Tier 1 – Higher Education Today

a. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?

Cal Poly Today

- Social and political accountability issues: graduation rates, efficiency in operations, role of the professorate (teaching, research/creative activities, outreach (industry relations (internships outreach, etc.), and service)), and cost of education are examples.
- Decreasing State Budget in real dollars.
- On-going concerns about faculty and staff compensation.
- The teacher-scholar model and current faculty workloads.
- Uncertainty about the future as new policies and procedures are implemented without much notice.
- Concerns about collegial governance relative to the perception of a top down style of management and a concern that communication between various constituencies on the campus is fragmented.
- Lack of financial resources to address significant deferred maintenance: classrooms, labs and older facilities in general.
- Addressing diversity issues.

Although not a force in the traditional sense low campus morale is certainly an issue that Cal Poly faces today. It can be argued that while the compensation issue is perhaps the primary driving factor in the low morale situation many if not most of the bullet points listed above are contributing factors.

Cal Poly 2030

- Demographic changes in the U.S indicate that U.S and California population growth will slow. Population growth among seniors (65 years and older) is projected to quadruple in the coming 20 years.
- New higher education organizations will continue to emerge. They will have different strategies to attract students: low cost (e.g. community college BS/BA programs); differentiated programs that appeal to different target markets (e.g. convenience, older student) and niched differentiated (e.g. wine and viticulture program). On-line education
will become more prevalent including MOOC’s providing competition to traditional liberal arts classroom education and perhaps providing some substitute for science and business courses.

- Increased costs of education will impact student body composition.
- Continual reduction in number of U.S high school graduates and specifically college ready high school graduates will result in increasing competition among California and out-of-state universities for those college ready graduates.
- Teaching pedagogies will necessarily need to change. Learning will need to take place both inside and outside the classroom. Faculty instructors will move away from the traditional “talking head” lecture and become facilitators and guides in the learning process. Outside learning will be encouraged through internships and international education.
- The bachelor degree is more and more limited as a terminal degree.
- Continually changing social and political demands on accountability in higher education.
- Pressures to find external sources of funding will continue.

Agribusiness/Agricultural Economics Disciplinary Changes Today

- Agricultural Economics will be absorbed in the broader field of Economics.
- There will be increased interdisciplinary collaborations. There is becoming an increased interest among the agricultural sciences, college of business, and engineering to include agribusiness/agricultural economics in interdisciplinary teaching and research.
- Future innovations will dilute the meaning of more narrowly specialized fields.
- Employers demand for future graduates will be skill-set driven instead of discipline driven.
- Demand for agribusiness/agricultural economics graduates is increasing. U.S, California and employer employment projections for agribusiness graduating seniors in the areas of marketing, sales, finance, data analysis, logistics and transportation, supply chain management, and food retail management range between 8% - 22% over the next ten years.
Agribusiness/Agricultural Economics Disciplinary Changes 2030

- Agribusiness programs will be absorbed into College of Business.

- Continued absorption of agricultural economics departments into economics departments and agribusiness departments into colleges of business.

- Increasing emphasis on international development.

- Increased emphasis on data analytics and analysis.

- Increased input into agricultural and food policy analysis.

- Increased professional performance reviews of economics and agribusiness programs.

- Curriculums will be continually updated to reflect rapidly changing socio-political-economic forces.

- Role of the teacher-scholar and scholar-teacher will continue to be redefined.

Tier 2 – Projections to 2030

a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests

- More diverse student body in terms of diversity and provenance (in/out of state).

- Freshmen students will continue to be highly prepared for a Cal Poly education

Tier 2 – Projections to 2030

b. What will the global and regional economy be like in 2030 (and how are these forces relevant to your field or discipline)? Again, please include challenges and opportunities.

- The world and U.S geo-political-social-economic milieu has become increasingly complex and is changing quickly thus increasing risk and uncertainty in decision making.

- The social environment has become polarized as differing opinions around the role of government in markets and societal issues such as climate change, sustainability, environmental goods and services, genetically engineered food, health issues, food availability and cost, trade, foreign policy, immigration, race relations, economic inequality, government regulation, and many others has intensified. That polarization argues for university graduates to be systems thinkers and lifelong learners.
• Sustaining and disruptive innovations are likely to increase in scope and possibly magnitude. These innovations will change entire markets. The innovations will be driven by declining natural resource availability, and socio-political forces.

• Economic and financial globalization will continue to drive markets and to a certain extent political economies and politics.

• Information transfer will continue to accelerate putting a premium technological and information competency.

Challenges

• As the number and complexity of global, U.S., state and regional regulations continue to increase, they will be increasing burdensome to the food, fiber, and affiliated industry firms. Concerns about new government issues and policies will continue to drive increased risk and uncertain in decision making and affect capital investment and hiring decisions.

• Increased uncertainly and risk will require the acquisition of risk management expertise and require critical and creative thinking, problem solving, communications, and interpersonal skills.

Opportunities

• Curriculum redesigned to increase opportunities for students to engage in critical and creative thinking, problem solving, decision-making, communications, and develop team-work skills. While it is easy to say we are already doing that, but on a micro level is it robust enough? Are the skills being taught truly reflective of competitive pressures in world and U.S. industries.

• Refine curriculum on how to effectively manage risk and uncertainty utilizing management software, including simulations with hurdles and failures. Project management skills are essential to achieving efficiency today and in the future regarding the adaptation to sustaining and disruptive innovations, development and implementation of new products, application, processes, etc.

• Learning centers that provide for students teaching each other with the instructor guiding instead of providing it all will allow for increased individual and group learning, activity based learning, and group problem-solving. Necessarily the learning center will require up-to-date computing technology and access to data resource.

• Continuation of efforts to “globalize” the curriculum is increasingly important.
• Increase number of guest speakers to provide for real-time, real-world discussions on emerging issues; both economic and cultural that affect food, fiber, and affiliated industries.

• Human resource management; understanding cultural diversity and how it impacts the work force. Resource management; skilled and unskilled labor force trends.

Tier 2 – Projections to 2030

1. What will we be preparing our graduates to do (in general, and in your discipline) in 2030? Create a list of activities that are similar to today and activities that will be different from today.

   • Information and technological literacy
   • Data analytics and analysis
   • Independent thinkers operating as a fully functional team member.
   • Graduates will be working in a global environment.
   • Graduates will be risk managers.
   • Management of global competitive situations.

Tier 2 – Projections to 2030

   c. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?

   • Need to learn to show appreciation for their college experience and learning.
   • Need to learn how to learn.
   • Need to become critical and creative thinkers, and problem-solvers. Have strong written and oral communication skills, develop ability to communicate in writing and verbally, and learn how to work and collaboration with diverse groups.
   • Need to learn how to adapt to a global environment that quickly changing.
   • Deal with risk and uncertainly in decision-making
   • Need to learn to be entrepreneurs: initiative and self-direction
• Need to be flexible and adaptable

• Need to be ethical individuals

• Master’s degree in a specialized field or Masters of Business Administration with an emphasis area (e.g. Finance)

**Tier 2 – Projections to 2030**

d. *What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?*

The two most relevant emerging fields and integrated learning that seem relevant to Agribusiness are metadata management and environmental and sustainability issues in the food and fiber supply chain.

Metadata management is defined as process framework for creating, controlling, enhancing, attributing, defining and managing a metadata schema, model or other structured aggregation system. This field has overlap with courses in the College of Math and Science, Orfalea College of Business, College of Agriculture, Food and Environmental Sciences, and College of Engineering. A number of different programs or degrees could address this field.

Virtually every agricultural firms and those firms affiliated with the agricultural system is concerned with environmental and sustainability issues. There is a number of cross collaborations that can occur.
“Academic Plan for Enrollment”
Responses from the Agricultural Education and Communication Department

Department Mission Statement

The mission of the Agricultural Education and Communication Department is to contribute to the improvement of agricultural instruction in the state of California and prepare agricultural communicators who will promote agriculture and serve the needs of the agricultural industry.

Two degree programs are conducted in the department; Agricultural Communication and Agricultural Science. The department relies heavily on off campus relationships with local school districts, the California Department of Education, and agricultural industry partners to fulfil the department’s mission. Our teacher education program must be responsive to federal and state initiatives. Our program is accredited by both state and national accrediting organizations. The department is dependent on other departments in the College of Agriculture, Food and Environmental Sciences to provide the technical coursework in agricultural disciplines, the College of Liberal Studies to provide technical coursework in communication, and the School of Education to provide for foundational educational coursework.

Tier 1 – Higher Education Today
a. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)? Please address challenging forces to higher education and opportunities stemming from higher education trends.

Cal Poly Today

- Strong job market for secondary Agriculture teachers who can provide instruction for students preparing for the Ag industry
- National education standards for secondary programs (i.e. Common Core and Next Generation Science Standards)
- The need for strong local school partnerships (observation and student teaching sites)
- Quality graduates are needed by the industry who possess the knowledge, skills, and attitudes necessary to “hit the ground running”
- Social attitudes regarding diversity
- Demand on new faculty to be a “Teacher/Scholars” and spend time in research and grant proposal writing
- Multiple employment options for graduates (because of the general nature of the academic program)
- Linkage between K-12 and higher education
• Lack of ethnic and other types of diversity (i.e. socioeconomic, international students)
• Advancement expectations at the department level, and especially upon the Department Head (i.e. 20% of time devoted to advancement work)
• Acquisition of technology (our ability to keep up with school districts and the Ag communication industry- rapid changes)
• Education on demand (on-line programs). We struggle with this concept to ensure students have the same hands-on resources as face-to-face instruction provides.
• Acquiring external funding and industry resources
• Opportunity to earn both a teaching credential and a Master’s Degree at the same time
• As expectations increase for external funds, more time will be spent, distracting from the primary mission of the program.
• There is a need for faculty to become more versed in attracting outside resources.
• The pressure on moving to larger class sizes and minimum student numbers in classes versus the ability to continue hands on learning in an effective manner

Forces in 2030

• Public policy and regulations (i.e. teacher credentialing requirements)
• National teacher certification and assessment processes
• The rising cost of education and its return on investment (i.e. missed opportunity costs)
• Globalization of education in general (i.e. proliferation of on-line courses and competition with our current degree programs)
• Shrinking middle class and the possible reduction in college ready students.
• “Big data” and “data mining” will likely influence decision making and allocation of resources, innovation, and research.
• Financial threat to the cost of learn-by-doing.
• As we become more specific and technical in the agricultural discipline, there will be a need to readily adapt to those changes. This will influence resources.

Tier 2 – Projections to 2030

a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be? Please include challenging demographic factors and trends and opportunities stemming from these factors and trends.

• Our students will likely come from more urban and suburban (hobby farms) settings
• More affluent
• Social justice will be important for this group of students. Students will want to
“save the world” and get paid for doing it.

- Agriculturally illiterate (lacking knowledge, skills, and the proper attitudes in basic agriculture production and issues)
- Students will come to Cal Poly with fewer agricultural skills
- Students will be globally inclined to travel
- Students will be more ethnically diverse than ever before
- Self-centered, rather than being servant-minded
- Used to being catered to by others
- More students may be coming from out-of-state
- Extreme competition from out-of-state universities attracting California students.
- Cal Poly students won’t look much different than 2014 unless structural changes are made to Cal Poly’s admission process that is primarily driven by GPA, selected coursework, and test scores.
- Students coming from partnership schools
- Expectation by students for more relevance to their individualized program of instruction
- Greater global awareness
- Continue to be more technological and digital savvy
- Students may have a stronger feeling of entitlement
- Stronger attitude toward environmentalism

**Tier 2 – Projections to 2030**

b. **What will the global and regional economy be like in 2030** (and how are these forces relevant to your field or discipline)? Again, please include challenges and opportunities.

**Challenges**

- Diverse and expanded markets for agricultural products and services (including teaching)
- More digital
- Will be a service economy
- More green technology (clean) industries in the San Luis Obispo area.
- The SLO community may be a local attraction for high tech companies
- More “for profit” institutions
- Driven by stronger regulations; both from State and Federal
- High taxes

**Opportunities**

- Cal Poly and the Agricultural Education and Communication Department may be providing leadership and educational opportunities to developing countries
- Increase in student ability as alumni to “pay back” the university. Increased advancement opportunity for the department
• More entrepreneurialism by Cal Poly graduates

**Tier 2 – Projections to 2030**

**c. What will we be preparing our graduates to do (in general, and in your discipline) in 2030?** Create a list of activities that are similar to today and activities that will be different from today.

**Similar to today**
- To be lifelong learners - to learn how to learn.
- Be critical thinkers
- Have a strong work ethic
- Be able to teach to all learners, no matter how diversified the student population
- Be tolerant and accepting of the ideas of others
- Use assessments that will guide teaching and learning
- Act as communication specialists
- Prepare students to lead others

**Different from today**
- Increased involvement in the development of policy
- Be bilingual or multilingual

**Tier 2 – Projections to 2030**

**d. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?**

- Effective use of social media
- Use of software programs current with the communications industry
- Problem solving and critical thinking
- “Soft skills” will remain important (i.e. leadership and especially communication skills)
- Effectively use and adapt to technology
- To be able to gather credible information quickly and efficiently
- Work collaboratively
- Use of GIS and other technologies to gather data
- Cross cultural interaction
- **Project-based** problem solving techniques
- Policy and government interaction
- A Bachelor’s Degree will be the base level of education in many areas, whereas a Master’s Degree may be the minimum requirement in the educational workforce
**Tier 2 – Projections to 2030**

- **e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?**
  
  - Redefining the university administrative structure (i.e. no departments along with convergence of colleges based on integrated problem solving).
  - Use of “Big Data” in education
  - Systems thinking
  - Collaboration and working in groups/teams/pods to solve real world problems

**Summary Comments:**

The mission fulfilled by the department will continue to be very important well into the future. The need for agricultural educators and communicators will only increase due to the nature of our society and the changing demographics that will take place in the near future. California’s agricultural workforce will need an educated and trained clientele who have been prepared with the knowledge, skills, and attitudes necessary for gainful employment. Agricultural issues will continually need to be discussed within the public sector with voters being keenly educated with the facts necessary to make educated and informed decisions on legislative issues.

Agriculture will continue to be the most important industry in California. We will be producing “more with less”, and the need for qualified graduates will only increase in the years ahead.

Our students will likely be coming from more urban areas of the state with less and less agricultural experiences. Technology and hands-on learning at all levels will continue to be important tools for students to use. The job market and the demands for our graduates will likely increase in the years ahead, with the real need attract a more diverse student clientele that reflects California’s population.

Our learn-by-doing approach to teaching and learning will be increasingly more appropriate in Agriculture.

BK3991 and "Academic Plan for Enrollment"
Tier 1 – Higher Education Today

a. What forces are shaping the Cal Poly Animal Science Department today (which are likely to continue into the future and what new forces may come into play by 2030)?

J. Carrol (2014), states a massive growth in food demand will occur: The UK Food and Agriculture Association estimates that the world population will increase 47%, to 8.9 billion, by 2050. Currently the food industry, from farm to gate, is estimated at 70 billion dollars in California alone. These facts substantiate the reality of an agricultural industry full of potential. The sheer size of the food industry represents enormous potential for support of the agricultural programs at Cal Poly State University, including the Animal Science Department.

Additional specific forces and trends influencing Cal Poly Animal Science today are related to the increased awareness of the effects of animal production practices on human and animal health, as well as the environment. The One Health Initiative, the move toward local, sustainable, and more wholesomely produced feed and food (Feed and Food Safety), and Animal Welfare have emerged as important social issues. Other general trends include a decrease in state funding support of higher education, the increasing debt loads of our students, and fast changing technologies in production and communication in society.
**One Health** has been identified as a significant focus in the future of agriculture and is particularly relevant to the Animal Science Department. We must consider the manner in which our students are prepared in terms of their understanding of the impact of food production on human and environmental health (One Health). While not novel (the concept of the link between animal, environmental, and human health existed as early as the 1800’s), the One Health Initiative is perhaps even more relevant today than 200 years ago. It may be the single most important trend affecting animal science today and in the future. In the age of global transportation of people, animals, plants, food, and related products, the impact of the One Health Initiative may likely be noted as prescient in 2030.

The mission statement of the One Health Initiative:

> “Recognizing that human health (including mental health via the human-animal bond phenomenon), animal health, and ecosystem health are inextricably linked, One Health seeks to promote, improve, and defend the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, other scientific health and environmental professionals and by promoting strengths in leadership and management to achieve these goals.”

The understanding of the relational dynamics of animal, human, and environmental health will drive a major shift in animal science education to one of increased integration and collaboration among people and disciplines. Cal Poly should demonstrate leadership in this area to accommodate the major shift from a single discipline-directed education, e.g. a beef cattle nutrition class, to the holistic approach considering the relationship among people, environment, and animals. Therefore, there exists a prime opportunity for the Cal Poly State University Animal Science Department to develop and support an integrative and collaborative approach to education embracing the inter-relationships of people, animals, and the environment. Increasing government regulations regarding environmental issues involving water and air quality, as it relates to animal production and ecological health, and the fast changing political arena responsible for these regulations, will also impact our curricular focus in the future.
The trend towards sustainability regarding practices of food animal production, local food production, and organic food production are taking the lead in shaping perceptions of animal science and must be incorporated into our curriculum to meet the demands of the future student. While global production of animal protein will continue to increase, there will be a state and national trend toward the development of niche markets driven by a societal desire to be more involved in their food, both from a production and selection standpoint. Consumers will make choices based on cost, but also production methods and the perception of sustainability in the production methods used.

The growth of the global marketplace has increased the awareness of feed and food safety issues, in the human, livestock, and pet food industries. The development and implementation of the new federal Food Safety Modernization Act (FSMA) will have far reaching influences on the way we produce feed and food in this country. Our curriculum will need to increase its focus on this issue.

Finally, societal perceptions of animal welfare challenges in food animal production will change the way we currently raise food animals in this country, as it has to a greater extent in Europe already. There is a need for robust, applied research to provide evidence-based practices to address animal well being while maintaining the profitability of animal production as the demand for food increases globally. We can play a significant role in developing these sustainable changes in the way we raise our food animals as we build our applied animal behavior program.

General trends regarding the future of higher education are reported from a variety of well-known sources. Perhaps one of the most significant trends is the shift away government funding of higher education to that of the individual. While significant contributions have been established, e.g. the American recovery and reinvestment act (2009) that supported university research and access, state support of higher education continues to dwindle. For example, state funding in California has decreased by 40% in the past 20 years according to a report released by the University of California. Federal and state governments have traditionally played key roles in forming partnerships in higher education; this will likely continue, but to a lesser degree. It is generally accepted
that universities need to find creative ways to support higher education in the face of declining state and federal support. Students generally must now borrow significant amounts and acquire debt to fund their education. Virtually every state is spending less on higher education (Fig 1) while these cuts have led to significant tuition hikes (Fig 4).

**Figure 1: Real Increase/Decline in State Higher Education Funding Per Student, 2008-2012**

![Graph showing state higher education funding changes](image1)

Fig. 1 The Great Cost Shift Continues; State Higher Education Funding After the Recession Robert Hiltonsmith and Tamara Draut

**Figure 4: Changes In Tuition & Per-Student Funding, 2008-2012**

*Top 10 States, By Largest Tuition Increase*

<table>
<thead>
<tr>
<th>State</th>
<th>Decrease in State Funding per FTE</th>
<th>Increase in Tuition Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>$3,508</td>
<td>$3,674</td>
</tr>
<tr>
<td>California</td>
<td>$2,561</td>
<td>$2,647</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>$2,032</td>
<td>$2,978</td>
</tr>
<tr>
<td>Hawaii</td>
<td>$1,744</td>
<td>$2,422</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>$1,284</td>
<td>$2,208</td>
</tr>
<tr>
<td>Alabama</td>
<td>$1,184</td>
<td>$2,193</td>
</tr>
<tr>
<td>Delaware</td>
<td>$2,331</td>
<td>$2,079</td>
</tr>
<tr>
<td>Virginia</td>
<td>$1,833</td>
<td>$2,033</td>
</tr>
<tr>
<td>Washington</td>
<td>$3,157</td>
<td>$1,090</td>
</tr>
<tr>
<td>Vermont</td>
<td>$2,394</td>
<td>$1,600</td>
</tr>
<tr>
<td>U.S. Average</td>
<td>$0</td>
<td>$0</td>
</tr>
</tbody>
</table>

![Graph showing tuition and funding changes](image4)

Fig. 4 The Great Cost Shift Continues; State Higher Education Funding After the Recession Robert Hiltonsmith and Tamara Draut.
California is considered one of the least affordable states in which to obtain a higher education. Full-time dependent students had an average out-of-pocket cost (total price of attendance minus all aid, including loans) of $18,100 at four-year private institutions in 2011-12 (NCES). This trend of declining state support of higher education will have a significant impact on the students in the Cal Poly Animal Science Department. Increases in tuition and debt burden (most students attend a college with tuition and fees of less than $11,100 per year (College Board)) will likely cause a shift in the enrollment in four-year universities like Cal Poly; a shift may occur to lower cost programs, particularly to the community college level. Therefore, competition for students is likely to increase as students seek lower cost programs. And while on an absolute basis, a greater number of students enrolled in our Animal Science program between 2007-2010, this trend may not continue in light of increases in costs. Additionally, while the total number of students has increased, the number of faculty members in animal science programs nationally has actually decreased (Fig 2).

Figure 2 offers the graduate student enrollment and faculty member headcount for the reporting years. The number of Bachelors students in Animal Science-related programs increased 8.1% between 2007 and 2010. The number of Masters students in Animal Science-related programs increased 5.0% between 2007 and 2010. The number of Doctoral students in Animal Science-related programs increased 8.5% between 2007 and 2010. The number of faculty members in Animal Science-related programs decreased 4.8% between 2007 and 2010. Review the detailed reports of 30 Land-grant institutions.
included in the analysis for Bachelors enrollment, Masters enrollment, Doctoral enrollment, and faculty headcount.

In the future, the Cal Poly State University Animal Science Department may contend with lowered enrollment, as well as a lack of qualified faculty in this discipline. Opportunity exists then to expand support of Cal Poly beyond the previous government supported model, and look in the future for other funding streams. It is likely this support will come from partnerships with alumni and commercial enterprises that benefit directly from Cal Poly State University Animal Science programs. Additionally, self-reliance in the form of university commercial activities will increase. For example, the Meat Processing Center providing a for-profit model that supports education and research will be evaluated for sustainability.

Equally impressive appears to be a trend towards an increased use of technology in animal science education. According to a report by the NMC Horizon Report: 2014 Higher Education Edition, social media and hybrid learning environments will increasingly take the place of the traditional classroom. Cal Poly State University Animal Science must take notice of this shift. These modes of education, especially online learning courses, will fill the learning landscape of the future. The Cal Poly Animal Science Department should take leadership in this, rather than languish (exhibit 4).
Particularly in Agriculture, with increasing use of high technology in processing and packaging, increases in traceability of food, food safety, transparency and optimization of resources, Animal Science graduates will be expected to be competent in areas of technology related to their discipline.

Further, technology driven advances in assessment of education likely will impact the face of animal science. In a world where awareness of return on investment is increasing, Cal Poly must be able to demonstrate their advantage over other programs to attract students. Therefore, applicable skills in technology must be nurtured including the integration of “big data” e.g. bioinformatics into our undergraduate program in animal science. We must collaborate, encourage integration and innovation, and engage other departments to prepare graduates in animal science that are fully versed in this type of technology. The challenge will be to identify faculty that are properly trained and educated to lead this technology driven mode of education. We must be willing to evolve, and engage people that may not perhaps fit the mode of the traditional animal scientist.
Tier 2 – Projections to 2030

a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be? Please include challenging demographic factors and trends and opportunities stemming from these factors and trends.

It is generally agreed that we will see a major shift in demographics of students in the Cal Poly Animal Science Department. Like higher education in general, we expect to see a shift to a more diverse population of students in Animal Science at Cal Poly State University. Indeed, as the trend to globalization of education continues (exhibit 5), we can only expect to see greater numbers of students from different regions of the United States and indeed the world.

Challenges exist then on how best to meet the needs of a more diverse population of students. Typical challenges in animal science include assisting students that have limited exposure to agriculture, including limited experience around livestock. We will need to accommodate students with language differences, and students with economic differences. Opportunities exist to enhance the education of all our students as the strengths of a diverse student population can be embraced and contribute to the global
perspective of all.

The expectations of the students of the future are significant. Most significant are the trends demanding increased teacher effectiveness and return on investment for their degree. The challenge will be to recruit and retain **qualified faculty and staff** in the animal sciences, particularly at Cal Poly State University, where the cost of living is a significant factor in the choice of potential faculty members and staff. While Cal Poly currently ranks well (13th among public universities according to Payscale Report) regarding median salaries of its graduates, it does not fare as well with faculty and staff. We will need to improve economic benefits for faculty, as well as softer measures, including providing additional mentoring and technological support for new faculty and staff.

b. **What will the global and regional economy be like in 2030** (and how are these forces relevant to your field or discipline)?

“There is widespread consensus that the world will be richer, older and with somewhat smaller differences in GDP per capita across countries by the year 2030” (ESPAS 2013)

This prediction is relevant to Cal Poly State University Animal Science Department, as we will need to prepare our graduates to enter this global economy. Many of our students will play a role in the massive need for the production of food. Additionally, as economies get richer and the population as a whole older, it is likely more will be spent on healthcare. This again represents a prime example of the relevance to the **One Health** concept and the opportunity that we have to integrate this into our education program. We will need to meet the demand for knowledgeable graduates in the diverse world of agriculture, as well as the increasing demand for allied health industries. As the population ages, demand for healthcare will continue to increase, and we can play a role in preparing graduates ready to enter health profession schools to meet these demands. It is expected that as the population becomes richer, more and more resources will be spent on companion animals. Recognizing the benefits of the human-animal bond will require our students to continue to have hands-on learning experience with animals, including
companion animals. It will continue to be a challenge to maintain animal populations on our campus. These units are very expensive and it will be a major challenge to provide both the food and companion animal experiences our students will need. This need can best be met under the umbrella of the One Health Center, a concept that integrates human and animal health professionals, in a center that meets the health needs of our campus animals while providing the opportunity for students from a diverse range of majors including kinesiology, food science and nutrition, psychology, biology, and environmental sciences, to study the human animal bond.

**What will we be preparing our graduates to do (in general, and in your discipline)?**
What kinds of careers will you be preparing your students for in 2030? (What will your graduates be doing at work?) How might this be different from what they do today as a result of the challenges and opportunities identify above?

The need for animal health professionals will continue to attract many of our students. There appears to be a global demand for veterinarians and other animal health professionals, and many of our students will enter these fields. Graduate programs and careers in disciplines such as nutrition, reproduction, range resource management, and biotechnology will continue to attract a portion of our graduates.

An interdisciplinary approach to animal science education that demonstrates our understanding of **One Health** will produce graduates that are adaptable, possess critical thinking skills, can communicate effectively, and are problem solvers that can take on global health and agriculture challenges. As society has become more aware of agriculture practices, specifically, food animal production, animal welfare has become a driving force regarding practices in food animal production. It is expected that demand for livestock products will continue to increase beyond 2030. To meet this demand, we likely will see the advancement of large-scale commercial livestock production that will be held to tight standards of **animal welfare**. Again, this represents an opportunity for the Cal Poly State University Animal Science Department to embrace this trend and
direct our graduates towards rewarding careers in this arena, including careers in policy and auditing of animal welfare programs.

As mentioned previously, a major trend towards increased production of food prepared in a safe and transparent manner will occur in the future. We will need to meet this demand by producing graduates that are educated with a global perspective on food production. Our students will have a better understanding of the relationship of food production, the environment, and human and animal health, with a concomitant understanding of the increased role that animal welfare plays. Animal science graduates will enter the growing job market for persons with expertise in policies and practices that affect food production regarding animal welfare, environmental health, and food safety. New careers will develop with regulatory assessment, enforcement, and food production audit opportunities.

c. What will our students need to learn to be successful (in general, and in your discipline)? What level(s) of education will they need (particularly in your discipline)? Discuss the implications and opportunities for Cal Poly’s academic programs, majors and its future students and graduates. Discuss the implications and opportunities for educating students to be successful members of global society. What competencies will our graduates need? What does this imply for the kind of holistic, interdisciplinary education experience that Cal Poly envisions, including its residential community?

Our students will need to learn to be creative, collaborative, integrative, and innovative. Our students will need to be able to:

1. Demonstrate problem-solving skills,
2. Integrate and apply technical and conceptual knowledge,
3. Exhibit an understanding of professional and ethical responsibilities, a respect for diversity, and commitment to sustainability,
4. Demonstrate proficiency in working as a leader and as part of a team to achieve common goals, and
5. Communicate effectively in a professional manner.
The implications for the Animal Science Department then of course is to meet these learning outcomes in an educational program that is just that: creative, collaborative, integrated, and innovative. Again this represents an enormous opportunity for not only the Animal Science department, but CAFES and the entire university. We need to embrace the concept that what we do in CAFES will affect what is done in COE… and on-and-on eventually realizing that the university itself is a whole and indeed greater than the sum of its parts. Realizing the integration of the Cal Poly community, the One Health of Cal Poly. The development of Cal Poly’s people, animals, and environment is perhaps the greatest opportunity with which we are faced. With this approach our students will experience truly the integrated nature of the world, build relationships required to exist in a global economy, and through creative experience, will innovate to meet the challenges of agriculture and health in 2030. Indeed the implications are huge, as are the opportunities. While we may no longer see the six silos of Cal Poly as we do today, it is exciting to look forward to 2030 when education reaches beyond an individual college, department, or major, and sees the student, and the world, as a whole.
Tier 1 – Higher Education Today

1a. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?

At Cal Poly in the BRAE and ASM majors, effective teaching and our learn-by-doing mandate is expected to affect the evolution of the professor/instructor from the traditional role of knowledge purveyor to more of a mentor, guide or coach. This view is not universally shared. External pressure to serve larger student audiences, on and off campus, usually drives the conclusion that greatly expanded “distance” and “online” learning is our future trajectory. Indeed, electronic course delivery could extend the reach of our instruction to larger audience, especially in rural communities. But the major challenge will be how to preserve our time-proven learn-by-doing format for skill-based fields such as BRAE and ASM.

We expect that the effects of changing priorities in public higher education will be evolutionary rather than revolutionary. The hands-on skills required in our majors are tough to impart over a network connection. Admittedly, the taxpayers that support the university system and the average educational consumer do not necessarily distinguish this fundamental difference in educational quality.

Current and future student populations comprised of millennial and subsequent generations are and will be accustomed to electronic information delivery, perhaps to a detrimental extent. The decreased element of personal connection involved in internet-based education leaves the holistic experience of the university is at risk. Further, the line between knowledge and information has been blurred. The ubiquity of information, despite the convenience, has changed the process of learning from the task of collecting knowledge and skills from credible sources in classrooms and libraries, to the task of distinguishing knowledge from the vast amount of unvetted information available online. This is expected to affect the role of the professor (and traditional textbooks), formerly assumed to be sources of encyclopedic knowledge in a course, to the roles of gate-keeper, guide and filter available to the students, either in a traditional classroom or via an online course.

One other negative ramification of the internet generation that may force fundamental changes in teaching methods is ease of access to personal electronics. Unlimited communication. Distractions from digital devices. A habitual need to be in contact with a large circle of online “friends” at all times. Overall, the effect on BRAE ASM is probably not as great as for other majors due to the experiential emphasis of our programs. Learning-by-example is strong in the BRAE department, maximizing student engagement and reducing ubiquitous distractions. But we do expect to have to provide additional guidance in academic etiquette to assure student maturity and self-discipline.

If the future of Cal Poly is that of an increasingly residential campus, we view positively the increased opportunity of students to participate in a whole-life experience, engaging them beyond the classroom experience. The heavy involvement of students at all levels in the BRAE department helps to foster this environment – a model of education that we believe would definitely benefit students in the future.
As the university expands its reach toward the international community, a shift in student demographics is inevitable. And since US agriculture, and especially California agriculture, leads the world in productivity, it’s likely that increased international accessibility of the university will disproportionately affect BRAE, with increased demand by non-US students. A potential increase in enrollment of international students will pose new challenges to maintain relevance of educational content and student services to a more diverse suite of student needs. Communication and cultural assimilation may involve disproportionate challenges for the BRAE programs, which were designed to primarily meet the needs of US and California. Recognizing the benefits of increased international awareness, these are as much opportunities as challenges, that can and will be met. But it is important that they be recognized by the university in conversations that focus on higher out-of-state and international tuition rates.

Similar challenges may follow from a changing student age distribution – both younger and old students. This may lead to difficult tradeoffs between services required by an aging population vs. services for youth. This is probably of small relevance in the next decade, but there is the potential for student demography to develop a bimodal age distribution as continuing education and career transitions impact the BRAE student population. Currently, our students are almost entirely in the 18-24 age range. Differences in learning styles could also drive modifications of classroom and laboratory methods.

Cal Poly has long been known for its high educational value relative to cost. In fact, it is a defining principle for the CSU system. If cost could be maintained as competitive, this is a major advantage for Cal Poly, especially in educational areas such as BRAE that directly address needs of existing and future employers.

But the declining role of State support is a dominant force that has already and will continue to shape Cal Poly. Increased tuition and student debt shifts costs to students and their parents. Financial aid opportunities target the lowest income households. Middle income households are disproportionately affected at Cal Poly, formerly a haven for education to the 20-80th percentile income households. The trend will clearly be continued loss of educational accessibility to middle class Americans, traditionally the core constituency of Cal Poly, especially in Ag-related areas. Broader class separation and the negative societal consequences will accompany this trend. Societal ramifications are unknown, but not expected to be positive.

Keeping up with rapidly changing technology is a necessity in all fields of education, but especially in rapidly evolving areas of engineering and technology management. This investment of professional time is an absolute necessity for faculty teaching our BRAE and ASM majors. Exponential growth in technology will inevitably bring increasing workload demands for faculty struggling to do their jobs as effective teacher-scholars.

Adaptability and readiness for change is considered by the BRAE faculty to be of high relevance, as future educational needs track rapidly advancing technologies in the field. Agility and resilience is facilitated not only by faculty interest and industry guidance, by attention of administration to the barriers to such agility, e.g., cross-department and cross-college institutional impediments and intransigent facilities services.

“Big data” has become a popular buzz word in education, as with almost all professional fields. Most is just hype. But in bioresource and agricultural engineering, the low-cost availability of large datasets will fundamentally change the way we do thing: a potentially large influence on the future of ag technology, of major relevance to BRAE. High-resolution geo-correlated data will enable new levels of precision
farming, automation and general productivity. This trend will inevitably require enhancement to the existing curriculum and educational resources to keep up with these advances.

Regarding advances in technology in the classroom, some ability to expand the educational audience is expected and will be supported to the best of the faculty’s ability, considering ancillary workload. But advances in educational research rarely take into account the special nature of experiential education, and the criticality of 1:1 supervision in the development of high-risk hands-on skills (e.g., welding, motive power system design, chemical handling). Consequently, educational delivery technologies are expected to be of less relevance to the BRAE and ASM majors than other educational fields.

Regarding the teacher-scholar model at Cal Poly. It is our perception that this term means different things to different levels and departments of the university. To most faculty in CAFES and BRAE who teach labor-intensive application-based courses, this translates to additional expectations in professional arenas beyond their primary teaching responsibilities. As discussed above, currency in field will surely increase in importance in the future as technology and the regulatory environment continue to grow. With increased future emphasis on the TS model, a shift in the type and experience base of faculty is inevitable. A faculty known for industry/operational experience may evolve into a more traditional academic-based body that lacks the pragmatic understanding that is critical in BRAE. This shift is not viewed as a completely positive development by either faculty or industry advisers.

One last prompt that evolved from the Academic Planning workshops was the ramification of Community colleges offering 4-year degrees in California. This would obviously create competition from lower cost purveyors of skill-based education. This could have significant impact on the more pragmatic Cal Poly programs/departments such as BRAE, as the declining middle class constituency opts for the reduced educational cost of community colleges. Overall, the combined forces of budgetary constraints, changing learning behaviors, changing demographics, and evolving public perceptions of higher education will no doubt shape the future of Cal Poly. The inevitable question will be, how will our special brand of “Learn-by-doing” evolve to meet these challenges?

**Tier 2 – Projections to 2030**

2a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be?

Among the focal points of the Academic Planning for Enrollment Workshops was the relevance of increasing ethnic and gender diversity among students. We were asked to assess the relevance to our academic programs and the ancillary service that we provide.

We expect that the impact of demographic changes on the BRAE department will be similar to the impact on the overall university. With a traditionally less-diverse student and faculty population, the demography of these groups could change to a greater extent than other areas. We anticipate a shift in the cultural environment, but little foreseeable effect on curriculum.

The student population in our program will probably shift toward a greater percentage of historically under- agriculture predicts continuous but slow growth. University-wide trends may not necessarily apply in pragmatic fields of opportunity growth such as BRAE. However, if we are to accept projections presented in the Academic Planning workshop of decreasing numbers of qualified applicants, and
assuming that this would proportionally affect funding, difficult choices may be required in resource allocation.

represented groups and first generations in college. We do not expect a reduction in our applicant pool as expected by other units in the university. The increased role of technology in
We have observed a radical increase in the percentage of female students in the BRAE and ASM majors. For example, the combined freshman class in Fall 2013 was 12% female, while in Fall 2014, the percentage increased to 25%. While other factors may be in play, we note the decision of the faculty in Fall 2013 to implement programs intended to increase female applicants and acceptance, for example, asking current female students to call undecided accepted female applicants. Further regarding gender balance, we recognize a growing need for additional female faculty to serve as mentors and role models. Among a very scarce pool of potential female faculty candidates with appropriate doctoral backgrounds, the need for competitive salaries will become even more important.

Of imminent concern is the quality and continuing unevenness of K-12 education for “home grown” California students in their college-readiness. Pre-college preparation in rural high schools is disadvantaged due to fewer college preparatory and advanced placement courses. The BRAE department has long been engaged in aggressive elementary and high school outreach activities, especially in rural high schools which are often overlooked in larger university efforts. We are dedicated to these efforts, but our ability to reach large numbers of prospective students is limited.

special programs usually inferior to the applicant norm. This could suggest the need for a greater emphasis in the lower division on coursework that is currently considered remedial.

The BRAE and ASM majors provide a strong opportunity to better serve a more diverse population, preparing these transitional students for the workforce. The nature of our curriculum also presents increased opportunity for transfer and non-traditional student pipelines, connecting with that population’s identity and harnesses their potential. This observation is of particular relevance for academic departments/majors that directly serve the needs of employers and focus strongly on expected areas of employment opportunity. BRAE is noteworthy in this sense. The expected shift in educational priorities to career opportunity and success will almost surely rebalance the objectives of the university back towards polytechnic education as exemplified by the BRAE and ASM majors. Increased ancillary services and financial aid would have uncertain relevance to the BRAE Department. Enhanced support for cross-over constituencies could increase the student applicant pool and academic success rate in this population. But current the student economic demographic in BRAE and ASM is strongly middle class and California-rural. If attention to this economic group is diminished to meet other university objectives, potential reduction in student numbers and success rate in BRAE and ASM majors is possible.

Following national trends, we expect a growing need for a more technically literate workforce in almost all areas of employment, but especially areas that are enabled by technical advances. BRAE and ASM programs must continue to evolve to track this evolution. And increased demand for continuing education in selective areas is reasonably expected, as well an increased demand for MS programs, especially in the water and energy areas.
2b. What will the global and regional economy be like in 2030 (and how are these forces relevant to your field or discipline)?

The economic and environmental future facing our graduates is probably less certain than any time in recent history. We anticipate that solutions to climate change will in a large sense depend on technologies for remediation, conservation and a transition to alternative energy and fuels. This prediction suggests strong relevance of BRAE and ASM skills, combining biology and engineering on a practical level.

Agriculture is the largest wealth generator in California and the USA. Technology is the driver of agricultural productivity. BRAE excels at engineering and high-tech in Ag. ASM curriculum is solid preparation for increased service component of US economy, in Ag or otherwise. There is a high probability that future career opportunities will emphasize knowledge and skills in these educational areas.

Regardless of the information source, there global agreement that the critical survival issues will be food, water and energy. All predictions for the future point to fresh water being the most critical global commodity, displacing oil as driver of international and domestic politics. This observation is of strong relevance to BRAE department, in which water engineering is a popular specialization and the Irrigation Training and Research Center (ITRC) is based. The interdependency of health/disease with food/water/sanitation/fuel is expected to further increase demand for graduates in BRAE and ASM.

The BRAE and ASM curricula emphases knowledge and skills that prepare students to create and implement innovative approaches to climate change, energy, resource management and environmental sustainability. Skill sets required to implement solutions to expected challenges of climate change, energy and resource management are essentially the core courses of the BRAE and ASM majors. Increased future relevance and educational demand is reasonably expected.

2c. What will we be preparing our graduates to do (in general, and in your discipline)? What kinds of careers will you be preparing your students for in 2030? (What will your graduates be doing at work?)

Future trends are usually extrapolated from current data, with a high degree of uncertainty due to major technological or political changes. For 2013 graduates of the BRAE program, the following information was obtained via Cal Poly Career Services:

<table>
<thead>
<tr>
<th>Category</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed Full-Time</td>
<td>3</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Employed Part-Time</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graduate School</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Seeking Employment</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Not Seeking Employment</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No Response to Survey</td>
<td>-2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>21</td>
<td>23</td>
</tr>
</tbody>
</table>
Median Salary = $62,000

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Gender</th>
<th>Annual Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Specialist</td>
<td>M</td>
<td>----</td>
</tr>
<tr>
<td>Packaging Systems Engineer</td>
<td>F</td>
<td>$45,000</td>
</tr>
<tr>
<td>Consultant</td>
<td>F</td>
<td>$48,000</td>
</tr>
<tr>
<td>Consultant</td>
<td>F</td>
<td>$50,000</td>
</tr>
<tr>
<td>Design Trainee</td>
<td>M</td>
<td>$54,000</td>
</tr>
<tr>
<td>Automation Engineer</td>
<td>F</td>
<td>$45,000</td>
</tr>
<tr>
<td>Process Engineer</td>
<td>M</td>
<td>$58,000</td>
</tr>
<tr>
<td>Farm and Equipment Manager</td>
<td>M</td>
<td>$62,000</td>
</tr>
<tr>
<td>Engineer</td>
<td>M</td>
<td>$61,200</td>
</tr>
<tr>
<td>Hydro Mechanical Engineer</td>
<td>M</td>
<td>$67,000</td>
</tr>
<tr>
<td>Consultant Engineer</td>
<td>M</td>
<td>$69,000</td>
</tr>
<tr>
<td>Program Manager</td>
<td>M</td>
<td>$75,000</td>
</tr>
<tr>
<td>Downstream &amp; Chemicals Engineering Development Program Member</td>
<td>M</td>
<td>$78,900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employer</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black &amp; Veatch</td>
<td>Rancho Cordova, CA</td>
</tr>
<tr>
<td>Chevron</td>
<td>San Ramon, CA</td>
</tr>
<tr>
<td>E&amp;J Gallo Winery</td>
<td>Modesto, CA</td>
</tr>
<tr>
<td>FM Global</td>
<td>Walnut Creek, CA</td>
</tr>
<tr>
<td>Intel Corp</td>
<td>Santa Clara, CA</td>
</tr>
<tr>
<td>Irrigation Training and Research Center</td>
<td>San Luis Obispo, CA</td>
</tr>
<tr>
<td>LA Consulting</td>
<td>Manhattan Beach, CA</td>
</tr>
<tr>
<td>Lorick Associates Consulting</td>
<td>Manhattan Beach, CA</td>
</tr>
<tr>
<td>MSO Technologies</td>
<td>Thousand Oaks, CA</td>
</tr>
<tr>
<td>Musco Family Olive Co.</td>
<td>Tracy, CA</td>
</tr>
<tr>
<td>Rain for Rent</td>
<td>Bakersfield, CA</td>
</tr>
<tr>
<td>Transbay Fire Protection</td>
<td>Pleasanton, CA</td>
</tr>
<tr>
<td>Zonneveld Farms</td>
<td>Laton, CA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graduate School</th>
<th>Gender</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Polytechnic State University</td>
<td>M</td>
<td>M.S. Engineering</td>
</tr>
<tr>
<td>Stanford University</td>
<td>F</td>
<td>Environmental engineering and science</td>
</tr>
</tbody>
</table>

Gleaned from this graduate data is an awareness that graduates of our programs contribute to the California economy at multiple levels – a technically advanced work force, enhanced agricultural productivity, and as taxpayers, leaders, and stewards of the next generation of wealth generators. Our
graduates address growing pressures in agricultural labor, water, and regulatory compliance. And uniquely associated with our programs is the contribution to the survival and vitality of the agricultural operations that form the economic centers of rural locations, the often-forgotten major contributors to national prosperity.

We expect that over the next 25 years, career opportunities in agricultural industries will continue to dominate for our graduates. But an additional range of opportunity in emerging opportunities that track technology growth in agriculture, energy and earth sciences is also expected.

2d. What will our students need to learn to be successful (in general, and in your discipline)? What level(s) of education will they need (particularly in your discipline)?

Entries in table below provide relative importance scores (H,M,L) for the BRAE and ASM majors.

<table>
<thead>
<tr>
<th>Indicate Importance or Relevance of Each Competency or Teach and Learning Practice to:</th>
<th>Students in Your Academic Major or Degree Programs</th>
<th>Other (or All) Cal Poly Students (Holistic Education)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Competencies – Add as Appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Global Awareness and Cultural Competence – most frequently listed by far as an area for future development</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>• Problem-Solving; Critical Thinking – noted both as an important continuity with present practice and an opportunity</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>• Career Readiness and Adaptability – including acknowledgment of how work and workplaces change over a career</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>• Life Skills – another area for development covers a range of skills that help students prepare for life, such as ethical behavior, reflection, and social responsibility, balance</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>• Communication, Collaboration, and Other Essential Skills for Working with People– recognizing current practice, and focusing on future development, both while students (e.g., with faculty) and as professionals</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>• Leadership, Entrepreneurship, Innovative Thinking, Change Management – noted as areas for development</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Specialized Knowledge and Competencies – Add as Appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Information Technology – particularly, keeping up with technological change and how information technology is applied in their careers, including societal implications</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>• Environment (including food, energy, sustainability)</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>• Engineering (many aspects)</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>• Health and Aging – recognition of how anticipated</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>
demographic change creates new career opportunities

<table>
<thead>
<tr>
<th>Teaching and Learning Practices – Add as Appropriate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integrated Learning; Education Beyond a Single Discipline – most frequently listed by far as a critical aspect of education, both currently and in the future; implications for facilities (teaching space) as well as majors and curriculum</td>
<td>H</td>
</tr>
<tr>
<td>• Learn by Doing – touted as a Cal Poly strength that can and should continue to evolve; incorporating new technologies; closely connected with applied learning and problem-solving</td>
<td>M</td>
</tr>
<tr>
<td>• High Impact Practices – reinforcement and extension of lab and studio settings, teamwork, and mentoring</td>
<td>Unclear</td>
</tr>
</tbody>
</table>

2e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines.

Topics identified in Nov 7 Academic Planning for Enrollment workshop, focused on multidisciplinary collaboration:

<table>
<thead>
<tr>
<th>Topics Identified for Potential Collaboration</th>
<th>Possible Forms – Faculty Oriented</th>
<th>Possible Forms – Student Oriented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and Industry (e.g., hospitality)</td>
<td>Faculty Learning</td>
<td>Coursework (elective or required)</td>
</tr>
<tr>
<td>Data and Computing (e.g., big data)</td>
<td>Community/Workshop</td>
<td>Project Lab</td>
</tr>
<tr>
<td>Engineering Design and Systems Environment and Sustainability</td>
<td>Collaborative Scholarship</td>
<td>University Prefix</td>
</tr>
<tr>
<td>Food Production</td>
<td>Research Center or Institute</td>
<td>General Education</td>
</tr>
<tr>
<td>Health and Well-Being</td>
<td>Integrated Course Development, Delivery</td>
<td></td>
</tr>
<tr>
<td>Problem-Solving, Management, and Leadership</td>
<td>Industry/Community Partnership</td>
<td>Option or Concentration</td>
</tr>
<tr>
<td>Science, Technology, and Society Scientific Discovery</td>
<td>Possible Forms – University as a Whole</td>
<td>Minor</td>
</tr>
<tr>
<td>Social Justice Using Technology in the Humanities</td>
<td>Lecture Series</td>
<td>Major</td>
</tr>
<tr>
<td></td>
<td>Collaborative Projects</td>
<td>Professional Certificate</td>
</tr>
<tr>
<td></td>
<td>Annual Theme</td>
<td>Master’s Degree</td>
</tr>
<tr>
<td></td>
<td>Summer Institute or Academy</td>
<td>Advising</td>
</tr>
<tr>
<td></td>
<td>Festival or Event</td>
<td>Student Club</td>
</tr>
<tr>
<td>Challenges (examples) Appropriate space for collaborative projects University governance structure Workload and accountability</td>
<td>Challenges (examples) Cross-disciplinary appointments (and RPT) Incentives for faculty (time, compensation) Funding for logistical support</td>
<td>Challenges (examples) Curriculum already packed Prerequisites Student identification with</td>
</tr>
</tbody>
</table>
The focus of the Nov 7 Academic Planning for Enrollment workshop was interdisciplinary opportunities and impediments. The list provided above is the focus group topics and some of the collaborative discussion comments. The BioResource and Agricultural Engineering Department faculty generally concur with the list of Topics Identified for Potential Collaboration and the list of nine identified Challenges. Among the challenges, of greatest relevance to BRAE in recent years have been:

1. Workload and accountability
2. Incentives for faculty (time, compensation)
3. Curriculum already packed
4. Cross-disciplinary appointments (and RPT)

Not captured in the list above was the distinction identified in the workshop between those challenges that are institutional in nature (can be solved by administrative decisions), as opposed to those that are systemic (those that are fundamental parts of the university culture or the reality of the educational mission each major). For example, 1, 2 and 4 above have administrative solutions. This leads to the obvious question as to why the faculty are prompted continually to discuss them, when, notwithstanding State budget realities, the solutions are within the power of the University or CSU administration. Challenge 3, as stated, is partially subject to administrative decisions (e.g., GE requirements), but is mostly a function of the growing minimum educational needs of most engineering (known as high-unit) majors. The knowledge and skills required of BS degree graduates cannot be met within the hard CSU unit limit targets.

Relevant to interdisciplinary collaboration: It is seems to be generally assumed that collaboration between existing educational departments and Colleges will yield improved educational efficiency, resulting in a potential reduction in program unit requirements. While there may be some efficiencies gained by shared resources (this is subject to debate), collaborative efforts represent an expansion of educational requirements for students. We perceive multidisciplinary curricula to be a positive educational trend, already at least partially embodied by the breadth of the BRAE and ASM curricula. There will almost surely be an even greater trend toward multidisciplinary and cross-disciplinary education for future graduates in technology-based and skill-intensive majors. However, it must be recognized that this trend will almost surely require increased rather than decreased units in a major.

With this in mind, we comment on the Faculty, University and Student oriented Forms (solution elements) listed above:

Possible Forms – Faculty Oriented
Faculty Learning Community/Workshop
Collaborative Scholarship
Research Center or Institute
Integrated Course Development, Delivery
Industry/Community Partnership
BRAE Comment: All great ideas. Some require resources. The BRAE department is already heavily engaged, noting especially its Irrigation Training and Research Center – the largest center at Cal Poly. Obvious in emerging fields.

Possible Forms – University as a Whole
Lecture Series
Collaborative Projects
Annual Theme
Summer Institute or Academy
Festival or Event

BRAE Comment: All great ideas. Already well under way at the Department, Center or College level. Greater university involvement may or may not yield a net positive impact, but worth a try.

Possible Forms – Student Oriented
Coursework (elective or required)
  Project Lab
  University Prefix
  General Education
Option or Concentration
Minor
Major
Professional Certificate
Master’s Degree
Advising Student Club

BRAE Comment: All great observations/ideas. All are existing solutions/options. Under “coursework”, project labs are the norm in the BRAE and ASM majors, as well as most field of engineering. Unclear what benefit to be gained by creation of additional courses under the “UNIV” prefix, compared with existing practice of cross-listing. Reform of excessive/inappropriate general education requirements for technical majors is the core issue underlying excessive unit counts. Must be addressed at the University level based on educational needs in a given major, not university politics. Uncertain implications for emerging fields.
Dairy Science Enrollment Planning Report

**Tier 1 – Higher Education Today**

1a. **What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?**

**Demographics.** The reduction in the number of farm families, and displacement of agriculture by an expanding urban population is expected to continue. In our discipline the decreasing number of farms will likely change our applicant pool. Additionally, demand for and production of milk will continue to increase, the growth will likely be slow due to regulations, draughts, and the increase conversion of agriculture land from dairy feed crops to specialty crops. At the same time, growth in the dairy foods processing industry is expected to continue to grow.

**Environmental and physical limitations.** A major concern for the agriculture industry, and in particular to the dairy production and processing industries, is the environmental impacts associated with animal and crop production. Increasing regulatory requirements faced by agriculture and the dairy industry will slow growth of the industry. While these factors will be a negative impact on the dairy industry, the need for human capital to help mitigate environmental impacts and to work within a more rigid regulatory environment will create new job opportunities within the dairy industry. Physical limitations, such as water and its distribution, limits on ground water use, and competition for limited agricultural land are forces that will drive change in agriculture.

**Digital and Communication Technologies.** Computers, big data analysis and statistics are more critical in all fields of agriculture. Both regulated and unregulated information is ubiquitous and having significant impact on public perception about agriculture. The expansion of the information age will require new methods of instruction and training of future agricultural communicators who can contribute to the public awareness about food and food production systems.

**Economy.** Money for higher education is likely to continue to be limited. CSU is no longer adequately funded by the state and the process of developing alternate funding for our programs is requiring a change in the culture of the CSU and Cal Poly. Shrinking resources for the CSU, and in particular Cal Poly, will increasingly threaten our laboratory-intensive curriculum. Reduction in funding for program development at the national (DMI, USDA) and state levels (CMAB, CDRF and ARI) make it harder to carry out innovation in teaching, research, and other scholarly activities. Increased dependence on private funds have the potential of changing the nature of higher education. However, programs like Dairy Science, which have a clear value to the agriculture industry, are in a better position to secure non-state funding to support development of human capital and applied research activities.

**Tier 2 – Projections to 2030**

2a. **Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be?**

We expect that the student population for Dairy Science in 2030 will be increasingly diverse, less likely to have prior on-farm experience and older than the current student population. With continued changes to the ethnic mix of the California population, we will
have to be more attentive to factor in cultural differences with respect to labor management, personnel relations, and, in fact, how we communicate to our students.

Yesterdays’ s students were attracted to Agriculture through traditional agricultural experiences (FFA, farm families, etc.). Millennials and our future students are introduced to food as a “foodie” through fine dining, Food Network and the web. Growth in food related “consumerism” will drive increased interest in programs like Dairy Science. At the same time industry will want to hire graduates who can develop efforts to improve relationships with consumers. Programs that can address consumer psychology and behavior beyond traditional marketing will be an opportunity.

Our future students will come to us with the expectation of just in time education and less interested in the traditional sequential learning models used in the past. Greater use of technology in education, more flexible forms of instruction, competency based program will be the preferred form of instruction for the generation that now enter the education pipeline.

We also expect a greater proportion of first generation college students. Given this reality, it is likely that more attention will need to be paid to nurturing college success skills, making advising a key part of college success for our students. With fewer students that have practical dairy or processing experience, we will not be able to rely on the same experiential foundation that we have historically seen as students enter our discipline.

A shrinking pool of our traditional student population base means that we will have to work with high schools and community colleges to ensure students are able to meet the high admissions standards and seek out more students from non-traditional pools. The curriculum to meet the needs of this diverse population will require education that is both in depth (for some) and broad based (for majority).

A shrinking pool of traditional applicants and shifting public interest in food policy will mean our students will expect and need their education to be broader in nature. Preparing students for a greater range of opportunities and giving them the skills to quickly re-tool as job market shifts will be what our students expect.

With respect to the observation that students in 2030 may be older, Dairy Science, especially dairy processing, represents an attractive career choice for more mature students. These students are motivated by the desire for a steady, solid income and good job security.

The industry will increasingly rely upon university based continuing education to provide specialized, content focused training that is timely, specific, meet immediate needs and satisfy professional development goals for their employees. Providing short courses, workshops and other outreach training programs can meet these needs.

**Tier 2**

2b. What will the global and regional economy be like in 2030 (and how are these forces relevant to your field or discipline)? Again, please include challenges and opportunities.

*Global Economy in 2020 and beyond...*
Based on most projections China will surpass the US as the largest economy by 2020 and will be twice the size of the US economy by 2030. Africa and other developing regions of the world are also expected to improve economically and drive demand for milk. This could have important ramifications on the US economic outlook and its role as a global dairy supplier. Additionally, US investment in education and technology are lagging behind other developed countries. This situation will create real challenges for the US to overcome.

Continued growth in the California population is expected. The Department of Finance estimates California population to grow to over 50 million by 2049. Hispanics become the plurality of the population in 2014 and will be ~48% of the population by 2060. In 2030, there will be 9.6 million Hispanics, 7.2 million whites and 3.1 million Asians in the prime working ages of 25 to 64.

**Global Marketplace for US Dairy and Cal Poly Dairy Expertise/Training**

While it is projected that many developing countries will continue to improve and have greater income growth with a reduction in population growth rates, there will also be an increase in the populations in poor underdeveloped countries where food insecurity is the highest. These wide swings in needs within a region or country will create a diverse range of opportunities and challenges to address requiring different talents and expertise. Increasingly the interconnectivity of the world and ability to supply products, services and knowledge will increase and create opportunities for those who can effectively work in this changing environment.

As the export of dairy foods (the percentage of US produced dairy solids sold for export has grown from <5% in 1985 to 17% in 2014) continues to grow, the US dairy sector will demand graduates who understand and can effectively work in an increasingly global marketplace. Given that dairy markets and technologies are complex, the US is in a great position to invest in dairy specific scientific and economic education, research, and technology transfer to train future generations of leaders who can put together discipline specific teams needed to keep pace with business needs domestically and globally. Because California is strategically located to major dairy importing regions worldwide, Cal Poly will have the opportunity to support this growing opportunity.

While animal based food production will come under increased scrutiny as natural resources become increasingly scarce, demand for higher quality animal based proteins will continue to grow as economic wealth increases globally. New technologies and thinking will be needed in the future to mitigate animal agriculture’s impact on the environment and at the same time increase the production of a high quality protein source. The dairy graduate will need to feel sufficiently confident to build and lead various teams of experts to address increasingly complex, multidisciplinary challenges and global opportunities.

**Tier 2c. What will we be preparing our graduates to do (in general, and in your discipline) in 2030?**

In general our students will need to be prepared to:

- Work in an environment where the pace of change continues to accelerate
- Adjust to global climate uncertainty through:
  - Greater focus on risk management
  - More flexibility
  - Willingness to test and adopt new innovations
• Understand the implications of a more globalized economy
• Work productively with different cultures
• Have the tools for a lifetime of continued learning in order to quickly adapt to new realities and opportunities.
• Have the critical thinking skills necessary to sort out complex problems and make better decisions concerning competing priorities
• Skills to communicate effectively from 140 character texts to large group presentations
• Use social media to identify emerging trends and to shape the opinion of others

Within Dairy Science our students will need to be prepared to:
• Continue to increase milk production under increasing regulation
  o Farm with less water
  o Increased energy costs
  o Reduce on farm emissions
  o Address issues related to food safety
  o Ensure appropriate animal welfare
• Integrate vast amounts of data into appropriate management decisions
• Manage employees that have more specialized training
• Adapt to greater dependence on technology and automation while still managing what is a biological system
• Respond quickly to changing consumer demands and expectations
• Respond in appropriate ways to emerging synthetic foods

Career that will continue
• Dairy herd management
  o Applied ecology requiring the integration of biology, chemistry, engineering, economics, environmental sizes, political science, and environmental law
• Animal health
• Animal nutrition
• Sales and service of dairy equipment
• Dairy foods processing
• Dairy foods research and development
• Agriculture communications
• Agriculture education

New careers
• Regulatory management
• On farm energy production and use

Tier 2d – Projections to 2030. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?

In general:
• Our students would need to learn how to adapt to the changing environment:
  o Increasing attention from consumers on social conscience and sustainability will drive need for students to understand how to balance a complex set of variables.
o Changing food policy that favors local producers and products, countered by the continued increase in world's population requiring higher yield in food production. A better understanding of the science of animal production and dairy processing will be necessary to be able to adapt to different production systems.

o Depleting non-renewable resources and advancement in technology related to renewable energy is likely to favor closed production systems where energy is produced and waste is managed on farm.

o Greater weather uncertainty will require more flexible agricultural practices due to more extreme weather fluctuations.

- Our students need to know how to analyze “Big Data”, as technology would push the nature of jobs towards data management as supposed to physical labor. Dairy specific software programs will become more standardized and students should become competent in using these programs. Skills relating to information access and management will be critical in managing risk.

- These high tech, efficient, and yet sustainable systems will also be dependent on both a clear business plan and on personnel management skills.

**In the discipline of dairy processing:**

- With increasing emphasis on food safety, students need to be well versed in rules and regulations relevant to dairy foods production. Food Safety Modernization ACT (FSMA) of 2011 would be in place for almost 20 years. Additions and modifications are expected, but by 2030, the sweeping changes due to FSMA would be a commonplace for dairy farmers and dairy processors. There would be probably a new emerging trend in food quality and safety management by then, and our students need to understand the evolving nature of the rules and regulations.

- Continuation of the evolution of milk ingredient technology would require our students knowing not only the processing aspects of dairy products, but also the unique functional properties of each component in milk. This would require a strengthening of our curriculum in ingredient applications, bio-separation techniques, product development, as well as health and nutritional properties of milk components.

- Our students also need to be exposed to the economics in dairy export, as well as the subtle differences in culture and consumer expectations from foreign buyers. The trend in dairy export is going up and our students must have a global view of the dairy industry.

**In the discipline of dairy production:**

- A continued emphasis on the dairy farm impact on the carbon footprint, rations and feeding management effects on nutrient utilization by the animal, waste management and nutrient management and water availability will likely impact the need for students to better understand the total impact of efficient production.

- Students will need to be able to manage technology as well as personnel. Labor expenses may likely be replaced with improved efficiency, including more mechanical and robotic technology.

- The advances in data collection and management will continue to increase. Risk management in a quickly changing environment will require greater skill in data management and in the use of computer software specific to dairy herd management.
• Locally grown and organic niche markets will likely continue to grow, but large scale, efficiently managed and sustainable dairies will be necessary to feed the world’s population. Managing a dairy operation, regardless of the size, will require students to have the ability to understand and integrate information from a wide range of sources and be able to use the information effectively in a more highlight regulated environment.

• Students will need to be able to make management decisions with an understanding of genomic evaluations and how specific genotypes may be suited for specific management and environmental conditions. This will likely impact both their reproduction and genetic management, and will include decisions related to reproduction and productive life. A few may be involved in the actual evaluations; it is more likely that graduates will need to evaluate the management implications.

• There will always be need for those individuals broadly trained in the Dairy Science field to assemble and manage multidisciplinary teams. However, with the increased technical complexity of Dairy Sciences and the need to adopt and utilize the most advanced technologies, advanced (graduate level, MS) training will be needed to create the human capital with quantitative problem solving skills and who can implement breakthrough technology. At the same time, programs such as the MPS in Dairy Product Technology will also become more important and in demand. The need for people who understand broadly the process of dairy food production and who can serve as integrators and leaders in the dairy foods industry will increase.

A flexible curriculum would be very valuable with some students interested in dairy farm management and others in a much more specialized science-based curriculum.

*Tier 2e – Projections to 2030 2e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?*

**PARTI: implications for emerging fields**

Food production increasingly demands both efficiency and sustainability. Given this reality we find opposing forces in the realm of food production. In the public perception there is a growing suspicion of food origins. A distrust of big company influence and concern about government’s ability to regulate intensive agriculture practices have led to a rising demand for organic foods, and a dislike for increasingly unnatural crop management, confined animal production practices and the use of pharmaceuticals. In dairy production and processing, the perception of the consumer is of critical importance. Students need to be aware of public perceptions in light of scientific findings.

As with recent lobbying against genetically modified organisms (GMOs), a growing portion of the public is wary of the use of genetic engineering to enhance crop and livestock production. Even food derived from animals consuming GMO’s is of concern to a significant portion of the public refusing to buy it. Starting with students, the public needs to understand what exactly genetic modification is and the full spectrum of ramifications.

There is a growing awareness of the impact on the environment as a result of agricultural production practices. Legislation shaping environmental policy created hurdles for producers, especially in California. Students will have to understand how to shape public policy that effectively controls land usage without being overly restrictive. Students will
need to have the tools to help ensure they can truthfully represent both agricultural interests and sustainable land use practices.

The threatening voice of antibiotic resistance and food safety will become louder in dictating alternative anti-microbials or immune modulation, as well as more standardized biosecurity measures. Knowledge of microbiology will also play a key role specific to dairy production in waste management and increasing feed efficiency. Nutriceuticals will become more important for management of plants, animals and humans.

On the opposite spectrum is the need for food production efficiency to fulfill the hunger of an expanding population. This aspiration will likely involve the use of genetic engineering at some level in both plant and animal production. Transgenics has the power if not abused to harvest the collective advantages across species, using the present genius in nature for the ultimate benefit of humans. Our students will need a deep understanding of both genetics and the ethics of the use techniques such as genetic engineering.

It is far more complicated than a dual market and marketing phraseology. In putting milk products on the shelves, producers and processors are confronting the conscience of society. Our food is now meant to suit the intellectual as well as physical palate of consumers. Designing courses that investigate both the science promoting food efficiency as well as the public perception of that science will be necessary. These opposing forces shape food production’s future and inevitably Cal Poly's students.

**PART II: integrated learning that goes beyond traditional disciplines**

The trend toward “programs” and not so much on majors will drive interdisciplinary approaches that allow concentrations on certain areas of a field of interest to extend beyond the borders of the department curriculum. The development of these concentrations would require the collaboration of cross-discipline studies and the involvement of faculty in multiple disciplines. The dairy production industry demands a more well-rounded, well-versed student who can act as public spokesperson, scientist, environmentalist, and at times even an engineer. Case-based, problem learning approaches fostering multi-discipline integration is one model of instruction that might help better prepare our students.
Academic Plan for Enrollment  
FSN – Drs. Amy Lammert & Gour Choudhury

1. How factors affecting higher education will affect Food Science and Nutrition.

Cost of the business of education:
- Less money input from the State of California
- Increasing cost of providing the Learn by Doing education
- Increasing student debt load
- Increasing need for obtaining external funding to support education and resulting limitations or conditions on the use of those funds

Concerns regarding online/distance learning:
- Movement away from the Learn by Doing mission
- Lack of hands on learning value that current stakeholders enjoy with our graduates
- Missing the face to face interaction may increase the gap in the ability to foster critical thinking and problem solving skills

Pace of technological innovations:
- Increasing gap in the technology skill set between faculty/staff and students
- Missing opportunities to implement current technology in the learning environment
- Personal digital devices are a distraction in class; how can that be modified to become an opportunity?
- Increased sources of information, regardless of sound or propaganda shaping the mindset of the student

Shift from “traditional professor in traditional classroom” to dynamic learning environment

2. Who Food Science and Nutrition students will be?

- Unequal K-12 educated students, less prepared students based school district
- Common Core influence
- Students with a sense of entitlement (millennial generation)
- Shrinking pool of applicants
- Increase in 1st generation and underrepresented students
- Generation gap (older students for second career vs. first-time freshman)
- Tech savvy

3. How the global context will affect Food Science and Nutrition?

- Limited or reduced natural resources
- Food security concerns
• Food safety/sanitation concerns
• Need to decrease food and agricultural production waste; reutilization of waste streams
• Need to decrease natural resources inputs into processing of food; alternative processing needs
• Increasing obesity rates and resultant long term health and well-being ramifications
• Role of aging society in the production of food and maintenance of life long well-being
• Role of technology and how it is used to create human capital
• Limited qualified personnel in food plant operations, food safety, sanitation, dietetics, health professionals
• Role of globalization in the US education, acknowledgement that other countries are contributing to key technological and scientific developments

4. What our Food Science and Nutrition graduates will be doing?

• FSN students will have a diverse skill set, written and oral communication, problem solving, critical thinking, team-player mindset, multitaskers, etc., without sacrificing comprehensive knowledge of core technical skills
• Developing food and nutrition policies that shape health care and food production
• Feeding and nourishing the population using innovative processing technologies from young to old
• Developing food and processing techniques that use less energy and water while retaining maximum nutrition
• Implementing policies and procedures to promote food safety
• Identification of raw material varietals that can grow in less than optimum conditions without sacrificing process ability and nutritional quality
• Addressing health care issues that relate to obesity, disease prevention/mitigation, aging populations, food security, etc.
• Working in health care industries and insurance organizations, hospitals, clinics, community agencies; private practice, online therapy; informatics (electronic medical records, all types of electronic communication for physical therapy, nutrition education, health promotion, etc.)

5. What Food Science and Nutrition students will need to learn (what competencies will they need to have).

• Evidence based technical writing and decision making
• Innovative and creative thinking to solve wicked problems
• Strong writing, speaking, and interpersonal skills
• Interdisciplinary and multidisciplinary knowledge
• Critical and analytical thinking and problem solving skills
• Awareness of issues (technical and global and societal)
• Team skills
• Career readiness
• Skills around diversity and ethics and ability to work with diverse work force
• “Big Data” role
• Life-long learning skills

6. How the FSN Department might engage with emerging fields and interdisciplinary opportunities.

• Continue to promote internships and work study programs to keep students and faculty engaged with industry and tracking industry trends. Continue to develop strategic partnerships with industry to keep on the forefront of trends.
• Increased pool of qualified health professionals, food safety experts, food processing and plant operations professionals
• Continued partnerships to develop future food and nutrition solutions to related to a global society
• Share teaching of GE courses across disciplines to create the interdisciplinary perspective; GE needs to bend
• Issue – balance of expertise vs. accreditation
Tier 1 – Higher Education Today

a. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?

The forces shaping Cal Poly have been discussed at length in a report entitled, “California at the Edge of a Cliff. The failure to invest in the Next Generation is crushing the economy and crippling our kid’s future,” by Thomas Mortenson, Senior Scholar at the Pell Institute for the Study of Opportunity in Higher Education in Washington DC. This report was prepared for the California Faculty Association in January 2009. It explains in referenced detail the current state of higher education in California and the role the CSU plays in reversing a trend toward mediocrity in terms of preparedness of US citizenry for the emerging Human Capital Economy. Essentially, the goods-based economy of the 20th century supported by manufacturing jobs has morphed into a service-based economy driven by burgeoning jobs in the health and education services (+2.8%), and professional and business services (+2.1%) just between 1990-2007. Concomitantly, employment in manufacturing (-6.1%) and agriculture (-1.2%) will decrease. These observations are supported by data reported from the Bureau of Labor Statistics (U.S. Department of Labor, Feb. 2012). However, the decreases in agricultural sector jobs being reported in national and state statistics do not accurately represent the true nature of jobs that are available to college graduates from plant-science related disciplines. The jobs available today and that will continue to increase in the future are, indeed, agricultural services jobs. The agricultural employment statistics being currently reported reflect the manufacturing, goods-based nature of agriculture from last century and earlier, where most farm labor was dedicated to planting, cultivating, harvesting, manual pest management and subsequent field maintenance. Technological advances in agriculture have greatly reduced the difficult manual labor required of our forefathers, with mechanical, chemical, and biotechnology tools now allowing less than 1% of the U.S. workforce to be directly involved with agricultural production. These technologies must be serviced by a college educated workforce that not only understands how to use these technologies, but one which is also capable of enhancing their effectiveness. Thus, Cal Poly, with its graduates in the plant sciences, is in the perfect position to provide the service-based workforce required of 21st century agriculture.

The State will face extraordinary challenges in providing the Human Capital Economy workforce because of statewide demographic changes and the decreased financial investment by the state to higher education. New populations in California that could contribute students to college and, ultimately, to the services-based economy tend to be under-represented and low income
populations that have not been served well, historically, by higher education. This is reflected in California’s college continuation rate for high school graduates. In 1996, California was ranked as the 5th-best state with 66.4% of high school graduates continuing to college. In contrast, in 2004, California was ranked 47th of 50 states, with only 43.7% of its high school graduates continuing to college. Furthermore, California now ranks 49th for its share of population age 25 and older with at least a high school diploma. It was 1st for this metric in the 1980’s. Participation of 18 to 24 year old students from low income families decreased from 30.0% in 1997 (23rd ranking nationally) to 21.2% in 2006 (31st ranking). In California, low income students are now the majority of students in K-12 headed toward higher education and, ultimately, the workforce.

California has essentially divested itself from higher education. In 1980, $12.86 per $1,000 of personal income appropriated from state tax funds was earmarked for higher education, ranking the state 11th in the nation in this category. In contrast, in 2008, only $7.71 per $1000 of personal income was invested in higher education, representing a 40% decrease and ranking the state 21st. The average tuition and fees charged to undergraduates by the California State University system was $3,604 in 2008 whereas the national average was $5,526, leading to a ranking of the CSU of only the 43rd most expensive university system. However, the rate of increase of fees and tuition between 2004 and 2008 was 36.1%, and was 17th highest among states during this period. Tuition is substantially higher in 2014, yet, at the same time, the State’s needs-based grant system has fallen billions of dollars short in providing for the State’s ever-increasing lower/lower-middle income populations. Unmet financial need is defined as the difference between costs of attendance and family/financial aid resources available to pay those costs. Based on data from the National Postsecondary Student Aid Study (NPSAS, 2004), metrics of adequacy were identified when assessing whether the needs of California undergraduates for financial aid were being met. Essentially, in 2004, millions of undergraduates had an unmet need of $4 billion (or $1,723 each), and over 80% of the unmet need was from low income students or their families. In California, students from the lowest income families now face the largest financial barriers, and these constitute the majority of K-12 students. The cost of higher education is being shifted from taxpayers to the students and their families.

Additional sources of funds will come from research and industry. Companies will be reluctant to fund research or programs that do not strongly endorse their products or services. The coupling of industry and higher education could undermine the credibility of the university if careful consideration and protection of academic freedom is not employed.

Tier 2 – Projections to 2030

a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be?
The state will have a more diverse population. The Hispanic segment of the population has and will continue to increase in the near future. As indicated in the Generational Projections of the California Population by Nativity and Year of Immigrant Arrival (Pitkin and Myers, 2012), the share of whites in the work force will recede to 23.5% for those of training age and to 36.1% to those of working age, by 2030. Meanwhile, the share of Latinos in the workforce will increase to 58.1% for those of training age and 46% for those of working age, by 2030 (www.pewresearch.org.fact-tank/2014/01/24/in-2014-latinos-will-surpass-whites-as-largest-racial-ethnic-group-in-california/). This represents a unique challenge for the plant sciences as opportunities for Latino populations are increasing in other countries, especially Mexico, relative to California so there is less incentive for continued emigration to California. Furthermore, the challenge is especially acute for the plant sciences because many Hispanic families desire that their children have more opportunity than has been traditionally offered in agricultural: historically unskilled labor. Therefore, the plant sciences have been stigmatized and there is now a significant hurdle to attracting potential students: plant science is especially unattractive to the segment of the population showing the largest projected increase by 2030.

Furthermore, many students will attempt to save money by attending community colleges and then transferring to Cal Poly (http://californiacommunity colleges.cccco.edu/PolicyInAction/KeyFacts.aspx).

**Tier 2 – Projections to 2030**

b. What will the global and regional economy be like in 2030

Agriculture may seem like a relatively straightforward system which begins with clearing the soil of unwanted vegetation followed by tillage, planting, irrigation, fertilization and harvesting the crop. However, modern agriculture as it is implemented in the U.S. and other industrialized nations requires that its workforce be knowledgeable in the Sciences, Technology, Engineering and Mathematics and is therefore a (STEM) discipline. Throughout history, agriculture has contributed to some of the most advanced technologies and scientific discoveries which have relieved humans of the basic toils of sustenance and survival. Due to the STEM training of agriculturalists, over 99% of the U.S. population has been relieved of the toil of directly producing food to feed itself.

A unique public-private partnership was founded in 2013, the STEM Food and Ag Council, which is dedicated to driving educational and career opportunities for the next generation of agriculturalists. Membership includes major corporations, universities, and science societies in the U.S. A large task tackled by the STEM Food and Ag Council was to assess the gap between the number of professional level jobs that industry will offer over the next few years, and the projected supply of graduating students from STEM-trained agriculturally-related disciplines. To
quantify this gap, the Council commissioned the research firm, Thomas P. Miller and Associates, LLC. to analyze supply data retrieved from 2 primary sources: the Food and Agricultural Education Information System (FAEIS)--supported by the Association of Public and Land-Grant Universities--which presents data for six agriculturally-related disciplines including Plant and Soil Sciences, and demand data from Economic Modeling Specialists International, a firm specializing in labor market analysis. This analysis revealed that there will be an enormous gap between the number of professional level jobs offered by the agricultural industry in the next decade and the projected supply of graduating students from those same disciplines (STEM Food and Ag Council, 2014).

Global population is projected to increase to 9 billion by 2050 which will require a concomitant increase in agricultural productivity of 70%. Almost all arable land on earth is currently being farmed. Therefore, meeting the challenge of feeding nearly 50% more people with little new farmable land will require that farmers be much more productive without diminishing the quality of land, water, or air. This monumental challenge will be met not by farmers working harder but smarter, and is where science and technology will play key roles. Feeding the growing world population will therefore require massive training and education of the next generation of agriculturalists, a group which will encompass the best minds from a broad spectrum of scientific and engineering disciplines. Plant scientists will be needed to inform and guide all aspects of food production, from grower to consumer: farm to table. The technologies adopted will have to be sustainable, defined in its purest sense as those methods and techniques that replace in the entire environment as much as is taken from it so that the practices can be repeated continuously without detriment or degradation in time (e.g., to future generations) or space (e.g., to the oceans, air, water).

The agricultural sciences are STEM disciplines striving for sustainability. This is very attractive to “millenials” because this generation prides itself on being “green,” and respectful of the environment, trying to minimize its environmental footprint (http://www.msnbc.com/morning-joe/millenials-environment-climate-change). And as discussed above, very few in this generation come from traditional agricultural backgrounds. Since the applied/hands-on nature of the agricultural sciences makes it an applied biology, plant science tends to be more immediately rewarding to millennials because the solutions to problems must be implemented quickly to be effective. Crop devastation associated with an insect or pathogens must be solved quickly, otherwise severe food shortages can result leading to global economic impacts, a process which has occurred frequently in history. In contrast, the more traditional biological sciences are afforded the time
required for grand discoveries that may take decades or even centuries to realize (e.g., the theory of evolution). Food and farm-related businesses from start-ups to global conglomerates, as well as universities and private research institutes, will be looking to grow to meet current and future food and environmental demands.

![Job Growth: Soil and Plant Sciences](image1.png)

**Fig. 1.** Projected growth in jobs in the soil and plant sciences, 2005-2019 (STEM Food and Ag Council, 2014).

![Enrollment Growth: Plant and Soil Science](image2.png)

**Fig. 2.** Distribution in undergraduate and graduate enrollment in the soil and plant sciences, 2005-2012 (STEM Food and Ag Council, 2014).

The data presented in Fig. 1 and 2 above present numbers for the following disciplines related to plant and soil sciences: agronomy and crop science,
horticulture science, plant protection and integrated pest management, plant pathology/phytopathology, plant physiology, plant molecular biology, plant genetics, and soil chemistry. Within these disciplines in the US:

- **Workforce Supply:** There was a 17.5% increase in enrollment in agriculturally-related disciplines between 2005 and 2012. In 2012, 2,752 undergraduate and graduate students completed degrees in 214 programs.

- **Workforce Demand:** There are 116,898 jobs agricultural job currently with a projected increase in demand of 6.5% from 2014 to 2019. There were 1,189 job postings per month in 2014 with 5,079 hires per month in this same year.

A quick assessment of these numbers reveals that there are thousands of positions to be filled either by current workers or future graduates. Employers in agriculture are expected to add 7,584 net new jobs between 2014 and 2019. Since 2005, agriculture in the U.S. has grown nearly 20%, and has added jobs every year since 2001 except in 2010. The situation in California mirrors national trends: an aging workforce soon due for retirement will create enormous opportunities for a new generation of Plant and Soil Scientists.

**Tier 2 – Projections to 2030**

c. What will we be preparing our graduates to do (in general, and in your discipline) in 2030?

The agricultural plant sciences have historically been associated with a manufacturing, goods-based labor force involved in relatively unskilled manual labor. However, the modern plant sciences are a STEM discipline as discussed above so that agricultural graduates who fill available positions of the future services-based human capital economy must be trained in Sciences and Technology. In anticipation of this trend, the Horticulture and Crop Science Department has adopted a science-and-technology-based curriculum.
<table>
<thead>
<tr>
<th>Career/work activity</th>
<th>Similarities to today</th>
<th>Differences from today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field operations</td>
<td>Outside in the field actually doing some of the manual labor, supervising employees doing labor.</td>
<td>Management and supervisory role on the farm. Certified Crop Advisor (CCA).</td>
</tr>
<tr>
<td>Pest management</td>
<td>Pest control advisors (PCA).</td>
<td>Whole farm advisors who possess PCA and CCA certifications.</td>
</tr>
<tr>
<td>Postharvest</td>
<td>Management of field and packinghouse operations.</td>
<td>Increased R &amp; D to develop new products, reduce liabilities and increase food safety.</td>
</tr>
<tr>
<td>Greenhouse production</td>
<td>Production managers based on traditional knowledge.</td>
<td>Controlled environments: balancing the cost:benefit to controlled environments.</td>
</tr>
<tr>
<td>Plant growth systems</td>
<td>One-crop focused.</td>
<td>Ability to move laterally into different plant production systems.</td>
</tr>
<tr>
<td>Communication</td>
<td>With cell phone technology there is a constant expectation that everybody be available always. Ability to communicate in Spanish is desirable.</td>
<td>Some balance between constant accessibility to effective connection / communication, soft skills and real world experience. Spanish-communication skills necessary.</td>
</tr>
<tr>
<td>Laws and regulations related to farm operations: soil, pesticides, fertilizer, organic</td>
<td>Already certificates exist in some of these areas.</td>
<td>Modern certification and accountability of operations related to demonstration of ability to assess impacts especially off-target implications.</td>
</tr>
<tr>
<td>Sustainability and environmental protection</td>
<td>Defining sustainability and the environmental compartments affected by each activity.</td>
<td>Developing standard operating procedures that represent best practices for sustained environmental stewardship.</td>
</tr>
<tr>
<td>Farm labor</td>
<td>Slowly reducing need for unskilled labors.</td>
<td>Incentivizing and maintaining worker effectiveness.</td>
</tr>
<tr>
<td>Food safety</td>
<td>Developing standard operating procedures that represent best practices for food safety.</td>
<td>Complete accountability through tracking records and a standardized documentation of proof of safety.</td>
</tr>
<tr>
<td>Information acquisition</td>
<td>Library transitioning to information services.</td>
<td>Information services: provided through information services and search engines for legitimate information (there will a quantifiable way to tell if information is legitimate).</td>
</tr>
<tr>
<td>Educational/family background</td>
<td>Applied training, students come from families and backgrounds deeply rooted in agriculture.</td>
<td>STEM training: agriculture’s future workforce will come from a population that has no natural connection to agriculture.</td>
</tr>
</tbody>
</table>
Tier 2 – Projections to 2030
d. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?

Some of the basics of plant growth can be learned during K-12 education. The specialized nuances of crop growth and production in the modern era in industrialized societies, such as plant biotechnology, pest diagnosis and management, postharvest physiology and packaging, controlled-environments, maintenance and management, records tracking, and assessment and interpretation of massive data sets will have to be taught at the university level.

In general, industries representing the HCS Advisory Council request that we provide a graduate that is a well-rounded, broadly trained agriculturist capable of transitioning to various aspects of the commercial production systems operating in California. They want a graduate who is a competent learner and who can think critically and thus adapt to a rapidly changing agricultural/horticultural landscape. Industry indicates that they will train such a graduate on the specifics of their industry upon employment.

tier 2 – Projections to 2030
e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?

Further industrialization and mechanization of agriculture will require a workforce knowledgeable in and adaptable to the areas in need of improvements. The plant science graduate of the next ten years will need to be able to anticipate a rapidly changing marketplace driven by international economics, evolving technologies, and a changing climate. They are not required to be expert economists or engineers but their plant science knowledge will be essential for providing a realistic mechanism for adopting new solutions to economic or engineering problems. For example, California produces a majority of the strawberries in the US, strawberries are a notoriously difficult crop to harvest, and there is a great need for efficient robotics adapted for strawberry production. Trained plant scientists will be required to guide these engineering efforts because of existing constraints in the strawberry production system that an engineer alone would not be able to anticipate. The emerging fields in horticulture and crop science are grounded in the sciences including but not limited to: plant science, soil science, hydrology, computer science, chemistry, biochemistry, molecular biology, statistics, and mathematics. Our graduates will
be truly inter-/cross-/multi-disciplinary scholars. In order to effectively achieve this, the institution will need to remove the barriers that prevent scholars of drastically different disciplines (e.g. social science and biological science) from being hired in a single department.
Enrollment Planning Narrative
NRES Department

Tier 1 – Higher Education Today
1. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?

Higher Education in General
In general global demand for higher education is expected to grow. Demographic projections in the U.S. and California indicate a flattening of the historic increases in demand while foreign demand is expected to grow significantly. Currently at 10%, Cal Poly’s target of 20% non-California students seems achievable and could be set higher if it weren’t politically or legally constrained. The growing upside-down demographic pyramid of the U.S. and California means that the upcoming generations approaching historic retirement age will have to work longer. This creates a need for retraining and a potential demand for certificate programs rather than traditional degrees.

The traditional role and benefit of a baccalaureate degree may be entering a period of transition where other models and institutional structures may arise, e.g., community colleges with blended 4-year on-line degrees, 5 year professional degrees, and 2 year degrees with certifications. However, Cal Poly’s growing technological reputation that has all but eliminated remedial education should help separate it from the pack.

Certainly student expectations and new pedagogies are beginning to erode the traditional role of the “sage on the stage”. Experiential learning involving both academics and practicing professionals is growing. Also, international education/experience is becoming a requirement in baccalaureate degree programs. Restoration of earlier teaching models is also occurring. One example is the “flipped or inverted classroom” where the lecture period is used for in-depth discussion having read the basic material before class.

We see a growing demand for graduates in the applied environmental sciences. This demand is driven by concerns over our ecological footprint, climate change, water shortage, soil conservation, sustainable energy sources and materials, and the need to restore deteriorated ecosystems.

Currently, NRES has 4 undergraduate programs: environmental earth sciences (EES), environmental management & protection (ENVM), environmental soil science (ESS), and forestry & natural resources (FNR). A proposal to merge EES and ESS is in the approval process for the AY 15-17 catalog. Demand for EES and ENVM continues to grow at a pace that is approaching our capacity to meet, i.e., they are becoming “impacted.” Demand for the FNR major remains steady.

Technology and Education
As with most fields of study in undergraduate higher education, cost is becoming the dominant issue for both the institution and prospective students. The result is an explosion in on-line courses, including MOOCs. Our belief is that this trend will be most relevant to the liberal arts, business, and even basic sciences. For the applied sciences and technology fields, the need for residential, hands-on learning should remain strong with some peripheral need to enhance learning with on-line pedagogies.

The NRES department envisions on-line courses as part of specific initiatives in fire research, education and outreach. We are working toward the establishment of the Wildland-Urban Interface Fire Center at Cal Poly (this is to be kept confidential). A primary goal of the center is education directed toward multiple audiences including public officials in municipal, county and state government; developers, and natural resources professionals. On-line courses for outreach and continuing education are clearly an appropriate format for these audiences. We also, foresee the potential of on-line courses in certification programs that we may pursue such as wetlands delineation, urban forestry, and product life-cycle assessment (ecological footprint analysis).

Textbooks are becoming an anachronism due to cost, changing science and technology, and learning styles of the current generation of students. New media are rapidly replacing the traditional Powerpoint presentation; however, we sense from our students a yearning for interaction with the instructor and each other. The old “chalk talk” style may see a return. Perhaps, this is a reaction to overuse of Powerpoint and the like, but it could be that students want a more tangible pedagogy. Students want concepts packaged in smaller bites, just as they obtain information from the Internet, not lengthy treatises.

Politics, Funding and Cal Poly’s Advantages & Obstacles
Perhaps the most salient fact in this entire planning process is that public investment in higher education continues its precipitous decline. All institutions of higher education are now competing for private sector funds. Though significant in amount, funds available from non-profit sources are limited and the competition for them is fierce. Partnering with for-profit private sector companies offers new, larger sources of funding but carries with it the risk of losing independence of the academy.

Overall, Cal Poly represents a very good deal for students – high quality education at below market prices. Students have approved several referenda to increase tuition over the last 10 years to replace reductions in state funding. Contrary to popular belief that students are borrowing more in response, demographic projections do not show significant increases in student debt (Dowell Myers, USC Sol Price School of Public Policy, presentation to Cal Poly, Oct. 2014). Therefore, increasing tuition costs should not affect the demand for Cal Poly, but we are politically constrained to do so which highlights the next and perhaps most important matter.

Cal Poly’s future is highly constrained by the laws, policies, and pressure to conform to be average as a member campus of the CSU System. Cal Poly should seek some new status that
releases our potential to grow in distinctiveness, e.g., “charter status” that retains the nvstate funding assistance and takes us out of the “zero sum budget game” in which we find ourselves.

If allowed to chart our own course unhampered by wasteful and ineffective policies and bureaucracy, Cal Poly has the potential to build upon its already solid reputation to become a nationally and internationally recognized university. Once freed, faculty salary constraints would be one of the first areas to address. Given its location/environment and reputation, one can only imagine the quality of faculty we could attract if this one limitation were addressed.

The second area to address is our weakness in graduate programs. Current funding formulas place graduate education at a significant disadvantage. If funding could be found, the first place to start is tuition waivers for graduate students. The NRES department has two masters degree programs: MS in Forestry Sciences, and an MS in Agriculture, Specialization in Soil Science. Demand for these programs has been steady but small. We project growth as more department resources are directed at graduate programs and new faculty are hired. To this end, we are planning to remodel our lab spaces on the 3rd floor of Bldg. 11 to accommodate 15 to 20 graduate students.

**Tier 2 – Projections to 2030**

2a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be?

According to Dowell Myers, we should not expect the same growth in demand from California residents for our undergraduate programs as we’ve experienced in recent years. Any growth in demand is likely to come from out-of-state and internationally. Also, the aging population of the U.S. and California suggests that there will be an increase in those seeking retraining.

Overall demographic trends in California point to a stabilization in racial and ethnic mix where Hispanic will comprise 50% of the population, Whites about a quarter, followed by Asian/Pacific Islander at 20% with the remaining small balance of African Americans. This suggests that Cal Poly’s predominantly White student population may not be under the increasing pressure to be more representative of the state’s racial/ethnic composition as it has in the past. Nevertheless, the need to increase diversity is clear. Our greatest constraint in doing so is that Cal Poly resides in one of the “Whitest” counties in the state. Combined with weak cultural support for underrepresented students and the cost of a residential university, the ability to diversify the student body further is very unlikely. Our greatest opportunity to diversify probably lies with international/non-California students, which has just reached 10% according to Skip Parks. The diversity of the NRES undergraduate student body has increased significantly over the last 10 years to now 26% comprised of non-White racial/ethnic groups (Cal Poly is 40% non-White).

As stated earlier, Cal Poly has emerged out of an era where matriculated students required remedial education. In fact, evidence suggests that incoming freshmen have an increasing number of Advanced Placement credits reducing demand for some GE courses.
2b. What will the global and regional economy be like in 2030?

Of all the questions this is the most fundamental and most difficult to see. However, one thing appears clear from observing political-economy trends – there is an increase in variability, risk and chaotic events. To cope with this apparent reality, it is incumbent upon higher education to respond just as any wise investor does – diversify and be careful not to overreact to the newest fad. Cal Poly should be very careful to avoid significant changes that could jeopardize our hard-earned reputation. More than any other institution, higher education should be focused on the long-run and provide a stable foundation for the nation.

Socio-economic trends in California show a growing outward migration of middle class, working age families. Therefore, college affordability will become more of a problem than at present. Cal Poly already has one of the best national reputations for affordability and return-on-investment.

U.S. economic dominance will continue to decline resulting in a need to further internationalize our programs. Environmental impacts from increased trade will require innovative solutions in areas of cleaner energy sources and conservation, natural resources management, and environmental policy. Ecosystems will be under increasing pressure from invasive species resulting from growing international trade.

2c. What will we be preparing our graduates to do (in general, and in your discipline) in 2030?

An oft quoted saying goes something like “people will change career x times in their working life”. The value for “x” appears to be increasing with every restatement. Certainly there is some truth to this, but it is more true that within specific professional disciplines expectations are increasing to handle a variety of external and internal demands and conditions. As a result, baccalaureate education will, and should, shift emphasis to more general skills such as critical thinking/problem-solving, information management, communications, and people skills like teamwork, conflict management, and leadership. This trend is certainly creating tension at a polytechnic university where discipline-specific skills are the basis for most of its degree programs. The solution to this dilemma is that the traditional technical baccalaureate degree needs to be redefined. Mechanisms to help bring this about will be offered in the next section.

2d. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?

Questions 2c and 2d are very close pertaining to our response. Cal Poly has several choices to chart its course against the backdrop of the need to build a more mobile and flexible skill set in our graduates. One may be to reconsider the policy of forcing freshmen to declare a major. Second, a fresh re-evaluation of how we meet General Education requirements, one that prevents it from being treated as distinct and unrelated to the technical degree programs. Third, the current course structure may need to be altered to create a more cohort-based progression
through a series of highly connected modules that advance the student through the Bloom’s learning progression. Another approach may be to emphasize hybrid undergraduate/graduate degrees, e.g., 4+1, or 3+2 programs. At a minimum, however, scientific/technical degree programs such as those in the NRES department need to de-emphasize memorization of facts in favor of discovery, evaluation, synthesis, and integration of knowledge.

Demand for graduates in the STEM disciplines is expected to be one of the fastest growing, outpaced only by medical and leisure services. In response, the NRES department is revising its curriculum structure to allow for a greater range of specializations but dropping a few concentrations and replacing them with many more “career elective areas” such as geospatial technology, soil geotechnical studies, environmental impact mitigation strategies, climate change science, and forest and environmental practices.

2e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?

In the environmental sciences of the NRES department, there is a huge range of emerging technologies and growth in interdisciplinary, collaborative approaches to environmental problems. Emerging technologies in NRES disciplines include:

• geospatial computer systems to refine and clarify problems, more targeted solutions, promote, communication, and improve policy;
• life-cycle assessment of products and services to address consumer demand for minimal environmental impact and certification mechanisms to assure the consumer;
• sustainable and resilient infrastructure, particularly in the wildland-urban interface of California;
• sustainable building materials, particularly wood products;
• soil and water conservation and management;
• restoration and rehabilitation of degraded ecosystems.

Many of these new technologies and practices are already being built into NRES curricula but there’s only so much that a 180 unit baccalaureate degree can achieve with all the other expectations being placed upon it. These new developments will only continue to grow making it more likely that the baccalaureate degree should emphasize those general skills referred to above, while offering more space to explore these emerging technologies through concentrations, minors, and certification programs.
Academic Program Narrative
November 21, 2014

Process

RPTA faculty met on October 24, October 31, and November 18 to respond to six questions relating to Tier 1 and Tier 2 of the Academic Program Narrative. In addition, RPTA faculty attended the university-wide workshops on October 17, October 24, and November 7. Responses to each of the six questions are detailed below.

Tier 1 – Higher Education Today
1a. What forces are shaping Cal Poly (and your discipline) today (which are likely to continue into the future and what new forces may come into play by 2030)?

Challenges:
• Changing funding model
• Dwindling funding program
• Smaller applicant pool to universities
• Changing k-12 common core – grading
• Work/life balance emphasis & challenges in society
• Tech/digital rate of change
• Increased adjunct faculty
• Increased outsourcing within the industry
• Speed of trends – lack of fluidity at Cal Poly [planning for catalog/course offerings 3 years out]
• Theory is a broad based knowledge; however not deep or depth is intermittent
• Affirmative action may be implemented
• Era of accountability – external measure of how successful our students are when they leave the university
• Pushback on some aspects of technology – drones within natural resources areas
• Cell phone free-zones implementation as self-regulation has not worked
• Obligated vs. leisure – discretionary time is reducing
• Dichotomy: emphasis on new trend of what grads need to be successful and CP growing grad program vs. RPTA emphasis on utilizing grads [putting them through paces] and faculty expectation

Opportunities:
• Hospitality being embraced by all sectors of travel, recreation, sports, parks, tourism, outdoor recreation, and event industries
• Blending of hospitality within all sectors – public, private, non-profit within traditional parks and recreation agencies, tourism organizations, destination management organizations
• Society’s desire for improved quality of life and memorable experiences
• Tourism explicit recognition as economic engine
• New research/new courses in experience management, hospitality, event planning, and tourism
• Increased diversity
• Privatization
• Events industry focus on graduates with an events focus rather than marketing focus
• Broader approach to hospitality industry – experience management movement beyond “heads in beds” and food and beverage
• Affirmative action may be implemented
• Empower students to do peer teaching and increased student-centered learning
• Trend towards knowledge in many things [broad as opposed to depth]
• More adherence to ‘active learning’ more recognition in active learning
• Outsourcing
• Event planning & management concentration – demand will continue
• Industry will have ‘events’ positions as opposed to marketing positions thus increasing demand for event planning students
• Push-back of ‘I’m on vacation’ – not responding to email or text messages – not on 24/7 availability
• Take back your time movement with increased vacations boosts economy – more delineation
• India/China/Brazil – will be highest visitation of tourists to U.S. in near future tourism
• Travelers will visit destinations online/remotely

_Tier 2 – Projections to 2030_
2a. **Who will our students be in 2030 (e.g., demographics, pre-college preparation)?** What are their expectations and interests likely to be?

**Challenges:**
• First generation and diversity of students increasing
• More international students
• Due to immigration cycles first generation students will decrease
• International vs. California students – regulated by legislature
• High achievers – hard to measure improvement
• Common core K-elementary level of achievement
• Diversity – not an issue – not really an issue w/ inclusivity and acceptance in society
• Personal time used in pursuit of leisure
• Shortcut – fast images vs. information, students want bytes – force them into deeper thoughts
• We are not teaching them to filter information – critically
• Culture – work not as traditional as today -- will need to be more diverse – more satellite offices and working from home
• Students like to be entertained – engaged – method of learning will be more engaging and dynamic as students want to get their money’s worth
Opportunities:
- More attention to youth development in 2030 – students need a place to go with parents working, more societal pressures, anxiety, ADHD, etc. need for quality leisure
- Students’ acute awareness of social justice and environmental issues
- Increased interest in non-profits
- RPTA students – work to live – not work to just survive
- Grow RPTA to 500 students in hospitality – reach out internationally
- Students will desire less distinction between leisure & work – culture – such as Red Frog Events in Chicago

Tier 2 – Projections to 2030
2b. What will the global and regional economy be like in 2030 (and how are these forces relevant to your field or discipline)?

- China will be a leader in internationalization and globalization – recognize the differences: internationalization – boundaries and globalization: no boundaries
- 2030 global terrorism will affect entire globe more
- RPTA students in hospitality and event planning will have the opportunity for employment globally particularly in Asia and Europe
- Increased hospitality and event planning internships and partnerships globally
- 2030 VISA travel issues will dissolve
- Restrictions on work visas relaxing
- Length of travel – time diminished
- Nearly every country will embrace travel as an economic driver
- Regional – ‘Diablo Nuclear Power Plant’ will be shut-down/recommission due to current
- Diablo Canyon developed into ‘paradise’ natural resource
- Non-profits will fill void left by decreasing federal government funding and services
- Sustainability (cultural, economic, social, environmental) will be linked without question in the travel and hospitality industry

2c. What will we be preparing our graduates to do (in general, and in your discipline)?

- Create, manage, and market experiences
- Develop seamless travel, outdoor, destination, and hospitality experiences internationally
- Manage hospitality, tourism, lodging, destination management, and event planning organizations
- Corporate event planning for nearly every industry
- Provide travel and outdoor experiences for the world
- Manage global tourism, travel services and operations
- Create leisure, travel, and local experiences that understand food’s relationship to – building connections – buy local, and emphasis on specialty crops
- Emphasis on outdoor experiences and connection to nature for youth and diverse groups
- Plan, evaluate, lead, market events, programs & services
- Manage budgets, resources, and people
- Develop resources – human, physical, environmental
- Collaborate effectively
- Create community
- Develop youth as leaders for the future – positive youth development and positive psychology
- Be leaders in creating healthy communities and lifestyles
- Create inclusive leisure experiences – daily, weekly, monthly
- Become lifestyle and experience coaches and entrepreneurs
- Offering of blended virtual and actual travel experiences

**Tier 2 – Projections to 2030**

2d. What will our students need to learn to be successful (in general, and in your discipline)? What level(s) of education will they need (particularly in your discipline)?

- Analytics
- Problem solving, decision making, critical thinking
- Resourceful and research savvy
- Increased social capital, social justice and social equity need
- Planning of experiences at destinations, attractions, sports events, in communities
- Sustainability
- Leadership considering diverse cultures and groups
- Communication
- Health sciences
- Technology competencies
- Global citizenship
- Management in an experience based economy
- Cultural awareness & understanding
- Mobile applications and travel platforms
- Resource development to include sponsorships, partnerships, collaboration
- Negotiation and conflict resolution
- Exceptional customer/client/participant service
- Understand connection between STEM and social and behavioral sciences
- Understand food to table, farmer’s market, culinary and healthy food trends, wine/food pairings
- Understand evolving political process
- Community development, evolvement, changing landscape of public land management and municipal agencies
- Cal Poly minor in event planning
- M.S. and Ph.D. growth opportunities at all levels of event planning – non-profit, corporate, public, private
- Proliferation of professional certificate programs
Tier 2 – Projections to 2030

2e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines?

- Opportunity to become the hospitality academic program leader on campus with upgrade of our hospitality and tourism management concentration to a major
- Recognized academic program contributor/leader in hospitality, environment and sustainability, health and well-being, and social justice
- Increased integration with technology [basic coding/templates]
- Increased communications mobile, graphically, social media
- Increased collaboration - project management, lifestyle management, culinary, food
- Hospitality and lodging finance and revenue management to include metrics, analytics, financial resource development, and entrepreneurship
- Evolvement of integrated leadership development
Enrollment Planning Narrative Cal Poly Wine and Viticulture Department

Background
To answer these questions it is important to first examine the existing and forecasted environment for the major: the wine industry and higher education.

Industry
The wine industry is strong economically and expected to increase in the future. This narrative assumes a modest growth rate continuing through 2030. The growth will require additional graduates for the industry.

Table 1: Wine Industry Sales and Projections

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dollars (MM)</td>
<td>$35,348.30</td>
<td>$34,704.00</td>
<td>$36,019.90</td>
<td>$37,651.60</td>
<td>$39,337.10</td>
<td>$40,382.40</td>
<td>$41,754.60</td>
<td>$43,084.00</td>
<td>$44,032.10</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
<td>-1.8%</td>
<td>3.8%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>2.7%</td>
<td>3.4%</td>
<td>3.2%</td>
<td>2.2%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Source: Euro monitor 2013 US Wine International from official statistics, trade associations, trade press, company research, store checks, trade interviews, trade sources

The wine industry has three key segments: business, enology and viticulture. Wine Business Monthly examined all job postings on Winejobs.com, the leading job site for the industry. For the period 2007 through 2013, there were 13,894 postings: 68.7% were business, 27.7% were winemaking and 3.5% were viticulture.

Higher Education
California high school graduation rates are expected to decline between 2013 and 2019. After 2019, graduation rates will increase moderately. This narrative assumes a modest growth rate continuing through 2030.

Table 2: California high school graduation rates

<table>
<thead>
<tr>
<th></th>
<th>418,411</th>
<th>420,149</th>
<th>410,964</th>
<th>404,828</th>
<th>402,503</th>
<th>402,132</th>
<th>408,282</th>
<th>408,385</th>
<th>406,143</th>
<th>414,872</th>
<th>419,478</th>
<th>424,331</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
<td>Projected</td>
</tr>
<tr>
<td></td>
<td>-0.42%</td>
<td>-2.19%</td>
<td>-1.49%</td>
<td>-0.57%</td>
<td>-0.09%</td>
<td>1.53%</td>
<td>-0.45%</td>
<td>0.43%</td>
<td>1.65%</td>
<td>1.11%</td>
<td>1.18%</td>
<td></td>
</tr>
</tbody>
</table>

Source: http://www.dof.ca.gov/research/demographic-reports/projections/k-12/new.php

National higher education enrollment levels are expected to flatten from 2013 through 2010. This narrative assumes a similar growth rate continuing through 2030 for California. However, the California Governor’s Budget Summary 2015-2015 forecasts a 4.5% reduction in college age population between 2013 and 2018.
Table 3: Higher Education Enrollment Actual 1995-2009 and Projected 2010-2020

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Students</td>
<td>14,262</td>
<td>14,368</td>
<td>14,502</td>
<td>14,507</td>
<td>14,791</td>
<td>15,312</td>
<td>15,928</td>
<td>16,612</td>
<td>16,911</td>
<td>17,272</td>
<td>17,487</td>
<td>17,759</td>
<td>18,248</td>
<td>19,103</td>
<td>20,428</td>
</tr>
<tr>
<td>Percent Change</td>
<td>0.7%</td>
<td>0.3%</td>
<td>0.5%</td>
<td>2.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>4.0%</td>
<td>4.3%</td>
<td>1.6%</td>
<td>2.1%</td>
<td>1.2%</td>
<td>1.6%</td>
<td>2.0%</td>
<td>4.7%</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, “Fall Enrollment Survey” (IPEDS-EF:95–99), and Spring 2001 through Spring 2010; and Enrollment in Degree-Granting Institutions Model, 1980–2009. (This table was prepared January 2011.)

The National Center for Education Statistics (NCES) indicates that 26% of US students and 17% of California higher education students at Title IV institutions took online courses in 2012. Interestingly, 54.2% of US students take online courses from institutions in their state and 87.4% of online students from California take online classes from institutions in California.

Table 4: Enrollment in Distance Education at Title IV Institutions
Higher Education and Wine and Viticulture
There are six programs in the U.S. that have a Wine and Viticulture major. Cal Poly has the largest number of students and is the only program that integrates business, enology and viticulture for all students.

Table 5: Higher Education and Wine and Viticulture

<table>
<thead>
<tr>
<th>University</th>
<th>Undergraduate Major</th>
<th>Number of Undergraduate Students</th>
<th>Concentration Business</th>
<th>Concentration Enology</th>
<th>Concentration Viticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Polytechnic State University</td>
<td>Wine and Viticulture</td>
<td>310</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fresno State University</td>
<td>Viticulture and Enology</td>
<td>152</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>University of California Davis</td>
<td>Viticulture and Enology</td>
<td>118</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oregon State University</td>
<td>Viticulture and Enology</td>
<td>26</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Washington State University</td>
<td>Winemaking and Viticulture</td>
<td>50</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Washington State University</td>
<td>Wine Business Management</td>
<td>NA</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornell University</td>
<td>Viticulture and Enology</td>
<td>33</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

California Demographics
California has a diverse population. The California Governor’s Budget Summary 2015-2015 reports that 39% of the population is Hispanic and 38.8% is white.

Table 6: Racial/Ethnic Composition in 2014 from Governor’s Budget 2014-2015

**Tier 1 – Higher Education Today***
1a. What forces are shaping Cal Poly (and Wine and Viticulture) today (which are likely to continue into the future and what new forces may come into play by 2030)?

<table>
<thead>
<tr>
<th>Challenging Forces to Higher Education – Add More as Appropriate to Your Field or Discipline</th>
<th>Relevance to Your Field or Discipline – write in text to describe likely impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Higher Education in General</strong></td>
<td></td>
</tr>
<tr>
<td>• Shift in role of professor away from traditional “instruction”</td>
<td>The wine industry has shifted away from many of the traditional practices. Social media is used for business communications. Technology is used to measure the components of wine and to assist in wine making. Drones and other technology are being used in vineyards. The professor needs to adjust and incorporate new technologies that enhance instruction.</td>
</tr>
<tr>
<td>• Millennial (and subsequent generations) culture – implications for how students learn</td>
<td>Faculty needs to be kept up to date in the newest learning tools. Dr. Cai et.al.’s research has shown that students are more engaged and motivated to learn when they have current and relevant information delivered using a social and collaborative tool. &lt;br&gt;<a href="http://ageconsearch.umn.edu/bitstream/149987/2/AAEA%20poster%202192.pdf">http://ageconsearch.umn.edu/bitstream/149987/2/AAEA%20poster%202192.pdf</a></td>
</tr>
<tr>
<td>• “Disruptive” challenges to traditional teaching/learning models in higher education</td>
<td>WVIT faculty are using a new social information and discussion tool (article above) to engage students with the latest information about the industry from new business practices to new techniques. This is a positive challenge for the students and faculty.</td>
</tr>
<tr>
<td>• Future role of residential campus</td>
<td>California is lagging the nation in using distance learning. Students from Cal Poly can only benefit from engaging in residential campus activities and distance learning opportunities. Since enology and viticulture require the ability to do laboratory work on a residential campus, the residential campus remains important. However, incorporating distance learning for GE requirements and other support courses can allow students to complete their coursework more efficiently with less class conflicts.</td>
</tr>
<tr>
<td>• Potential increase in enrollment of international students</td>
<td>The wine industry is global. Our major is unique in the US since it is the only Wine and Viticulture major that incorporates business. International students would be attracted to our major.</td>
</tr>
<tr>
<td>• Student debt, especially as costs shifted to</td>
<td>Scholarships are needed to offset the student debt. Industry outreach can</td>
</tr>
<tr>
<td><strong>students</strong></td>
<td>possibly solve this problem.</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Technology and Education</strong></td>
<td></td>
</tr>
<tr>
<td>• Keeping up with rapidly changing technology</td>
<td>This is extremely important for our majors. Technology adoption is moving from computer to mobile. Our students and our faculty need to be able to learn new technologies on their own. We need to instill a life long learning culture in our students. Access to new technology and encouraging experimentation is important to the success of our students.</td>
</tr>
<tr>
<td>• Unfiltered access to information</td>
<td>Students need to understand that it is important to investigate the source.</td>
</tr>
<tr>
<td>• Distractions from digital devices</td>
<td>The distractions will exist upon graduation. Students need to learn how to focus in the current climate.</td>
</tr>
<tr>
<td><strong>Politics and Funding</strong></td>
<td></td>
</tr>
<tr>
<td>• Competition between services for aging population vs. services for youth (e.g., education)</td>
<td>The wine industry is expected to grow. Partnerships between industry and Cal Poly need to be forged to generate financial support.</td>
</tr>
<tr>
<td>• Continuing decline in public (state) support for higher education</td>
<td>The wine industry is expected to grow. Partnerships between industry and Cal Poly need to be forged to generate financial support.</td>
</tr>
<tr>
<td>• Political control over educational policy</td>
<td>This is a factor that may impact the wine and viticulture department. It is important to show the policy makers the importance of the wine industry to the state’s economy.</td>
</tr>
<tr>
<td>• Community colleges offering 4-year degrees in California</td>
<td>This is a factor that will directly impact the wine and viticulture department.</td>
</tr>
<tr>
<td><strong>Opportunities Stemming from Higher Education Trends</strong></td>
<td>Relevance to Your Field or Discipline – write in text to describe likely impact</td>
</tr>
<tr>
<td><strong>Cal Poly’s Advantage</strong></td>
<td></td>
</tr>
<tr>
<td>• Low cost for value</td>
<td>Will increase applicants to major.</td>
</tr>
<tr>
<td>• Residential campus</td>
<td>Needed for hands on laboratory work.</td>
</tr>
<tr>
<td>• Adaptability, readiness for change</td>
<td>Important for students to be able to adapt to changes such as climate, plant diseases and technology.</td>
</tr>
<tr>
<td>• Teacher-scholar model at Cal Poly</td>
<td>Important that faculty are up to date with new research and practices in wine and viticulture.</td>
</tr>
<tr>
<td><strong>Other Opportunities</strong></td>
<td></td>
</tr>
</tbody>
</table>
• Use of “big data” in education

Wine businesses use big data to target their consumers. Students need to be able to understand the trends that can be revealed through the use of big data.

• Adoption of new technologies in higher education – due to the rate of change in technology, this area reflected the highest degree of uncertainty during discussions

Cal Poly needs to provide more resources for faculty and students to use emerging technologies.

Tier 2 – Projections to 2030***
2a. Who will our students be in 2030 (e.g., demographics, pre-college preparation)? What are their expectations and interests likely to be?

<table>
<thead>
<tr>
<th>Challenging Demographic Factors and Trends</th>
<th>Relevance to Your Field or Discipline – write in text to describe likely impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increasing diversity among students</td>
<td>The major will reflect the state population. The major has diverse subjects that will attract a diverse student body. Since the wine industry is growing, it will be attractive to students of all backgrounds.</td>
</tr>
<tr>
<td>• More students from historically under-represented groups, first generation in college</td>
<td>The major will reflect the state trends.</td>
</tr>
<tr>
<td>• Shrinking pool of applicants, due to lower birth rates</td>
<td>Since Cal Poly is one of only six U.S. universities that offer a bachelor’s degree in wine and viticulture, the department will continue to attract applicants.</td>
</tr>
<tr>
<td>• Concerns about quality and continuing unevenness of K-12 education for “home grown” California students and their college-readiness</td>
<td>The major will have the same problems that reflect the state trends.</td>
</tr>
<tr>
<td>• Out-migration of young adults due to higher cost of living in California</td>
<td>Since Cal Poly is one of only six U.S. universities that offer a bachelor’s degree in wine and viticulture, the department will continue to attract applicants.</td>
</tr>
</tbody>
</table>

Opportunities Stemming from Demographic | Relevance to Your Field or Discipline – write in text to describe likely impact
### Factors and Trends – Add More as Appropriate to Your Field or Discipline

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• “… a strong opportunity to become a site for preparing [a more diverse population] for the workforce. It presents the increased opportunity for transfer and non-traditional student pipelines, 1st Gen services, and curriculum that connects to that population’s identity and harnesses their potential.”</td>
<td>The major will have the same problems that reflect the state trends.</td>
</tr>
<tr>
<td>• Appropriate services, including financial support for new student profile</td>
<td>The major will have the same problems that reflect the state trends. The department will need to partner with industry for more support to provide the workforce they need.</td>
</tr>
<tr>
<td>• More women in STEM fields</td>
<td>We are attracting females as faculty to lead by example.</td>
</tr>
<tr>
<td>• Recruitment of high-quality, diverse students from California</td>
<td>The department will need to partner with industry for more support to provide the workforce they need.</td>
</tr>
<tr>
<td>• Recruitment of students from elsewhere – domestic and international</td>
<td>Since the wine industry is global and Cal Poly is one of only six U.S. universities that offer a bachelor’s degree in wine and viticulture, the department will continue to attract applicants from other domestic locations and international locations.</td>
</tr>
<tr>
<td>• Marketing to older/non-traditional students; mid-career “re-education”</td>
<td>Our mission is to provide the wine industry with leaders and provide “life-long” learners. The Wine and Viticulture department can provide certificate programs to update the careers of those in the industry.</td>
</tr>
<tr>
<td>• How to serve older generation</td>
<td>Certificate programs.</td>
</tr>
<tr>
<td>• “Common Core” in K-12 education</td>
<td>Support math and science in K-12.</td>
</tr>
</tbody>
</table>

### Tier 2 – Projections to 2030

2b. **What will the global and regional economy be like in 2030** (and how are these forces relevant to your field or discipline)?
<table>
<thead>
<tr>
<th>Challenging Global and Regional Factors and Trends – Add More as Appropriate to Your Field or Discipline</th>
<th>Relevance to Your Field or Discipline – write in text to describe likely impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment</strong></td>
<td></td>
</tr>
<tr>
<td>• Climate change</td>
<td>Impacts the types of grapes grown in California and every region of the world.</td>
</tr>
<tr>
<td>• Food, water</td>
<td>Impacts the types of grapes grown in California and the ability to grow grapes and produce wine.</td>
</tr>
<tr>
<td>• Global health/disease</td>
<td>Consumption of wine has been shown to have positive and negative impacts on human health. Grapevine diseases threaten crops.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities Stemming from Global and Regional Forces – Add More as Appropriate to Your Field or Discipline</th>
<th>Relevance to Your Field or Discipline – write in text to describe likely impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Programs and Curricula</strong></td>
<td></td>
</tr>
<tr>
<td>• Preparation for careers that don’t exist today</td>
<td>Students need to learn how to change and adapt. Now the use of drones is coming to viticulture. A career in vineyard management using drones did not exist 5 years ago. Social media directors at wineries did not exist 10 years ago. Cal Poly can take the opportunity to offer certificates for new careers. These are opportunities for Cal Poly.</td>
</tr>
<tr>
<td>• Environment – educational opportunities regarding innovative approaches to climate change, energy, resource management, sustainability</td>
<td>This is extremely relevant. The wine industry is very interested and involved in educational opportunities regarding innovative approaches to climate change, energy, resource management and sustainability. We plan to build a sustainable Wine and Viticulture Center.</td>
</tr>
<tr>
<td>• Globalization – awareness, culture, language and experience abroad</td>
<td>The wine industry is global. Understanding differences in culture and economics is important. Students are encouraged to study and work abroad.</td>
</tr>
<tr>
<td>• Health-related fields to serve aging population</td>
<td>Not related to the Wine and Viticulture Major.</td>
</tr>
<tr>
<td>• Technology – take advantage of students’ interest and ‘literacy’ as well as new technologies as they emerge</td>
<td>Our students need to be adaptable to new technologies.</td>
</tr>
<tr>
<td>• Demand for highly educated work force, including more post-baccalaureate education</td>
<td>Undergraduate education is important to the basic needs of the wine and viticulture industry. Research requires post-baccalaureate education. Our graduates need to be lifelong learners.</td>
</tr>
</tbody>
</table>
**Tier 2 – Projections to 2030**

c. **What will we be preparing our graduates to do (in general, and in your discipline) in 2030?** Create a list of activities that are similar to today and activities that will be different from today.

<table>
<thead>
<tr>
<th>Career or Work Activities</th>
<th>Similar to Today</th>
<th>Different from Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating components of wine</td>
<td>Using technology</td>
<td>Enology</td>
</tr>
<tr>
<td>Reaching consumers</td>
<td>Using media and social media</td>
<td>Wine Marketing Legal constraints</td>
</tr>
<tr>
<td>Vineyard management</td>
<td>Irrigation Plant breeding Clones</td>
<td>Viticulture</td>
</tr>
<tr>
<td>Indicate Importance or Relevance of Each Competency or Teach and Learning Practice to:</td>
<td>Students in Your Academic Major or Degree Programs</td>
<td>Other (or All) Cal Poly Students (Holistic Education)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>General Competencies – Add as Appropriate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Global Awareness and Cultural Competence – most frequently listed by far as an area for future development</td>
<td>High</td>
<td>Moderately high</td>
</tr>
<tr>
<td>• Problem-Solving; Critical Thinking – noted both as an important continuity with present practice and an opportunity</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• Career Readiness and Adaptability – including acknowledgment of how work and workplaces change over a career</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• Life Skills – another area for development covers a range of skills that help students prepare for life, such as ethical behavior, reflection, and social responsibility, balance</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• Communication, Collaboration, and Other Essential Skills for Working with People–recognizing current practice, and focusing on future development, both while students (e.g., with faculty) and as professionals</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• Leadership, Entrepreneurship, Innovative Thinking, Change Management – noted as areas for development</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Specialized Knowledge and Competencies – Add as Appropriate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Information Technology – particularly, keeping up with technological change and how information technology is applied in their careers, including societal implications</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>• Environment (including food, energy, sustainability)</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>• Engineering (many aspects)</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>• Health and Aging – recognition of how anticipated demographic change creates new career opportunities</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Tier 2 – Projections to 2030**

d. What will our students need to learn to be successful (in general, and in your discipline) in 2030? What level(s) of education will they need (particularly in your discipline) in 2030?
<table>
<thead>
<tr>
<th>Teaching and Learning Practices – Add as Appropriate</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integrated Learning; Education Beyond a Single Discipline – most frequently listed by far as a critical aspect of education, both currently and in the future; implications for facilities (teaching space) as well as majors and curriculum</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• Learn by Doing – touted as a Cal Poly strength that can and should continue to evolve; incorporating new technologies; closely connected with applied learning and problem-solving</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>• High Impact Practices – reinforcement and extension of lab and studio settings, teamwork, and mentoring</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

**Tier 2 – Projections to 2030**

**Tier 2 – Projections to 2030**

2e. What are the implications for emerging fields and integrated learning that goes beyond traditional disciplines? [NOTE: While this question is implied in the earlier discussion, the forthcoming workshop on November 7 is designed to address this question directly.]

New technology in climate, plant breeding, disease resistance, sustainable practices and consumer acceptance are important to understand and integrate into a multidisciplinary curriculum for wine and viticulture.