narrowly focused with only two areas. The ASP committee acknowledged that the two areas of “Adapting to Climate Change” and “Vibrant Healthy Communities” in the college survey resonated with college faculty and that the survey findings underscored the college desire to integrate and tangibly connect the core pillars of the college by creating interdisciplinary approaches to questions by blending social, biological, and technological science. The ASP committee desired to consider a fuller range of thematic umbrella priority areas. The ASP approach struck a middle ground between the perceived breadth of the CVC report and the confines of the College Survey.

The approach taken was to review the previous plans and obtain current Departmental mission, vision, and key programmatic thrusts. The eight multidisciplinary opportunities of the CVC and the previous plans’ areas for investment were mapped into a matrix to illuminate commonalities (these compilations are provided to the Deans office as supplementary material). Through an extensive series of discussions as a group and in small teams, a small number of core themes coalesced as well as an overall CA&ES mission. The four key, highly interrelated priority umbrella themes capture existing strengths and defined priority areas that will maximize the impact of CA&ES regionally, nationally, and globally.

The ASP then developed key topical areas of focus within each of the four priority themes based upon the past plans and the Departmental programmatic thrusts. In most cases, departmental aspirations and needs mapped directly onto the themes that emerged from the previous planning documents. Various analogies were employed to demonstrate how defining topical areas could structure a road map for planning purposes. The drilling down, though still at a moderately high level, helped to focus on the essential elements and identify critical components for each priority theme. This effort enabled faculty and departments to visualize their role more explicitly within the themes and led to the appreciation of extensive areas of overlap and integration with similar topical areas were found in multiple priority themes. The Venn diagram helped conceptualize the integrative nature of the constituent components underpinning each priority theme and demonstrated how the classical CA&ES divisions work together to address the pressing challenges facing human society.

With agreement on an overall conceptual framework, the committee focused efforts on developing implementation strategies, first by starting broadly (using subgroup discussion loosely structured into priority theme groups) and then sorting into overarching, recurrent strategies that apply to multiple priorities and focused strategies that were more specific to a single priority theme. This was then followed by defining emerging integrative areas that present opportunities for new investment in CA&ES and suggested workgroups to explore and define implementation action items.

Appendix 3. Ideas for future investment to build capacity

Table 1 within the report summarizes the emerging integrative areas that present opportunities for new investment. The following text presents more fully the discussion and elements that underlie those areas defined within the table.

- a. *Sustainable global food security and adaptation to global change* — Assuring food security with limited negative impact on natural ecosystems and human health is one of the most pressing issues of our day. Our college has many faculty working on various aspects of this issue, and “Big Picture” hires who think about this holistically could pull this effort together and cement UC Davis as a global leader. Our college needs faculty with different but complementary skills to address issues related to sustainable agricultural systems. These hire suggestions necessarily transcend a given priority theme because of the highly interrelatedness and interdisciplinary nature of the topical areas. Examples of needed areas of expertise include:
 - Food safety and quality (addressing such questions as how does food affect human health? Is food quality related to increasing incidence of allergies and some diseases? How does food and food processing/preparation affect gut microbiomes (and meta-transcriptomes) and ultimately health and quality of life? What steps in production can improve the end-product? How to balance production practices for reduction of pathogens with ecosystem management?)
 - Sustainable agriculture & food systems; Agroecology (an important strategy for agriculture to adapt to climate change and supply ecological co-benefits; utilization and development of mariculture and aquaculture)
 - Ensuring resource efficient utilization along the production supply chain
 - Plant pathogen biology (epidemiology of plant diseases in a changing climate) and impact of biotic stress on plant-pathogen interactions
 - Fair and equitable food distribution systems (poor distribution is a major cause of hunger and food waste worldwide)
 - Growth of production on marginal lands (which may be needed to feed 9 billion people in the era of climate change)
 - Dealing with declining agricultural labor through technology development; Expand work on agricultural technology development such as mechanical fruit harvesters and automation in general
- b. *Equitable, Healthy Communities* — Social equity within American society, interactions between environment and health, food and nutrition personalized intervention, molecular basis of chronic diseases (such as obesity, diabetes, etc.), healthy aging
 - Food safety and quality; how does food affects human health? Is food quality related to increasing incidence of allergies and some diseases? How does food and food processing/preparation affect gut microbiomes (and meta-transcriptomes) and ultimately health and quality of life? How can nutritional value of food be increased?
 - Livestock health and welfare — Integrating livestock with other agricultural, natural, and human systems. This relates to animal welfare but also to human health (diet and possible diseases from animals) as well as the effect of livestock on natural systems, which include large potential impacts on things like impacts on vegetation to microbial contamination of water
- c. *Climate change science* - climate change modeling and forecasting, alternative energy, or climate change adaptation in the agricultural, environmental, or social sciences, perhaps including TOE hires. Climate mitigation policy and planning at state, regional, and local levels,

Behavior change and social marketing related to reducing household GHG emissions; Green infrastructure for climate adaptation; Urban ecosystems; Drought adaptation strategies

- d. *Integrated water sciences* — water is a critical resource that is at risk locally and globally. California is in a unique position to address this issue in terms of water use/efficiency, quality, resource preservation, recycling, climate change, impact on natural ecosystems, sustainable marine and coastal systems, etc. Our college should be a global leader in this area, an issue that cuts across all the traditional pillars of the college.
- e. *Integration of social and environmental sciences* — How do policymakers understand and translate science into decision-making? How are decisions made under conditions of uncertainty? What types of networks, programs, and other mechanisms accelerate or decelerate the effective integration of science into policy? In the field of climate change science, CA&ES is currently relatively strong on climate science but weaker on policy, especially mitigation policy and planning at state, regional, and local levels. Faculty who can bridge the gap between climate science and climate policy are needed. Our location adjacent to the state capital provides an exceptional opportunity for UC Davis and CA&ES to become more involved in the State of California’s global leadership on this issue.
- f. *Informatics, remote sensing and spatial modeling* — Geospatial methods are essential for environmental planning, management and research; they enable assessment and prediction of the responses of complex ecosystems facing multiple threats from changing climate and land development. Spatial analytical methods, which support the integrative research that is needed to solve complex environmental problems, are pervasive across the environmental disciplines. These technologies have broad application in the food supply chain as well as use in urban planning. Our college has a critical need for FTE, facilities, and course offerings at the graduate and undergraduate levels in these areas. Closely tied to this is the emerging field of remote sensing technologies, which are being researched in fragmented programs across campus. These initiatives and efforts could be consolidated and expanded upon through a combination of investments in facilities, FTEs and development of a new degree program with foci/emphases, such as:
- robotics and drones,
 - cameras and sensors,
 - data processing and calibration,
 - data analysis and presentation (including more conventional GIS), and
 - models, recommendations and policies derived from remote sensing data.

This includes capacity in handling “big data.”

- g. *Sustainable energy systems* — Rapid innovation and intensifying calls for climate stabilization are transforming the very nature of our energy and transportation systems, and California is a world leader in this revolution. In turn, UC Davis is at the heart of the state’s leadership in policy innovation and investment in energy efficiency, low-carbon vehicles and fuels, renewable energy, and grid storage. With the boost of additional faculty in strategic areas, UC Davis is poised to be a world leader in renewable energy, energy efficiency, and transportation. For example, additional positions are needed in energy systems design, energy policy, renewable technology development, transportation energy planning, carbon neutral building, bioresources for materials and energy, and the integrated modeling of energy, climate, and system sustainability.

- h. *Disease* — characterization and mitigation of disease applies to both the human ecosphere and natural systems. The microbiome and microbial communities as applied to soil, plants, animals and humans impacts resilience in the face of a changing climate. Diet and disease are highly correlated with integrated social, behavioral and biologic inputs to health. A changing climate also impacts pathogen distribution, longevity, and virulence.
- i. *Big Ideas* — The college should aggressively pursue the campus Big Idea initiative to promote **broad** thinking and the development of overarching concepts that link multiple departments and programs (and perhaps colleges) that can be used in outreach, education, and as research laboratories. The following is just one example; many others are possible and several are currently under development for the new campaign:
 - i. *“A River Runs Through It”* – UC Davis is defined by the landscape in which it is located, which has a strong connection to waterways, floods, and droughts. The connection is through Putah Creek, Cache Creek, and Willow Slough watersheds, which water our farms and cities and provide habitat for diverse, often endemic, biota. In many respects, the UC Davis campus and its environs are together a microcosm of rural and suburban California, and therefore a testing ground for new ideas for living with and adapting to the changing landscape, especially in relation to water use. We see UC Davis as being the center of a movement towards reconciliation ecology as a dominant paradigm of land and water management, where humans are recognized as an integral part of ecosystems that are truly novel in composition, structure, and function. This initiative would position Putah Creek as a living laboratory connecting campus to Russell Ranch, campus collections (Museum of Natural History, Bohart, Plant, others), the UC Davis Farm, an “Ag Pavilion” (showcasing our animal and plant sciences), the Arboretum and more. It would integrate experiential training, internships, long-term research, human health and community, traineeships in disease. (NOTE: the human sciences have not yet been fully worked into this concept.)
- j. *Facilities Investments* — Maintaining excellence in the college requires state-of-the-art facilities to conduct research, teaching, and extension. Many of the college’s facilities were constructed in the 1950’s and are inadequate. A concerted effort by the college to review, prioritize, and fundraise to replace or upgrade our facilities is imperative. Some examples (not a comprehensive list) of facility investments that would enhance and grow experiential learning activities, include:
 - i. Instructional facilities to support smaller undergraduate laboratory classes
 - ii. Support for off-campus UC Davis field stations
 - iii. Upgrading the Dairy Teaching and Research Facility
 - iv. Upgrade equipment and facilities at the UC Davis Farm
 - v. Develop improved space and greater public access for CA&ES animal and plant collections
 - vi. Consider an Ag Pavillion or Expo for outreach and stakeholder engagement
 - vii. Improve analytical instrumentation for food safety analysis
- k. An Environmental Sciences Building has been a long-standing aspiration of CA&ES, and the idea should not be abandoned. This building would co-locate the college’s numerous environmental sciences programs, facilitate integration and interaction, and would highlight the exceptional depth and breadth of the environmental sciences in the college. This could be a component for a new Big Idea initiative if it were integrated into a broader campus wide concept.
- l. Support for Environmental Institutes (CMSI, JMIE,)— Our college has supported the efforts of the John Muir Institute of the Environment, and its component centers and programs (such as the Center for Watershed Science), to foster innovative interdisciplinary environmental

problem-solving in areas that are highly relevant to the goals of this academic plan. Likewise, the college has faculty invested in the Coastal and Marine Sciences Institute (CMSI) and its mission, which is poised to achieve excellence in meeting the challenges of 21st century sustainability as they pertain to the Californian marine ecosystem. We advocate support for excellence in the JMIE and CMSI as a means of achieving the goals of this academic plan.