

Development of Undergraduate Major Committee (DUMC)
Report of Findings to Department of Bioagricultural Sciences and Pest
Management Faculty

January 2018

Timeline for Undergraduate Major (Cini Brown)

The soonest we can have a new undergraduate major is Fall 2019. There is a hard deadline for the University Curriculum Committee to consider new programs in mid-September each year. To make this deadline, all new courses and minor and major revisions to existing courses must be approved by affected departments (e.g. if students in our department's major will be required to take courses in their department) and the CAS Academic Affairs Committee before the end of Spring semester 2018. New courses and major changes to existing courses (such as new course objectives or titles) must be approved by UCC during Spring 2018. Thus, development of new courses and the curriculum for the major must begin immediately.

Alternatively, we can initiate the major in Fall 2020, which would allow for more careful and deliberate development of the curriculum and courses for the program. This will delay the realization of financial benefits of adding students to the department's roles, but the Committee has not yet identified any other negative consequences of delaying.

Post Mortem of Major (Frank Peairs and Janet Dill)

This is based, for the most part, on interviews with faculty who were active in undergraduate instruction during the time that this major was offered in the department of Bioagricultural Sciences and Pest Management. These include Whitney Cranshaw, Tom Holtzer, Bill Jacobi, Boris Kondratieff and Elaine Roberts.

The transfer of the major from the Dean's office to the department was part of a package of "incentives" for the merger of Entomology with Plant Pathology and Weed Science. At the time of the transfer, the major did not meet the CCHE graduation rate requirements (10 per year) and was given one of the five campus-wide temporary exemptions to allow time to recruit sufficient students.

Three concentrations (agricultural biotechnology, entomology and plant health) within the major were developed and recruiting efforts targeting current and future biology majors were initiated. The number of majors increased as a result, peaking at about 30 students. While this was substantially more than when the major was housed in the Dean's office, it was only about half of what would be needed for a viable major according to CCHE standards. The Provost decided that sufficient time to establish the major had passed and that the exemption was needed elsewhere in the university. The last academic year for the major was 2002-2003.

Interviewees suggested several possible explanations for the failure to attract a viable number of students and the resulting loss of the major.

- The differences and advantages between this major and others such as biology were not clear to potential students.

- The major lacked name recognition.
- The major had a history of under-performance and low enrollments, prior to its transfer to the department.
- Faculty did not feel connected to the major.
- Sufficient faculty effort was not available for recruiting, retention and teaching. It was suggested that 3-4 faculty who were passionate about the major and its students would have been necessary to be successful.
- Course requirements were developed from available classes. New classes tailored to the needs of the major were not developed.

After the major was lost, the department looked for new ways to remain a “player” in undergraduate instruction. This was accomplished through large courses such as AGRI 116, BSPM 102, and LIFE 102, and other courses serving the needs of majors in CAS and elsewhere.

Financial Considerations (Amy Charkowski)

Table 1. BSPM Total Funding in \$Million

	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Base	\$2.59	\$2.72	\$2.72	\$2.81	\$2.72	\$2.96	\$2.66	\$3.02
One-Time	\$0.48	\$0.12	\$0.30	\$0.46	\$0.82	\$0.47	\$0.89	
Differential Tuition		\$0.01	\$0.03	\$0.04	\$0.04	\$0.04	\$0.05	\$0.06
Loans					\$0.17			
Total	\$3.07	\$2.85	\$3.05	\$3.31	\$3.75	\$3.47	\$3.60	

Table 2. BSPM total funding as a percentage of total CAS Funding in \$1000

	EG-Instruction	AES	Extension	IDC	Gifts	Online	Self-funded	Sponsored
BSPM	\$1,408	\$1,698	\$466	\$183	\$678	\$21	\$370	\$2845
	18%	22%	6%	2%	9%	0.5%	5%	37%
DARE	\$1,603	\$771	\$370	\$137	\$113	\$347	\$28	\$1,379
	34%	16%	8%	3%	2%	7%	1%	29%
ANEQ	\$2,879	\$1,209	\$313	\$150	\$1,489	\$35	\$2,232	\$2,205
	27%	12%	3%	1%	14%	0.5%	21%	21%
HLA	\$1,860	\$878	\$332	\$61	\$192	\$11	\$260	\$936
	41%	19%	7%	1%	4%	0.2%	6%	21%
SOCR	\$1,157	\$1,239	\$328	\$125	\$238	\$8	\$1,672	\$7,229
	10%	10%	3%	1%	2%	.01%	14%	60%

Increases to base funds = potential to increase faculty lines

Increases to IDC and Online funds = potential to improve facilities and equipment, classroom supplies, TA support, travel funds, start-up for faculty, etc.

2017-2018 Budget Reallocations - BSPM = -\$6,467

Online courses - 11% of proceeds go to Provost. After Provost, 35% goes to Online and 65% goes to Department (11-30-59)

Examples:

BSPM 356A – Introduction to Horticultural Entomology

1 credit = \$462 => \$272 to department per student

Food Safety Certificate (9 credits) – BSPM will teach PCQI (Preventative Controls Qualified Individual)

3-credit online course serving 35 students = \$28,560 / year

3-credit on-campus course serving 35 students = \$14,280/year, if “new” credits

2-3-6 Incremental Revenue Base Allocations FY18

\$163 per credit

\$775 per major

Funds are not provided for increases in the number of grad students in our courses.

Example: a “magical mushrooms” course at the 100-200 level that increases CAS # of students

	3 credit course at \$163/credit
25	\$12,225
50	\$24,450
100	\$48,900
200	\$97,800
300	\$146,700

*Differential tuition = \$32.40 per credit

A major requires 27 unique credits, but some could be in other departments. A major could also increase enrollment in AUCC courses offered through BSPM.

Example: a major serving 20 or 30 new students per year (80-120 people total) that increases the number of credits in CAS by 21 credits per student. (\$163/credit and \$775/stable major) (Table 3)

Table 3. (a) Annual and (b) cumulative proceeds to the department from an undergraduate major.

(a)

	Year 1	Year 2	Year 3	Year 4
Students	Credits: 3	3+6	3+6+6	3+6+6+6
10	\$4,890	\$14,670	\$34,120	\$45,820
20	\$9,780	\$29,340	\$68,240	\$91,640
30	\$14,670	\$44,010	\$102,360	\$137,460

(b)

	Year 1	Year 2	Year 3	Year 4
Students	Credits: 3	3+6	3+6+6	3+6+6+6

10	\$4,890	\$19,560	\$53,680	\$99,500
20	\$9,780	\$39,120	\$107,360	\$199,000
30	\$14,670	\$58,680	\$161,040	\$298,500

What Do Demographic Patterns Indicate? (Andrew Norton)

1. Population in Colorado will grow along the front range, not so much in other areas (Figure 1, Table 4).
2. We will become less white and more brown (Figure 2).
3. We can expect fewer traditional farms, but more farm support jobs.
4. Farm labor is not available. We will see a huge shift to mechanization and robots.

North Front Range
fastest growing
region

Elbert County
stronger growth
due to expected
job growth.

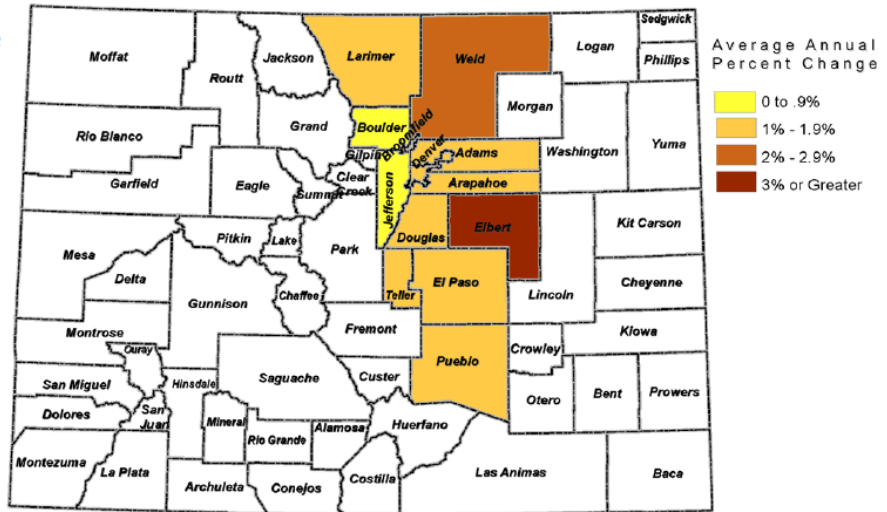


Figure 1. Expectations of growth 2010-2040 in the metropolitan Front Range.

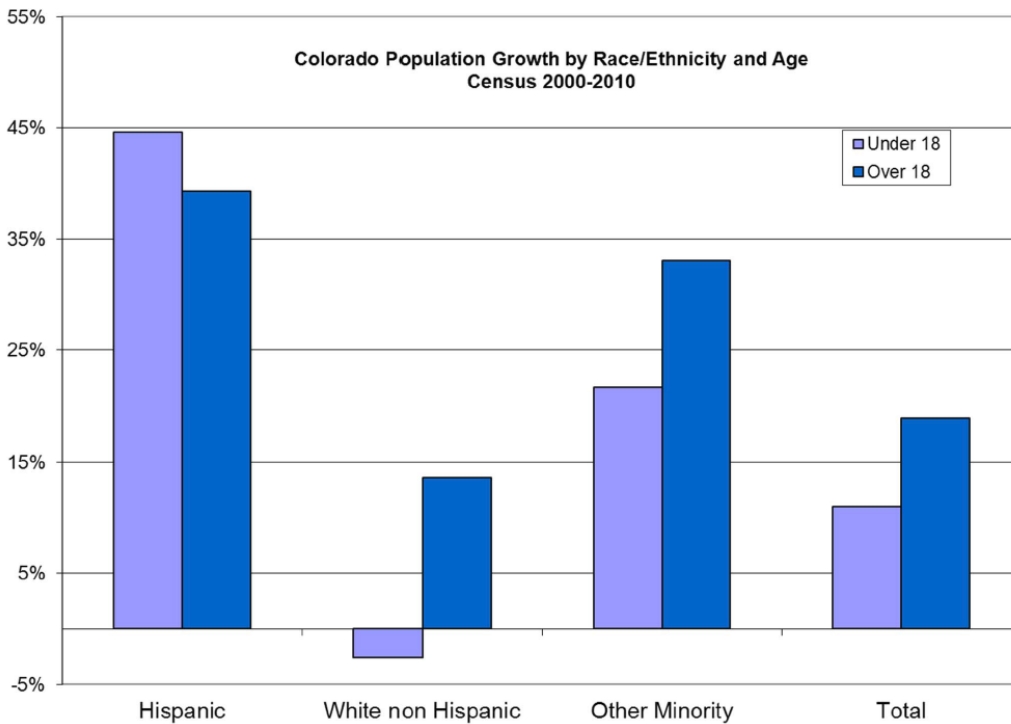
Table 4. Population growth 2000-2010 in Colorado from the State Demography Office (2012).

Top 5 Counties for Population Growth

Population Change 2000-2010

Percent		Total	
Colorado	16.92%	Colorado	727,935
Douglas	62.41%	Douglas	109,699
Weld	39.73%	El Paso	105,334
Garfield	28.77%	Arapahoe	84,036
Mesa	26.21%	Adams	77,746
Eagle	25.30%	Weld	71,889

Source: Census 2010



Source: Census 2000, 2010

Figure 2. Colorado population growth by race, ethnicity and age based on the 2000 and 2010 census (Colorado Demography Office 2012).

What Potential Students Want (Cini Brown)

We held focus groups with university and high school students to help us understand better what they are looking for in a college education. We met with one group of college students, the Ag Ambassadors, and two groups of high school students, Saint Vrain Valley Future Farmers of America and Fossil Ridge High School science students.

Focus groups were led by Dr. Karen Falkenberg from The Institute on Learning and Teaching with Dr. Brown in attendance. Sessions were recorded and transcribed by a professional transcription service.

The main questions we wanted to answer through these focus groups were:

1. What do you want to get out of a university education?
2. Would this appeal to you? Do you like what we have to offer?
3. How will a degree in science help you meet your professional goals?

Dr. Falkenberg developed an interview guide for each focus group (Appendices) to address these questions and evenly pace the questioning and answers.

One of the discussion topics we addressed was curriculum topics. The question was set up as follows and students were asked to respond with a “thumb-o-meter,” pointing their thumbs up for high interest, parallel to the ground for neutral or ambivalence, and down for little or no interest in the topic.

“Most jobs in agriculture do not involve actual farming. Rather, they support the production and distribution of food. Much of this work depends on understanding the science behind food production. Knowing that, which of the following curriculum topics sounds appealing to you and why?”

- A. Food and food production
- B. Sustainable agriculture
- C. Invasive pests (plant diseases, insects and weeds) and how they affect natural, agricultural and urban systems
- D. Improving food security
- E. How pests impact agriculture and how to manage them
- F. How plants, insects, and microbes function in natural systems

This question was intended to inform marketing and design of the curriculum. The results are summarized in Table 5.

Table 5. Thumb-o-meter responses of focus group participants when asked to rate their interest in a potential curriculum topic. The number of participants is included in parentheses.

Potential curriculum topic	Ag Ambassadors (6)			St. Vrain Valley FFA (6)			Fossil Ridge High (7)		
	Up	Flat	Down	Up	Flat	Down	Up	Flat	Down
Food and food production	1	4	1	1	5	0	0	4	3
Sustainable agriculture	4	2	0	6	0	0	4	3	
Invasive pests (plant diseases, insects and weeds) and how they affect natural, agricultural and urban systems	3	2	1	3	2	1	3	1	3

Improving food security	6*	0	0	4	2	0	4	1	2
How pests impact agriculture and how to manage them	3	3	0	0	6	0	0	3	4
How plants, insects, and microbes function in natural systems	3	3	0	0	1	5	6	0	1

*Immediate response without hesitation.

The two topics of most interest across all focus groups were **improving food security** and **sustainable agriculture**. The only topic for which all of the CSU Ag Ambassadors gave the immediate thumbs up was improving food security. When they discussed the reasons for their interest, they talked about reducing food insecurity, thus, have identified food insecurity as the problem that needs to be solved. Food security was not as strong a draw for the high school students, but was still of interest. For the group of high school students who may not have much first-hand knowledge of agriculture (Fossil Ridge High), **how plants, insects, and microbes function in natural systems** was of most interest. One young man from Fossil Ridge High told us that what he is most passionate about is helping people, yet he did not give *improving food security* the thumbs up. This indicates a different level of awareness and ability to connect food issues with human welfare among students who are less likely to have experience with agriculture.

We asked focus group participants to express their interest in a number of possible names for an undergraduate major. These names were designed to explore how certain words that might be used in the name of the major resonate with the participants and were not necessarily candidate names for the major. The responses of the three focus groups are summarized in Table 6.

Table 6. Written responses of focus group participants when asked to rate their interest in a given potential name for an undergraduate major. The number of participants is included in parentheses.

Potential name of new undergraduate major	Ag Ambassadors (6)			St. Vrain Valley FFA (6)			Fossil Ridge High (7)		
	High	Med	Low	High	Med	Low	High	Med	Low
Agricultural Biology	1	3	1	1	5		4	3	
Sustainable Pest Management	2	2	1	1	1	4	1	3	3
Integrated Pest Management	1	2	2	1	1	4		3	4
Plant and Ecosystem Health	2	1	2	3	2	1	6	1	
Plant Protection		1	4	1	3	2		5	2
Applied Pest Biology	2	1	2		4	2	2	1	4
Food System Protection	5	1		5	1		2	4	1
Food Security Studies	Not included for this group. Added later bcs of their interest in food security			5	1		2	3	2

Some of the general trends that Dr. Brown gleaned from the discussion with focus group participants are:

- We only know what we have experienced or have been exposed to. For high school students, this is primarily limited to what we see at home and at school. It may include what the people we interact with in those places direct us to in the real or virtual world.

If young people are going to choose to come to CSU and enroll in the undergraduate major offered by our department, engaging and educating them must start very early.

- It is important that there is someone at CSU who is the point person for young people who may become majors. Emails from an individual at CSU to a student can be effective, but mass emails are not and can be counterproductive.

Much more information can be gleaned from careful scrutiny, scoring and analysis of the responses and discussions during the focus groups. This analysis will be conducted when the Committee has received authorization from the faculty and support to proceed. We also intend to hold focus groups with biology students at CSU and Fort Collins High when we have learned what we can from the data we have collected thus far and revised our questions.

What Employers Want

When applying for a job, it is assumed that an applicant's education fulfills the educational requirements (adequate knowledge of a particular subject) to qualify for that position. Industry has mentioned that it likes to train their employees in specific skills (hard skills) so it would prefer candidates that have received broad training at university level rather than hyper-specialized scientists.

Generally, the reputation of the College/University where the degree was obtained and exceptional GPA are not critical factors in being offered a job. These are superseded by work experience and internship during College.¹ As a summary across the labor market (industry, scientific societies and other resources),²⁻⁵ key requirements from employers list the following skills as desirable:

- 1- Problem-solving skills, critical thinking, creativity, and analytical skills (data management and analysis).
- 2- Communication skills (preparing and giving presentations and reports), interpersonal skills.
- 3- Team work, organizational skills, broad training to be able to work across discipline, leadership.
- 4- Enjoy working on challenging projects.

A survey funded by USDA NIFA Higher Education Challenge grant (#00125812) assessing the skills cited by employers as lacking among recent graduates with BS degrees in plant science fields includes the following top skills most needed in new graduates.⁶

- 1- Basic lab skills
- 2- Writing skills
- 3- Statistical skills
- 4- Readiness to learn new skills

Resources

¹Skill gaps, skill shortages and skill mismatches: Evidence for the US (2014) The national bureau of economic research.

²Skill Requirements across Firms and Labor Markets: Evidence from Job Postings for Professionals (May 2017) The national bureau of economic research.

³The Balance - Top Skills and Attributes Employers Seek (2017) <https://www.thebalance.com/analytical-skills-list-2063729>

⁴Top Resume. The top 5 job skills that employers are looking for in 2017.

<https://www.topresume.com/career-advice/the-top-5-job-skills-that-employers-are-looking-for-in-2017>

⁵Communication from Bayer and Monsanto

⁶USDA NIFA Higher Education Challenge grant (#00125812) from the American Phytopathological Society

What Peer Institutions Offer (Cris Argueso)

As part of our analysis on the feasibility of a new major, we examined the existence of similar majors in peer, regional institutions. The universities queried were land grant institutions with strong emphasis in agricultural research. These included: University of Wyoming, New Mexico State University, University of Nebraska Lincoln, Kansas State University, Montana State University, University of Idaho, Utah State University, University of Arizona, North Dakota State University, South Dakota State University, Oklahoma State University and University of Nevada.

All the above named universities were analyzed for the presence of majors with focus on the areas of pest management, including Plant Pathology, Entomology and Weed Sciences. The only major in all the universities analyzed that offers specializations on all these three areas was the Agricultural Biology major, at New Mexico State University. The aim of this major is to prepare students for a variety of careers in the biological sciences and agriculture, including emphasis on preparation for advanced degrees and admittance to professional schools, such as medical and dental school. The major is composed of five separate options: Applied Biology, Applied Microbiology, Entomology, Environmental Biology and Invasive Pest Biology. This major prepares students for careers in the commercial sector, agricultural consulting, pest management, research positions at government and private agencies, as well as extension.

Program and Coursework (Todd Gaines, Andrew Norton, Kirk Broders, Cris Argueso)

The Committee considered the structure and the coursework for the undergraduate major, but proceeding with this process will require full commitment of the faculty. This sub-committee generated the following findings:

Timeline: first courses approved, then major is approved

Need 27 credits for major, we currently have ~22 credits

- Most of our courses are at 300/400 level

- Need 100-level freshman seminar

- 200-level course

- 3 credit capstone

- Likely need ~4 new courses

- Integrate quantitative skills into existing and new courses, part of 400-level

 - E.g., graphing, graph interpretation, data presentation; sprayer calibration

Student Learning Outcomes

- Experiential Learning

- Interpersonal Skills

- Quantitative Skills, Data Literacy

Double major fits with:

Soil and Crop Science
Horticulture
Ag Business

Additional Activities

We have initiated exploration of getting assistance from the business school with marketing of a new major. But we need faculty commitment to creating a major before we pursue this.