



California State University

Agricultural Research Institute

CSU ARI

2015-2016 Annual Report

Submitted by: David W. Still, ARI Executive Director

Overview

The Agricultural Research Institute (ARI) was created through legislation in 1999 to conduct applied research within the California State University (CSU) system to address challenges facing agriculture and natural resource industries in California. To date, the ARI has allocated over $70 million in competitive grants that have been matched with an additional $80 million from industry and federal grants. Matching dollars from industry demonstrates the value they see in ARI research, while federal matches speak to the competiveness of the faculty receiving these grants. During FY 2015-2016, faculty were awarded $2.8 million in federal grants to extend the work of their ARI-sponsored research. In addition to leveraging ARI, industry and federal dollars, a less obvious benefit of ARI projects is the collaboration among faculty with industry, colleagues within the CSU, UC and federal agencies like the USDA. Complex problems require polytechnic research teams that promote new ways of thinking and ones that are capable of utilizing and developing new technologies. Virtually all faculty indicate ARI-sponsored research allowed them to continue or start new collaborations.

The vast majority of academic research takes place in research-intensive doctoral granting institutions, yet these comprise only 7% of all institutions in the U.S. The ARI provides research opportunities to these students whom would otherwise not have access to a research lab. Students are a key component to the success of an ARI research project. Over the last year, ARI-sponsored students received over 48,000 hours of intensive science training and mentoring. They are involved in all aspects of science – from the planning stages to collecting and analyzing data, to presenting the project in conferences and ultimately as co-authors on peer-reviewed papers. Almost 25% of ARI expenditures last year were used to support 295 students through wages, stipends and tuition reimbursements. Our students learn discipline-specific research methods but the common thread of all science is the necessity to think critically. Their research skills are a value-added component to their CSU degree and each will be a valuable addition to industry or a graduate school research lab.

Faculty from diverse disciplines are funded by the ARI to apply their talents and skills to solve problems that will help sustain the economic competitiveness and sustainability of California agriculture. The continued drought and the negative consequences of climate change on California agriculture and natural resources have the potential to fundamentally change these industries. These challenges have been recognized and the ARI is funding projects across the state that addresses climate change and seek to lower the environmental impact of agriculture. Water use efficiency is the focus of several projects that are developing new technologies and remote sensing to improve irrigation and water management models. Other projects address water use and greenhouse gas emissions from the other side of the equation, that is, by breeding plants to use less water and nitrogen. Reflecting the diversity of agriculture, multi-disciplinary teams are seeking to lower California's carbon footprint by developing technologies to convert algae and tree biomass into energy.

Dr. David W. Still

WELCOME
from the Director

The ARI continues to evolve. In October 2015, I took over as Executive Director after the retirement of Dr. Mark Shelton. Dr. Shelton did a remarkable job in organizing and bringing uniformity to the ARI and demonstrated great leadership during his tenure. I would be remiss in not recognizing the founding Executive Director, Joe Bezerra, who successfully got the program started and firmly established to the point it matured from an "Initiative" to an "Institution". I took over a strong organization.

As part of the evolution of the ARI, we have implemented an annual assessment that includes quantitative metrics associated with research output and qualitative measures of long-term impact. These metrics characterize the type of research funded. Qualitatively, they are measures of human knowledge capital and through their industry and academic partnerships, represent the dissemination of ideas and shared resources that are leveraged to a common purpose. Much of this assessment is included in this report. Importantly, assessment data will allow us to determine objectively if we are fulfilling our mission and goals and make adjustments as needed.

The four CSU Colleges of Agriculture located at Chico, Fresno, Pomona and San Luis Obispo are charter members of the ARI, while Humboldt State and Monterey Bay became Associate Members during FY 2015-2016. Further changes are ahead. Beginning FY 2018-2019, system competitive funding will be opened to the remaining 17 CSU campuses. This will allow a greater pool of faculty to directly compete for funding and contribute to finding solutions that face the California agricultural and natural resources industries.

Contents

Mission, Vision, and Strategic Objectives	3
Allocation and distributions	4
Projects by campus	5
NCE and rebudgets	5
Faculty rank and project distribution	6
Outputs	6
Research expenditures	
Overview	7
By campus	9
Developing leaders and innovators	12
Communicating ARI-sponsored research	13
Student profiles	14
System funding project profiles	20
Active projects	22
Acknowledgements	28

Mission

To support and fund applied agriculture and natural resource research within the California State University (CSU) system that improves the economic efficiency and sustainability of California agriculture.

Vision

California has diverse and abundant agricultural and natural resources. Through education and research, we envision the ARI being a valuable resource to the State on policy and informed decision-making based upon robust science to ensure the sustainability of California's agricultural economy and the preservation of its natural resources.

Strategic Objectives

- Invest in applied research to address emerging and high-priority issues facing California agricultural and natural resource industries;
- Develop a highly-trained professional workforce for California agricultural and natural resource industries through student participation in research projects;
- Communicate research results to industry stakeholders, scientists and the public.

Allocation and distributions

The ARI's most important function is to award grants to support research in applied agriculture and natural resources with funding decisions based on scientific merit, evidence of economic impact to California agriculture and natural resource industries and student involvement in research. Every project is matched at least one-to-one with non-CSU matching funds from a closely related project.

Strategic objective 1: Invest in applied research to address emerging and high-priority issues facing California agricultural and natural resource industries.

ARI funding, allocation, distribution and utilization

The Agricultural Research Institute (ARI) is comprised of four charter Member Campuses (Chico, Fresno, Pomona and San Luis Obispo) and two Associate Campuses (Humboldt and Monterey). The ARI is allocated $4.37 million annually in State General funds through the California State University (CSU) budget to support applied research in agriculture and natural resources. Of this amount, approximately 14.1% is used to support the administration of the grant program (Figure 1A), a low percentage compared to granting programs in agriculture and the life sciences.

Each Member and Associate Campus and the ARI central administration (hereafter referred to as "system administration" or "system funding") receive allocations to fund applied agricultural research projects through a competitive grants process. In FY2015-2016, campus allocations ranged from $100,000 (Monterey Bay) to $756,000 (San Luis Obispo (SLO) and Fresno) to support intra-campus competitive grants (Figure 1B). System administration received $800,000 to fund multi-campus research projects (Figure 1B). In addition, each Member Campus received an $85,000 allocation for campus administration and coordination activities (Figure 1C). System administration, which resides at the home campus of the Executive Director, was allocated $220,000 for the overall administration of the program, to provide oversight to Associate Campuses and system-wide research projects. Proposal evaluations and decisions regarding project awards are made on each campus. System proposal funding evaluations and decisions are made through a combination of external reviewers, Deans' Council and the Executive Director with final approval by the Board of Governors.

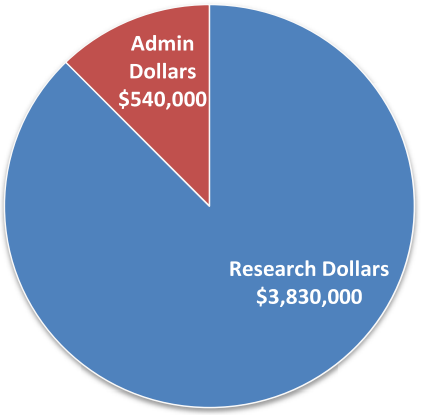


Figure 1A

Figure 1. *The Agricultural Research Institute's allocation of $4.37 million supported competitive grants and administration of applied agriculture and natural resource research projects (Figure 1A). Formula-based allocations to Member and Associate Campuses supported intra-campus projects while multi-campus research was funded through the System administration (Figure 1B). Indirect cost recovery of individual projects is prohibited. Instead, administrative functions were supported through an allocation to each Member Campus while the System administration supported the overall program and Associate Campuses (Figure 1C).*

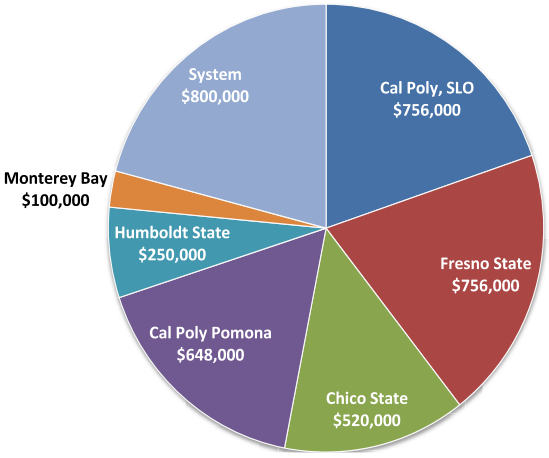


Figure 1B

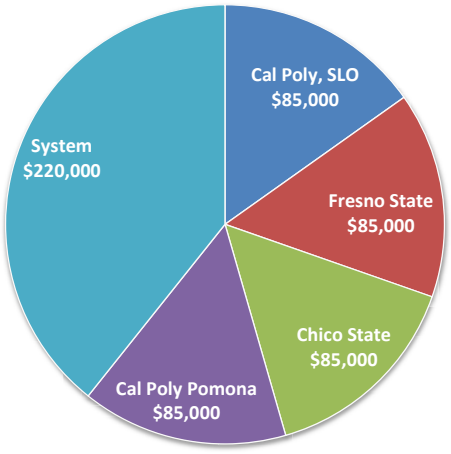


Figure 1C

Projects by campus / NCE and rebudgets

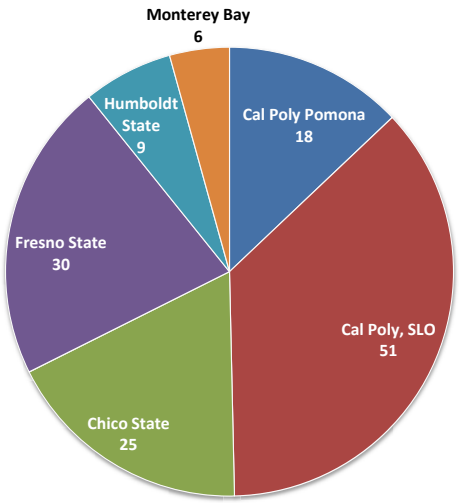


Figure 2. *Number of active projects during FY 15-16.*

The number of active projects on Member Campuses during FY 2015-2016 ranged from 18 at Cal Poly Pomona to 51 at SLO (Figure 2). The number of projects a campus funds depends on a multitude of factors including faculty interests, industry concerns and support and the ability to secure matching funds. The types of projects often reflect the agriculture and natural resource economies near that ARI campus.

Over the duration of a project, a no-cost extension (NCE) and/or budget revision may be requested. The request may be attributed to funding dates that are out of sync with research activities, for example, projects that are dependent on growing seasons and crop cycles. Realistically, research rarely proceeds trouble-free and may require a period of trouble-shooting. Labs may be required to develop methodology before experiments are started and data gathered. Taken together, these are factors that commonly contribute to a NCE request. The percentage of active projects operating under a NCE of the Member Campuses ranged from 30 to 68% for Pomona and Fresno, respectively (Figure 3). The relatively high percentage of NCE by Associate Campuses is simply due to these campuses receiving their funding near the end of the FY cycle.

Proposals often require forecasting three-to-four years in advance but personnel changes and experimental results while executing the project may require the Project Director to request a budget revision. The percentage of projects that received a budget revision at any time during their project ranged from 15 to 59% for Pomona and Fresno, respectively (Figure 4).

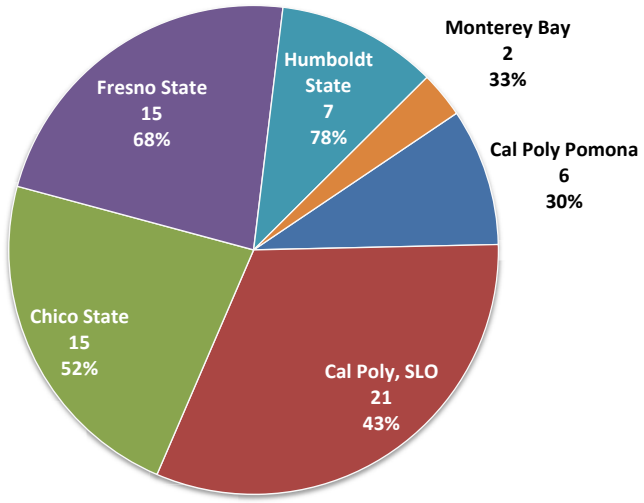


Figure 3. *Number and percentage of active projects in Member and Associate Campuses that have received a no-cost extension at any point of time during the project.*

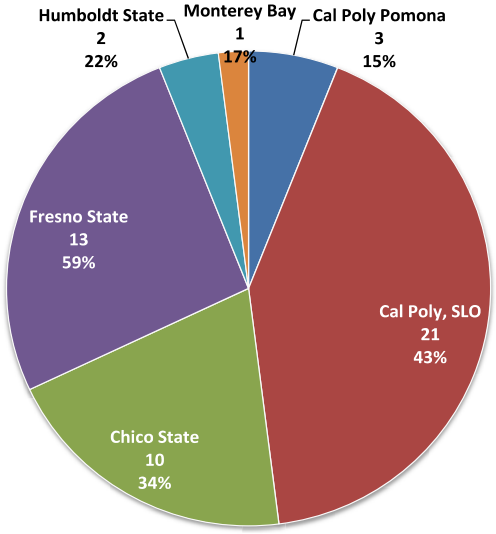


Figure 4. *Number and percentage of active projects that received a budget revision at any point of time during their project.*

Faculty rank and project distribution / Outputs

Important drivers of a successful research program include the development of a research culture and a dependent source of funding that is used to generate research capacity which itself is an indispensable tool to attract and retain talent.

To develop a robust research portfolio, the ARI should seek to support well-established scientists to maintain and strengthen their research capabilities and profile within the scientific community. This will, by extension, increase the visibility and credibility of the ARI program. In other words, funding research programs and investing in training is an investment toward increasing the level of science and capabilities of our ARI faculty. Excluding Associate Campuses, ARI projects are funded an average of 2.2 years, while system projects are funded an average of 2.9 years. The distinct advantage of funding multi-year projects is it allows labs to maintain continuity while focusing on generating data and conducting experiments. To ensure the ARI is developing and retaining faculty for the future, it is important to mentor and fund junior faculty. Funding is well-balanced across all faculty ranks, with 37, 23 and 29% of the active projects during FY 2015-2016 being led by professors, associate professor and assistant professors, respectively (Figure 5). Often, assistant professors have had little experience in writing grants to secure funding for their research. The ARI proposal review committees at each campus provide mentoring and detailed feedback in proposal reviews, especially to junior faculty. In the ARI assessment survey, 93% of all faculty, regardless of rank, agreed or strongly agreed that writing ARI grants improved their grantsmanship.

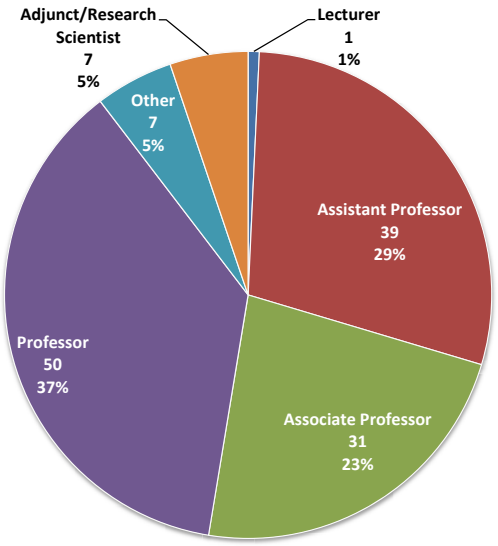


Figure 5. *The number and percentage of active projects across faculty ranks during FY 15-16.*

The annual assessment results indicated ARI-sponsored faculty were engaged in creating a variety of research-related products (Figure 6). Faculty most commonly reported creating data sets in 21% of the projects, developing new methods (12%), producing Master's theses (12%) or senior projects (10%). Eleven other output categories were reported across all projects, reflecting the broad diversity of research and the products created. The complexity of issues facing agriculture often requires new technologies from disciplines outside traditional agricultural training. The annual survey results indicated that Project Directors of 16% of all projects developed new collaborations (Figure 6). Overall, 74% of all projects "strongly agreed" that ARI funding allowed the Project Director to continue or create new collaborations, but this response varied by campus (55% to 89% for Fresno and Pomona, respectively). In addition to cooperating with private industry, many of these collaborations involved colleagues at the USDA or the University of California system. Collaboration is important to the ARI mission since it brings additional expertise to a project and encourages the exchange of ideas and intellectual capital among the participants. Further, collaborations can lead to pathways for students to matriculate to graduate school or secure an industry job.

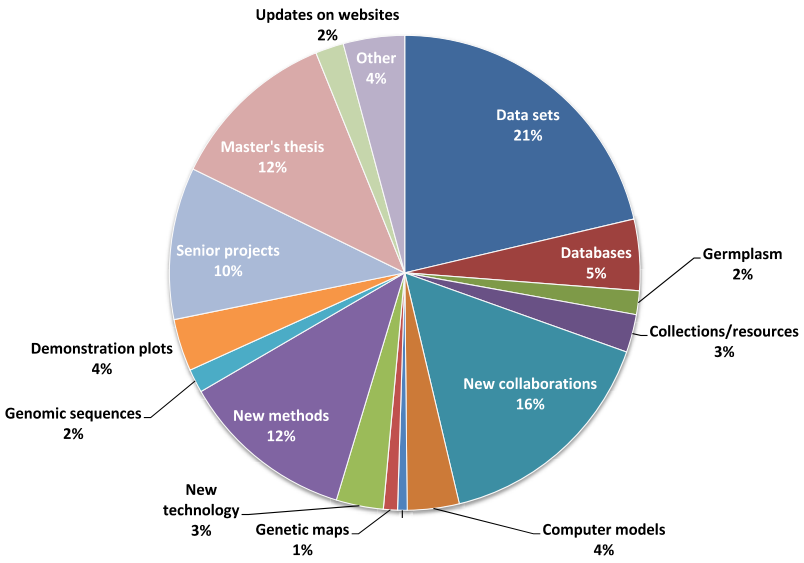


Figure 6. *Outputs and activities from 139 active projects across Member and Associate Campuses during FY 15-16.*

Research expenditure characterization - overview

The dollars spent in support of ARI projects were categorized into six broad categories that include salaries, benefits, lab supplies, equipment, other and travel. Overall, across all campus and system funding, ~63% of budget expenditures were allocated to salaries, 9.7% to benefits and 15% to lab supplies (Figure 7). Collectively, equipment, travel and "other" comprised 12.3% of the expenditures. The "other" category includes funds used to support land rental, services to outside vendors, instrument repair and maintenance, publication charges, and other miscellaneous charges that directly support the research project.

The salary category is comprised of faculty release time, faculty additional employment, salaries to postdoctoral scientists and other professionals, and students (undergraduate and graduate). Within the salary category, the largest percentage (24%) is used to support students to work on projects. Additional employment (e.g., summer salary) comprise the next largest percentage (17.3%) followed by professional salaries and release time (14.1 and 7.2%, respectively). In addition to compensation, ARI funding demonstrably helps attract and retain faculty by allowing them to engage in research and publish papers. In fact, 59% of faculty reported that the ARI program was a contributing factor in deciding to accept employment at their campus while another 79% indicated it is one reason they remain. As many departments across the CSU have implemented requirements to publish original research to obtain tenure and promotion, ARI funding has helped more than 81% of faculty with active projects meet these requirements.

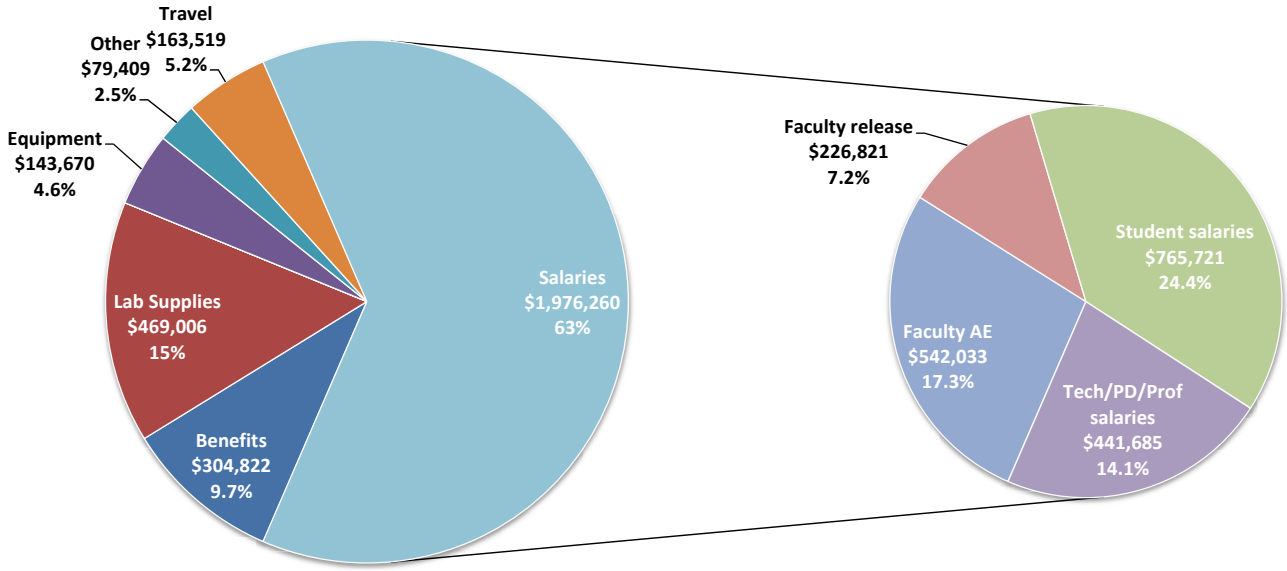


Figure 7. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16. These data represent expenditures summed across all Member Campuses and Humboldt State; Monterey Bay data were not available. The inset provides details of the largest catergory, salaries. The student salaries category includes wages and tuition remittance to undergraduate and graduate students. Faculty additional employment (AE) is typically summer employment. Technical (Tech), postdoctoral (PD) and other professionals (Prof) are tracked as a separate salary category.*

Research expenditure characterization - overview

Within each of these expenditure categories, among campuses there is a range in how the funds are used to support research (Tables 1, 2; Figures 8-12). Expenditures in support of salaries (all categories) range from a low of 54.4% at Pomona, to a high of 70.4% at Chico. The budgets of each campus are flexible and reflect the realities of implementing research on that campus. The Project Director submits a detailed budget and budget justification for each project that is scrutinized by the respective campus' proposal review committee. The data indicate that the ARI funding clearly provides funding for release time and salaries that allow both faculty and students to engage in research that likely would not otherwise occur. Research capability is enhanced by acquiring instrumentation and equipment and is often the critical factor in conducting better experiments, developing new techniques and capabilities to generate new types of data. Each campus acquired new equipment, ranging from 1.3% of the overall campus budget (Fresno) to 10.4% of the budget expenditures (Pomona) (Figures 9 and 10, respectively).

Table 1. *Comparison across campuses of budget expenditures used in support of salaries for faculty additional employment (AE), teaching release time, students (graduate and undergraduate), professionals including post doctorate associates (PD), research scientists and technicians. The data represent minimum, maximum and range as a percentage of the respective campus' total budget expenditures. Data include Chico, Fresno, Humboldt, Pomona and SLO.*

		Salaries				Benefits
		Faculty AE	Faculty release	Student	Tech/PD/Prof	
Minimum	% of total	5.7	0	15.8	0	6.2
Maximum	% of total	44.8	28.7	29.3	21.4	13.2
Range	% of total	39.2	28.7	13.5	21.4	6.9

Table 2. *Comparison across campuses of budget expenditures used in support of lab supplies, equipment, other and travel (local, national, and international). The data represent minimum, maximum and range as a percentage of the respective campus' total budget expenditures. Data include Chico, Fresno, Humboldt, Pomona and SLO.*

		Lab Supplies	Equipment	Other	Travel
Minimum	% of total	10.2	1.0	1.0	2.7
Maximum	% of total	21.2	10.4	3.7	7.6
Range	% of total	11.0	9.4	2.7	4.9

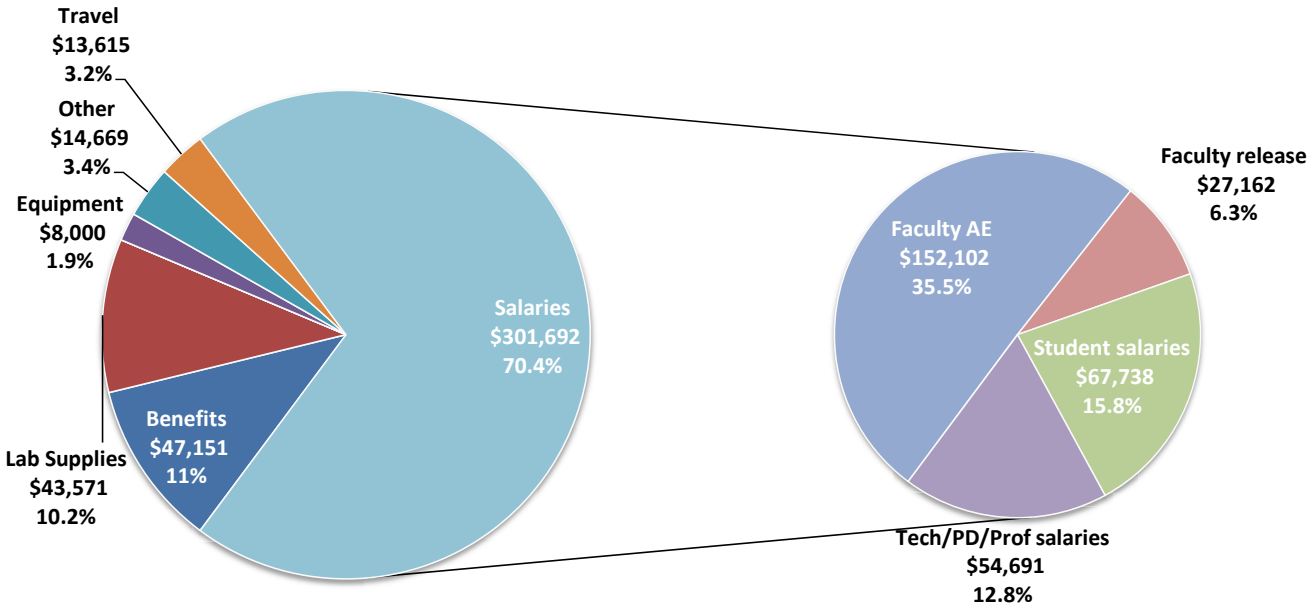


Figure 8. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16 for* ***Chico State University****. Details as in Figure 7.*

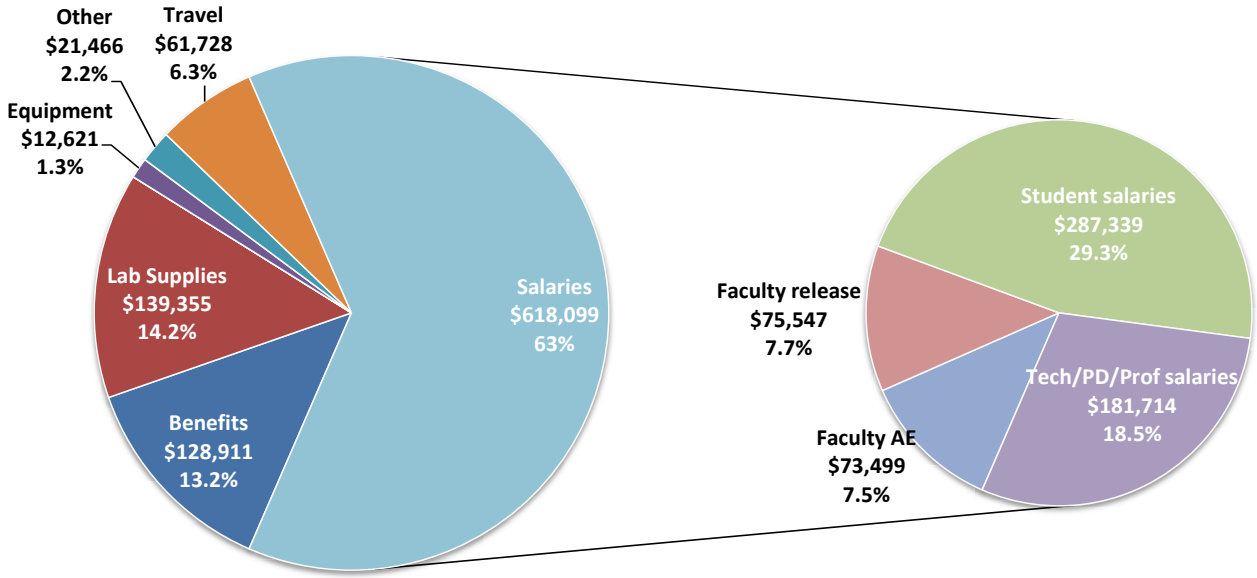


Figure 9. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16 for* ***Fresno State University****. Details as in Figure 7.*

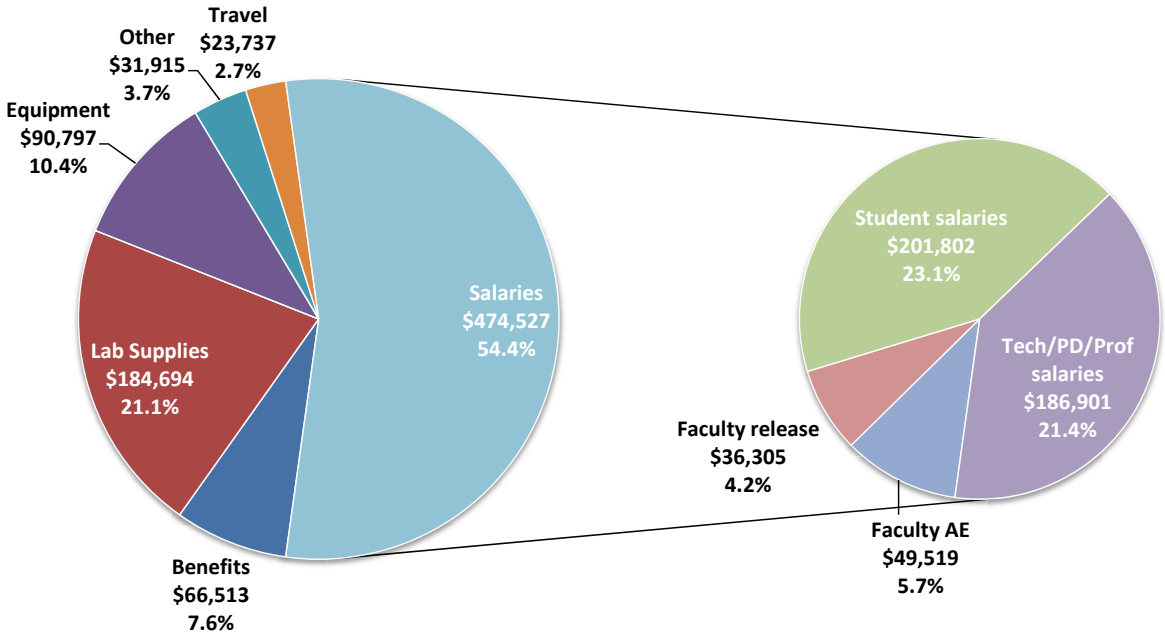


Figure 10. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16 for* ***Cal Poly Pomona****. Details as in Figure 7.*

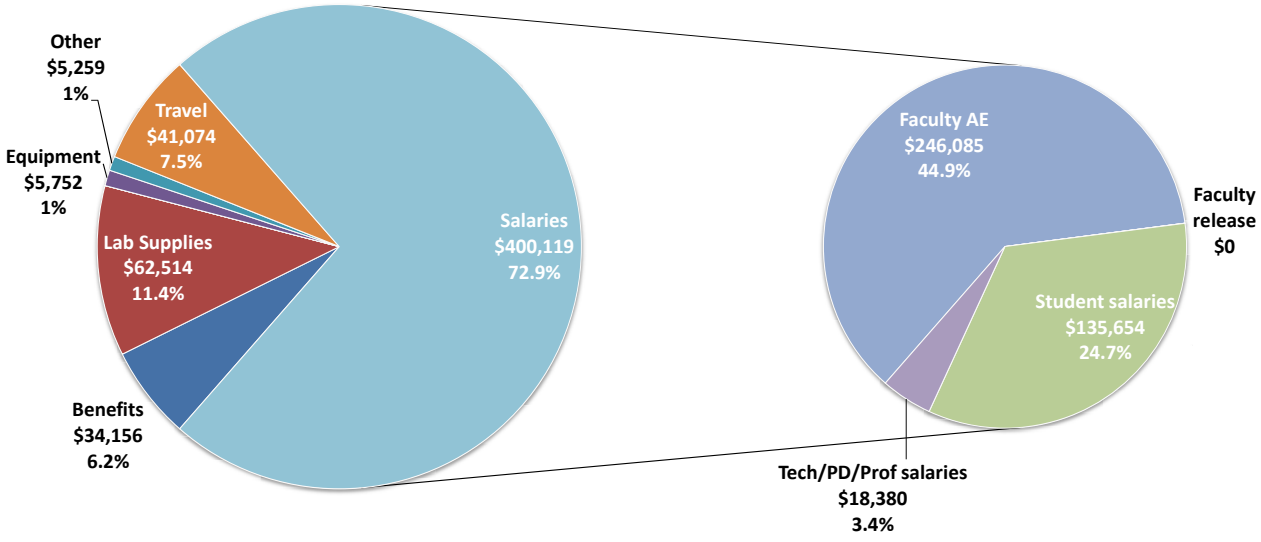


Figure 11. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16 for* ***Cal Poly, San Luis Obispo****. Details as in Figure 7.*

Campus expenditures

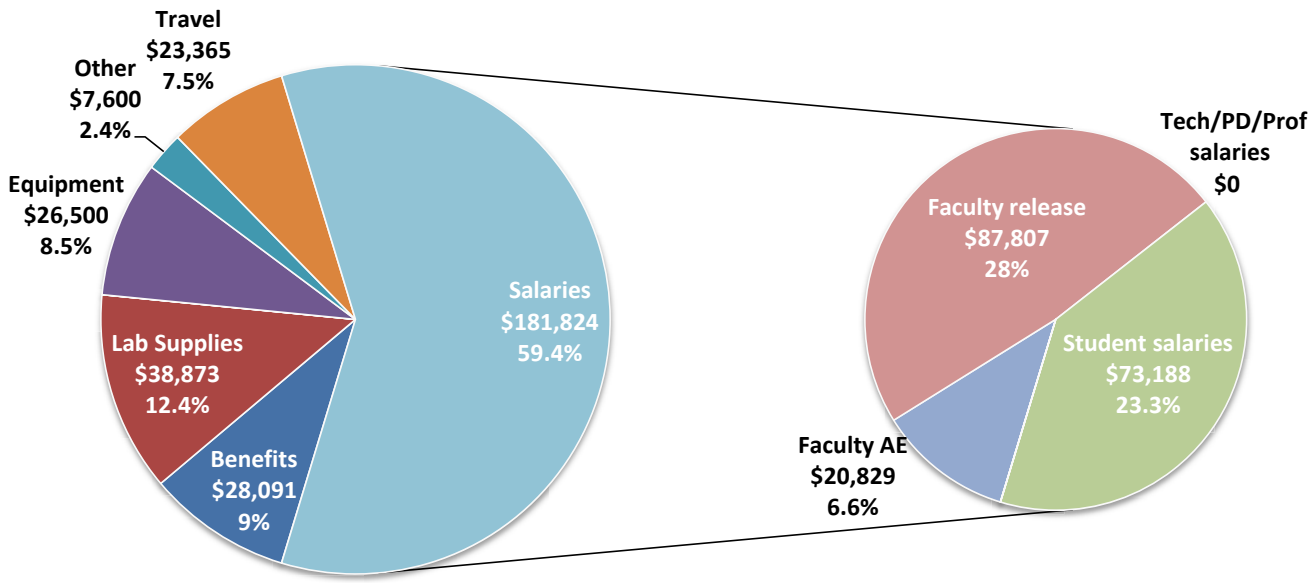


Figure 12. *Characterization of funding expenditures in support of research projects, expressed as dollars per category and as a percentage of overall expenditures during FY 15-16 for* ***Humboldt State University****. Details as in Figure 7.*

Developing leaders and innovators

Investing in student research training serves to create an environment that is conducive to the generation of knowledge and the development of a talented workforce.

Strategic objective 2: Develop a highly-trained professional workforce for California agricultural and natural resource industries through student participation in research projects;

Students are an integral part of the ARI research mission:

California's next leaders and innovators in agriculture and natural resources are being trained through research projects conducted by ARI-sponsored faculty. Impressively, virtually all ARI –sponsored faculty mentor and train students. During the last year, 96% of all projects used ARI funding to support students in their projects. The benefits to undergraduate students that are involved in research are multifold: they are more likely to graduate, enroll in graduate school and be employed in a major-related career than undergraduates who are not involved in research. Students working on ARI projects receive intensive training and mentoring that help develop critical thinking skills. This undergraduate research experience sets our ARI students apart from their peers in the CSU and UC, making them competitive for graduate school and valuable employees to industry. Over the last year, the ARI provided over 47,600 hours of training in a broad range of applied agricultural and natural resource projects. The students involved in this training are also compensated, receiving an average wage of $14.39 per hour. ARI funding keeps students on campus allowing them to learn about their discipline through hands-on research that is not part of their curricula. Last year, ~25% of the ARI budget supported undergraduate and graduate students to participate in lab and field research including bioinformatics, remote sensing, water management, bioenergy and a wide variety of other projects. Most Project Directors have multiple students working on the same project with the same goals; this provides valuable experience in a skill needed for success – teamwork!

A significant component of training students in science is providing opportunities to analyze data, derive meaning and conclusions from the data, and then tell the story through posters, oral presentations or peer-reviewed manuscripts. Students from 45% of the projects attended a research meeting or symposium, and 24% of the projects included students as a co-author of the poster or oral presentation at a regional or national meeting. Cal Poly Pomona, for example, hosted an annual ARI Research Showcase with students from each campus delivering an oral presentation in addition to a poster. Students that make presentations, by necessity, thoroughly know their research, can clearly communicate it and answer questions on their feet. These abilities are a clear demonstration of the student's high level of critical thinking skills.

Communicating ARI-sponsored research

The value of knowledge increases when it flows among the people engaged in research at all levels and when it flows at the right times and places.

Strategic objective 3: Communicate research results to industry stakeholders, scientists and the public.

Creating new knowledge is a primary attribute of research. Across all campus and system projects, 98% of all faculty agreed or strongly agreed that ARI funding allowed them to create new knowledge. Sharing results and knowledge occurred through many venues, including faculty introducing and using this knowledge with their students in the classroom. Information from approximately 53% of all ARI-sponsored projects were introduced into classes from broad disciplines that included entomology, plant breeding, food science and technology, immunology, ag business, soil science, organic production, forest management, plant pathology, genomics and various molecular biology courses. ARI funding allowed faculty to bring in specialized knowledge from their projects into the classroom, and in all campuses except Fresno, this occurred mainly in upper division and graduate courses.

The ultimate value of our research investments depends on their widespread dissemination and ultimately their adoption and use. The importance of identifying and communicating to the public the societal benefits resulting from the ARI's research investments cannot be understated.

To remain competitive and up-to-date, our faculty must both disseminate and receive knowledge. Many science conferences and meetings are, in effect, intensive multi-day seminars for faculty and students to learn something new, perhaps inspiring and influencing the way they think about their own research. By participating, ARI scientists and our students can discuss research projects with their academic peers, receive feedback, and importantly, hear the latest research results and technology often well before it is published. To that end, ARI faculty presented 178 posters and abstracts in a variety of venues across California, the U.S. and internationally (Figure 13). Another output metric commonly used in academia, is the number of peer-reviewed research publications. Our faculty had a total of 14 peer-reviewed manuscripts, book chapters or trade journal articles published during the last year that were associated with an ARI project.

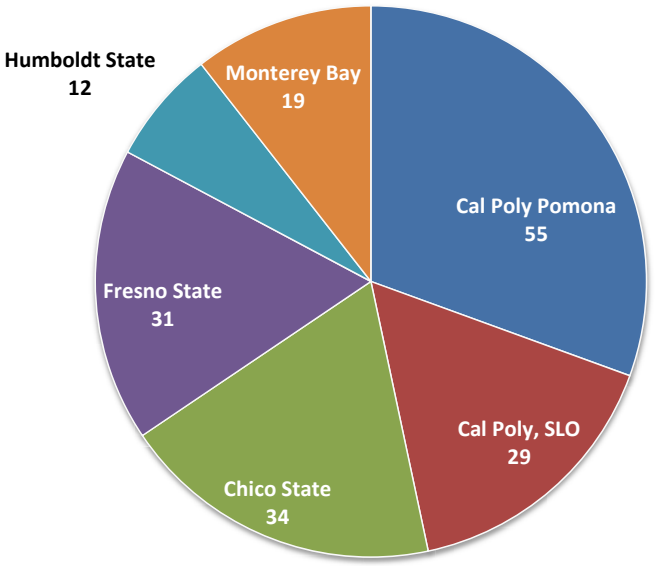


Figure 13. *Number of posters, oral presentations and abstracts presented by faculty in FY 15-16 highlighting ARI-sponsored projects.*

Communication and outreach to the agriculture and natural resources industry is often accomplished through the popular press and field days or workshops. These venues are meant to communicate with a general audience or offer demonstrations directly to industry personnel that may not attend scientific conferences. Of 139 active projects, 16 projects reported outreach through popular press venues, which included radio, newspapers, magazines, television and the internet. It is difficult to quantify the numbers that are reached through the popular press, but its potential audience is sizeable, and re-tweets and other social media can have appreciable amplification of the story. Faculty also reported that 39 ARI-sponsored projects were shared through field days or workshops. The number of people attending the field day or workshop event can typically be quantified, but there is a degree of uncertainty regarding how many heard about a specific ARI project or viewed the field plot. Never-the-less, faculty indicated reaching 4,290 people with their project-related information. The uncertainty in accurately capturing the number of individuals reached increases in proportion to the event size; in the future faculty can implement procedures to increase accuracy.

Students, the future of California

One way the ARI addresses the future needs of the California workforce is through student involvement in research projects. Critical thinking and problem solving skills are essential for success in any career. A student involved in research projects will have abundant opportunities to develop these skills during their training. Although students are involved in research that may be specific to the ARI project they are working on, they are learning approaches to solve problems, develop new methods and make discoveries. Research is arguably the best venue to develop these skills and provides an ideal environment for our students to think independently and critically. These skills make our students a valuable resource for future employers. Ideally, our students will remain in agriculture after graduating, but with their skills and broad training allow many to find employment well beyond the agriculture field – and that is just fine! On the following pages we introduce students from across the ARI campuses that are involved in ARI research projects. Each student has a different story about how they got here, but each leaves their program with some common traits: they are bright, confident, capable, and impressive!

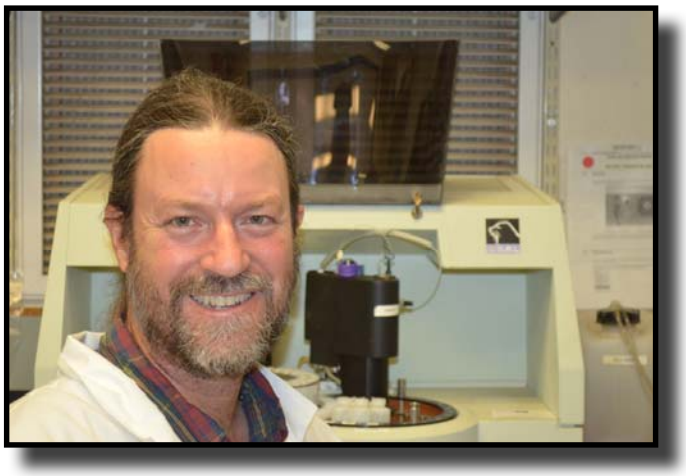
Blakeley Green, Chico State

Although her father is in the dairy business, Blakeley had no intention of going into agriculture. Instead she entered Chico State as a psychology major. After taking a few courses from that curriculum, she took a plant science course to satisfy a general education science requirement. One of the plant science projects required her to plant and tend to a garden. As she puts it, this course changed her life; she switched majors to Crops and Horticulture and became "an accidental ag student". The hands-on activities in her ag courses were far more exciting than the typical psychology class, which Blakeley found "boring".

Blakeley started working as a student research assistant in her junior year and now has over four years of working on ARI projects both as an undergraduate and graduate student. As she became involved with more projects, Blakeley cultivated an interest in insects and entomology. Her enthusiasm and abilities were not lost on Dr. Betsy Boyd who recruited Blakeley to work on an ARI research project for her Master's thesis. Her thesis project is working with an insect called psocoptera, commonly known as booklice, a tiny insect less than 2 mm long, found in almond and pistachio orchards. Almond growers have not considered these insects to be a pest, but Blakeley and Dr. Boyd suspect otherwise. Although difficult to find, Blakeley has already collected over 4,500 specimens in almond orchards with the goal of learning more about their biological role and determining if they have an economic impact on marketable yields.

When she first started in college, she had no idea about research, but soon realized she liked it. "It was like a puzzle and you learn so much." She likes working in the lab and feels if it wasn't for Dr. Boyd she would have never picked up research. The research experience has been valuable to Blakeley, opening new ways to learn and think about things that could be applied to classwork. With this knowledge she has gained confidence in her abilities. When finished with her thesis, Blakeley wants to work with insects in a research lab and help develop information that allows farmers to identify insects without having to depend on somebody else. She would like to use her knowledge and skills to conduct research that can be used by growers to better manage their crops.

Charles Cochran, Fresno State University



Most students come to college, take classes, graduate and hope to get a job and begin their career. Charles Cochran's returned to college after a successful career rubbing elbows with the legends of blues and rock. Charles' first career was as a concert lighting engineer where he designed and implemented state-of-the-art lighting technologies in support of live concerts for artists and bands that included Eric Clapton, Michael Jackson, the Eagles, and Neil Diamond.

After 20 years of living on the road, Charles decided he wanted a less hectic life. He got married, had a child, and moved back to his hometown of Visalia where he enrolled in a local community college (College of the Sequoias). A soils class at the community college resonated with him, and he decided to transfer to Fresno State as a Plant Science major.

Professors are often looking for talented and bright students to help with their projects, and as it happened, Dr. Dave Goorahoo recognized this in Charles and asked him to join his lab five days after graduating. As one might guess, Charles has an affinity for electronics and instruments, so he easily learned how to use and troubleshoot a variety of instruments being used in the lab for the soils and irrigation projects.

If Charles has any regrets, it is that he did not learn earlier that research was a viable career for students in plant sciences. He observed that being involved and paid to work as a student researcher in your field of study provides an additional focus and is not a "throw away" work environment. Charles will apply to a Master's program at Fresno and will definitely seek a research career once he graduates.

Corie Owen, Cal Poly San Luis Obispo

Corie Owen was pretty sure she wanted to be a wildlife veterinarian – until she went to Nepal for a year-long study abroad program during her sophomore year. While there, she volunteered at a veterinarian clinic but left the country questioning if that really was the career she wanted to pursue. Returning to fall classes at Cal Poly she started taking advanced cellular biology courses and found them interesting. In particular, she really enjoyed two embryology courses taught by Dr. Fernando Campos and asked if there were any openings in his lab. There was, and she has worked in his lab for one-and-a half years where she is studying lipid metabolism and cryopreservation of horse embryos with the aim of using this knowledge to improve the success rate of in vitro fertilization and embryo transfer.

Corie Owen, cont'd

This research experience has allowed her to learn general lab skills and these specific projects greatly improved her fine motor skills. She has realized research requires the ability to keep good notes and records to make sure the experiments stay organized and on track. Perhaps most surprising to Corie, is that research takes a lot more time than she anticipated. Sooner or later, something will go wrong with an experiment but Corie enjoys the challenge of trouble shooting to systematically and logically figure out what is wrong and how to fix it. Corie has been involved in all aspects of research but when she had to write her first abstract for a scientific conference she learned this was surprisingly difficult, but fun. Undaunted, once she finishes her program at Cal Poly, she plans to matriculate to a Ph.D. program.

Emilio Ortiz, Cal Poly Pomona

Emilio grew up in the Cayo District of Belize where their high school system requires one to choose an academic focus among business, science or engineering. He chose engineering and never wavered, receiving his Bachelors in Computer Engineering at Cal Poly Pomona (CPP). As an undergraduate at CPP, Emilio interned during summers for several companies including Southern California Edison and Parasoft Corporation where he specialized in automated testing of software and websites. During the school year, Emilio worked for the Cal Poly Pomona IT department and received an assignment to configure a server on the far end of campus to communicate with Amazon Web Services. The lab where the server resided puts together and analyzes genomes. The interface of big data, computers and biology was not something being taught in the Computer Engineering courses, but he thought it was interesting. While working on the server, he started asking questions to research scientist Dr. Youngsook You, and by the time he finished the installation he decided this was pretty cool. Dr. You recognized his computer skills and knowledge and offered to teach him bioinformatics and sponsor him for a Master's degree. His project would be to put together and compare the genomes of the cut flower *Gerbera hybrida* and its wild progenitor *G. jamesonii*, a plant that grows in South Africa. The genomic data would allow breeders to develop DNA-based markers to develop varieties with longer-lasting flowers and greater disease resistance.

Although he had never taken an agriculture, genetics or biology class, he decided to take Dr. You up on her offer and joined an ag program for his Masters. He easily learned scripting (Pearl, Python, R) and found biology classes interesting, but way different than any of his previous classes. When asked the difference between being an undergraduate and graduate student, he replied, "in graduate school you have to be able to learn on your own, to teach yourself. You also have to really understand things so you have to read a lot. You especially have to have a good answer when your professor asks you why you did something this way". Emilio concedes that his program was difficult, but amazingly satisfying once you have accomplished something. He said he was always super shy but once he started going to conferences and networking events and interviews, he became much more comfortable meeting people and networking. What will Emilio do with this unique background once he graduates? He has already been hired by Pfizer as a technical analyst to work on a joint Amazon/Pfizer bioinformatics/pharma project.

Grace Woodmansee, Chico State University

Grace spoke to us from a mixed grass prairie in the middle of Wyoming where she is interning at the USDA-ARS High Plains Grasslands Research Station in Cheyenne. During her internship she is working on production and conservation projects on rangelands under the supervision of Dr. Justin Derner of the USDA. Upon returning from a study abroad program in New Zealand she volunteered to work on an animal nutrition project with Dr. Kasey DeAtley. She became involved in every step of the project, from collecting and analyzing data to drawing out conclusions and recommendations. The first project led to an appointment in Dr. DeAtley's lab as a research assistant, and with that, different projects and greater challenges.

Grace realized that the undergraduate research experience enhanced her academic learning. The science and critical thinking she was using in her research projects led to greater understanding and insight of the concepts and materials presented in the classroom. "It became easier to make connections between concepts we were learning about in class and their real world application", Grace said, and in turn "it motivated me to conduct applied research that directly impacts the producer."

She has discovered the information and knowledge from these research projects are meaningful and can be communicated back to cattle producers so they can profitably and sustainably manage their herds and rangeland. Grace describes her undergraduate research experience as being "transformative". Although she expected to grow as a student, she was surprised of its role in helping her grow as a person and a researcher. Grace's rangeland internship will end in November 2016. Her immediate plan is to continue gaining experience in the field before heading off to a master's program in rangeland management.

Jonathan Winslow, Cal Poly, San Luis Obispo

Jonathan is a first year graduate student in Dr. Kelly Ivors' lab at Cal Poly, SLO. Growing up on the coast, south of San Francisco, he was aware of the fruit and vegetables being grown in the area. He earned his undergraduate degree in 2014 at UC Santa Cruz in the Environmental Studies/Agroecology program.

Upon graduating he worked in industry where he conducted research on using soil amendments to control diseases affecting strawberry production. This experience reinforced in him that growing crops successfully means learning about diseases and how to control them. He developed an interest to learn more about soil-borne diseases, amendments, and methods to control crop diseases and improve soil health. Thankfully, his employers sent him to professional meetings that focused on soil pathogens where he met Dr. Kelly Ivors, who had recently taken a position at Cal Poly. These meetings encouraged Jonathan to want to learn the science at a deeper level, so he left his job and began working in Dr. Ivors' lab marking the first stages as a graduate student.

Jonathan Winslow, cont'd

Initially there were no guarantees of funding for the research so this transition was indeed a leap of faith, but Jonathan felt getting involved with this research would be worth the risk. Shortly after he started, Dr. Ivors received ARI funding and now Jonathan is a paid research assistant.

This fall, he will start a Master's thesis project at SLO where his objective are to identify commercial strawberry cultivars and soil amendments that confer resistance against an emerging pathogen. He already began working in the field and lab to get a head start in his research. Most of the difficulty he has experienced to date is in developing methods that will be used to sample, identify and quantify this pathogen.

Regarding his research project, a big challenge for him is to narrowly define the problem, develop discrete objectives and an approach to achieve those objectives. He believes that learning more about microbiology will be the key to knowing how things work and the research-based evidence from these studies is the right approach for developing crop management plans. While he appreciates the academic side of the research, his industry experience gave him greater appreciation for the difficulties of farming and making ends meet. After completing his Master's program, Jonathan intends to pursue a Ph.D. and hopes to stay in California.

Touyee Thao, Fresno State University

Growing up in Fresno, Touyee helped on the family farm growing Asian vegetables and specialty crops. He noticed that although there are a lot of minority farmers, there were virtually no young people in the field with formal education that could help overcome some of the language and cultural barriers that have made it difficult for minority growers to obtain help. These experiences provided the impetus for Touyee to enter Fresno as a plant science major.

In his sophomore year, Touyee met Dave Goorahoo and started working on projects with both Dr. Goorahoo and Florence Cassel Sharma. By the time he was a senior, he had taken over a major research project whose objective was to implement water management practices to improve water use efficiency in processing tomato and sugar beet production. The project integrates Landsat satellite images of fields and ground truthing using lysimeters. Both as an undergraduate and graduate student, Touyee worked on various research projects for Drs. Goorahoo and Sharma for the last six years. He plans to obtain an additional year of data before he graduates with his Master's degree. Reflecting on how research and classes intersect, he noticed that his professors talk about what they have learned in their research projects but also how much more there is to learn. Indeed, Touyee has observed this in his own research. This drive to learn more and create new knowledge has provided the drive for Touyee to continue his studies on soil-water management in a Ph.D program once he graduates.

Yaad Rana, Humboldt State

Yaad grew up in Humboldt but moved to San Jose State University to attend college as a mechanical engineer major. As global warming made people rethink energy sources and sustainability, he found alternative energy was something he was passionate about and wanted to learn more. Looking for an institution with more expertise in this field, he realized it was back home in Humboldt. Yaad joined the Environmental Resources Engineering program at Humboldt State, and was hired by Dr. Arne Jacobson as a student research assistant in the summer of 2015.

In 1955, 70% of the Humboldt economy was related to the forest industry. Today, the region has much broader economic diversity, but the forestry industry is still a major presence and is evolving into new areas that are focused on sustainability. For example, Yaad explained that the forest industry produces a lot of waste from logging and thinning and usually this is just burned or left to decompose. An alternative is to convert this biomass into useful energy. To that end, Yaad is working on an ARI-funded project that evaluates the efficiency of a small biomass dryer when using different feedstocks (tree species). The dryer reduces the water content removing volatiles and concentrating the energy content of the wood, converting it to a clean energy source that can be burned as a fuel. His analyzes the data from different feedstocks and determines how different moisture content and particle size affect dryer efficiency. Optimally, Yaad said the goal is to replace coal with biomass as an energy source that will reduce greenhouse gas emissions.

Working on this project has allowed Yaad to come into contact with personnel and CEO's of large forestry and alternative energy industries, which he feels would not have happened if he was not involved in this research. Given the large numbers of undergraduate students in the program and the relatively few research positions open, Yaad said "I feel lucky to have a job where I am essentially being paid to learn; it's been an awesome opportunity. Working with the staff and professors at the Schatz Energy Research Center makes it obvious that I'm being paid to use my brain as opposed to a service job where I probably would not learn much about what really interests me". His research job provides opportunities for him to learn outside of class and makes some of the complex concepts he learns in class less abstract when he sees how it can be used – thermodynamics for example. When Yaad graduates he plans to stay in California and work in the alternative energy industry.

System funding project profiles

Water quality and availability have long been issues affecting California agriculture. California uses more water than any other state, withdrawing some 38 billion gallons per day (USGS 2010 estimates). Of that daily use, almost 61% is used to irrigate crops. The consequences of global warming and competing demands will reduce the amount of water available for agriculture in the future. As the drought in California stretches into a fifth year, climate change models predict that in the coming decades, drought severity will only increase in the state and across the Southwest.

To address these issues, the ARI has and will continue to fund a wide variety of water-related projects that aim to increase efficiency and sustainability of California agriculture. Two projects received FY 2016-2017 funding through the ARI system competition. If successful, both projects will enable crops to be irrigated with lower quality water.

In one project, research led by Dr. Sharon Benes (CSU Fresno) will blend saline water with high quality water. The project led by Dr. Florence Sharma-Cassel, will blend high quality water with water produced from gas/oil wells. A brief overview of the project and objectives is provided.

Dr. Sharon Benes, Fresno State University

Project title: Irrigation and soil management tools for saline-irrigated alfalfa.
ARI funding: $179,074 over two years; match funding $232,580.

The Co-PIs on this project include Daniel Putnam (UC Davis), Hossein Zakeri (CSU Chico), and Robert Hutmacher (UC Davis).

As water for irrigation becomes scarcer, one strategy to extend available water is to reserve high quality irrigation water for salt-sensitive high-value crops like vegetables, tree crops and wine/table grapes. Water with higher salt content is likely to be used for forages, such as alfalfa, that are used to support the dairy industry. Saline irrigation can have negative effects on both the soil and the crop. Sharon's research project addresses soil impacts through saline management tools, and crop sensitivity through plant breeding. Released alfalfa varieties and selections still under development will be screened for salinity tolerance with varieties developed by her industry partners, Alforex Seeds, Forage Genetics International, and S&W Seeds. Detailed data regarding the amount of water applied and soil salt content at various depths will be obtained to validate and improve the CSUID-II salinity management software model. Since soils irrigated with saline water must be flushed periodically to remove salts, it is imperative that management models perform accurately to minimize negative impacts on soil and plant health. Dr. Benes states that often the limits of developing useful management tools is the lack of input data to test and refine these models. Ultimately, their goal is to provide real-time salinity management for saline-irrigated alfalfa fields.

Dr. Florence Cassel Sharma, Fresno State University

Project title: Physiological performance and nutritional quality of forages irrigated with oilfield waters.
ARI funding: $450,000 over three years; match funding $514,000.

The Co-PI's of this multi-institutional team include Dave Goorahoo (CSU Fresno), Tim Jacobsen (CSU Fresno), Luis Cabrales (CSU Bakersfield), Shankar Sharma (UC Merced).

Oil and gas production, including hydraulic fracturing, typically requires the injection of a few million gallons of water into the well or formation. A portion of this water, termed "produced water", is brought back to the surface and must be managed. Recent estimates indicate about 11 billion gallons of produced water is generated annually in California. Produced water varies considerably, but typically contains dissolved salts, hydrocarbons, inorganic and organic compounds and naturally occurring radioactive material. Although some of this water is used to irrigate crops, surprisingly little is known about the short and long term consequences on soil properties and crop responses. A team headed by Dr. Florence Cassel Sharma will examine the effects on soil and forage crops irrigated with a blend of fresh and produced water. Produced water will be characterized and treated to remove some of the contaminants. The treated water will be blended with high quality irrigation water and applied to sorghum grown both in the greenhouse and field. Soil physical and chemical properties, as well as crop growth responses will be assessed.

Dr. Cassel believes the water treatment and blending approach is easily scalable and can be performed by growers and irrigation districts on large volumes of water and remain cost effective. The results of this study will allow the team to develop long-term studies to determine levels of produced water usage that are safe for agriculture and will produce science-based guidelines that will be beneficial to the petroleum industry while stretching water resources for agriculture during periods of water scarcity.

Active projects, by campus

ARI projects cover a wide variety of agricultural and natural resource issues. Stakeholders have not provided direct input into identifying high-priority funding areas. Instead, faculty propose projects that are based on their interests and expertise. Since each project is matched with non-CSU funds, this might indirectly indicate priorities and when matched with federal grants, attests to the grantsmanship and competiveness of faculty obtaining those grants. Below, is a list of projects funded through system and campus competitive grants during FY 2015-2016.

2015-2016 Active Projects

SYSTEM				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Cassel Sharma, Florence	Estimating water requirements and developing new crop coefficients for drip-irrigated crops in California's central valley	3	$127,410	$254,820
Choudhury, Gour	Green approaches to reduce water use and discharge salinity in California winery and food processing cleaning operations	3	$0	$450,000
Johnson, Lee	Linking landsat data with an online irrigation tool for California orchards	2	$133,148	$268,083
Melton, Forrest	Quantifying benefits of on-farm BMPs for irrigation and nutrient management	3	$147,971	$443,720
Murinda, Shelton	Production of algae animal feed from dairy waste nutrients	3	$150,000	$450,000
Still, David	Development of slow-bolting iceberg and romaine cultivars for desert production areas	3	$145,991	$418,887
Zoldoske, David	Integrated energy beet biorefinery ancillary research program	3	$119,230	$357,690
	total:		$823,750	$2,643,200

CHICO				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Altier, Lee	Selection and marketing of specialty crops in northern California	3	$0	$76,704
Altier, Lee	Market evaluation of specialty crops in northern California	3	$43,510	$145,651
Ataie, Feraidon	Utilization of rice straw in concrete	2	$20,176	$46,082
Bayham, Jude	The implicit cost of home protection in the wildland urban interface	1	$5,000	$5,000
Bianco, Stephanie	Farm to school food safety cooperative	3	$0	$214,766
Bianco, Stephanie	Enhancing agricultural safety year-round: good agricultural practices (EASY GAP)	3	$125,631	$343,194
Bianco, Stephanie	Right to know: Is our food safe?	3	$59,635	$171,932
Boyd, Elizabeth	Examining the biological and ecological parameters of Psocoptera in almonds	2	$39,474	$78,920
Brimlow, Jacob	Growth & limitations: tri-county local food sales in intermediated markets	2	$14,756	$47,567
Chao, Michael	Meeting the demand for meat of different ethnic groups	1	$5,000	$5,000
Daley, Cynthia	Utilization of sprouted grains as an alternative source of energy in the dairy cow ration	1	$0	$100,677

Active projects, by campus

CHICO (cont'd)				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
DeAtley, Kasey	Utility of spent brewer's grain as a winter supplementation strategy for beef cattle	3	$65,802	$197,082
DeAtley, Kasey	Backgrounding and feedlot growth performance measures of Angus and Angus-influenced cattle	1	$0	$66,548
Doyle, Patrick	Relationship between post-weaning, RFI, and reproduction in commercial Angus & lowline-influenced yearling heifers	1	$36,346	$36,346
Greene, Joseph	Biobased composites made from plant-based polymers and Ag waste	2	$13,315	$32,857
Greene, Joseph	Riceboard laminated biocomposite development	2	$0	$58,234
Houk, Eric	The measure of agriculture in the northern Sacramento valley	3	$0	$71,186
Houk, Eric	Effects of water management and conservation practices on aquifer recharge in the Sacramento Valley	2	$0	$93,450
Houk, Eric	Understanding the economic and hydrologic imapcts of sustainable groundwater management decisions in the face of uncertain water supplies	3	$43,686	$130,968
Johns, Mitchell	Soil, edaphic, and economic transformations in the reclamation of a degraded soil used in land application of fruit processing water	2	$98,000	$196,000
Liles, Garrett	Quantifying carbon soil at the CSU, Chico University farm	1	$5,000	$5,000
Phillips, Celina	Evaluation of crossbred rams for commerical lamb production	3	$0	$54,073
Rosecrance, Richard	Effects of mulching and cover crop on tree growth in super high density olive oil orchards	3	$0	$138,373
Rosecrance, Richard	Olive oil production practices	3	$0	$107,529
Varahamurti, Ramesh	Precision and autonomous farming applications	2	$0	$67,446
		total:	$575,331	$2,490,585

FRESNO				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Ashkan, Shawn	Monitoring crop growth for year-round energy beet production	3	$38,712	$106,545
Ashkan, Shawn	Recycling CO_2 emissions to enhance sugar beets productivity	3	$32,034	$90,811
Banuelos, Gary	Identification and quantification of potential cancer inhibiting selenium compounds and heathful nutritional contents in fruit, cladode, and in fresh fruit products made from Opuntia (cactus pear) a drought and salt tolerant nutraceutical fruit crop for the Westside of Central California.	3	$0	$273,643
Bushoven, John	Mapping and evaluation of permanent crop root systems by ground penetrating radar	3	$0	$83,466
Cassel Sharma, Florence	Estimating water requirements and developing new crop coefficients for drip-irrigated crops in California's Central Valley	2	$22,590	$45,180
Cassel Sharma, Florence	Managing high-nitrate irrigation water in agriculture	3	$50,000	$245,000
Dormedy, Erin S.	Establishing the incidence of salmonella in retail California almonds	1	$41,216	$41,216
Gonzalez, Jorge	Study of chemically mediated behaviors of bee associated polyphagous parasitoid wasps	1	$0	$10,000

Active projects, by campus

FRESNO				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Gu, Sanliang	Crop forcing for quality winegrape production of cool climate fruit in warmer regions - cultural practices and economic analysis	3	$0	$241,100
Konduru, Srinivasa	Competitive intensity and attractiveness of cotton in California	1	$19,999	$19,999
Letaief, Hend	Polysaccharide-tannin interactions and their influence on red wine stability	3	$40,786	$128,358
Letaief, Hend	Structure-activity relationships and sensory properties of tannins in red wine	3	$61,262	$183,786
Lone, Todd	Consumer willingness to pay for the Fresno State brand: A case study of wine	1	$10,000	$10,000
McKeith, Amanda	Evaluation of the reduction of *E. faecium* and bactiferm LHP dry in beef prime rib roasts	1	$15,000	$15,000
Riley, Larry	Effects of selenium-enriched feed in an important aquaculture species, tilapia (*Oreochromis mossambicus*)	3	$0	$336,020
Shrestha, Anil	Effect of shade and soil moisture of herbicides in junglerice	2	$17,129	$37,258
Van Zyl, Sonet	The evaluation of different cultural practices on 'Scarlet Royal' to determine post harvest quality by using plastic cover materials	2	$0	$66,012
Van Zyl, Sonet	Interactive effects of plant growth regulators and phenology based regulated deficit irrigation on the color development of 'Autumn Royal' table grapes	2	$60,265	$120,530
Vang, Kaomine	Measuring and monitoring nitrogen dynamics in central valley crops	3	$75,000	$225,000
Zoldoske, David	Energy beet yield research program	3	$40,300	$120,900
		total:	$524,293	$2,399,824

POMONA				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Adler-Moore, Jill	Optimization of a liposomal avian influenza virus (AIV) vaccine for chickens and mice using different TLR adjuvants	2	$0	$182,000
Adler-Moore, Jill	Combination therapy for avian and mammalian pulmonary aspergillosis using a liposomal aspergillus protein vaccine and anti-fungal drugs	2	$75,434	$150,868
LaMunyon, Craig	Engineering RNA interference in plant roots against nematode parasites	3	$0	$317,670
LaMunyon, Craig	Tissue-limited expression of genetic modifications in *Arabidopsis thaliana*	2	$12,118	$159,116
Leong, Joan	Impact of kaolin clay particle films on silverleaf whitefly, natural enemy assemblages and bee pollination	2	$0	$75,990
Li, Yao Olive	Technical and economic feasibility study of utilizing orange pomace for food applications by incorporating its dried powder in extruded food products	1	$10,000	$10,000
Liu, Junjun	Development of DNA aptamers specifically targeting shiga toxin type 2	2	$42,626	$75,626
Mellano, Valerie	Studies to increase field establishment of and parasitism by *Tamarixia radiata* for control of asian citrus psyllid	3	$29,194	$110,535
Mellano, Valerie	Maximizing the production of *Tamarixia radiata*, the biological control agent of the asian citrus psyllid	3	$75,000	$325,000
Questad, Erin	Uses of southern California black walnut (*Juglans californica*) in landscaping, restoration, and control of weedy plant species	3	$127,256	$363,085

Active projects, by campus

POMONA (cont'd)				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Singh, Harmit	HPLC and antioxidant analysis of crude natural food colors extracts purified by ultra- and nano- filtration system	1	$26,685	$26,685
Still, David	Identification of physiological and genetic factors associated with higher nitrogen use efficiency in lettuce grown under limiting nitrogen	3	$107,690	$405,225
Still, David	Breeding lettuce for increase water and nitrogen use efficiency	3	$58,490	$275,571
Still, David	Development of slow-bolting iceberg and romaine cultivars for desert production areas.	1	$0	$147,663
Still, David	Carbon assimilation in low and high nitrogen use efficiency lettuce inbred lines grown under low nitrogen	1	$0	$48,792
		total:	$564,493	$2,625,034

SAN LUIS OBISPO				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Bennett, Darin	Bioinformatics workshop	1	$2,200	$2,200
Bennett, Darin	Role of the gastrointestinal microbiota in poultry production: probiotics as an alternative to the use of antibiotics	2	$50,834	$85,101
Bisbing, Sarah	Effects of variable density thinning and prescribed fire on forest resilience and stand dynamics in Sierra Nevada forests	3	$72,329	$218,904
Bisbing, Sarah	Coastal forests under a changing climate: identifying the regeneration niche of coastal redwood	2	$20,000	$40,000
Cai, Xiaowei	The impact of produce purchasing on household health outcomes	3	$79,969	$241,651
Cai, Xiaowei	Determinants of California agricultural land values	3	$29,987	$99,987
Campos-Chillon, Fernando	Transfer of in-vitro produced frozen bovine embryos: a field study	2	$6,508	$13,006
Campos-Chillon, Fernando	Cryopreservation and evaluation of epigenetic changes of in-vivo and in-vitro produced Jersey cattle embryos	2	$0	$20,000
Chiu, Yiwen	Developing life-cycle analysis framework for a coupled livestock-crop water recycle system	2	$19,979	$39,937
Cooper, Jim	Evaluation of continuous flow vermi-compost systems for use in conventional specialty crop production	3	$43,202	$173,887
Costello, Michael	Plant defense responses to pesticides and spider mites on grapes: from genetics to wine quality	2	$0	$37,849
Dicus, Chris	Geospatially analyzing fire risk in the wildland-urban interface of California	3	$27,409	$72,629
Dodson Peterson, Jean	Grapevine bud fruitfulness and timing of budbreak as a function of spur diameter and the position along the cordon	2	$20,000	$40,000
Garner, Lauren	Evaluation of pomegranate cultivars for coastal California production		$3,199	$50,241
Goldenberg, Marni	Outcomes of participation in first descents, an outdoor adventure therapy program for young adults with cancer	3	$0	$16,481
Greenwood, Brian	Awakening and strengthening the connection of urban youth to the land	3	$51,389	$132,358
Headrick, David	Development of an artificial trap for *Tupanea vicina*, the marigold fruit fly, a recent pest in coastal California flower production	3	$3,000	$59,656
Hendricks, William	2012 California public opinions and attitudes survey on outdoor recreation	2	$0	$99,132

Active projects, by campus

SAN LUIS OBISPO (cont'd)				
Project Director	Project Title	Duration (Years)	2015-16 Allocation	Total ARI Commitment
Hoover, Benjamin	Biochar use in plant propagation and production	2	$6,666	$18,027
Hurley, Sean	A technology and market feasibility analysis for using unmanned aerial systems in California agriculture	3	$0	$122,727
Huzzey, Julie	Seed funding to support program development in animal behavior and welfare	1	$5,000	$5,000
Huzzey, Julie	Acute behavior effects of regrouping holstein and jersey cows in pairs or individually after calving	2	$20,000	$40,000
Jimenez-Flores, Rafael	Assessment of biological activity in different fractions of phospholipids from milk and egg after supercritical CO_2 treatments	3	$11,165	$58,061
Jung, Stephanie	Food production seed funding	1	$5,000	$5,000
Jung, Stephanie	From olive oil milling to the concept of an olive oil biorefinery	2	$20,000	$40,000
Kravets, Robert	Optimization of food thermal processing	1	$5,000	$5,000
Lammert, Amy	Development and consumption behavior of ready-to-eat frozen oatmeal and fruit products	3	$117,383	$300,492
Lammert, Amy	Linking emotion to texture: A new consumer perspective on sensory properties of cheese	3	$0	$90,324
Lammert, Amy	Assessment of biological activity in different fractions of phospholipids from egg after supercritical CO_2 treatments	1	$11,165	$11,165
Lathrop, Amanda	Development of microbiologically-based intervention strategies for the control of food-borne and fungal plant pathogens that threaten CA produce production	3	$64,251	$181,720
Lin, Kevin	Leisure activity benefits in older adults	1	$2,500	$2,500
Liu, Bo	Development of a wireless sensor network-based cattle grazing management system	1	$5,000	$5,000
Liu, Bo	Agriculture management based on aerial and ground robots	2	$20,000	$40,000
Malama, Bwalya	Instrumentation for laboratory and field-scale monitoring of the saltwater-freshwater interface in coastal agricultural areas	1	$5,000	$5,000
Malama, Bwalya	Hydrogeophysical investigation of potential impacts of groundwater abstraction on Lower Scotts Creek Stream Flows	2	$19,692	$40,000
Papathakis, Peggy	Use of dairy in treatment of malnutrition in pregnancy in Malawi	3	$89,979	$269,979
Pilolla, Kari	Weight management training	1	$5,000	$5,000
Reaves, Scott	Effects of a sports nutrition program on muscle glycogen	1	$5,100	$5,100
Retallick, Keela	Alternate byproduct storage methods and reduced beef input costs	2	$11,333	$31,333
Schwab, Keri	Pro-environmental behaviors among PCT thru-hikers and the impact to California land & natural resources	1	$0	$5,000
Steinmaus, Scott	Effects of seeding rate, seeding time, and mowing height on mixed stands of Tall Fescue (*Festuca (Lolium) arundinacea*) and Zoysiagrass (*Zoysia japonica*)	2	$20,000	$34,880
Surfleet, Christopher	Hydrologic response to mountain meadow restoration following conifer removal	3	$15,025	$40,909
Surfleet, Christopher	Hydrologic characteristics of summer stream temperatures in Little Creek and Scotts Creek at the Swanton Pacific Ranch	2	$0	$40,000

Active projects, by campus

SAN LUIS OBISPO (cont'd)				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Swan, Benjamin	Developing the next generation of Ag safety and health leaders	2	$13,333	$26,666
Thompson, Cole	Effects of seeding rate, seeding timing, and mowing height on mixed stands of tall fescue (*Festuca arundinacea*) and zoysiagrass (*Zoysia japonica*)	2	$20,000	$40,000
Volpe, Richard	Market structure and price markups in the food retail industry	1	$5,000	$5,000
Yeung, Vince	Enhancing effects of lactulose on the expression of intestinal DMT-1 and Calbindin-D9k transport proteins assessed with the Caco-2 cell culture model	2	$20,000	$40,000
Yeung, Vincent	Antioxidant activities of non-digestible oligosaccharides	1	$0	$5,000
	total:		$952,597	$2,950,737

MONTEREY BAY				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Melton, Forrest	Quantifying benefits of on-farm BMPs for irrigation and nutrient management	2	$65,327	$136,412
Miles, Timothy	Simplifying molecular diagnostics for field use in detecting plant pathogens	2	$17,268	$36,914
Skardon, John	Improving nitrate removal rates in agricultural bioreactors by immobilizing a denitrifying bacteria onto a high specific surface area support matrix	2	$11,773	$21,773
	total:		$94,368	$195,099

HUMBOLDT				
Project Director	**Project Title**	**Duration (Years)**	**2015-16 Allocation**	**Total ARI Commitment**
Berrill, John-Pascal	Climate change adaptation for threatened Pacific southwest forests: moving trees to different locations and climates to study performance and drought tolerance	1	$0	$78,963
Greene, David	A theory of masting behavior	1	$0	$17,008
Han, Han-Sup	Managing forest residues	2	$132,240	$153,956
Jacobson, Arne	Biomass dryer system	1	$117,760	$117,760
Johnson, Matthew	Can birds help control pests in California's winegrape vineyards?	1	$0	$60,553
Jules, Erik	Assessing the impact of red fir mortality in northwest California forests	1	$0	$23,190
Kane, Jeffrey	Effectiveness of prescribed fire and raking to promote sugar pine resilience in the Sierra Nevada	1	$0	$29,326
Kelly, Erin	Social science lands management	1	$0	$15,247
	total:		$250,000	$495,993

Acknowledgements

The dedicated work, skill and knowledge exhibited by Executive Assistant Rhiannon Ricketts and ARI Analyst Andrea Frontino is gratefully acknowledged. Many thanks for the creative talent of Deanna Stewart for the report design theme. Thanks also to all ARI Member and Associate Campus folks for providing data that were included in the report (Wei Bidlack, Karen Hansen, Anthony Johnson, Cindy Lopez, Linda Lopez-Atkins, Debbie Schroeder-Linthicum, Gloria McAllister and Sue Tonik). The Campus Coordinators are valuable team members whose help and oversight contribute to the overall success of the ARI program.

Recognition is given to the Board of Governors and Deans' Council for their support, participation and guidance through the year, the members of which are listed below.

ARI Board of Governors

Jeffery Armstrong, President, Cal Poly, San Luis Obispo
Joseph Castro, President, Fresno State
Soraya Coley, President, Cal Poly Pomona
Glenda Humiston, Vice President, University of California, Agriculture and Natural Resources
Gayle Hutchinson, President, Chico State
A.G. Kawamura, Grower/Shipper, Orange County Produce
Gregory Kelley, President and CEO, California Olive Ranch, Inc.
William Smittcamp, President, Wawona Frozen Foods
Donn Zea, Executive Director, California Dried Plum Board

ARI Deans' Council

Mary Holz-Clause, Dean, Cal Poly Pomona, College of Agriculture
David Daley, Interim Dean, Chico State, College of Agriculture
Andrew Thulin, Dean, Cal Poly San Luis Obispo, College of Agriculture, Food and Environmental Sciences
John Unruh, Dean, Chico State, College of Agriculture
Sandra Witte, Dean, Fresno State, Jordan College of Agricultural Sciences and Technology