Colorado State University

College of Agricultural Sciences

2006-2007
Report of the Strategic Plan

College of Agricultural Sciences

Table of Contents

THE 2006-07 REPORT of PROGRESS on the STRATEGIC PLAN of the COLLEGE of AGRICULTURAL SCIENCES COLORADO STATE UNIVERSITY

Preface

The College of Agricultural Sciences at Colorado State University submitted its Strategic Plan to President Larry E. Penley and Provost/Senior Vice President Tony Frank on December 1, 2005. This is the first report of progress in fulfillment of the Strategic Plan covering project activities for calendar year 2006, financial activities covering fiscal year 2006-2007 (July 1, 2006-June 30, 2007), and student activities covering academic year 2006-2007 (August 15, 2006-July 31, 2007).

A useful Strategic Plan is a living document that guides major developmental and resource allocation decisions and changes as strategic initiatives are achieved and new challenges arise. In the College of Agricultural Sciences, strategic initiatives are accomplished by faculty, staff and students. Each strategic initiative is led by an administrative advisor and a steering committee comprised of faculty, Extension agents and researchers. These individuals determine the paths to follow to achieve effective teaching, research and outreach. Twice annually, the administrative advisor and steering committee chairpersons of each strategic initiative meets with the Dean and Associate Deans of the College to review operations and accomplishments and to change, where necessary, the "strategic actions" and the "critical resource growth" areas. "Strategic Actions" are critical measures which must be taken to remove barriers to success in achieving desired objectives. "Critical resource growth" areas are resource constraints which must be addressed to permit progress toward goals. During the bi-annual meetings, the Dean, Associate Deans, Administrative Advisors, and Steering Committee Chairs agree to strike strategic actions and critical resource growth areas which have been achieved, keep those still in progress, and add new actions and resource growth goals to maintain progress. These "strategic actions" and "critical resource growth" areas become the jointly accepted steps to be taken by faculty and administration over the following six months. A special thanks goes to Cristie Sexton, Manager of Strategic Initiatives for the College of Agricultural Sciences, who is responsible for keeping strategic planning actions on schedule and for composing most of this annual report.

The College has vowed to be accountable to its stakeholders for progress on the Strategic Plan. Imbedded in the Strategic Plan are the following output measures used to measure performance:

- Number of BS, MS, and PhD degree graduates and the number of Post-Doctoral Fellows trained in the program.
- Magnitude of grant/contract/gift awards to the program.
- Number of refereed scientific publications published.
- Outreach products including non-refereed publications and participation in state, national, and international committees, programs, and task forces, and number of consumers, regulators, and industry personnel educated and/or served.
- Evidence of adoption of practices recommended through Colorado State University.
- A narrative summary of accomplishments toward goals which are not readily measurable in numerical terms.

Executive Summary

The College of Agricultural Sciences at Colorado State University submitted its Strategic Plan to central administration on December 1, 2005. This report of progress includes project activities for calendar year 2006, financial activities for fiscal year 2006-2007 (July 1, 2006-June 30, 2007), and student activities for academic year 2006-2007 (August 15, 2006-July 31, 2007).

For Academic Year 2006-07, undergraduate instruction in the College resulted in the graduation of 276 bachelor's degrees from among 1,236 majors. The number of majors has declined slightly during the last two academic years. However, smaller graduating classes and a 20 percent increase in freshmen in the Fall 2007 class promises a turnaround for sustained growth in enrollment. Despite smaller enrollments, generation of undergraduate student credit hours has grown over the last three years. The goal of the College is to raise undergraduate enrollment to 1,600 by 2012. To accomplish this goal, the College has embarked on the following actions: heightened recruiting effort in Colorado high schools; development of a much greater effort to recruit and graduate Agricultural Education majors to fill high school agriculture teacher vacancies; increase alumni contacts (the College has the highest proportion of alumni giving back financially to the university); continued development of attractive new degree programs (the interdisciplinary degree in organic agriculture started in fall 2006, the viticulture/enology concentration started in fall 2007, and a golf course management concentration is being developed to start in fall 2008); focus additional emphasis on experiential learning to build maturity in the context and use of knowledge (in-class and out-of-class experiences and study abroad put students in a position to apply knowledge and skills); and pursue renovation of building facilities to provide improved and attractive learning spaces.

Scholarship distribution has grown to over $600,000 ($567,516 for undergraduate students) and experiential learning scholarships have been developed to support students to attend leadership conferences and study abroad. The National Western Stock Show remains the largest organizational donor to scholarships and the College is saddened by the passing of Col. Arthur Allen, of Kansas City, our largest single individual donor.

For Academic Year 2006-07, graduate instruction resulted in 55 masters and doctoral degrees conferred by the College and completion of 14 post-doctoral training programs. The numbers of graduate majors increased for the first time in many years to 214 for the Fall 2007 semester. The goal of the College is to raise graduate enrollment to 100 Master of Agriculture, 150 Master of Science, and 150 PhD students by 2014. Reallocation of existing College and Agricultural Experiment Station research funds, use of growing grant funds, and additional support from the Graduate School have been started and will continue until the goal is reached.

The College of Agricultural Sciences departments have been shown to be highly productive relative to peers. Examples include the department of Agricultural and Resource Economics being ranked 1st and the department of Soil and Crop Sciences being ranked 8th nationally in terms of productivity measured by the Faculty Scholarly Productivity Index produced by Academic Analytics in 2005. For 2006, the department of Horticulture and Landscape Architecture was ranked 3rd in horticultural science and the department of Bioagricultural Sciences and Pest Management was ranked 5th in terms of productivity in the same index. Each of the programs is very competitive in attracting students nationally and internationally in spite of the fact that Colorado's tuition policies make financial competition for graduate students difficult.

Total financial expenditures for teaching, research and outreach have grown continuously over the last three years to exceed $30 million (growth of 10.5 percent in the last year). The most significant growth was in self-generated resources resulting from grants and contracts, sales of products and services, and gift funds. In 2006, a sponsored program coordinator was hired to assist faculty in being more efficient in finding and responding to research and teaching grant opportunities. The Agricultural Experiment Station was merged into the College of Agricultural Sciences and the Director, Dr. Lee Sommers, was appointed Associate Dean for Research and Graduate Programs in addition to his Director responsibilities. This dual appointment has enhanced coordination of research in the

College. With the merger of AES into the College, commitments to research in other Colleges relevant to agriculture continue to expand.

Facility improvements are a high priority on the College agenda. Conceptual drawings have been developed for renovation and expansion of the Animal Sciences and Shepardson Buildings. The program plans for these buildings have been approved by the President, Board of Governors and the Colorado Division of Higher Education. The University has allocated $12.2 million in future building funds to the two projects and a fund-raising effort is in progress to finance the improvement of facilities so students and faculty can work and learn in modern, fully functional spaces. Additionally, the College and AES were able to join a campus bonding effort from which Agricultural Sciences is gaining $1.55 million in long-term bonds to renovate greenhouse facilities to meet USDA-APHIS heightened regulations on plant science research and renovate the greenhouses at the Plant Environmental Research Center (PERC).

Indicators of productivity in research and outreach include the production and publication of 195 refereed journal articles and 852 other publications. The College of Agricultural Sciences values continuous interaction with citizens to transmit the results of applied research to those who can use it; faculty and students presented information at 1,286 Extension and other meetings with 52,042 people in attendance. More than 1,000 FFA youth participated in the College-produced annual state contests and 2,000 third graders experienced "where their food comes from" in the Agriculture Adventure program presented annually at ARDEC.

The full report identifies accomplishments for each of the 12 strategic initiatives. The following are just of few of the highlights from 2006-2007:

- The Beef Improvement Center at the Rouse Ranch near Saratogo, Wyoming was the subject of a 10-year review by a team of specialists from Cornell, Iowa State and USDA. The team found the work at Rouse Ranch productive, relevant, and well-integrated into the teaching function for educating future professionals. One focus is beef improvement for high altitude growing conditions. Cattle at the Center outperform industry averages (26 percent higher grading as choice carcasses this year) and 90 agricultural science and veterinary students were involved in capstone classes, internships and practice experiences on the ranch. (Ruminant Production Systems)
- The CSU Beef Team drew together the faculty and County Extension Agent personnel in a cohesive approach to public beef education. The team produces a CSUBeef.com website and monthly Ag Press articles in addition to regular state-wide meeting opportunities, e.g., ranch days. (Ruminant Production Systems)
- Research by the meat science/food safety group resulted in NCBA Guidelines for Beef Aging and in USDA Agricultural Marketing Service approval of video image analysis (VIA) instruments for official measurement of marbling scores. Faculty delivered invited lectures on meatborne pathogens in 21 countries. Dr. John Sofos was named a University Distinguished Professor, a group of 12 internationally renowned scientists at Colorado State. (Meat Science and Animal Product Food Safety)
- The second annual Legends of Ranching Sale was held in March, 2007. Noted ranches consign young horses to the Equine Science program. Three classes are involved in preparing for the sale: students in the horse training class train the horses for sale, students in the equine exhibition class put on a cowboy competition for workhorses during the sale, and students in the equine marketing course produce and advertise the actual horse sale. Consignors appreciate the opportunity to have a sale in the east-central Colorado area and the opportunity to support the preparation of young people for the professional equine industry. (Equine Science and Business)
- Students participating in various competitions fared extremely well. The Horse Judging Team won the World Competition in Oklahoma City. The Meats Judging Team was named Reserve Champion at the 2007 National Western Stock Show. In 2006, the Wool Judging Team was crowned National Western Champion. Students majoring in Landscape Horticulture placed 1st in the Professional Landcare Network competition. At the Western Collegiate Food Marketing Competition, the Food Marketing team placed 2nd in the professional judged competition and 1st place in each of three peer-judge categories.

- Plans to expand faculty expertise in the area of animal environmental science have resulted in the hire of a Civil Engineer, Sybil Sharvelle, and the interview of candidates for a Soil Scientist focusing on air quality issues related to livestock production. Workshops on animal environmental issues were presented in 28 places with 981 attendees. A two-part symposium on Antibiotics and the Environment was presented at the International Soil and Water Conservation Society's annual meeting. (Animal Environmental Systems)
- A number of the College's plant scientists have been included in a Plant Disease Cluster in the Infectious Disease Supercluster; Dr. Jan Leach, plant pathologist is leading this cluster. Dr. Leach also was named a University Distinguished Professor during the last year, one of 12 scientists with this designation at Colorado State. (Fundamental Biology of Plants and Plant Pests)
- A Clean Energy Supercluster is forming to coordinate the research on renewable energy across the campus and represent Colorado State in the Renewable Energy Collaboratory (with the University of Colorado and the Colorado School of Mines). The College of Agricultural Sciences is an active participant focusing on the development of new feedstocks for renewable energy; emphasis is being placed on dryland crop production sources. (Fundamental Biology of Plants and Plant Pests)
- The College has participated in the development of a Bioinformatics Center to assist genetic scientists in managing the great amounts of data related to genetic research for plants, animals and microbes. (Fundamental Biology of Plants and Plant Pests)
- A high school outreach program has been established to enhance the knowledge of plant biotechnology for students and teachers and to encourage a new generation of youth to consider plant biology as a career. In 2005, 525 students and several teachers were involved in the program. In 2006, 684 students and several teachers were involved. (Fundamental Biology of Plants and Plant Pests)
- Five universities have collaborated to develop ten on-line learning modules related to herbicide modes of action, herbicide resistance, and herbicide absorption, translocation and metabolism. Cross state collaboration brings the value of a broader range of resources to Colorado citizens. (Fundamental Biology of Plants and Plant Pests)
- About 50 percent of potato acres and 60 percent of wheat acres are planted to Colorado State University released varieties. It is estimated that the economic impact of the potato breeding program is $15-$18 million annually and the impact of the wheat breeding program is $20 million annually. Nationally, three of the top ten potato cultivars in acreage planted are from the Colorado State program. Molecular marker work is being conducted to identify new resistance genes for Russian Wheat Aphid. (Crop Improvements)
- What started five years ago as the Cancer Prevention Laboratory in Horticulture and Landscape Architecture has become a major research thrust in "Crops for Health." Combining human nutrition with crop genetics, Colorado State researchers are searching for and finding variety differences in wheat, potato and dry edible beans in the ability of these foods to promote health and prevent cancer, diabetes, and heart disease. University investments in metabolomics and bioinformatics capabilities have spurred this effort forward. Faculty have received very competitive USDA National Needs Fellowships to support graduate students working in this area. (Crops for Health)
- Horticulture faculty work with the Denver Botanic Gardens and GreenCo (a collaboration of green industry associations) on two major initiatives. First is Plant Select© which is a program to select and test ornamental plants which are water conserving and sustainable in semi-arid environments; these climatically tested plants are identified with a special tag in nurseries to guide consumers. Second is Plant*talk*™ which added 50 new scripts to their website in 2006. There were approximately 2,862 calls in 2006 and over 900,000 world-wide web hits; Plant*talk* is approaching the 6.0 million web hit mark. (Design and Management of Colorado Landscapes)
- Master Gardener training has moved to rural areas. Addition of computer cameras in all County Extension Offices has made it possible to simultaneously deliver Master Gardener training to small groups in rural counties. In 2006, Master Gardener training was modified for distance delivery during 2007 in the southwestern counties of Archuleta, LaPlata and Montezuma along with mountain counties of Chaffee, Fremont, Gunnison, Routt and Summit. (Design and Management of Colorado Landscapes)

- Colorado State weed scientists hosted and organized a meeting on the biology and management of Tamarisk attracting over 250 scientists, resource managers and policymakers from 14 western states. (Science and Management of Pest Insects, Plant Pathogens and Weeds)
- A 14-member team is addressing the possibility of a new rural-urban water solution. The team is evaluating cropping system options which can maintain profitability in irrigated agriculture while saving water which can be made available for transfer to urban areas. (Science and Management of Pest Insects, Plant Pathogens and Weeds)
- Iris Yellow Spot is an emerging disease threatening Colorado onion production. Since insecticides have limited effect on thrips which vector the disease, Colorado State scientists are evaluating other management practices for effective prevention of the disease. (Science and Management of Pest Insects, Plant Pathogens and Weeds)
- A new biotype of the Russian Wheat Aphid is threatening the Colorado wheat crop. While new genetic sources of resistance are being sought for incorporation into new wheat varieties, other management practices are being tested to diminish the impact of this insect pest. (Science and Management of Pest Insects, Plant Pathogens and Weeds)
- Measuring carbon sequestration capability of crop plants has been a topic of research at Colorado State for 10 years. Cost-effective carbon dioxide "trapping" is important to slow climate change and provide the opportunity for producers to sell carbon credits to users of fossil fuels, e.g., power plants. Colorado State scientists have been involved with several international projects to reduce climate change, including the United Nations Framework Convention on Climate Change which received a Nobel Prize in 2007. (Managed Ecosystems)
- The Dryland Agroecosystem Project has assisted in the adoption of no-till intensive cropping systems in Colorado and the Western Great Plains. The project has helped producers convert 1.5 million acres from a wheat-fallow system to a wheat-summer crop-fallow system resulting in increased annual net returns of over $22 million in eastern Colorado. (Managed Ecosystems)
- Agricultural economists have been involved in the Congressionally-mandated USDA Livestock and Meat Marketing Study for the USDA Grain Inspection and Packers and Stockyards Administration and the Farm Foundation's *Future of Animal Agriculture* project. Colorado State economists produced the book *The Economics of Livestock Disease Insurance: Concepts, Issues and International Case Study.* (Economics, Management, Policy and Trade for Agribusiness and Communities)
- The Colorado State-Wyoming authored RightRisk program presented another 20 programs in 2006 bringing the total to more than 100 presentations in 12 states. A grant was received to provide risk management training for women in farming and ranching and the group was invited to present the program to Washington, D. C. staff of USDA's Risk Management Agency. (Economics, Management, Policy and Trade for Agribusiness and Communities)
- Colorado State agricultural economists and production scientists have become national leaders in the evaluation of alternative production and marketing practices for food products, including organic, hormone-free, grass-fed and farmers' market methods. Dr. Dawn Thilmany served as the USDA-CSREES National Program Leader for organic agriculture during her recent sabbatical. (Economics, Management, Policy and Trade for Agribusiness and Communities)
- Community and industry studies have provided an objective assessment of the value of community development activities for Colorado. The value of agricultural land preservation was determined for Routt County. The role of conservation easements in environmental control and economic development was studied for Colorado. Evaluation of the potential for a lodging tax in Huerfano County led to passage of the tax to support rural tourism in the county. The economics of the Colorado Wine Industry measured the economic impact of this emerging industry on the Colorado economy. (Sustainable Community Development)
- Campus and county Extension faculty have been brought together as never before to focus effort on rural development opportunities in Colorado. This organization is moving toward the creation of a Center for Rural Development to gain recognition for this group of applied scientist and educators to attract more resources for rural development to Colorado. (Sustainable Community Development)

College of Agricultural Sciences
2006-07 Annual Report

Mission Statement: The College of Agricultural Sciences (College) and the Colorado Agricultural Experiment Station (AES) are committed to excellence, setting the standard for undergraduate and graduate education (resident and distance), basic and applied research, and public education related to agricultural, ornamental, and equine industries on topics of inputs, production, processing, merchandizing, management, finance, policy, food quality, landscape design, environmental impacts, and community development, using plant, animal, soil, ecological, and economic sciences.

Vision Statement: The College and AES will be recognized locally and nationally as leaders in developing professionals and generating and disseminating knowledge to keep Colorado agriculture competitive, food safe, the environment clean, Colorado green, and build food products which contribute to health and prevent disease.

Core Values: The College and AES base their activities on the following core values:
1. Develop and apply objective knowledge based upon the scientific process and peer review.
2. Provide open access for all to the university.
3. Provide open and timely communication of results to peers and the public.
4. Encourage and reward teamwork to solve issues.
5. Demonstrate respect for the unique contribution of each person.
6. Employ high standards of academic and scientific integrity.
7. Provide high value added performance in education and research for customers and the public.
8. Demonstrate respect and a collaborative and helpful spirit for people inside and outside of the organization.
9. Promote and reward excellence in teaching, research, outreach, and service.

Strategic Initiatives: The strategic planning process in the College and AES involved faculty and staff representing each department, researchers and Extension agents. As a result, 12 specific planning initiatives were identified which will drive our focus and provide direction for the future. To implement these initiatives, a steering committee was established for each planning study area comprised of faculty, staff, researchers and Extension agents. The steering committees have designated leaders who are charged with implementing various strategic objectives and ensuring success in the various areas. The strategic initiatives identified include:

- Ruminant Production Systems
- Meat Science and Animal Food Product Safety
- Equine Science and Business
- Animal Environmental Systems
- Fundamental Biology of Plants and Plant Pests
- Crop Improvement
- Crops for Health
- Design and Management of Colorado Landscapes
- Science and Management of Pest Insects, Plant Pathogens and Weeds
- Managed Ecosystems
- Economics, Management, Policy and Trade for Agribusiness and Communities
- Sustainable Community Development

Outcome Measures:

I. **Majors:** The following table shows the history of the number of undergraduate primary majors in the College:

Fall 2004	Fall 2005	Fall 2006	Fall 2007
1,247	1,267	1,236	1,226

The goal of the College is to increase the enrollment of undergraduate primary majors to 1600 by Fall 2012.

The following table shows the history of the number of graduate primary majors in the College:

Major Type	Fall 2004	Fall 2005	Fall 2006	Fall 2007
MS majors	164	152	136	133
PhD majors	66	67	72	81
Totals	230	219	208	214

The goal of the College is to increase graduate enrollment to 250 for MS students and 150 for PhD students by Fall 2020.

II. **Degrees:** The following table shows the history of the number of undergraduate degrees conferred by the College:

AY 2003-04	AY 2004-05	AY 2005-06	AY 2006-07
313	285	300	276

The following table shows the history of the number of graduate degrees conferred by the College:

AY 2003-04	AY 2004-05	AY 2005-06	AY 2006-07
77	62	59	55

The following table shows the history of the number of post docs trained in the College:

AY 2003-04	AY 2004-05	AY 2005-06	AY 2006-07
10	10	14	14

III. **Student Credit Hours:** The following table shows the history of total undergraduate student credit hours for faculty and staff in the College:

AY 2003-04	AY 2004-05	AY 2005-06
26,729.8	26,938.7	27,035.0

The following table shows the history of total graduate student credit hours for faculty and staff in the College:

AY 2003-04	AY 2004-05	AY 2005-06
3140.6	2719.5	2783.5

IV. **Student/Faculty Ratios:** For Academic Year 2006-07, the student to faculty ratio was 28 students per every 1 resident instruction faculty member. For Academic Year 2006-07, the faculty to student credit hour was 1 resident instruction faculty for 677.4 student credit hours (includes both undergraduate and graduate).

V. **Financial Resources:** Expenditures from resident instruction, state and Federal Agricultural Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with all strategic initiatives were evaluated to determine the level of financial resources dedicated to these areas throughout the college. The following table demonstrates the relevant expenditure history within these areas:

Fund Type	**FY 2004-05**	**FY 2005-06**	**Change**	**FY 2006-07**	**Change**
Res. Instr.	$4,310,725	$4,383,973	$73,248 (1.7%)	$4,780,753	$396,780 (9.1%)
AES					
State	$5,095,862	$5,315,547	$219,685 (4.3%)	$5, 309,303	-$6,244 (-0.1%)
Federal	$1,671,730	$1,700,753	$29,023 (1.7%)	$1,710,153	$9,400 (0.6%)
Extension					
State	$1,740,630	$1,791,452	$50,822 (2.9%)	$1,814,260	$22,808 (1.3%)
Federal	$100,146	$97,504	-$2,642 (-2.6%)	$93,032	-$4,472 (-4.6%)
Grants/Contracts	$9,848,638	$10,392,697	$544,059 (5.5%)	$11,353,595	$960,898 (9.2%)
Cash	$2,933,240	$2,858,440	-$74,800 (-2.6%)	$4,147,642	$1,289,202 (45.1%)
Gift	$834,772	$811,226	-$23,546 (-2.8%)	$1,017,972	$206,746 (25.5%)
Totals	**$26,535,743**	**$27,351,592**	**$815,849 (3.1%)**	**$30,226,710**	**$2,875,118 (10.5%)**

VI. **Scholarships:** The following table shows the history of the number and amount of undergraduate and graduate scholarships in the College:

AY	**Undergraduate**	**Undergraduate Amount**	**Graduate**	**Graduate Amount**
2004-05	**227**	**$419,850**	**8**	**$27,268**
2005-06	**237**	**$468,308**	**8**	**$34,938**
2006-07	**287**	**$567,516**	**10**	**$35,000**

VII. **Publications:** For calendar year 2005, faculty, staff and students published 186 refereed journal articles. For calendar year 2006, faculty, staff and students published 195 refereed journal articles, an increase of 9 (4.8%) from 2005.

In addition, for calendar year 2006, faculty, staff and students in the College produced 852 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

VIII. **International Opportunities and Experiences**: Currently, the College has International Memorandums of Understanding (IMOUs) with several universities. Five of these IMOUs are comprehensive across the entire College: Mendel University of Agriculture and Forestry (Brno, Czech Republic), L' École Supérieure d' Agricultur (Purpan, France), Lincoln University (Canterbury, New Zealand), Instituto Tecnologico y de Estudios Superiores de Monterrey (Mexico), and Saratov State Agrarian University (Saratov, Russia). The College also has student exchange agreements with each of the five college-wide relationships, except for Saratov State Agrarian University. During the last year, College faculty have traveled to our partner institutions in the Czech Republic, New Zealand, and Russia and students have attended educational experiences in New Zealand and France. In addition, delegations of partner

institutions have visited Colorado State University from the Czech Republic and Russia. Internationalization goals of the College include having 25 percent of graduates with a study abroad experience and 50 percent of faculty with professional experience abroad by 2014. The College is working with a major, international agribusiness to jointly sponsor Spanish-speaking students and combine a study abroad and a work experience exchange with a facility in Mexico. Additionally, next year the College will initiate a Faculty International Committee to guide actions to achieve international goals, initiate a Student International Club to serve the international interests of students, and initiate a Global Hunger Initiative to provide opportunities for awareness and service to contribute to the worldwide goal of ending world hunger by 2030.

IX. **Outreach:** Based on reported activities and total number of participants for each activity, faculty and staff associated with the College participated in approximately 1,286 workshops/presentations reaching more than 52,042 total participants.

X. **Student opportunities:** Students in the College have many opportunities to engage in experiential learning through activities such as clubs, judging teams and internships. The College offers the opportunity to participate in the following clubs:

1. Ag Ambassadors
2. Agribusiness Association
3. Ag Council
4. Agronomy Club
5. Alpha Gamma Rho
6. Alpha Tau Alpha
7. Student Chapter of the American Society Landscape Architects
8. Block & Bridle
9. Collegiate 4-H Club
10. Collegiate Chapter of FFA
11. Collegiate Cattlewomen's Association
12. Collegiate Horseman's Association
13. CSU Farm Bureau
14. CSU Farmer's Union
15. CSU Pre-Vet Club
16. CSU Versatility Ranch Horse Club
17. Farm House Fraternity
18. Gillette Entomology Club
19. Horticulture Club
20. Meat Animal Evaluation Team
21. Mountain Riders Horse Club
22. Phi Alpha XI
23. Polo Club
24. Rodeo Club
25. Shotgun Sports
26. Sigma Alpha
27. SOLDAC (Student Organization of Landscape Designers and Contractors)
28. SusDev (Sustainable Development)
29. Turf Club

The College offers students the opportunity to participate in the following judging teams:

- Dairy Judging
- Horse Judging
- Livestock Judging
- Meats Judging
- Wool Judging

Students participating in judging teams achieved unprecedented success in 2006-2007.

CSU Meats Judging Team: Won Team Reasons Award and was named Reserve Champion Team at the 2007 National Western Stock Show; Named the Reserve Champion Team at the Southwestern Stock Show and placed 4th in the Houston Livestock Show and Rodeo.

CSU Livestock Judging Team: Finished 3rd in cattle, 4th in reasons and 5th in hogs at the 2007 National Western Stock Show. Highlight was winning the Carload Contest for the first time in the history of the contest.

CSU Wool Judging Team: Crowned National Western Champion Team, claiming High Team in Reasons, Wool Grading, Handspinning and Overall; Won High Team overall in placings with three members marking a perfect 300 score and High Team in reasons with an average of 47 in the reasons room during the 2006 Houston Livestock Show and Rodeo; Completed the year undefeated in Reasons & Total Judging: The 2007 Wool Judging Team placed 3rd in the National Western Stock Show.

CSU Horse Judging Team: Dominated the AQHA World Championships by winning High Team Halter, High Team Performance, High Team Reasons and High Team Overall honors.

Other highlights: 2006 Women's Polo Team won the Central Region competition and placed runner-up at Nationals; The women's JV Polo Team won the CSU J.V. Tournament 2006-07; a CSU student was named Dairy All-American for judging success on the 2006 Spring Team; the CSU 2007 Team claimed Champion Academic Quadrathlon honors for the Western Section ASAS by winning the written test competition and placing 2nd in the lab practicum.

Collegiate Turf Bowl: In February 2007, two teams consisting of eight turf management students competed in the Collegiate Turf Bowl competition at the Golf Course Superintendents Association of America (GCSAA) Conference in Anaheim, CA. The two teams finished 20th and 32nd. The Collegiate Turf Bowl Competition tests teams of up to four participants in areas of mathematics, turfgrass growth and development, and identification of soils, diseases, weeds, insects and turfgrass species. The competition focuses on the business and financial management side of the superintendent's profession, by including a business management case study. Each team submits one case study essay and one exam for grading. A total of 81 teams competed, representing around 50 university and community colleges from around the country. CSU also completed in the 2006 competition, finishing in the top half out of 90+ teams.

Professional Landcare Network (Planet): Students majoring in Landscape Horticulture (primarily in the Landscape Design and Contracting concentration) make up a team of approximately 18 students who go to the PLANET (Professional Landcare Network) National Student Career Days every year to represent Colorado State University. In March 2006, the event was held at the University of Maryland, where the CSU team was honored to take first place among over 50 colleges and universities. In 2007, the event was held at Michigan State University. Over 55 colleges and universities competed and the CSU team was proud to maintain its top ranking by placing third. The competitive events cover all aspects of the design and contracting field, including sales presentation, plant identification, cost estimating, equipment operation, and construction installation. Not only does the competition give schools the opportunity to showcase their strengths, but it also allows the top employers in the country to find the best students for internships and soon-to-be-graduates for career positions.

ValleyCrest/McWhinney Enterprises Annual Color Design Competition: The ValleyCrest/McWhinney Enterprises Annual Color Design Competition is held each fall semester among students in the CSU landscape design and contracting program. This competition is facilitated by Valleycrest Companies and McWhinney Development. Student teams design and present plans for numerous planting beds in the Centerra Development located in Loveland, Colorado. The winning teams' design is installed the following growing season and each team receives a $600 cash prize as well as a trip to the Valleycrest Corporation headquarters in Calabasas, CA.

CSU Food Marketing Team: The CSU Food Marketing Team (FMT) enjoyed another successful year in 2007. With support from its parent organization, the Agribusiness Association, the FMT competed at both the Western Collegiate Food Marketing Competition in Anaheim, CA and the National Agribusiness Marketing Association (NAMA) Competition in Dallas, TX. At the Western, the team took 2nd place in the professionally judged competition and 1st place in each of three peer-judge categories for "Best PowerPoint Presentation", "Most Likely to Succeed", and "Most Innovative Product" for their plan to market the "Pop-A-Cob" popcorn product. At NAMA, the team faced tough competition and fell to the eventual winning team in an early round. Still, the judges had some highly encouraging comments for the team. The FMT plans to return to NAMA for a second year in 2008.

Internship Opportunities: Each department in the College provides internship opportunities through their respective courses of study. For Academic Year 2006-07, a total of 80 students participated in various internships.

Other Experiential Learning Opportunities:

Legends Horse Sale: The first Legends of Ranching Sale was held on March 11, 2006. Two-year old horses from leading ranches across the US were consigned, fitted and prepared by CSU students. Students from the program, with Dr. Karen Hansen's direction developed the advertising program, the sale catalog and ran the sale. The sale averaged $5,800.00 with the top horses averaging over $15,000. Approximately 1,500 spectators attended the event.

Ag Adventure: Ag Adventure is a program developed to educate elementary school students about the importance of agriculture in their daily lives, such as common products that agriculture provide including milk, cheese, corn, wheat, and wool for clothing, before those products are available in stores. The program provides students with focused, hands-on activities at ARDEC to teach them about a wide range of agricultural enterprises and products. In September, 2007, over 2000 local third-graders participated in the program.

Seed Stock Team: A team of animal science students at Colorado State University practices business and marketing skills by building a cattle breeding stock business. The group, called the seed stock merchandising team, studies breeding and genetics as well as animal care with a project that involves tracking the bloodlines of numerous bulls and heifers, caring for the animals, designing a sale catalog, produce newsletters and advertisements, calling previous customers, and promoting and hosting an annual livestock sale at the college campus. As part of the promotion of their breeding stock, the group brings livestock to show at the National Western Stock Show as well as man a booth about their project on the Stock Show grounds. The sale attracts ranchers from around the west and gives students the opportunity to understand the ins and outs of real business. They meet once a week to discuss the business and plan the sale with the supervision of a professor. Students credit the experience with giving them an edge of experience over other college graduates.

XI. Facilities: The College has made significant progress towards the renovation of two buildings on campus related to agricultural sciences, Shepardson Hall and Animal Sciences. Designs and program reviews were completed in 2006. The President of the CSU System, the Board of Governors and the Colorado Commission of Higher Education have all approved the plans and state funds ($12.2 million) have been committed to aid in the renovations. Significant efforts are underway to raise private funds so that construction may begin. Plans for the renovations may be found at the following website: http://www.agsci.colostate.edu/development/renovation_index.htm

Plant Environmental Research Center (PERC) and campus greenhouses: A total of $1.55 million from bond revenues has been committed to the upgrade and renovation of the campus greenhouses and head houses as well as the facilities at PERC.

XII. Research: Faculty, staff, and students in the College are committed to conducting fundamental and applied research supporting the initiatives outlined in the strategic plan.

The following table shows the history of the number of proposals submitted by faculty and staff in the College:

2004	2005	Change	2006	Change
145	162	17 (11.7%)	189	27 (16.7%)

The following table shows the history of the number and amount of awards received by faculty and staff in the College:

2004	2005	Change	2006	Change*
152 ($9,717,369)	176 ($9,698,415)	24 (15.8%)	166 ($10,995,868)	-10 (-5.7%)

*Note the increase in total dollars awarded ($1,297,453) in spite of fewer awards received.

For FY 2006-07, personnel in the College expended in excess of $11 million dollars on research related activities. This outcome represents a 9.2% increase from the previous year. The goal of the College is to achieve $20 million in expenditures related to research by 2012.

XIII. Undergraduate Education: As stated earlier in this report, the goals of undergraduate education include raising enrollment in the College to 1,600 undergraduate majors, improving the student/faculty ratio, and enhancing international and experiential learning experiences to supplement excellent classroom experiences. Over the last four years undergraduate enrollment rose approximately 100 students and then decreased by 60 students in academic year 2006-07. The College is down just 10 students in fall, 2007. With smaller graduating classes and a 20 percent growth in new freshmen in fall, 2007, the prospect is for a turnaround in total College enrollment. The strategy for enrollment growth is to improve recruiting activity, provide more scholarships, offer new degree programs attractive to a broader range of student interest, improve physical facilities for learning, and provide CSU trained teachers for agricultural teaching positions throughout the State of Colorado.

Recruiting efforts have increased substantially under the leadership of Associate Dean Nancy Irlbeck. Working with the Office of Admissions and our College of Agricultural Sciences Student Ambassadors, College representatives are in a growing number of high schools annually telling the story of career opportunities with an agriculture degree. As reported earlier, total scholarship distribution has risen nearly 50 percent in the last four years growing from $420,000 in 2004-05 to over $600,000 in 2007-08. Scholarships and experiential learning opportunities are a major element of our capital campaign plan. Several new degrees were offered to students in the College. Last year the Interdisciplinary Degree in Organic Agriculture was started. This year we have a new degree concentration in viticulture and enology. The College is planning a new degree in golf course management to begin next year. Improvement in physical facilities will take time. Elsewhere in this report is a description of plans to renovate and expand the Animal Sciences Building and Shepardson. Every student in the College is affected by classrooms in these two buildings; attractive, effective spaces are important for learning success and for successful recruiting. Building renovations and expansions are another important element of our capital campaign.

The College has taken a particularly active position on improving the degree offering in Agricultural Education. This program suffered a lack of attention in past years and low student enrollment and graduation of a small number of agriculture teachers resulting. In the past two years, the College has worked with the School of Education at CSU to hire a faculty position devoted to Agricultural Education. This partnership resulted in the hiring of Kellie Enns. Our objectives are to double enrollment to 60 students, create double majors with Agriculture Education, provide a departmental home for Ag Ed majors, as well as, provide depth of knowledge in one subject field, and create a much stronger relationship with existing agriculture teachers throughout Colorado's high schools. The Agricultural Education Foundation has been helpful in strengthening the program.

XIV. Graduate Education: Departments in the College are attractive to students seeking MS and PhD degrees. However, Colorado is nearly unique in the way it finances graduate education. In most states, a student on a graduate teaching or research assistantship is immediately identified as an employee of the university and offered in-state tuition. In Colorado, only citizens are offered in-state tuition. So, graduate students from other states must pay out-of-state tuition for the first year and do what is necessary to become a citizen during their first year in Colorado to qualify for in-state tuition in their second year. International students can never become Colorado residents and never qualify for in-state tuition. This policy makes graduate education in Colorado much more expensive than other states. The strategy adopted in the College is to allocate more research funds to research projects such that the funds must be spent on graduate students. In fall, 2007, the College experienced the first increase in total number of graduate students in many years. The College desires to raise the number of graduate students from the 214 present in fall, 2007 to 400 in fall, 2014. It will take continuous attention to financial strategies to draw that number of graduate students to the College. The importance of building a graduate program is that the reputation of the institution in the State of Colorado is tied strongly to the quality of the undergraduate and applied research programs. The reputation of a university in the nation and world is tied to the quality of graduate and fundamental research programs. Both are important in building reputation of the institution and maintaining value of Colorado State University degrees.

XV. K-12 Initiatives: The College is significantly involved with youth from kindergarten to high school ages. In spring each year, the College hosts and creates the annual Future Farmers of America (FFA) state competitions bringing over 1,000 high school youth and 300 parents and advisors to campus. The College provides specialist support for 4-H projects, especially in livestock learning and competition projects in counties and at the State Fair. The College hosts Agriculture Adventure, an agricultural awareness program for third graders in the Poudre Valley School District; more than 2,000 third graders visited ARDEC for the program in fall, 2006. The Agriculture Adventure program has been invited to present experiential learning modules for youth at the National Western Stock Show and the Colorado State Fair. Agricultural scientists serve as advisors to high school students participating in Science Fairs on the Western Slope, the San Luis Valley, the Arkansas River Valley and in Fort Collins. The College also is greatly expanding the Agricultural Education degree program with the strategic intent to raise the number of majors in the program to no less than 60 and make it possible to provide a sufficient number of agriculture teachers to fill annual vacancies in Colorado high schools. The University has allocated a new faculty position to the College to enhance the degree program. Additionally, the College is a regular participant in the statewide coordinated effort to organize agricultural education in high schools, community and junior colleges and four-year colleges; this effort is led by the Community College System Office.

XVI. Departmental Analysis: Selected data associated with each department in the College are presented below.

A. Agricultural and Resource Economics: The following table shows the history of the number and type of degrees conferred by the department:

Type of Degree	Number of graduates	Change
BS 2004-05	30	
BS 2005-06	32	2 (6.7%)
BS 2006-07	46	14 (43.8%)
MS 2004-05	10	
MS 2005-06	5	-5 (-50%)
MS 2006-07	2	-3 (-60%)
PhD 2004-05	2	
PhD 2005-06	0	-2 (-100%)
PhD 2006-07	2	2 (100%)

The following table shows the history of student credit hours attributed to the department:

	Hours	Change
2003-04		
Undergraduate	4342.0	
Graduate	754.8	
Total	5096.8	
2004-05		
Undergraduate	4499.0	157 (4%)
Graduate	592	-162.8 (-22%)
Total	5091.0	-5.8 (0%)
2005-06		
Undergraduate	4346.0	-153.0 (-3%)
Graduate	578.0	-14.0 (-2%)
Total	4924	-167 (-3%)

The following table shows the history of the number and amount of grant proposals submitted by faculty and staff in the department:

2004	2005	Change	2006	Change
16 ($1,459,760)	12 ($989,422)	-4 (-25%, -$470,338)	14 ($1,529,051)	2 (16%,$539,629)

The following table shows the history of the number and amount of grants received by faculty and staff in the department:

2004	2005	Change	2006	Change
15 ($2,106,103)	11 ($388,469)	-4 (-27%, -$1,717,634)	14 ($803,037)	3 (27%, $414,568)

Publications: For calendar year 2005, faculty and staff in the department published 23 refereed journal articles. For calendar year 2006, faculty and staff in the department published 34 refereed journal articles, an increase of 11 (48%) from the previous year. In addition, for calendar year 2006, faculty, staff and students in the department produced 178 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

B. Animal Sciences: The following table shows the history of the number and type of degrees conferred by the department:

Type of Degree	Number of graduates	Change
BS 2004-05	150	
BS 2005-06	135	-15 (10%)
BS 2006-07	128	-7 (-5%)
MS 2004-05	5	
MS 2005-06	11	6 (120%)
MS 2006-07	12	1 (9%)
PhD 2004-05	5	
PhD 2005-06	3	-2 (-40%)
PhD 2006-07	4	1 (33%)

The following table shows the history of student credit hours attributed to the department:

	Hours	Change
2003-04		
Undergraduate	7247.0	
Graduate	1025.0	
Total	8272.0	
2004-05		
Undergraduate	6928.5	-318 (-4%)
Graduate	886.0	-139 (-14%)
Total	7814.5	-457.5 (-6%)
2005-06		
Undergraduate	6473.5	-455 (-7%)
Graduate	975.1	89.1 (10%)
Total	7448.6	-365.9 (-5%)

The following table shows the history of the number and amount of grant proposals submitted by faculty and staff in the department:

2004	2005	Change	2006	Change
29 ($4,237,105)	38 ($7,411,952)	9 (31%, $3,174,847)	37 ($3,909,889)	-1 (2.6%, -$3,502,063)

The following table shows the history of the number and amount of grants received by faculty and staff in the department:

2004	2005	Change	2006	Change
36 ($1,481,180)	26 ($1,972,900)	-10 (28%, $491,720)	22 ($3,152,293)	-4 (-15%, $1,179,393)

Publications: For calendar year 2005, faculty and staff in the department published 35 refereed journal articles. For calendar year 2006, faculty and staff in the department published 56 refereed journal articles, an increase of 21 (60%) from the previous year. In addition, for calendar year 2006, faculty, staff and students in the department produced 213 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

C. Bioagricultural Sciences and Pest Management: The following table shows the history of the number and type of degrees conferred by the department:

Type of Degree	Number of graduates	Change
MS 2004-05	5	
MS 2005-06	6	1 (20%)
MS 2006-07	12	6 (100%)
PhD 2004-05	4	
PhD 2005-06	2	-2 (-50%)
PhD 2006-07	1	-1 (-50%)

The following table shows the history of student credit hours attributed to the department:

	Hours	Change
2003-04		
Undergraduate	5429.5	
Graduate	634.5	
Total	6064.0	
2004-05		
Undergraduate	6033.9	604.4 (11%)
Graduate	498.8	-135.7 (-21%)
Total	6532.7	468.7 (8%)
2005-06		
Undergraduate	5386.3	-647.6 (-11%)
Graduate	531.3	32.5 (7%)
Total	5917	-615.1 (-9%)

The following table shows the history of the number and amount of grant proposals submitted by faculty and staff in the department:

2004	2005	Change	2006	Change
48 ($15,161,118)	54 ($13,205,379)	6 (13%, -$1,955,739)	60 ($5,667,182)	6 (11%, -$7,538,197)

The following table shows the history of the number and amount of grants received by faculty and staff in the department:

2004	2005	Change	2006	Change
42 ($1,382,837)	65 ($1,806,409)	23 (55%, $423,572)	69 ($2,302,909)	4 (6%, $496,500)

Publications: For calendar year 2005, faculty and staff in the department published 49 refereed journal articles. For calendar year 2006, faculty and staff in the department published 50 refereed journal articles, an increase of 1 (2%) from the previous year. In addition, for calendar year 2006, faculty, staff and students in the department produced 98 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

D. Horticulture and Landscape Architecture: The following table shows the history of the number and type of degrees conferred by the department:

Type of Degree	Number of graduates	Change
BS 2004-05	78	
BS 2005-06	110	32 (41%)
BS 2006-07	83	-27 (-25%)
MS 2004-05	1	
MS 2005-06	3	2 (200%)
MS 2006-07	2	-1 (-50%)
PhD 2004-05	2	
PhD 2005-06	0	-2 (-100%)
PhD 2006-07	2	2 (100%)

The following table shows the history of student credit hours attributed to the department:

	Hours	Change
2003-04		
Undergraduate	5938.0	
Graduate	222.0	
Total	6160.0	
2004-05		
Undergraduate	5558.0	-380 (-6%)
Graduate	208	-14.0 (-6%)
Total	5766.0	-394 (-6%)
2005-06		
Undergraduate	6484.0	926 (17%)
Graduate	196.8	-11.2 (-5%)
Total	6680.8	914.8 (16%)

The following table shows the history of the number and amount of grant proposals submitted by faculty and staff in the department:

2004	2005	Change	2006	Change
24 ($11,896,688)	21 ($11,054,108)	-3 (-13%, -$842,580)	27 ($9,267,703)	6 (29%, -$1,786,405)

The following table shows the history of the number and amount of grants received by faculty and staff in the department:

2004	2005	Change	2006	Change
16 ($1,376,928)	25 ($2,235,215)	9 (56%, $858,287)	17 ($1,937,010)	-8 (-32%, -$298,205)

Publications: For calendar year 2005, faculty and staff in the department published 41 refereed journal articles. For calendar year 2006, faculty and staff in the department published 22 refereed journal articles, a decrease of 19 (-46%) from the previous year. In addition, for calendar year 2006, faculty, staff and students in the department produced 130 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

E. Soil and Crop Sciences: The following table shows the history of the number and type of degrees conferred by the department:

Type of Degree	Number of graduates	Change
BS 2004-05	20	
BS 2005-06	16	-4 (-20%)
BS 2006-07	11	-5 (-31%)
MS 2004-05	6	
MS 2005-06	6	0 (0%)
MS 2006-07	3	-3 (-50%)
PhD 2004-05	1	
PhD 2005-06	6	5 (500%)
PhD 2006-07	2	-4 (-33%)

The following table shows the history of student credit hours attributed to the department:

	Hours	Change
2003-04		
Undergraduate	3002.3	
Graduate	396.3	
Total	3398.6	
2004-05		
Undergraduate	2958.6	-43.7 (-1%)
Graduate	264.7	-131.6 (-33%)
Total	3223.3	-175.3 (-5%)
2005-06		
Undergraduate	3165.4	206.8 (7%)
Graduate	374.3	109.6 (41%)
Total	3539.7	316.4 (10%)

The following table shows the history of the number and amount of grant proposals submitted by faculty and staff in the department:

2004	2005	Change	2006	Change
28 ($5,844,711)	36 ($5,981,328)	8 (29%, $136,617)	50 ($7,741,565)	14 (39%, $1,760,237)

The following table shows the history of the number and amount of grants received by faculty and staff in the department:

2004	2005	Change	2006	Change
43 ($3,370,321)	47 ($3,268,681)	4 (9%, -$101,640)	41 ($2,637,108)	-6 (-13%, -$631,573)

Publications: For calendar year 2005, faculty and staff in the department published 46 refereed journal articles. For calendar year 2006, faculty and staff in the department published 40 refereed journal articles, a decrease of 6 (-13%) from the previous year. In addition, for calendar year 2006, faculty, staff and students in the department produced 233 other publications, including but not limited to, proceedings, transactions, abstracts, reports, software, websites, textbooks, etc.

Annual Report
2006-07

Ruminant Production Systems

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research, and outreach in cattle/beef production systems and be recognized as the leading university program in cattle/beef production systems in the West. This will include experiential learning in the animal sciences BS degree designed to add practical experience in the science, production, and business aspects of the industry to prepare students for leadership positions in ranch, farm, and agribusiness management. Graduate education and research will focus on fundamental and applied research in breeding, nutrition, physiology, behavior, integrated resource management systems, economics, health, and range/forage management. Outreach will span the breadth of the topics of research to assure that industry participants have practical knowledge in modern beef, dairy, and sheep production systems, biosecurity, economic and risk management, and response to policy and consumer changes. Outreach to youth involved in livestock production and judging events will continue as part of experiential learning in 4-H, FFA, and college judging teams.

Purpose: Animal agriculture is a major economic sector in the United States and the leading agricultural activity in Colorado. In 2006, live meat animal sales in Colorado were valued at $3.6 billion and the value of dairy production was $327 million. Livestock and livestock products accounted for 72% of crop and livestock sales in Colorado. Remaining competitive requires that the industry produce with the most technically sophisticated systems available while considering environmental and animal welfare dimensions to maintain confidence of the consuming public. Ruminant production agriculture is the only significant agricultural enterprise, which is ubiquitous in Colorado. In addition to novel and economic production practices, today's livestock producers must be knowledgeable of alternative supply chains to select a lucrative market, be aware of animal identification and trace-back requirements, understand the effects of emerging animal public health conditions, and understand the international and domestic trade environment and trends and how to respond with risk management strategies. Colorado State has many resources devoted to this broad subject, and it is a fertile field to foster multi-department, multi-college, and multi-county interactions. Young people on or near farms and ranches have opportunities to build maturity by taking responsibility for raising and showing ruminant species; Colorado State University supports experiential learning opportunities for youth through 4-H, FFA, and college judging team contests. Colorado State University is in a strong position to provide undergraduate and graduate education to prepare people for ruminant industry positions, research in the basic animal sciences and production management systems and methods to respond to national and international markets and policy, and outreach to assure dissemination of research knowledge to livestock industry practitioners.

Strategic Actions:

- Renovate the Animal Sciences Building.
- Reposition the Integrated Resource Management teaching and research program.
- Replace critical faculty positions: Livestock Environmental Systems, Animal/Breeding Position, and Dairy Extension Position.
- Elevate the Southeastern Colorado Research Center regarding research/outreach mission.

Critical Resource Growth Needs:

- Secure funds to renovate the Animal Sciences Building ($13 million). Align land and field laboratory facilities with future research and teaching directions.
- Significantly increase grant and contract revenue sources to support all programs.

Accomplishments: Successful programs are built with strong teams comprised of faculty members with complementary skills. This team champions the land grant mission for a ubiquitous cattle/beef industry in Colorado. With a coordinated effort, this team understands what the process requires, and has a passion to get things done. Innovation and discovery are ongoing processes, which reenergizes the members and stakeholders. By having a strategy, this brings the process to the vision and it identifies resources and mobilizes members of the team.

1. CSU Animal Sciences/ Ruminant Production Capstone Courses:

The beef capstone courses create an environment for integrative learning, multidisciplinary thinking, and problem solving. During the past several years, we have increased enrollment in the 476-478 series as students look for opportunities to understand the industry on a broader scale and from the perspective of supply chain management.

2. CSU Seedstock Team:

The seedstock merchandising team is a case-based, industry focused yearlong experience that allows students to make decisions that are measured with customers and market response. The course provides highly motivated students the opportunity to build a professional network based on functional interactions with customers, suppliers, and other participants in the beef industry.

3. CSU Beef Extension/outreach:

During 2006, the CSU Beef Team began to coalesce more fully. A retreat was held in Frisco in late 2006 where members of the team discussed the missions and vision of the team effort. From this forum, the following actions were assigned to be championed by the team (Many of them were completed during the first quarter of 2007): Identify coordinator and other leadership (Jack Whittier, Roger Ellis, and David Colburn), develop the Beef Team List Serve, review CSUBeef.Com, improve internal communication, develop a monthly Ag Press article and annual schedule, schedule 2-4 Beef Team meetings per year, summarize the survey used at Fall Trail Drive meetings, complete the Beef Expert and Structure inventory, inform CSU affiliated departments of the vision and goals of CSU Beef Team, plan and schedule relevant training, organize joint appointments and campus/field organizational structure, finalize involvement of exterior partners in the Beef Team, perform a review of the Beef Team by an outside group and report and update the funding plan.

4. NCBA Producer Education:

Tom Field's work with NCBA has provided us the opportunity to have significant impact on the direction of the beef-learning center. This foundation was built on the white paper dealing with the future of information dissemination in the industry. The first round of the visions steer test for the North American Limousin Foundation (NALF) was so successful that the foundation committed another round of cattle; the results from this project will significantly influence the selection decisions of Limousin breeders throughout North America. We had a successful Taylor Beef Cattle Symposium that reached out to not only regional producers but also our students. This symposium was held in December, 2006 with renewable energy, food systems and opportunities for verification and managing the ranching landscape.

5. South Eastern Colorado Research Center (SECRC):

SECRC Research – This past year has been a very productive year for nutrition research at SECRC. Research activities have included experiments investigating the impacts of: 1) trace minerals, 2) growth promotants and feed additives, 3) feed processing, and 4) feed management strategies on immunity, performance, and carcass characteristics of feedlot steers and heifers. From these research activities, four graduate students have been supported and are responsible for data collection, analysis, manuscript preparation, and formal presentations at producer and scientific meetings. Two posters have been presented at a local scientific meeting and one graduate won the poster competition. Three of the four graduate students presented their research findings at the 2007 Western Section Animal Science Meeting in Moscow, ID.

During the summer of 2006, SECRC hosted two interns from CSU. Each intern was heavily involved in the day-to-day operations of the research feedlot. These activities included feed intake assessment, feed mixing, feed delivery, animal health checks, and maintenance and repair projects. South Eastern Colorado Research Center also hosted an open house consisting of several scientific presentations as well as a dinner for the attendees. Furthermore, the research center continues to host short courses on feedlot processing and management techniques.

6. Agriculture, Research, Development, and Education Center (ARDEC):
ARDEC Research – This past year has been a very productive research year at ARDEC. Several metabolism experiments have been conducted investigating techniques to potentially alleviate the long-term impacts of certain nutritionally related metabolic disorders in cattle and swine. This research has produced one post-doctoral fellow, a presentation at a scientific meeting, an abstract, and a manuscript that is in preparation. Other research has included immunological and nutritional investigations in horses and sheep.

This past summer a Ph.D. student from Spain conducted an internship in the Department of Animal Sciences and conducted several experiments in the metabolism building at ARDEC. She also presented a portion of her Ph.D. research at the Colorado Nutrition Roundtable held at ARDEC. Several laboratories for the Front Range Community College Veterinary Technician Program were also held at ARDEC.

7. Eastern Colorado Research Center (ECRC):
A study was conducted at the Eastern Colorado Research Center to determine the nutritive value, characterize the protein degradability, and determine the effects of seasonal changes on diets selected by cows grazing on northeastern Colorado rangelands. Nutrient content of diets was determined from grab-samples, collected from three ruminally fistulated cows, using the rumen evacuation technique. Samples were collected twice a month during the spring and summer, and once a month during the fall and winter, over a 3 yr period. Forage availability was determined as adequate by ocular assessment. Ingested forage was analyzed for CP, NDF, ADF, NDIP, ADIP, EE and Ash. *In situ* neutral detergent fiber nitrogen kinetics of disappearance was determined. Regression equations to predict nutrients levels (NDF, ADF, CP and undegradable intake protein; **UIP**) were developed from these data. Range samples were highest in quality during the spring and early summer months, especially when precipitation levels were adequate. Crude Protein and UIP levels followed the same trends throughout the year. Fiber content increased with the advance of the growing season, after mid July, for years with average weather conditions. Nutrient levels were highly dependent on weather conditions, especially during the growing season. Understanding seasonal effects, on native range nutritive values, is important for developing cost effective nutrition programs for the cowherd.

8. Beef Improvement Center, Saratoga, WY (Rouse Ranch):
The Center began the year setting a record high average price at the annual bull sale in April. Research continued into the genetics of adaptability to high altitude disease in beef cattle with matings designed to establish genetic ties between the Center's cowherd and popular Angus sires where genetic ties are an essential element of advancing research plans and external funding requests to establish a regional center for genetic evaluation of High Altitude (Brisket) Disease. Student involvement continued as over 90 (under)graduate and veterinary students were involved with internship, classroom, and graduate/capstone project activities involving the ranch animals and production system. To better evaluate the unique beef genetics at the Center and to genetically tie CSU beef cattle research herds, the Center continued to produce replacement females for the ECRC (see above). The resulting offspring will enhance research opportunities and leverage animal resources for more robust data. The Center also provides data for use in development and testing of new genetic evaluation techniques by the CSU Center for Genetic Evaluation of Livestock (see #11). The Center completed a 10 year review with considerable positive feedback from the external review committee (committee consisted of scientists from Cornell University, Iowa State University, and the USDA). Cattle from the Center continue to outperform industry standards with the latest harvest group averaging 26 percentage points' greater choice carcasses than current industry levels.

9. Center for Genetic Evaluation of Livestock

The Center continued to provide genetic evaluation services for 14 beef breed associations with a total membership in excess of 50,000. Funds from these services supported a research associate and two graduate students. As one of the three primary institutions involved in beef cattle genetic evaluation research and production, the Center continued its pivotal role in the National Beef Cattle Evaluation Consortium receiving over $180,000 in research support. These monies support travel, a post-doctoral fellow, a research associate, a graduate student, and summer faculty appointments. Evaluation and research results were used for education purposes in four courses with over 60 undergraduate and graduate students. The Center also provided free genetic evaluation services for the Beef Improvement Center.

Internal Linkages: Several internal linkages have been made over the past year. Members in the Department of Animal Sciences along with the members from Microbiology, Immunology and Pathology (MIP), Clinical Sciences, Philosophy, and Engineering are working together to evaluate alternative methods for animal euthanasia. Furthermore, the Department of Animal Sciences and Clinical Sciences are investigating alternative field diagnostic tools to monitor animal health and Plant Sciences and Animals Sciences are working together investigating endocrine disruptor residues in waste streams.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Majors:

The following table illustrates the trend in the number of undergraduate majors for this strategic initiative:

Major (Fall Semester)	2005-06	2006-07	Increase/Decrease	2007-08	Increase/Decrease
Animal Science	265	277	12 (4.5%)	273	-4 (-1.4%)

*Includes secondary majors

The following table illustrates the trend in the number of graduate majors for this strategic initiative:

Major	2005-06	2006-07	Increase/Decrease	2007-08	Increase/Decrease
Animal Sciences	48	48	0	59	11 (22.9%)

II. Financial Resources:

Faculty and staff representing the departments of Animal Sciences, Agricultural and Resource Economics, Soil and Crop Sciences and the Agricultural Experiment Station dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	FY 2004-05	FY 2005-06*	Change	FY 2006-07**	Change
Resident Instruction	$750,222	$720,290	-$29,932 (-3.99%)	$681,327	-$38,963 (-5.4%)
AES					
State	$508,427	$545,443	$37,016 (7.28%)	$472,945	-$72,498 (13.3%)
Federal	$183,615	$179,807	-$3,808 (-2%)	$155,987	-$23,820 (-13.2%)

Extension					
State	$196,608	$174,245	-$22,363 (-11.37%)	$160,718	-$13,527 (-7.8%)
Federal	$414	$610	$196 (47.34%)	$321	-$289 (-47.3%)
Grant/Contract	$413,117	$399,615	-$13,502 (-3.27)	$569,867	$170,252 (42.6%)
Cash	$1,433,672	$1,107,081	-$326,591 (-22.78)	$2,491,773	$1,384,692 (125.1%)
Gift	$29,583	$40,290	$10,707 (36.19)	$74,932	$34,642 (86.0%)
Totals	**$3,515,658**	**$3,167,381**	**-$348,277 (9.9%)**	**$4,607,870**	**$1,440,489 (45.5%)**

* 30.05 FTE ** 30.08 FTE

III. Refereed Journal Articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 14 refereed journal articles were published. For 2006, 23 journal articles were published.

Analysis: Refereed journal articles increased by 9 from calendar year 2005 to calendar year 2006 for this planning initiative.

IV. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with this strategic initiative participated in approximately 180 workshops/presentations reaching more than 4,440 total number of attendees.

B. Participation in state, national and international committees, programs and task forces:

1. David Ames: ASAS -2008 Century Celebration Chair, Morrison Award Selection, and Representative to ARPAS; ARPAS Board of Directors; AGR Regional Vice President and 2006 National Convention Steering Committee, Co-Chair; Stock Show Association Board; National Western Judges Committee

2. Terry Engle: WSASAS Symposium Committee, Chair; Colorado Nutrition Roundtable Symposium, Chair.

3. Mark Enns: Beef Improvement Federation Board of Directors, Western Region Secretary and Program Planning Committee member; Western Region Coordinating Committee (WERA-1), member and chair.

4. Tom Field: Producer Education Strategic Working Group, NCBA; Liaison with Colorado Livestock Association; Advisor to the Board of Directors, North American Limousine Foundation.

5. Dorian Garrick: ASAS Board Member and program committee; Member, American Society of Animal Science Editorial Board; Western Section ASAS Advising and coordinating committee; Director, National Beef Cattle Evaluation Consortium.

6. Brett Kaysen: Livestock Task Force for 4-H; Projects and Curriculum committee; 4-H and MQA Task Force; National Western Stock Show Catch-a-calf and Junior Show committees; National Association of 4-H Agents, Livestock Task Force, Vice President.

7. Steve LeValley: Livestock Task Force for 4-H; 4-H QA Task Force; NWSS Judges Committee; NWSS Junior Show Committee; CSF Livestock Committee; CWGA Promotion Committee; Craig Ram Sale Committee; Mountain State Lamb Coop – Technology Committee; Colorado Ram Test Association Coordinator.

8. Jack Whittier: AFIA Ruminant Nutrition Research Award Committee.

9. Norm Dalsted: Advisory Committee member for the Western Center for Risk Management; Member of the Advisory Board, Northern Colorado Agribusiness Association, Inc.

10. Steve Koontz: Coordinated the NCCC-134 Project Tactical Advisory Committee member, Livestock Marketing Information Center.

11. Jay Parsons: Serves as member of the NAIS Sheep Working Committee and Colorado Animal ID Working Committee.

12. Joe Brummer: Colorado Section of the Society for Range Management, Board of Directors and Investment Committee, member; Member, High Altitude Revegetation Committee; Member, Western Coordinating CommitteeWCC-1002.

13. Danny Smith: Member, Statewide Water Supply Initiative – Phase II Panel: Alternatives to Permanent Agricultural Water Transfers.

External Linkages:
Faculty have excellent working relationships with key personnel in federal agencies, e.g., USDA-APHIS, USDA-FAS, and associations such as, NCBA, CLA, CCA, WDPA, CPPC, CFB, CBC, CWG and CHC as well as an excellent interaction with meat processors such as Swift & Co., Cargill Meat Solutions. Additionally, the Group has conducted numerous research and educational activities for the National Cattlemen's Beef Association, the American Sheep Industry Association, and numerous beef breed associations. Research is underway, funded by APHIS-USDA, to help select appropriate means for identifying cattle, sheep and swine for animal-health protection traceability. Numerous other nutrition research trials are underway funded by the private sector at our ruminant research facilities.

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: William Wailes
Steering Committee Chair(s): Jack Whittier, Terry Engle, Shawn Archibeque
Steering Committee Members: Kraig Peel (IRM & AS), Frank Garry (CVMBS), Joe Brummer (SCS), Stephen Koontz (DARE), Robbie LeValley (CE), Bruce Bosley (CE), George Beck (BSPM), Roger Ellis (VMBS), Mark Enns (AS) Hyungchul Han (AS), Steve LeValley (AS)

A. Agricultural and Resource Economics:
Faculty: Norm Dalsted, Jay Parson, Dustin Pendell

B. Animal Sciences:
Faculty: Tom Field, Temple Grandin, Brett Kaysen, John Wagner, Jack Whittier, David Ames
Post Docs: Nichole Marcillac
Admin. Pro. Michael Boyce, Brian Brigham, Doug Couch, Travis Hoffman, Mike Moon, Chad Murnin, Misti Roberts, Scott Speidel, Casey Thompson, James Wood, Randy Blundell, Dusty Wallace
Fac. Affil.: Patrick Burns

C. Soil and Crop Sciences
Faculty: Jessica Davis

D. Agricultural Experiment Station
Admin. Pro.: Beth Lashell, Doug Zalesky

E. Colorado State University Extension
County agents: Adrian Card, David Colburn, John Deering, Marlin Eisenach, Bill Ekstrom, Bruce Fickenscher, Eldon Fisher, Larry Hooker, Michael Jarosz, Michael Livingston, Keith Maxey, Tom McBride, CJ Mucklow, Bill Nobles, Dean Oatman, Rod Sharp

F. Other Non-College Faculty and Staff: NREL – Niall Hanan

Annual Report
2006-07

Meat Science and Animal Product Food Safety

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research and outreach in meat science and animal product food safety and be recognized nationally as one of the top three university programs. This will include experiential learning in the animal science BS degree designed to add practical experience in meat science and microbiology and to prepare students for leadership positions in the meat production and food manufacturing industries and regulatory agencies. Graduate education, research, and outreach will focus on pre-harvest management of livestock to prevent acquisition of human pathogens in livestock production and handling, post-harvest detection and management systems to prevent and control contamination of meat products with human pathogens, assessment of production systems and regulatory protocols for effective food safety results and domestic and international credibility of the meat products, and producer, consumer, and food handler education in food safety to prevent or control contamination and food safety risks.

Purpose: Animal agriculture is a major economic sector in the United States. The red meat industry contributes substantially to the U. S. economy. Each year 30 to 35 million cattle (26.5 million fed steers and heifers), 80 to 92 million hogs, and 5 to 7 million lambs are marketed in the U. S. Remaining competitive requires that the industry provide consumers with products that meet their demands for safety, wholesomeness, quality, convenience, and price. Efforts in meat science focus upon the manner in which food animals are produced, harvested, processed and presented to consumers in order to be safe and desirable for consumption, and on appearance and palatability of fresh beef, pork and lamb. A specific need is to assure that US fresh meat is acceptable to both domestic and international markets and performs beyond expectation when consumed. Extensive efforts have generated research results and pertinent documents intended to assist the industry to solve problems related to *Escherichia coli* O157:H7, *Salmonella* and other pathogenic bacteria in fresh beef or pork, *Listeria monocytogenes* in processed ready-to-eat meat products, and bovine spongiform encephalopathy in beef. As new food safety issues develop (e.g., the advent of antimicrobial resistance of food-borne pathogens, etc.), it will be increasingly important that proactive scientific investigations occur for policy-makers and regulators to have access to the necessary factual information from which sound regulatory decisions may be made. Additional efforts are aimed to enhance consumer confidence that livestock producers, packers, and processors generate products from animals that are reared in a compassionate manner, handled appropriately, and produced with environmentally responsible methods. Colorado State is in a strong position to assist with the economic development of Colorado's livestock and meat industry and to enhance the public health of citizens by educating meat industry scientists and professionals, by researching technical and economic issues related to improved product quality, safety and international competitiveness, and by being actively involved with the livestock and meat industry and governmental agencies to assure that the latest knowledge is incorporated in management, education and regulatory decisions.

Strategic Actions:

- Continue developing approaches for meat science and safety research management to be more responsive to industry, regulatory, and export issues.
- Develop new approaches with which to transfer technology from research to industry and governmental partners.
- Increase support staff including graduate students and Research Associates.
- Develop a five-year BS/MS degree program in Meat Science, following consultation with industry to determine needs and commitment.
- Secure funding for renovation of Animal Sciences building

Critical Resource Growth Needs:

- Renovate and expand the Animal Sciences Building to improve laboratory, classroom, and office space (estimated at $17 million).
- Add a faculty position in the area of meat processing.
- Secure one endowed faculty chair to raise the level of one faculty position.
- Add two Post-Doctoral Fellows, two Research Associates, two meat science/food safety outreach professionals, and 18 graduate student first-year stipends.
- Secure an additional $50,000 annually for faculty, student, and outreach professional travel and project development.

Accomplishments:

The increasing complexity of our food production, processing and distribution systems, as well as the continuous development of new products by the food industry to answer consumer demands for convenience, changing lifestyles and dietary preferences, challenges producers, processors, distributors, retailers, researchers, regulators and public health authorities to work on ensuring exemplary product safety and quality at a reasonable cost. Assuring that consumers have access to a dependable supply of high quality and safe meat products is the main mission of the Meat Science and Animal Product Food Safety program, as applied by the Center for Meat Safety & Quality (CMSQ) at Colorado State University.

In general, food safety is a dynamic, ever-changing issue, which requires generation of new information and continuous re-evaluation of existing knowledge in order to counter newly developed, perceived or recognized threats or risks, and to develop effective and economic means for their control, without adverse effects on product quality. Specific meat safety and quality issues which have received scientific, public health, industry and regulatory attention, as well as publicity, in recent years include: meat and poultry inspection activities, procedures and priorities of the Food Safety and Inspection Service of the United States Department of Agriculture such as performance-based inspection, decontamination of carcasses with chemical rinses, control of pathogens in ready-to-eat meat and poultry products, nationwide microbiological baseline surveys for pathogens, and Hazard Analysis Critical Control Point (HACCP) programs; humane treatment of animals; meat composition, quality and palatability; growth and development of meat animals; work-place safety; bovine spongiform encephalopathy (BSE); pesticide, hormone, antibiotic and drug residues in carcasses; bans of exports of red meat products to countries such as those of the European Union and Japan due to inspectional differences or safety issues such as BSE; instrument grading and tenderness assessment; nutritional labeling; food irradiation; product cross-contamination; levels of fat, cholesterol and other lipid components in meat products; and, in general, control of microbiological pathogens such as *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella* and *Campylobacter*. In addition, interest is increasing for adoption of International Organization for Standardization (ISO) Quality Standards by various segments of the food industry as they seek equal and fair competition in overseas markets. A major concern for the cattle and meat industry is the pathogenic bacterium *E. coli* O157:H7 which may be transmitted through consumption of undercooked ground beef or other beef products, and now other foods (such as fresh lettuce and spinach), and affect children and immunocompromised individuals. Another pathogen of concern is *Listeria monocytogenes* which causes an estimated 2,493 cases of listeriosis and 499 deaths annually in the US due to meningitis, abortions and stillbirths. The pathogen survives and multiplies in adverse environments, even under refrigeration, and may contaminate ready-to-eat meat and poultry products. Because there is an obvious need to control such pathogens in order to enhance the safety of meat and other food products, federal regulatory and public health agencies (FSIS, FDA, CDC) have established regulations that require the industry to develop and implement means of pathogen control in sensitive foods. The expertise available at the CMSQ of Colorado State University has the capability to/and contributes to the solution of all of the above issues.

Colorado State University scientists conducted research addressing current red meat (a) safety, (b) quality, and (c) marketing issues in 2006. Efforts to restore beef export trade continued following the 2003 detection of BSE in the U.S. Although several key export markets were re-opened to shipments of U.S. beef (e.g., Japan, Korea,

etc.) in 2006, export volume remained low due to overly-restrictive trade terms concerning definitions for prohibited tissues; research was initiated to assist U.S. negotiators and domestic policy-makers in clarifying such definitions. Prevalence of BSE in U.S. cattle has remained at two positive cows since initiation of enhanced surveillance in June of 2004. Research conducted to modify Egyptian storage life requirements for imported U.S. beef variety meats was presented to the Egyptian government, resulting in modification of import restrictions and significant increases in U.S. beef exports during 2006 and the first quarter of 2007. Additionally, the group conducted a study to better characterize cattle that do, versus cattle that do not, persistently shed *E. coli* O157:H7 using molecular techniques; this research resulted in isolation of *E. coli* O157:H7 molecular subtypes from a larger population that displayed relatively greater attachment efficacy than less prevalent subtypes, even in light of equal presence of virulence factors. Over time, food safety efforts continue to generate reduced prevalence of food-borne pathogens on meat as documented by USDA-FSIS and CDC.

Red meat quality issues were addressed by completing efforts to characterize postmortem aging patterns and tenderness improvement of 18 beef muscles, resulting in NCBA Guidelines for Beef Aging. In addition, research addressing reduced value of "out" non-conforming beef carcasses marketed in formula, grid, or branded beef programs was conducted leading to better understanding of how fed cattle should be priced in such markets; an effort that will improve value of fed cattle substantially. Efforts to research beef carcass instrument grading technology resulted in significant advancements during 2006; USDA-AMS now has approved video image analysis (VIA) instruments for official measurement of ribeye area (REA) and marbling scores, as well as for official application of Yield Grades. Commercial adoption of instrument augmentation for purposes of beef carcass grade application is anticipated to be widespread in 2007, and a similar project has been initiated by the American Sheep Industry Association, USDA, and our scientists to accomplish similar advancements in lamb carcass grading.

Summarizing, in the past 24 months, accomplishments of scientists at the CMSQ include:

- Red meat quality issues were addressed by completing efforts to characterize postmortem aging patterns and tenderness improvement of 18 beef muscles, resulting in NCBA Guidelines for Beef Aging.
- Efforts to research beef carcass instrument grading technology resulted in significant advancements during 2006; USDA-AMS approved video image analysis (VIA) instruments for official measurement of marbling scores.
- Grading instrumentation now is approved for use in official USDA assessment of (a) ribeye area (REA), (b) Yield Grades, and (c) marbling scores for application of Quality Grades. Commercial adoption of instrument augmentation for purposes of beef carcass grade application is anticipated to be widespread in 2007.
- Faculty members of CMSQ interacted with management personnel of National Pork Board, National Meat Association, National Cattlemen's Beef Association, AMS-USDA, Southwest Meat Association, American Meat Science Association, National Institute for Animal Agriculture, American Association of Meat Processors, National Renderers Association, APHIS-USDA, FSIS-USDA, U.S. Meat Export Federation, FDA-USDHHS and American Meat Institute as well as with cattlemen, cattle feeders, beef packers and beef retailers on issues related to foreign animal disease, meatborne pathogens, quality/palatability/shelf-life, value-determining characteristics, export-market access, animal identification and traceability, animal care and handling and meat-waste disposal.
- The CMSQ scientists were interviewed by persons from the local, state, national and international media, appeared on television and on expert panels, have participated in teleconferences and have worked diligently—behind the scenes—to help shareholders in the meat industry mitigate risk and maximize profitability.
- Faculty members of the CMSQ delivered lectures on meatborne pathogens in 21 countries and traveled to Egypt, Vietnam, Japan, South Korea, Mexico, Taiwan and China as members of U.S. trade teams.

- A test developed by CSU scientists for demonstrating safety (freedom from central nervous system tissue) of U.S. beef relative to BSE Specified Risk Material removal in U.S. beef packing plants is used throughout the world.
- Faculty members served on the US/Japan BSE Working Group, US Beef Export Verification Program Planning Committee, USDA Age-Month (Beef Carcass Maturity) Expert Committee, and International BSE Expert Forum.
- A faculty member presently serves as Editor of the Journal of Food Protection, is a member of the National Advisory Committee on Microbiological Criteria for Foods, and serves as international advisor on European Union funded food safety projects of multi-institution consortia.
- A substantial amount of research geared towards addressing prevalence and control of *E. coli* O157:H7 and *Salmonella* in live animals pre-harvest, and on carcasses and fresh meat post-harvest and during processing, and on *Listeria monocytogenes* in ready-to-eat meat and poultry products was conducted, presented at national and international meetings, and published in scientific journals and trade magazines. Over time, these food safety research efforts continue to contribute to the reduction of food-borne pathogens on fresh meat and processed products as documented by USDA-FSIS and CDC.
- Four major research grants were obtained in 2005-2006 to support research related to *Listeria monocytogenes* as it applies to control in food and to human health. Results obtained from this research will be used to determine the ecology of bacterial pathogens in settings related to human health, and will develop ways to mitigate risks associated with the pathogen.
- Three research grants were obtained in 2006 to support development of rapid methods for toxic microorganisms including rapid assays for detection of *Salmonella* and *Listeria monocytogenes*, and work is ongoing to develop a rapid test for *E. coli* O157:H7.
- Training was provided for graduate students in food safety at the pre-harvest, post-harvest, processing and retail level, in molecular approaches to track and control foodborne pathogens in the human food chain, and in pathogen detection and identification. These students are highly sought-after for employment at the national and international level to fill positions that will contribute to the enhancement of the safety of our food supply.
- Independent research opportunities were provided for undergraduate students in order to facilitate interest in pursuing graduate training in food safety.
- Educational and research opportunities were provided for women and minorities in food safety.
- Results of studies are being used by industry as it applies antimicrobial interventions to animals pre-harvest, carcasses during slaughter, and to processed meat products for reduction, inactivation or control of pathogens. This allows meat plants to comply with regulatory criteria, meet commercial product specifications, and provide safer products to consumers.

Dr. John Sofos, a professor in the Department of Animal Sciences, was recently named a University Distinguished Professor, a title conferred upon the most outstanding faculty members of Colorado State University for the duration of their association with the institution. The status is determined by records of performance ranking him among the most outstanding members of his discipline as reflected by his research, publications, exhibitions, artistic performances or other mode of accomplishments appropriate to his discipline. Distinguished Professors have received national and international competitive awards, prizes, honors, and/or other forms of recognition of outstanding achievement. They will have earned the title of University Distinguished Professor because of their records of continuing and cumulative accomplishment in their areas of specialization, artistry or expertise. Teaching and mentoring are also considered in the selection process.

Internal Linkages:
In completing several live-cattle pre-harvest food safety efforts, the group has worked closely with the Animal Population Health Institute (APHI) in the College of Veterinary Medicine and Biomedical Sciences—both on projects in which APHI faculty were PIs and on projects in which Animal Science faculty were PIs—and with USDA/APHIS Center Epidemiology and Animal Health. Additionally, the group currently is conducting collaborative research with the Veterinary Diagnostic Laboratory and the USDA/APHIS National Wildlife Laboratory (Foothills Campus) related to biowaste disposition and dissemination of Transmissable Spongiform

Encephalopathies. The group has an on-going relationship with Clinical Sciences personnel in the College of Veterinary Medicine and Biomedical Sciences, and has submitted several research proposals in conjunction with that group. Relative to diagnostics development efforts associated with BSE and trade issues, along with Beef Quality Assurance programs, the group has worked closely with Microbiology, Immunology, and Pathology Department and Biomedical Sciences Anatomy Section scientists in the College of Veterinary Medicine and Biomedical Sciences. They have conducted collaborative projects related to animal traceability and biosecurity with the Department of Computer Sciences and the USDA/APHIS/VS/NCAHP/SIP National Animal Identification System. Scientists in the Departments of Animal Sciences and Agricultural and Resource Economics are presently working together on a project related to the National Animal Identification System, to assist APHIS-USDA in improving "Animal Termination Reports" filed by cattle, sheep and swine harvesters and renderers. Scientists of the CMSQ are involved in conducting research related to farm animal and human health aspects of BSE. They had a very close working relationship for a number of years and are working collaboratively on several projects with Pat Kendall of the Department of Food Science and Human Nutrition of the College of Applied Human Sciences. Animal sciences faculty provide the food microbiology expertise and Dr. Kendall the consumer and health care provider extension/outreach component in a really integrated effort. They are participating in the Food Safety cluster in the Colorado State University Infectious Diseases Supercluster; John Sofos will be directing that effort. Lastly, the group works very closely on most research activities with Drs. Chapman and ZumBrunnen of the Department of Statistics, and have co-authored many peer-reviewed publications with our group.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Financial Resources:

Faculty and staff representing the departments of Animal Sciences and Agricultural and Resource Economics in the College of Agricultural Sciences dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident tuition, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant expenditure activity within these areas:

Fund Type	**FY 2004-05**	**FY 2005-06***	**Change**	**FY 2006-07****	**Change**
Resident Instruction	$509,510	$482,626	-$26,884 (-5.28%)	$503,261	$20,635 (4.3%)
AES					
State	$268,594	$280,981	$12,387 (4.61%)	$252,706	-$28,275 (-10.1%)
Federal	$117,543	$112,828	-$4,715 (-4%)	$106,343	-$6,485 (-5.7%)
Extension					
State	$128,635	$110,795	-$17,840 (-13.87%)	$110,866	$71 (0.1%)
Federal	$20	$451	$431 (2155%)	$264	-$187 (-41.5%)
Grant/Contract	$547,663	$1,224,887	$677,224 (123.66%)	$1,598,521	$373,634 (30.5%)
Cash	$575,587	$695,278	$119,691 (20.79%)	$491,894	-$203,384 (-29.3%)
Gift	$212,088	$118,238	-$93,850 (-44.25%)	$118,476	$238 (0.2%)
Totals	**$2,359,640**	**$3,026,084**	**$666,444 (28.24%)**	**$3,182,331**	**$156,247 (5.2%)**

* 12.30 FTE ** 17.13 FTE

II. Refereed Journal Articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 24 refereed journal articles were published. For 2006, 34 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased 10 from calendar year 2005 to calendar year 2006.

III. Outreach activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the planning initiative participated in 194 total workshop/presentations. The number of participants at these workshop/presentations was not reported in the Annual Faculty Evaluations and therefore, cannot be reported here.

B. Participation in state, national, international committees, programs and task forces:

1. Wendy Umberger: W-1177 Committee Chair and coordinated the January 2006 meetings; WEMC Chair; AAEA Extension Section Western Director; Farm Foundation Executive Panel on the Future of Animal Agriculture; Served on expert panel for the GAO National Animal ID Systems.

2. Keith Belk: USDA-AMS-LS "Beef Summit" participant (2006); National Western Stock Show Fed Beef Committee (1996-2006); USDA-NCBA Beef Instrument Grading Task Force (2003-2006); USDA-ASI Lamb Instrument Grading Task Force (2006); American Meat Science Association "Scientific Information Committee" (2006-2007); Secretary, U.S. International Organization for Standardization (ISO)/American National Standards Institute (ANSI) Technical Advisory Group for ISO Subcommittee 6, Technical Committee 34 (1997-2006).

3. Lawrence Goodridge: American Society for Microbiology, Annual Biomedical Research Conference for Minority Students Travel Grant Selection Committee.

4. John Scanga: Superintendent NWSS Fed Beef Contest and Committee Member; Superintendent NWSS 4-H/FFA Round-Up Meats Judging Contest; Superintendent NWSS Jr. Market Livestock Carcass Data Collection; Superintendent Colorado State FFA Meats Judging Contest; Superintendent Colorado State 4-H Meats Judging Contest; National Meat Association Undergraduate Scholarship Selection Committee; USDA-AMS-LS "Beef Summit" participant; USDA-NCBA Beef Instrument Grading Task Force.

5. John Sofos: American Meat Science Association Committee on RMC Program, Member International Association for Food Protection, Journal of Food Protection Management Committee, Ad hoc Member; International Association for Food Protection, Meat and Poultry Safety and Quality Professional Development Group, Member; International Association for Food Protection, Retail Food Safety and Quality Professional Development Group, Member; International Association for Food Protection, Microbial Risk Analysis Professional Development Group, Member; International Association for Food Protection, Food Hygiene and Sanitation Professional Development Group, Member; International Association for Food Protection, Food Safety Network Professional Development Group, Member; Institute of Food Technologists Expert Panel on Antimicrobial Resistance (2004-2006), Member; Institute of Food Technologists, Food Microbiology Division, Chair-

elect and Chair; National Advisory Committee for Microbiological Criteria in Foods, Member; Board of Scientific and Policy Advisors, American Council on Science and Health, Member; Experiment Station Committee on Organization and Policy (ESCOP) / Extension Committee on Organization and Policy (ECOP), Food Safety Subcommittee, Member; United States Department of Agriculture Food Safety and Inspection Service, HACCP Coordinator for the State of Colorado; Food and Drug Administration, Denver District Laboratory, Science Advisor for Microbiology; Food and Drug Administration, Division of Field Science, Science Advisors Working Group, Member; Food Microbiology Research Conference, Executive Committee, Member; Promotion and Tenure Evaluator for University of Georgia and Ohio State University.

6. Joseph Tatum: American Meat Science Association: Chair, Recognition Committee; International Congress of Meat Science and Technology, U.S. Delegate and Participant; NWSS Fed Beef Committee; Elanco Animal Health – Meat Science Advisory Committee; Beef Improvement Federation Program Committee; Pfizer Animal Health – Technical Consultant; Coleman Natural Beef – Technical Consultant.

External Linkages:
Faculty have excellent working relationships with key personnel in several federal agencies, e.g., USDHHS-FDA, USDA-AMS, USDA-FSIS, USDA-APHIS, USDA-FAS, and associations such as AMI, FMI, NMA, and NAMP, and excellent interaction with meat processors such as Swift & Co., Cargill Meat Solutions, Tyson Fresh Meats, National Beef Processors, the Smithfield Beef Group, Harris Ranch Beef, Sam Kane Beef Processors, Hormel, etc. Additionally, the Group has conducted numerous research and educational activities for the National Cattlemen's Beef Association, the National Meat Association, the American Meat Institute Foundation, the American Meat Science Association, the National Pork Board, the National Pork Producer's Council, the American Sheep Industry Association, several beef breed associations, and a wide array of private companies (e.g., Booth Creek, Purac, Novozymes, RMS Research Management Systems, Inc., Nolan Ryan Tender Aged Beef, Food Safety Net Services, LLC, Chipotle, etc.). Research is presently underway, funded by CSREES-USDA under the National Integrated Food Safety Initiative, involving collaboration with scientists from Cornell University, Ohio State University, University of Nebraska, and Kansas State University. Additional research is underway, funded by APHIS-USDA, to help select appropriate means for identifying cattle, sheep and swine for animal-health protection traceability.

Faculty and staff associated with Strategic Initiative

Administrative Advisor: Bill Wailes
Steering Committee Chair: John Sofos
Steering Committee Members: Daryl Tatum (AS), Gary Smith (AS), Keith Belk (AS), John Scanga (AS), Pat Kendall (FSHN), Larry Goodridge (AS), Kendra Nigthingale (AS), Marisa Bunning (FSHN), Dustin Pendell (DARE)

A. Animal Sciences
Faculty: Temple Grandin, Hyungchul Han, John Wagner
Admin. Pro.: Ifigenia Geornaras, Tanner Carpenter, Travis Hoffman
Post Doc.: Avik Mukherjee, Yohan Yoon, Hua Yang

B. Agricultural and Resource Economics
Faculty: Wendy Umberger

Annual Report
2006-07

Equine Science and Business

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, and outreach in equine sciences, and be recognized as the leading university program in equine science in the nation. Undergraduate education will include experiential learning designed to add practical experience in the science, production, sales, and show management aspects of the equine industry and prepare students for leadership positions in the equine industry. Graduate education will consist of a master's degree program in Equine Industry Leadership to further scientific and business knowledge in the field. This will complement existing graduate programs in Reproductive Physiology and Equine Nutrition. Outreach will focus on youth and adult horse competition organization and teaching, nutrition and waste management for horse owners, and equine management on small acreage holdings. NOTE: This goal refers only to the planned activity of the College of Agricultural Sciences and the Agricultural Experiment Station. It does not include strategic goals of the College of Veterinary Medicine and Biomedical Sciences.

Purpose: Estimates place the U. S. population of horses at 9.2 million with an industry economic impact of $102 billion. In Colorado, the horse population is 194,000 and the economic value of the equine industry in Colorado is $754 million. At Colorado State, the undergraduate program is a major within the Department of Animal Sciences in the College of Agricultural Sciences. In fall 2007, the program had 389 undergraduate majors. The program is the largest undergraduate major in the College of Agricultural Sciences and enjoys a national reputation; approximately 50% of the students are non-residents. The equine teaching and outreach program was reviewed in 2004 with considerable input from industry leaders and others. A thorough revision of the curriculum was undertaken during the fall of 2004 to make changes deemed important by the industry leaders to better prepare students to be successful in the industry. The largest service and outreach audience are participants in the 4-H equine project, one of the largest 4-H projects with activities ranging from competitions to educational activities. Adult outreach is offered with an adult horsemanship program, farrier science and management short courses, and extension programs in nutrition, small acreage management, and waste management.

Colorado State University is in a strong position to assist with the economic development of Colorado's equine industry and enhance the well-being of citizens with interests in horses by educating equine industry professionals and hobbyists, researching technical and economic issues related to equine production, training, and utilization, and being involved with the equine industry, governmental agencies, youth and other consumers to assure that the latest knowledge is incorporated in management and regulatory decisions.

Strategic Actions:

- Enhance faculty size.
- Develop $500,000 annually in scholarship support.
- Pursue additional support for the CSU Polo Program.
- Classroom addition to the existing facilities that would become an outreach center for the entire equine program.
- Renovation of existing office complex.
- Either cash donations or an endowment that will generate $50,000 per year for administrative and faculty/staff development needs.
- Research endowment for faculty located within the Equine Teaching and Outreach program.
- Addition of 30 stall heated barn for the fitting and preparation of horses for the Legends of Ranching Sale.
- Addition of a cover for the outdoor arena to increase the potential space for classes.

Critical Resource Growth Needs:

- Acquire one additional tenure track faculty position.
- Continue to develop a significant fund-raising program to support the Equine Sciences undergraduate program, especially for scholarships and facility and animal maintenance.
- Continue International emphasis.
- Secure an Extension specialist dedicated 100% to equine program.

Accomplishments

A. The non-thesis master has been developed under the direction of Dr. David Denniston and the first students were enrolled in the fall of 2005. The first student completed her program of study in the Spring 2007. She has assumed a leadership position with the American Quarter Horse Association. Expectations are that future graduates will do the same.

B. A show team was in place for the fall of 2005. Students participated in several shows within the local area. This provided an opportunity for a major gift of $35,000 in equipment from TransWest trucks.

C. A therapeutic riding class was added to the curriculum starting in the fall of 2005. The course was taught again in the spring of 2006. Approximately 60 students took the courses. The equine program maintains 3-5 horses for this program and has developed a partnership with the Front Range Exceptional Equestrians program. In the fall of 2006, CSU hosted a major Therapeutic Riding workshop exposing its facilities to a national audience. The first Legends of Ranching Sale was held on March 11, 2006. Horses from leading ranches across the US were consigned and the two year olds were fitted and prepared by CSU students. Students from the program, with Dr. Karen Hansen's direction developed the advertising program, the sale catalog and ran the sale. The sale averaged $5,800.00 with the top horses averaging over $15,000. Approximately 1,500 spectators were there for the event. In addition, the event was publicized in several national magazines. The Legends of Ranching Sale has not only exposed students to the opportunity but also to leading breeders and exhibitors. The national exposure due to the sale has greatly increased the programs visibility. The sale continued in 2007 and again was successful. For 2008, the sale will move to campus and will include a one day outreach event for the equine community and the program's students.

D. A detailed individual advising plan is in place. Students receive group advising for curricular issues and individual advising by faculty members for career counseling. In addition, with the help of additional support from the department a half-time advisor has been hired. The first small acreage management/nutritional program was conducted in the fall of 2005. This event was well attended and supported by the industry. The program's presence at the Colorado Horse expo was expanded both in Denver and at the regional events in Durango and Grand Junction (25,000 people attend these three events). The program is receiving recognition for its individual attention to students. In addition, the program has initiated a 1st year experience program for all of its entering students.

E. An internship coordinator has been hired and there seems to be additional activity and participation by students. Twelve students traveled to Europe to conduct clinics for AQHA during 2007. This has allowed greater exposure of our students to the industry and fostered greater support from industry.

F. The judging team continues to be successful. This spring they won the APHA spring contest. In addition, the women's polo team was reserve national champions. The Judging team's success is a prime recruiting tool for outstanding students and provides national publicity.

Internal Linkages: Within Colorado State, the Equine Teaching and Outreach program has worked with the College of Business, CSU Extension, Department of Ag and Resource Economics, College of Veterinary Medicine and Biomedical Sciences, Facilities, and the Veterinary Teaching Hospital

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Majors:

The following table illustrates the trend in the number of undergraduate majors for this strategic initiative:

Major (Fall Semester)	2005-06	2006-07	Increase/Decrease	2007-08	Increase/Decrease
Equine Science*	413	397	-16 (-3.8%)	389	-8 (-2.0%)

*Includes secondary majors

II. Financial Resources:

Faculty and staff representing the Animal Sciences department in the College of Agricultural Sciences dedicated time to this strategic initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	FY 2004-05	FY 2005-06*	Change	FY 2006-07**	Change
Resident Instruction	$291,152	$275,237	-$15,915 (-5.47%)	$425,112	$149,875 (54.5%)
AES					
State	$153,362	$160,797	$7,435 (4.85%)	$213,727	$52,930 (32.9%)
Federal	$67,165	$64,463	-$2,702 (-4%)	$89,871	$25,408 (39.4%)
Extension					
State	$72,410	$61,779	-$10,631 (-14.68%)	$91,625	$29,846 (48.3%)
Federal	$12	$265	$253 (2108%)	$228	-$37 (-14.0%)
Grant/Contract	$33,707	$34,646	$939 (2.79%)	$14,236	-$20,410 (-58.9%)
Cash	$0	$0	$0 (0%)	$0	$0 (0%)
Gift	$8,164	$0	-$8,164 (-100%)	$27,175	$27,175
Totals	**$625,972**	**$597,187**	**-$28,785 (-4.6%)**	**$861,974**	**$264,787 (44.3%)**

* 7 FTE ** 7 FTE

III. Refereed Journal Articles:

Refereed journal articles published from faculty and staff dedicated to this strategic initiative were counted for calendar years 2005 and 2006. For 2005, 3 total refereed journal articles were published and for 2006, 5 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased by 2 from calendar year 2005 to calendar year 2006.

IV. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with this planning initiative participated in approximately 55 workshops/presentations reaching more than 605 total number of attendees.

B. Other highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- David Denniston: Engaged in developing several new programs. The Equine Science faculty has created the first ever Horse Judging Short Course. Continued to develop new and innovative programs involving horses and youth in Colorado. Continued to enhance the youth horse program and bring innovative programs and educational opportunities to the largest extension meeting in the state of Colorado – the Rocky Mountain Horse Expo (RMHE). Continued to further national and international presence within the horse industry to forward the credibility and reputation of CSU.
- Roberta Skelton: Assisted in the production of the first Legends of Ranching Performance Horse Sale –March, 2006 – Denver, CO. Coordinated Students in training and fitting 21 head of horses for the sale and during the sale coordinated 25 students in the care, presentation, demonstration of 21 horses during the sale.
- Tiare Wells: During the course of the year, put together seven 4-H riding clinics. These clinics were taught in AN442 class and were offered to 4-H members along the Front Range. These clinics were well received and will be offered again in the next year.

C. Participation in state, national and international committees, programs and task forces:

1. David Denniston: Colorado Horse Council Board Member, 2006; APHA Show and Contest Committee, 2006; Rocky Mountain Horse Expo Educational Program Committee; Colorado Horse Council Board Member; National Horse Judging Team Coaches Association – President; and American Paint Horse Association Show and Contest Committee.

2. Robbie Skelton: **Ring Steward -** Redbud Spectacular – Oklahoma City, Oklahoma – June, 2006; American Paint Horse Association World Show – Fort Worth, Texas – June 20-July 5, 2006; American Quarter Horse Youth Association World Show – Fort Worth, Texas – August, 2006.

3. Jim Heird: Judged numerous competitions including AQHA World Championship Show, NWSS, and Palarmo Livestock Expo; Member and Vice Chair, Colorado Board of Stock Inspection; Chair, Colorado Horse Development Authority; Chair, Versatility Ranch Horse and Horse classification committees, NWSS; Vice-Chair, AQHA Show committee, Chair, Versatility Ranch Horse sub-committee, member, World Show Task Force and Show Council.

External Linkages: The Colorado State Equine Teaching and Outreach program maintains relationships with the Quarter Horse Association, American Quarter Horse Association, National Western Stock Show, Various ranches and farms, feed companies, realtors, banks, truck and trailer dealers and equipment dealers.

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Bill Wailes
Steering Committee Chair: Jim Heird
Steering Committee Members: Jason Bruemmer (AS), Karen Hansen (AS), Jeff Goodwin (CE), Pat McCue (CVMBS), Dave Denniston (AS), Alexis Lamm (CE), Robbie Skelton (AS), Tiare Wells (AS), Equine Advisory Committee

A. Extension Agents: Members of the 4-H Equine Advisory Committee.

B. Non-College of Agricultural Sciences faculty and staff:
College of Business: Ajay Menon, John Olienyk, John Hoxmeier, Sue Hine

Annual Report
2006-07

Animal Environmental Systems

Goal: Colorado State University will enhance its focus, depth, and integration in undergraduate education, graduate education, research, and outreach in environmentally sound systems for animal production units and be recognized as the leading university program in the West and among the top five university programs nationally in cattle and equine environmental systems. This will include experiential learning in courses contributing to the BS in Animal Sciences, Equine Sciences, and Soil and Crop Sciences designed to add practical experience in the science and applications of environmental management systems for air and water quality protection related to animal production systems. Graduate education, research, and outreach will consist of masters and doctoral degree programs related to livestock nutrition and management, soil science, engineering, and economics of waste management systems and the evaluation of production systems and regulatory protocols for effective environmental protection.

Purpose: In 2006, live meat animal sales in Colorado were valued at $3.6 billion and the value of dairy production was $327 million. Livestock and livestock products accounted for 72% of crop and livestock sales in Colorado. The Colorado horse population is 194,000 with an economic value of $754 million. Cost effective technologies to protect soil, water, and air quality near livestock production sites is one of the most limiting factors to growth in the livestock industries. Livestock production in the South Platte Basin is known to have resulted in nitrate contamination of groundwater and elevated phosphorus levels in reservoirs. Water quality issues are not limited to nutrients, but could include pathogens and pharmaceuticals. The Arkansas Basin, Great Plains, and Tri-River Area (Gunnison, Uncompagre, and Colorado Rivers) on the West Slope face similar issues. Over the last decade livestock operations have become more concentrated, thus multiplying the potential for environmental hazards. Rapid urbanization along the Front Range has led to increased competition between urban and rural water uses and increased conflict between urban and rural people. Regulatory enforcement has increased at both federal (EPA) and state (Colorado Water Quality Control Commission and Colorado Air Quality Control Commission) levels.

Colorado State University is in a strong position to assist with the economic development of Colorado's livestock and equine industry, to enhance environmental quality, and to enhance the public health of citizens with improved livestock environmental solutions by educating livestock and equine industry professionals and small acreage owners in best management practices for nutrient management and odor and dust control; researching technical and economic issues related to improved animal production practices; and being actively involved with livestock and equine industry personnel, governmental agencies, and small acreage owners, to assure that the latest knowledge is incorporated in management and regulatory decisions.

Strategic Actions:

- Establish an active Institute for Livestock and Environment with a governance structure to regularly promote professional development, communication, joint project and grant proposal development, and teaching and outreach program development; the Institute will organize continuous relationships with livestock production organizations and regulatory agencies to create the position of knowledge leader in the topic area; potential subunits include water quality, air quality, improved production systems, and policies and regulations.
- Develop new approaches for animal environmental system research management to be more cohesive and more responsive to industry and regulatory issues.
- Develop new approaches with which to transfer technology from research to industry and governmental partners.
- Develop Colorado industry funding mechanisms, like market order (check-off) systems, to provide sustainable sources of revenue for research and educational work in animal environmental systems.

- Develop an active graduate program in animal environmental systems, thereby, attracting more graduate students in this area to CSU.

Critical Resource Growth Needs:
- Hire staff to support the Institute for Livestock and Environment, especially a program assistant.
- Add a producer-based check-off fund of $500,000 annually to support animal environmental research and education, and increase grant funding.

Accomplishments: Knowledge of livestock producers (feedlots, dairies, and swine) regarding management practices to reduce their environmental impact has been improved in 2006 through two efforts: the Agricultural Air Quality Workshop and the inclusion of a monthly article by Animal Environmental Systems scientists in the Colorado Livestock Association newsletter. We have not attempted to document how this knowledge may have influenced attitudes or actions at this point, but that is our long-term goal.

In addition, we have aided regulators in increasing their scientific understanding of agricultural and environmental issues so that regulations can be written and enforced based on the best science available. We participated in several Colorado Department of Public Health and Environment stakeholder groups including Concentrated Animal Feeding Operations, Housed Confined Swine Feeding Operations, Composters, and the Rocky Mountain National Park Ag Team.

We have also increased the knowledge base of livestock by-product composters (through participation in the Rocky Mountain Organics Council), environmental consultants, and Natural Resource Conservation Service and Extension field staff through various outreach activities. In addition, several CSU faculty members spoke at the national conference for state and federal Concentrated Animal Feeding Operations regulators, the International Soil and Water Conservation Society's Annual Meeting, and the World Congress of the International Union of Soil Scientists in 2006, broadening the impact of our research beyond Colorado's boundaries.

Internal Linkages: Development and implementation of environmental solutions for livestock production require a multi-disciplinary effort. Therefore, our steering committee is made up of faculty from three departments in the College of Agriculture, as well as, faculty from the colleges of Engineering, Liberal Arts, Natural Resources, and Veterinary Medicine. In total, 11 departments are represented in our satellite teams (air, water, pathogen, energy, and pharmaceutical teams).

Graduate student knowledge of environmental issues facing animal agriculture was improved through the development and teaching of AN/SC 548 Issues in Manure Management for the first time in Fall 2006. Five students from Animal Science, Equine Science, and Soil Science programs were trained. These students will become leaders in their respective fields where they will be making choices based on their new knowledge.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Financial Resources:

Faculty and staff presenting Agricultural and Resource Economics and Soil and Crop Sciences departments in the College of Agricultural Sciences dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agricultural Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to

determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas.

Fund Type	FY 2004-05	FY 2005-06*	Change	FY 2006-07**	Change
Resident Instruction	$54,566	$62,939	$8,373 (15.34%)	$55,291	-$7,648 (-12.2%)
AES					
State	$56,952	$54,396	-$2,556(-4.49%)	$53,380	-$1,016 (-1.9%)
Federal	$26,809	$30,512	$3,703 (13.81%)	$28,062	-$2,450 (-8.0%)
Extension					
State	$19,959	$21,909	$1,950 (9.77%)	$18,894	-$3,015 (-13.8%)
Federal	$521	$0	-$521 (-100%)	$0	$0 (0%)
Grant/Contract	$24,659	$93,549	$68,890 (279.37%)	$142,991	$49,442 (52.9%)
Cash	$0	$0	$0 (0%)	$0	$0 (0%)
Gift	$6,847	$63	-$6,784 (-99.08%)	$271	$208 (330.2%)
Totals	**$190,313**	**$263,368**	**$73,055 (38.39%)**	**$298,889**	**$35,521 (13.5%)**

* 3.5 FTE ** 4.5 FTE

II. Refereed Journal Articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 0 refereed journal articles were published. For 2006, 3 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased by 3 from calendar year 2005 to calendar year 2006.

III. Outreach activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in 28 workshop/presentations reaching more than 981 total number of participants.

B. Other highlighted examples demonstrating engagement and outreach in this strategic initiative include:

- the Agricultural Air Quality Workshop on February 9, 2006 co-sponsored with the Colorado Livestock Association
- the beginning of a monthly article in the Colorado Livestock Association's newsletter in November 2006
- Nutrient Management training with the Natural Resource Conservation Service and the Colorado Department of Public Health and Environment for the Rocky Mountain Ag Business Association in January 2006

C. Participation in state, national, international committees, programs and task forces:

- Participated in the Outreach Team and lead the Emerging Issues team of the National Livestock and Poultry Environmental Learning Center (led by the University of Nebraska)
- Participated in S-1000, a regional project with a focus on animal waste management impacts on the environment

- Developed and organized 2-part symposium on Antibiotics and the Environment for the International Soil and Water Conservation Society's Annual Meeting
- Served as a member of the program development team for the CAFO Roundtables, a national conference for state and federal Concentrated Animal Feeding Operation regulators.

External Linkages: We have strong external linkages with the Colorado Livestock Association and the Colorado Department of Public Health and Environment. It is our intention to improve the scientific basis of environmental decision-making by both livestock producers and regulators. In addition, we are partners with the Rocky Mountain Organics Council (professional composters organization), the USDA Natural Resource Conservation Service (technical advisors to livestock producers), the Livestock and Poultry Environmental Learning Center (linking scientists to decision-makers), EPA Region 8, and the Rocky Mountain Ag Business Association; and we testify regularly before the Colorado Water Quality Control Commission and the Colorado Air Quality Control Commission.

Faculty and Staff associated with this Strategic Initiative

Administrative Advisor: Lee Sommers
Steering Committee Chair: Jessica Davis
Steering Committee Members: Catherine Keske and Gorm Kipperburg (DARE), Shawn Archibeque (AS), Sybil Sharvelle (Civil Eng), Michael Carolan (Sociology), Maria Fernandez-Gimenez (FRWS), Frank Garry (Clinical Sciences)

A. Agricultural and Resource Economics
Faculty: Chris Goemans, Dustin Pendell

B. Animal Sciences
Faculty: Lawrence Goodridge, Kendra Nightingale

C. Soil and Crop Sciences
Faculty: Thomas Borch, Reagan Waskom, Troy Bauder
Admin. Pro.: Kathy Doesken, Adriane Elliott

D. Extension Agents: An extension field staff team will be added in 2007.

E. Non-College of Agricultural Sciences faculty and staff:
Civil and Environmental Engineering: Sybil Sharvelle, Amy Pruden, Kenneth Carlson
Mechanical Engineering: Bryan Willson
Atmospheric Sciences: Jeffrey Collett
Forestry, Rangeland, and Watershed Stewardship: John Stednick, Richard Knight
Sociology: Michael Carolan, Michael Lacy
Environmental Health: Stephen Reynolds
Clinical Sciences: Paul Morley
Microbiology, Immunology, and Pathology: Daniel Gould

Annual Report
2006-07

Fundamental Biology of Plants and Plant Pests

Goal: Colorado State University will enhance its focus and depth in graduate education and research in fundamental plant biology and be recognized nationally and internationally as a competitive institution for national and international grants that is attractive to graduate students across the United States and the world. This will include graduate education and research in molecular biology and genomics of crop plants and their pests, mechanisms of biological resistance to pests, mechanisms of invasion of weed species, plant physiology and ecology, and understand the molecular, cellular, whole plant, and ecological foundations for crop improvement and crop pest management.

Purpose: Fundamental plant biology linking basic science with applied science is important to bring the results of basic plant science toward a usable form for applied agricultural sciences. Molecular biology and genomics are opening many new pathways for crop plant improvement and pest management, which will enhance the economic development of agricultural regions, enhance human health through more nutritious and safer food products, and find fundamental solutions to societal issues through renewable and sustainable crop production and pest management. Successful applied crop science, environmental science, and pest management do not occur in the absence of scientists actively involved in fundamental plant and pest sciences. Colorado State University is in a strong position to assist with the economic development of Colorado's agricultural industry and to enhance the public health and well-being of citizens with research in fundamental genetic potentials of crop plants, management of plant pests, and preparation of industry, government, and academic scientists.

Strategic Actions:

- Build greenhouse and laboratory facilities (including growth chambers) to EPA, USDA-APHIS, and NIH standards to permit research with transgenic and exotic pest organisms.
- Build faculty capacity in secondary metabolism and the genomics and population genetics of complex traits.
- Fully engage in the cross-college plant molecular biology consortium to seek jointly major grants, training grants, and graduate student recruiting.
- Expand a separate cross-college graduate degree program.
- Expand involvement in a Clean Energy supercluster, Crops for Health, C2B2 and Infectious Diseases to build Plant Science program strategically.

Critical Resource Growth Needs:

- Secure funds to build/improve greenhouse and growth chamber facilities for future phases. Develop vision for long-term growth.
- Secure one endowed chair faculty position.
- Enhance contract and grant income.
- Add $100,000 annually for first year graduate students support in the molecular plant science consortium.
- Renovate or build new office and research laboratory space for two new faculty positions.
- Add faculty positions in secondary metabolism, genomics of complex traits and population genetics of complex traits.

Accomplishments

1. Graduate Education

This planning study has supported the development of the Program in Plant Molecular Biology, an interdepartmental program formed with the goal to train and produce the next generation of world-class plant biologists. This program is a vehicle for recruiting the very best, highly motivated graduate students into fundamental plant biology and will enable Colorado State to greatly enhance graduate education and thereby the

university's research capacity. Students are exposed to faculty in several departments and are better able to find appropriate mentors.

2. Research

a. Biofuels: Personnel from the Planning Study have been actively involved in the development of Colorado State's Clean Energy Supercluster. The Supercluster has a major emphasis on the development of biofuels. The strengths of the planning study group in plant genomics, metabolomics, and more broadly in plant molecular biology will enable it to play a critical role in the development of plants that are better suited to the production of biofuels. Increased production and utilization of biofuels will enable progress toward US energy independence and the reduction in net release of the greenhouse gas CO2 into the environment.

b. Genetic Sequencing of Multiple Varieties of Rice: Important resources are being developed, including data on genome sequences of 20 comprehensively characterized rice lines, valuable rice genetic stocks and an expansive single nucleotide polymorphism (SNP) database. This publicly available, multi-varietal SNP data will be a powerful resource to investigate the frequency and distribution of molecular variation across the rice genome, assess evolutionary forces shaping the rice genome, and identify candidate genes controlling important traits. In the long term, the information will be used to improve rice and other crop plants (such as the close relative, wheat), and to enhance plant genomic research. Expected impacts include the development of varieties with higher nutritional value and varieties resistant to devastating plant diseases.

c. Broad Spectrum, Durable Resistance in Crop Plants: Important insights are being developed into the molecular basis of quantitative disease resistance. Such insights are a critical step toward developing broad spectrum, durable resistance. From a practical perspective, knowledge of the effects of the targeted candidate genes will guide breeding programs as they strive to provide long-term solutions to disease problems. For example, this information will provide the basis for deciding which candidate genes should be transferred together into a given crop variety to provide optimal quantitative resistance. Initial target crops are rice and other related cereals such as wheat.

d. Genomics of Economically Important Colorado Crops: Wheat Genomic studies are leading to Russian wheat aphid (RWA) resistance, improved end-use quality, and stress tolerance. Genomics tools are helping to identify new resistance sources, map resistance genes, improve cultivar evaluation methodology, and evaluate drought tolerant lines. One aspect of this effort is the identification of genes from unadapted wheat lines and wild wheat and barley germplasm that can then be moved into ergonomically acceptable cultivars. Already, additional wheat germplasm has been identified that is resistant to the new RWA biotypes that overcome the resistance factors in existing cultivars. This germplasm can form the basis of the development of cultivars effective against the new RWA biotypes.

e. Build capacity in bioinformatics, especially related to the evolution and distribution of novel, complex traits.

Internal Linkages:

A number of members of the Fundamental Biology of Plants and Plant Pests Initiative are involved in the Infectious Disease Supercluster. Jan Leach is a leader of the plant sciences section of this supercluster. Cross linkages are expected to grow. In addition, there are active linkages with the newly named Supercluster in Clean Energy, and there are a number of opportunities for linkages with the newly named Cancer Supercluster. Strong linkages are already in place with the Center for Bioinformatics. Within the College of Agricultural Sciences, recently hired faculty and faculty who will take positions in which searches are in process in Animal Sciences and Horticulture and Landscape Architecture likely have some interests in common with this initiative. These faculty are expected to become involved in this Initiative.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Expenditures:

Faculty and staff representing the Bioagricultural Sciences and Pest Management and Soil and Crops Sciences departments in the College of Agricultural Sciences dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agricultural Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	2004-05	2005-06*	Change	2006-07**	Change
Resident Instruction	$169,621	$185,228	$15,607 (9.2%)	$249,225	$63,997 (34.6%)
AES					
State	$289,270	$317,974	$28,704 (9.92%)	$387,381	$69,407 (21.8%)
Federal	$91,137	$103,092	$11,955 (13.12%)	$117,042	$13,950 (13.5%)
Extension					
State	$101,730	$107,737	$6,007 (5.9%)	$136,403	$28,666 (26.6%)
Federal	$16,084	$15,957	-$127 (-0.79%)	$20,468	$4,511 (28.3%)
Grant/Contract	$507,260	$449,667	-$57,593 (-11.35%)	$703,914	$254,247 (56.5%)
Cash	$0	$0	$0 (0%)	$0	0%
Gift	$3,219	$1,680	-$1,539 (-47.81%)	$29,898	$28,218 (1679%)
Totals	**$1,178,321**	**$1,181,335**	**$3,014 (0.26%)**	**$1,644,331**	**$462,996 (39.2%)**

* 11.35 FTE **14.24 FTE

II. Refereed Journal Articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 9 total refereed journal articles were published. For 2006, 10 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased by 1 from calendar year 2005 to calendar year 2006.

III. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the planning initiative participated in 10 workshop/presentations reaching more than 500 total number of participants.

B. Other highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- Scott Nissen: Obtained a successful grant from the Agricultural Distance Education Consortium (ADEC), which provided $75,000 to develop online modules dealing with herbicide mode of action, weed ecology and herbicide resistant weed management. A group of weed scientists and education specialists from Colorado State University, University of Nebraska, Kansas State University, New

Mexico State University and Oregon State University cooperated in the project. These Internet-based modules deal with applied and advanced biochemical information on herbicide mode of action. The modules were designed to be suitable for credit and non-credit offerings as well as providing computer animations that could be downloaded for classroom or outreach educations. A total to ten lessons were developed covering 1) herbicide absorption, translocation and metabolism, 2) herbicide modes of action and 3) herbicide resistance.

- Pat Byrne: Spoke on different aspects of transgenic crops with the Northern Colorado Dietitians' Association, the Colorado chapter of the American Institute of Chemical Engineers, and a public issues program televised by the City of Aurora; and gave a lab tour and presentation on molecular markers to a group of 28 high school students in the Univ. of Northern Colorado's Frontiers in Science program.
- Jan Stephens and Jan Leach: Established an outreach project in 2005 designed to enhance knowledge of plant biotechnology for public school students and teachers. This program, supported by the National Research Initiative Plant Genome Program of USDA's Cooperative State Research, Education and Extension Service, introduces children and young adults, particularly those in rural Colorado, to the processes of biotechnology and helps them to conduct research on the topic and understand the benefits and drawbacks of genetically modifying plants for human use. The project also aims at encouraging a new generation of students to consider plant biology as a field of study at the university level. In 2005, 525 students and several teachers and mentors went through the program. In 2006, 684 students and their teachers were involved, and in 2007 training has been provided to one elementary school teacher and one high school teacher in the use the a classroom kit developed by the project. These teachers are now conducting the activities in their classrooms. In addition, 90 5th grade students went trough the training. More events are planned in 2007.

C. Participation in state, national and international committees, programs and task forces:

1. Ranu Rajinder: Hosted National Center for Biotechnology Information-NIH Training Program in Bioinformatics and Genomics, March 23-24, 2006.

2. Jan Leach served as President of the American Phytopathological Society.

External Linkages

The most productive external linkages for this strategic initiative are likely to be related to biofuels and more traditional uses of plants in agriculture. The lead in biofuels is being taken by the Clean Energy Supercluster. Discussions with both Monsanto and Beyer are ongoing regarding partnering in various ways. Opportunities for interactions with other agribusinesses entities are being pursued through College of Agricultural Sciences development efforts.

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor and Steering Committee Chair: Tom Holtzer
Steering Committee Leadership: Jan Leach (BSPM) and Dan Bush (Biology)
Steering Committee Members: Nora Lapitan (SCS), Cecil Stushnoff (HLA), Dennis Knudson (BSPM), Sarah Ward (SCS), Craig Bond (DARE)

A. Bioagricultural Sciences and Pest Management
Faculty: Stephen Chisholm, John McKay, Scott Nissen, Rajinder Ranu,
Post Docs: Maria Diaz, Hiromichi Ishihara, Harald Meimberg
Admin Pro.: Janice Stephens, Cory Zoetewey

B. Horticulture and Landscape Architecture
Faculty: Harrison Hughes

C. Soil and Crop Sciences
Faculty: Patrick Byrne, Junhua Peng
Admin. Pro.: Deborah Badillo

D. Potential additional faculty include: Patricia Bedinger, June Medford, Marinus Pilon, Elizabeth Pilon-Smits, A.S.N Reddy

E. Center for Bioinformatics
Faculty: Andre Ptitsyn, Ann Hess, Richard Casey

Annual Report
2006-07

Crop Improvement

Goal: Colorado State University will continue undergraduate education, graduate education, applied research, and outreach in:

- genetics and breeding of cultivars for wheat, potatoes, and dry edible beans focusing on characteristics relevant to pest resistance and climatic conditions of Colorado.
- the improvement of human health attributes of crops via shared planning and purpose with those focused on the Crops for Health initiative.
- evaluating and selecting specialty crops, and appropriate production/marketing approaches for Colorado growers.

Purpose: Non-hybrid crop plants require public investment in genetic improvement to provide varieties of cultivars which improve yield, resist environmental and pest stresses, and serve the consuming public. Colorado State has a history of providing cultivar breeding for wheat, dry beans, and potatoes to serve the industries in climatic zones represented in Colorado. Additionally, Colorado State has a history of providing crop selection and testing in other agronomic crops and fruits and vegetables to support the development of these agricultural industries in Colorado. In 2006, wheat generated $184 million in commodity sales, dry beans $24 million, potatoes $207 million, and other agronomic crops and vegetable and fruit crops generated $1.17 billion, in Colorado. The value of these industries to the Colorado economy through other related economic activity is at least double these combined amounts. The miracles of molecular biological science have presented new opportunities to extend the selection and improvement of Colorado crops to incorporate improved human nutritional characteristics. Colorado State University is in a strong position to assist with the economic development of Colorado's agricultural industry and to enhance the public health of citizens with research and education to:

- Improve crops which resist environmental and biological pests, increase price and lower cost of production
- Enhance the success of small-acreage producers who will meet the growing demand for locally produced fruits and vegetables grown organically.
- Incorporate higher human nutritional values of food crops
- Educate agricultural industry, governmental, and academic professionals in the principles of crop selection and improvement.

Strategic Actions:

- Pursue transdisciplinary "Supercluster" status for the Crops for Health Program.
- Recruit more graduate students and post-doctoral fellows supported by grants and check-off resources.
- Add faculty expertise needed to sustain the new program in Organic Agriculture. For both of these efforts in Colorado, vegetable crops expertise is the greatest need.
- Add faculty positions (one an endowed chair) in plant chemistry, plant biochemistry and molecular genetics of novel nutritional traits.
- Finalize trademark for Crops for Health and marketplace opportunities.

Critical Resource Growth Needs:

- Secure substantial grant support for fundamental research linking human nutrition to the development of food crop improvement.
- Secure funds for two faculty positions, including one endowed chair in the area. These include :
  - one in plant biochemistry and one in molecular genetics; both with responsibility to establish a research program to clarify, and more fully commercialize, the mechanisms whereby metabolites confer health-promoting attributes to dry bean, potato and wheat cultivars.

- Substantial investment in Crops for Health supercluser.
- Shepardson building renovation and labs.

Accomplishments

This topical area has been given high priority in planning because of the important impacts that are expected. The long term impact will be to assure the profitability of food crop production in Colorado, while establishing agriculture as an instrument of public health via the disease preventing attributes of crops and their products in human diets. These are life-altering impacts that will only be felt as the cumulative result of strategic actions over many years. Initial impacts from this effort will include specific outcomes that benefit producers, as well as ones that guide well-conceived program planning and priority-setting.

Impacts that can be identified now include:

- New crop cultivars developed by plant breeders to sustain the profitability of Colorado crop producers. This represents long-term cumulative impact. The potato breeding program - through increased yields, improved quality and reduced need for nitrogen and other inputs –is estimated to have added $15M to $18M in annual value to the Colorado crop. Approximately 50 % of the state's total potato acreage is planted with cultivars developed and characterized by the CSU program. This positive impact is also felt nationally. Of all potato cultivars released since 1990 by the 12 U.S. breeding programs, those developed by CSU ranked first in the nation in total acreage approved for seed certification. Furthermore, three of the top 10 cultivars in the U.S. for seed were developed by CSU. Similarly, the wheat breeding program – through increased yields, end-use quality improvement and reduced production risks – is estimated to have added about $20M to the state's annual crop value. Nearly 60% of Colorado wheat acreage was planted with CSU-bred cultivars in 2006. CSU researchers have also now provided markers for a gene that confers resistance to the Russian Wheat Aphid, promising new solutions to a significant economic problem for Colorado wheat growers. In addition, the CSU dry bean breeding program continues to provide high yielding cultivars with resistance to all major races of rust. Released cultivars support a viable bean seed industry in western Colorado, worth about $2M.
- Clarification of the plant breeding/cultivar development priorities at CSU, to include the importance of value-added aspects of dry bean, potato and wheat breeding for Colorado growers, especially the marketing potential in "Crops for Health". This approach has become a focal point for research and outreach at CSU. The award of the USDA National Needs Fellowship grant in this area illustrates its growth and potential as does the early effort to obtain "supercluster" status.
- Applied research and the transfer of water-conserving technology to vegetable growers in the Arkansas Valley has enabled those producers to enhance their profitability now, and to look forward to a positive future in the face of increasing water transfers to urban areas. The key part of this has been the adoption of drip irrigation and plasticulture techniques.
- Greatly expanded service to a wide network of small acreage fruit and vegetable growers delivered by the applied research and outreach of the Specialty Crops Program (SCP), made possible by a unique partnership with the Colorado Department of Agriculture (CDA). This involves multiple teams of CSU researchers, specialists and agents throughout the state, with grower-initiated projects guided by CSU technical advisors. There have been about 60 grower grants over the last five years, providing a strong foundation for innovation and increased profitability. The Rocky Mountain Small Organic Farms Project, which demonstrates optimum cultivar selection and crop production practices, as well as marketing approaches to small acreage producers, is another key element of the SCP.
- Viticulture research and outreach has contributed to the success and growth of grape production and wine-making, especially in western Colorado, where this is now not only an important component of agriculture, but a key driver of that region's tourism industry. This positive impact has led to program growth, made possible by the funding of a new enology position through collaboration between CSU and the wine grape industry.
- Implementation of the Interdisciplinary Studies Program in Organic Agriculture. Early student response suggests a highly viable future for this program. Viticulture & Enology has also been developed as a new concentration, with implementation expected in the next academic year.

- Organization and delivery of the 2nd Annual "Agriculture Big and Small" Conference, with emphasis on vegetable crops and organic practices.
- Facilities improvements and development of a comprehensive program plan for the San Luis Valley Research Center. A similar program plan approach has been initiated for the Western Colorado Research Center.
- Breeding programs in wheat, dry bean, and potatoes are well organized in the departments of Soil and Crops and Horticulture and Landscape Architecture with financial support from the Agricultural Experiment Station and respective industry check-off programs. The new metabolomics initiative calls for the establishment of the Research Consortium in Agriculture and Metabolic Diseases.
- Secured faculty position in enology with responsibility to establish a program of research and outreach designed to improve the quality of wines made from Colorado-grown grapes.

Internal Linkages: Much of the work which has produced these impacts, and which will generate more in the future, has involved active interaction with faculty and staff from multiple disciplines, agencies and academic units. This includes notable collaborations between those in the College of Agricultural Sciences and colleagues in other Colleges at CSU, involving efforts such as: the supercluster pre-proposal, and the successful USDA National Needs Fellowship grant in Crops for Health; planning of, and probable teaching contributions to the Viticulture & Enology program ; and involvement in chemical ecology studies that seek to add value via medical and/or agricultural applications. In addition, future work under this strategic initiative will have greater impact as CAS faculty contribute to the incipient inter-institutional School of Public Health.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Financial Resources:

Faculty and staff representing the Horticulture and Landscape Architecture and Soil and Crop Sciences departments and the Agricultural Experiment Station in the College of Agricultural Sciences dedicated time to this strategic initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**2004-05**	**2005-06***	**Change**	**2006-07****	**Change**
Resident Instruction	$117,327	$120,395	$3,068 (2.61%)	$265,676	$145,281 (120.7%)
AES					
State	$514,063	$523,972	$9,909 (1.93%)	$767,421	$243,449 (46.5%)
Federal	$150,402	$150,360	-$42 (-0.03%)	$237,549	$87,189 (58.0%)
Extension					
State	$94,548	$112,862	$18,314 (19.37%)	$195,334	$82,472 (73.1%)
Federal	$193	$0	-$193 (-100%)	$0	$0 (0%)
Grants/Contracts	$2,343,395	$2,157,343	-$186,052 (-7.94%)	$1,906,333	-$251,010 (-11.6%)
Cash	$463,415	$533,530	$70,115 (15.13%)	$672,220	$138,690 (26.0%)
Gifts	$21,787	$89,950	$68163 (312.86%)	$69,876	-$20,074 (-22.3%)
Total	**$3,705,130**	**$3,688,412**	**-$16,718 (-0.45%)**	**$4,114,409**	**$425,997 (11.5%)**

* 39 FTE ** 39.58 FTE

II. Refereed journal articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 20 total refereed journal articles were published. For 2006, 18 total refereed journal articles were published.

Analysis: Total refereed journal articles published decreased by 2 from calendar year 2005 to calendar year 2006.

III. Outreach Activities

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in approximately 119 workshops/presentations reaching more than 5,482 total participants.

B. Highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- Frank Stonaker: The Rocky Mountain Small Organic Farm Project (established in 2004) continued to provide demonstration plantings of interest to growers, extension agents from Colorado and Wyoming. The trials also provided employment and internship opportunities for several CSU students wishing to experience intensive organic vegetable production and Community Sustainable Agriculture (CSA) marketing. The self supporting CSU CSA, in its second year, continued to be enjoyed by 55 members (CSU faculty and staff). Families were invited to visit the farm on two occasions and share in the experience of picking a wide selection of vegetables. The CSA marketing effort also allows SCP to develop educational materials for growers with valuable marketing and production information specific to CSA operations.
- Mike Bartolo: Met directly with many growers and other individuals directly involved with agriculture. Many of the aforementioned contacts were in the office, at conferences, or in the field. In addition to contacts with growers, met with and spoke to community service organizations and local and regional economic development groups. As part of my community service activities, served as a judge at the local and state fairs.
- Rob Davidson and Merl Dillon: co-host in organizing the Southern Rocky Mountain Ag Conference, a four day event with a trade fair for the agriculture industry in southern Colorado. Typically, over 250 individuals attend each day of the conference which includes a potato day (100% responsible), a grain day, livestock/forage, water day and miscellaneous topics. Additionally, the Colorado Potato Administrative Committee and the Colorado Certified Potato Growers' Association, Inc. have scheduled their annual meetings to coincide with this conference.
- Calvin Pearson: During 2006, responded throughout the year to telephone calls, office/research center visits, emails, and a few onsite visits for people for information related to agronomic issues and problems. These contacts are not limited to western Colorado. Some inquiries come from people in other regions of the state and other states. Handled several inquiries from the Midwest from seed company representatives and university personnel during September and October 2006 regarding technical information on Blunt Ear Syndrome (BES) of corn.

C. Participation in state, national and international committees, programs and task forces:

1. Rob Davidson: National Potato Council and US Potato Board to the Potato Association of America (past President 2005/06) as a member of several committees; WERA-089 Potato Virus Disease Control Coordinating Committee, Colorado's representative and an active member.

2. Mike Bartolo: Vegetable Crops Situation/Outlook Review: 2006 Colorado Agricultural Outlook Forum; Member, Pueblo Chile Marketing Grant Advisory Board; Member, Lower Arkansas Valley Water Conservancy District Grant Advisory Board; and Member, Planning Committee for the 2006 and 2007 Colorado Produce Conference / Colorado Big and Small Conference.

3. Harrison Hughes: Served as Co-Chair of the opening scientific session of the Third International Date Palm Conference in Abu Dhabi, UAE held February 19-21, 2006. Served on the Scientific Committee of the conference.

4. Jorge Vivanco: Meeting Organizer for the Second International Symposium on Plant Neurobiology, Beijing, China, May 22-27, 2006.

5. Samuel Essah: Vice Chair, Physiology section of Potato Association of America; Member, Potato Association of America Executive Committee; American Society of Agronomy, Crop Science, and Soil Science Membership and Society Identity Committee; Minorities in Agronomy, Crop Science, and Soil Science Society of America (ACS) Steering Committee.

6. David Holm: WERA027 (Western Coordinating Committee for Potato Variety Development) – Colorado Representative; Southwest Regional Potato Cultivar Development Working Group.

7. Horst Caspari: Member of the Steering Committee for the National Grape and Wine Initiative; Member of Review Panel – Cultural Practices, USDA-Viticulture Consortium West (30 proposals)

External Linkages
There are major external linkages to numerous program elements related to Crop Improvement, reflecting the economic importance of this work to Colorado. Examples include the Colorado Certified Potato Growers Association, Colorado Department of Agriculture, Colorado Potato Administrative Committee, Colorado Wheat Research Foundation, the USDA, the Rocky Mountain Association of Viticulturists and Vintners, and the Colorado Wine Development Board.

Faculty and Staff associated with the Strategic Initiative:

Administrative Advisors: Gary Peterson, Steve Wallner
Steering Committee Chair: TBD
Steering Committee Membership: Scott Haley (SCS), Mark Brick (SCS), David Holm (HLA), Frank Stonaker (HLA), Horst Caspari (HLA), Mike Bartolo (HLA), and Jerry Johnson (SCS), Greg Graff (DARE)

A. Horticulture and Landscape Architecture

Faculty:	Robert Davidson, Harrison Hughes, Harold Larsen, Jorge Vivanco, Cecil Stushnoff
Admin.Pro.:	Kathi Nietfeld, John Ray, Teresa Rivera, Kent Sather, Mary Snell, Tiffany Weir, Emily Wortman-Wunder, Dana Christensen, Teresa Dobson, Elie El Kassis, Mercy Essah, Samuel Essah, Omer Falik, Richard Haslar, Andrew Houser, Sastry Jayanty, Victor Loyola-Vargas
State Class.:	Deanna Brown
Post Doc.:	Dayakar Badri

B. Soil and Crop Sciences

Faculty: Pat Byrne, Nora Lapitan, Calvin Pearson, Junhua Peng, Sarah Ward, James Quick

Admin. Pro.: Barry Ogg, Donna Jean Rath, Scott Reid, Xueyan Shan, John Stromberger, Hong Wang, Deborah Badillo, Aaron Brown, Joshua Butler, Brad Erker, James Hain, Emily Heaton, Cynthia Johnson, Hayley Miller, Ethan Waltermine

Annual Report
2006-07

Crops for Health

Goal: Colorado State University will combine knowledge of phytochemistry, human nutrition and plant genetics to extend crop improvement and dietary intervention with the objective to improve human health and human disease prevention via consumption of these crops and be recognized nationally and internationally as an institution attractive to graduate students in Biomedical Agriculture. Crops for Health will include graduate education and research that will define Biomedical Agriculture as a new discipline.

Purpose: The power of molecular biological science has presented new opportunities to extend the selection and improvement of Colorado crops to incorporate improved human nutritional characteristic. The quantity and quality of the foods we eat have a dramatic impact on the current epidemic of metabolic diseases, e.g., cardiovascular disease, Type 2 diabetes, cancer, and obesity. Metabolites are biochemical compounds that carry out the business of cells in all organisms. Metabolites (like lipids and anti-oxidants) present in food and in the human body are critical to understand the development and prevention of metabolic disease. Metabolomics is the comprehensive analysis in which all of the metabolites of an organism are identified and quantified. Colorado State has invested in building the capacity to be a leader in discovery research in metabolomics by establishing an interdisciplinary research consortium to determine relationships between metabolites and disease, and to identify metabolites in animal and crop foods to help prevent disease and improve health. Colorado State University is in a strong position to assist with the economic development of Colorado's agricultural industry and to enhance the public health of citizens with research to improve crops by understanding and enhancing their human nutritional food value.

Strategic Actions:

- Secure faculty expertise in plant biochemistry, molecular genetics, and food chemistry with interests in applying knowledge to characterizing genetic traits of plants useful to human nutrition, i.e. Crops for Health.
- Organize existing faculty expertise, and seek new positions needed to strengthen and formalize research teams focused on 1) cultivar improvement for : dry bean, potato, wheat, rice, and corn and 2) human diet intervention.
- Pursue transdisciplinary "Supercluster" status for the Crops for Health Program.
- Recruit graduate students and post-doctoral fellows to support the Crops for Health program.
- Secure new space for new faculty and additional lab space for existing faculty and programs.

Critical Resource Growth Needs:

- Secure substantial grant support for fundamental research linking human nutrition to the development of food crop improvement.
- Secure funds for three faculty positions. These include one in plant biochemistry, one in molecular genetics and one in food chemistry, all with responsibility to establish a research program to clarify, and more fully commercialize, the mechanisms whereby metabolites confer health-promoting attributes to dry bean, potato and wheat cultivars.
- Secure new space for new faculty and additional lab space for existing faculty and programs.

Accomplishments:

This topical area has been given high priority in planning because of the important impacts that are expected. The long term impact will be to assure the profitability of food crop production in Colorado, while establishing *Agriculture as an instrument of public health* via the disease preventing attributes of crops and their products in human diets. These are life-altering impacts that will only be felt as the cumulative result of strategic actions

over many years. Initial impacts from this effort will include specific outcomes that benefit producers, as well as ones that guide well-conceived program planning and priority-setting.
Accomplishments that can be identified now include:

- New crop cultivars developed by plant breeders to sustain the profitability of Colorado crop producers. This represents long-term cumulative impact. The potato breeding program - through increased yields, improved quality and reduced need for nitrogen and other inputs –is estimated to have added $15M to $18M in annual value to the Colorado crop. Approximately 50 % of the state's total potato acreage is planted with cultivars developed and characterized by the CSU program. This positive impact is also felt nationally. Of all potato cultivars released since 1990 by the 12 U.S. breeding programs, those developed by CSU ranked first in the nation in total acreage approved for seed certification. Furthermore, three of the top 10 cultivars in the U.S. for seed were developed by CSU. Similarly, the wheat breeding program – through increased yields, end-use quality improvement and reduced production risks – is estimated to have added about $20M to the state's annual crop value. Nearly 60% of Colorado wheat acreage was planted with CSU-bred cultivars in 2006. CSU researchers have also now provided markers for a gene that confers resistance to the Russian Wheat Aphid, promising new solutions to a significant economic problem for Colorado wheat growers. In addition, the CSU dry bean breeding program continues to provide high yielding cultivars with resistance to all major races of rust. Released cultivars support a viable bean seed industry in western Colorado, worth about $2M.
- Clarification of the plant breeding/cultivar development priorities at CSU, to include the importance of value-added aspects of dry bean, potato and wheat breeding for Colorado growers, especially the marketing potential in "Crops for Health". This approach has become a focal point for research and outreach at CSU. The award of the USDA National Needs Fellowship grant in this area illustrates its growth and potential as does the early effort to obtain "supercluster" status.
- Greatly expanded service to a wide network of small acreage fruit and vegetable growers delivered by the applied research and outreach of the Specialty Crops Program (SCP), made possible by a unique partnership with the Colorado Department of Agriculture (CDA).
- Viticulture research and outreach has contributed to the success and growth of grape production and wine-making, especially in western Colorado, where this is now not only an important component of agriculture, but a key driver of that region's tourism industry.
- Colorado State has the highly regarded Cancer Prevention Laboratory (CPL) imbedded among strong programs of plant breeding and crop production research. There are solid "crop improvement teams" in place for dry beans, potato and wheat. The CPL is focused on diet-based approaches to cancer prevention. Research capacity was added with funding of the "metabolomics" academic enhancement program (AEP) to add mass spectrometers for small molecule chemistry, and funding of the "bioinformatics" AEP to enhance database development of the genetic foundation of metabolites in food crops.

Internal Linkages:
Much of the work which has produced these impacts, and which will generate more in the future, has involved active interaction with faculty and staff from multiple disciplines, agencies and academic units. This includes notable collaborations between those in the College of Agricultural Sciences and colleagues in other Colleges at CSU, involving efforts such as: the supercluster pre-proposal; the successful USDA National Needs Fellowship grant in Crops for Health; and involvement in chemical ecology studies that seek to add value via medical and/or agricultural applications. In addition, future work under this strategic initiative will have greater impact as CAS faculty contribute to the incipient inter-institutional School of Public Health.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Financial Resources:

Faculty and staff representing the Horticulture and Landscape Architecture and Soil and Crop Sciences departments in the College of Agricultural Sciences dedicated time to this strategic initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**2004-05**	**2005-06***	**Change**	**2006-07****	**Change**
Resident Instruction	$282,595	$312,715	$30,120 (10.66%)	$188,736	-$128,979 (-41.2%)
AES					
State	$428,481	$418,050	-$10,431 (-2.43%)	$168,044	-$250,006 (-59.8%)
Federal	$155,255	$163,994	$8,739 (5.63%)	$66,254	-$97,740 (-59.6%)
Extension					
State	$115,518	$129,067	$13,549 (11.73%)	$55,767	-$73,300 (-56.8%)
Federal	$1,911	$0	-$1,911 (-100%)	$0	0%
Grant/Contract	$1,378,010	$1,510,427	$132,417 (9.61%)	$1,223,884	-$286,543 (-19.0%)
Cash	$18,180	$13,678	-$4,502 (-24.76)	$12,052	-$1,626 (-11.9%)
Gift	$12,404	$10,659	-$1,745 (-14.07%)	$18,216	$7,557 (70.9%)
Totals	**$2,392,354**	**$2,558,590**	**$166,236 (6.95%)**	**$1,727,953**	**-$830,637 (-32.5%)**

* 12.55 FTE ** 11.30 FTE

II. Refereed journal articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 14 total refereed journal articles were published. For 2006, 10 total refereed journal articles were published.

Analysis: Total refereed journal articles published decreased by 4 from calendar year 2005 to calendar year 2006.

III. Outreach Activities

A. Participation in Workshop and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in approximately 23 workshops/presentations reaching more than 780 total participants.

B. Other highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- Mark Brick: Participated in the Research Committee for Colorado Dry Bean Administrative Committee; Participated in the Midwest Regional Performance Nursery with breeders from NE, MI

and ND; Participated in the Western Regional Bean Trials with breeders from ID and WA; Participated in the National Cooperative Bean Nursery with ~14 other participants.

C. Participation in state, national and international committees, programs and task forces:

1. Rob Davidson: National Potato Council and US Potato Board to the Potato Association of America (past President 2005/06) as a member of several committees; WERA-089 Potato Virus Disease Control Coordinating Committee, Colorado's representative and an active member.

2. Jorge Vivanco: Meeting Organizer for the Second International Symposium on Plant Neurobiology, Beijing, China, May 22-27, 2006.

3. David Holm: WERA027 (Western Coordinating Committee for Potato Variety Development) – Colorado Representative; Southwest Regional Potato Cultivar Development Working Group.

4. Horst Caspari: Member of the Steering Committee for the National Grape and Wine Initiative; Member of Review Panel – Cultural Practices, USDA-Viticulture Consortium West (30 proposals).

5. Mark Brick: Past Chair, Division, C-4 Crop Science Society of America; Committee member, Golden Opportunities for the Tri-Societies; Research Committee, Colorado Dry Bean Administrative Committee. This committee obtained $32,000 for dry bean research at Colorado State University in 2006; Member W-150 Regional Project, Genetic Improvement of Beans for Yield, Pest Resistance and Food Value; Member W-6, Regional Committee, Plant Germplasm Introduction, Increase, Evaluation, Documentation and Distribution; Board of Directors, Colorado Seed Growers Association; Member USDA Phaseolus Crop Advisory Committee; Committee member, Graduate School Workshop at ASA/CSSA/SSSA annual meeting (ended in 2006); Member, A237 Membership and Retention Committee, ASA/CSSA/SSSA, elected chair for 2007-2009; and Executive Vice President, Western Society of Crop Science.

External Linkages:
There are well-established external linkages with stakeholder groups interested in the understanding and enhancement of food crop genetics for human health. In addition to federal funding agencies, these include grower organizations and international research centers. The most significant at this time are the Colorado Certified Potato Growers Association and the Colorado Wheat Research Foundation. Important emerging relationships are also being developed with the local medical community, i.e., the Cancer Center of the Rockies (Ft. Collins) and McKee Medical Center (Loveland).

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Steve Wallner
Steering Committee Chair: Henry Thompson
Steering Committee Members: Mark Brick (SCS), Pat Byrne (SCS), David Holm (HLA), Chris Melby (FSHN), Jan Leach (BSPM), Gary Peterson (SCS)

A. Horticulture and Landscape Architecture

Faculty:	Horst Caspari, Robert Davidson, Weiqin Jiang, Jorge Vivanco, Zongjian Zhu, Cecil Stushnoff
Admin. Pro.:	Elizabeth Neil, Kathi Nietfeld, Naira Quintana, Denise Rush, Jennifer Sells, Tiffany Weir, Emily Wortman-Wunder, Dana Christensen, Eli El Kassis, Omer Falik, Vanessa Fitzgerald, Sastry Jayanty, Victor Loyola-Vargas, John McGinley, Elizabeth Miller
Post Doc.:	Dayakar Badri

B. Soil and Crop Sciences
Faculty: Scott Haley
Admin. Pro.: Barry Ogg

C. Faculty from other Colleges at CSU : Mike Pagliossotti, Chris Henry.

Annual Report
2006-07

Design and Management of Colorado Landscapes

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research, and outreach in design and management of Colorado landscapes, serve as the primary provider of new management talent for Colorado's green industry, be recognized as the primary source of knowledge for Colorado's landscape industries, and be recognized nationally for graduate education and research in green industry crop evaluation and limited-water landscape plant cultivation. This will include continuation of the nationally recognized BS degree in landscape architecture and BS degree in landscape horticulture, graduate education and research in plant selection and improvement, limited-irrigation landscape plant cultivation, and landscape policies, and outreach in landscape industry plant selection, cultivation management, and Master Gardener education and volunteer development.

Purpose: Colorado is an urban and urbanizing state in which demographic evolution is changing the scope of "agriculture." The landscape (green) industry of Colorado, and the nation, is large and growing and comprises a significant part of Colorado agriculture (the green industries have been recognized as "agriculture" by the Colorado General Assembly). The industry includes production, wholesale, and retail sales for floriculture, nursery, and tree crops, garden supplies, irrigation equipment, outdoor equipment, and development and care services for landscapes, such as golf courses, landscape design and construction, and landscape maintenance for homes, businesses, and public gardens and cemeteries. Colorado expenditures on garden-related products, landscape and lawn service, and other related green industries (irrigation, botanical gardens, and outdoor equipment) have averaged 10 percent annual growth since 1993, resulting in $1.67 billion in direct sales, in 2002. (This generates an economic impact of $2.1 to $5.0 billion depending on the economic multiplier used.) The value of the Colorado golf industry alone is $1.2 billion. The landscape-related industries of Colorado employ nearly 34,000 positions (6 percent average annual growth) with a payroll of $825 million annually (18 percent average annual growth). Thirty percent of industry revenues are generated from out of state (domestic and international) sales. Appropriate design and management of the landscape, especially in the environmentally sensitive regions that typify subdivisions and development of ranch lands, are essential for the quality of life in Colorado and for economic development related to tourism, industry location, retention of home valuation, and the green industry itself. Community landscaping strongly influences the physical/biological environment and mitigates many aspects of urban development by moderating climate, conserving energy, using carbon dioxide, improving air quality, controlling rainfall runoff and flooding, lowering noise levels, preserving green spaces, harboring wildlife, and enhancing the attractiveness of cities.

The Department of Horticulture and Landscape Architecture offers the B.S. in Landscape Architecture (178 majors in Fall 2006-07) and the B. S. in Landscape Horticulture (145 majors in Fall 2006-07). These degree programs have excellent support from industry. Colorado State University is in a strong position to assist with the economic development of Colorado's green industry and to enhance the well-being of tourists and citizens by educating green industry professionals, researching commercial and residential issues related to ornamental plantings and landscape restoration, and providing continuing education to industry employees and citizens on best practices for plant selection, plant production and maintenance, water conservation and irrigation, pest control, and landscape design.

Strategic Actions:

- Establish a Center for Designing and Managing Colorado Landscapes (Sustainable Landscape Management) with faculty and county agent working groups to maintain cohesion of teaching, research, and outreach efforts, build professional expertise, and strengthen relationships with the industry.
- Establish a concentration in golf course management.

- Grow the B.S. in Landscape Horticulture student enrollment by double the rate of Colorado population growth, or 3 percent per year.
- Develop a proposal to establish a Master of Landscape Architecture degree.
- Restructure the majors and concentrations in Landscape Horticulture and Horticulture.

Critical Resource Growth Needs:
- Add a position in Landscape Architecture and Landscape Management, critical resources associated with the high student: faculty ratio that threatens national accreditation of the LA at CSU, and thus the viability of the degree program.
- Add GTAs to support laboratory instruction, and the expanded enrollment in HCC100.
- Secure funds for renovation and development of the Shepardson Building ($18 million) and the Plant and Environmental Research Center (PERC) ($8 million).
- Prepare a facilities program plan to address the need for field, greenhouse and laboratory space for Landscape Horticulture.

Accomplishments: The long term impact of this work will be to assure the sustainable utilization of land, water and human resources to beautify Colorado landscapes, especially those impacted by the state's growth and development. This will be accomplished by generating and disseminating knowledge that will also foster the profitability of Colorado's Green Industry.

This ultimate comprehensive impact will occur over time as strategic planning determines program priorities and activities. Initial impacts from the effort in "Design and Management of Colorado Landscapes" will include specific outcomes with value to the Green Industry per se and/or to the public good, as well as to the planning and priority-setting needed for wise investment of CSU resources. Impacts that can be identified now include:
- Comprehensive training of CSU Extension agents and Master Gardeners in sustainable landscape management through the team-based efforts of specialists from several disciplines. Most recently, a clear impact has been the increased capacity of agents to diagnose turfgrass management problems in local communities.
- Introduction and promotion of well-characterized ornamental plants through the Plant Select program. Such efforts will result not only in profitable products for nurseries and garden centers, but also in the planting of water-conserving, more sustainable Colorado landscapes. Future efforts will be enhanced by the organization of Plant Select as a non-profit corporation.
- Multidisciplinary collaboration among specialists and county-based agents via the Environmental Horticulture Core Competency Area, especially the Sustainable Landscapes work team, to deliver Master Gardener training and educational programs such as the "Composing Colorado Landscapes" workshop.
- Expanded collaboration among colleagues from multiple Colleges at CSU. Previous interactions have included the development of substantial grant-funded research programs (CAS and CNR; CAS and CVMBS; CAS and CNS) and periodic shared teaching of selected courses. More recently, faculty from five Departments in three Colleges (CAS, CNR, CNS) are working together to develop a comprehensive approach to the teaching of introductory and general ecology, which is central to the success of numerous programs related to this planning theme.
- Field exploration and collection of saltgrass ecotypes for utilization by the Bureau of Reclamation in revegetating riparian areas in Colorado following the removal of tamarisk, thereby contributing to solution of problems associated with its invasion of native ecosystems.
- Selection, breeding, characterization and management of highly salt and drought tolerant saltgrasses with enhanced turfgrass quality attributes.
- Characterization of landscape plants' salt tolerance, and related suitability for use in landscapes that are irrigated with reclaimed wastewater. This information has been generated with financial support from Colorado municipalities and water providers which, along with the general public, benefit from the water savings that result.

- Use of historical records of turfgrass management practices on golf courses in the region, and contemporary measurements, to demonstrate that turfgrass-based systems have significant carbon sequestration capacity. One potential benefit of these findings is in justifying the payment of carbon-based credits to those who own/manage golf courses and other urban landscapes.
- Multidisciplinary focus on water – to include water in Colorado landscapes - through the coordinated recruiting of new faculty in four different academic departments. This has been accompanied by development of a collaborative new approach to teaching landscape irrigation.
- Curriculum design for "Golf Management" as a new concentration in the Landscape Horticulture major. The golf industry has been engaged in this process, which integrates education in business, hotel/resort management and turfgrass science. Student interest and strong demand for graduates are expected to result in high enrollment.
- In the CSU Extension Answerlink system, 'Gardening and Home Horticulture' topic, which comprises an important part of this strategic initiative, was the top topic reviewed with 68,646 "hits" representing 56.41% of all topics viewed. This topic also received 1,080 questions in 2006, and this was the greatest number of questions for any topic – the second was Insects with only 161 questions for 2006. Total number of questions for 2006 was 2,354, so the Gardening and Home Horticulture questions represented 46% of all inquiries.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Majors:

The following table illustrates the trend in the number of undergraduate majors for this strategic initiative:

Majors (Fall Semester)	2005-06	2006-07	Change	2007-08	Change
Landscape Architecture*	175	178	3 (2%)	180	2 (1.1%)
Landscape Horticulture	168	145	-23 (-14%)	118	-27 (18.6%)
TOTALS	**343**	**323**	**-20 (-5.8%)**	**298**	**-25 (-7.7%)**

*Includes Pre-Landscape Architecture majors.

There are no graduate majors for this strategic initiative.

II. Financial Resources:

Faculty and staff representing the Horticulture and Landscape Architecture and Agricultural and Resource Economics departments in the College of Agricultural Sciences dedicated time to this strategic initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**FY 2004-05**	**FY 2005-06***	**Change**	**FY 2006-07****	**Change**
Resident Instruction	$582,333	$582,946	$613 (0.1%)	$638,090	$55,144 (9.5%)
AES					
State	$400,506	$382,606	-$17,900 (-4.4%)	$386,308	$3,702 (1.0%)
Federal	$157,267	$128,352	-$28,915 (-18.4%)	$149,325	$20,973 (16.3%)
Extension					
State	$195,680	$203,452	$7,772 (4%)	$139,886	-$63,566 (-31.2%)

Federal	$0	$0	$0	$0	$0
Grant/Contract	$347,603	$368,261	$20,658 (6%)	$403,000	$34,739 (9.4%)
Cash Accounts	$53,343	$60,682	$7,339 (13.8%)	$63,553	$2,871 (4.7%)
Gift	$101,516	$100,333	-$1,183 (-1%)	$134,710	$33,710 (33.6%)
Total	**$1,838,248**	**$1,826,632**	**-$11,616 (-0.6%)**	**$1,914,205**	**$87,573 (4.8%)**

* 19.80 FTE **18.05 FTE

III. Refereed Journal Articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 13 total refereed journal articles were published. For 2006, 11 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative decreased by 2 from calendar year 2005 to calendar year 2006.

IV. Juried performances/exhibits/productions/designed/built project:

For calendar year 2006, a total of 6 juried performances/exhibits/productions/ designed/ built projects were accomplished by 4 faculty and staff dedicated to this strategic initiative.

V. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in approximately 153 workshops/presentations reaching more than 12,197 total participants and 11 broadcasts reaching more than 475 total participants.

B. Other highlighted examples demonstrating engagement and outreach in this strategic initiative include:

- Brad Goetz: Continued work with the Town of Mead as Park Planner and Landscape Review adviser. Included illustrative exhibits, design standards and long-range recreation center study. The experience was integrated into teaching efforts, particularly in the context of urban design, public policy and comprehensive planning.
- Jim Klett: Coordinated collaboration between CSU Cooperative Extension, Denver Botanic Gardens and GreenCO on Plant*talk* Colorado. Fifty new scripts were edited and placed on the Plant*talk* Colorado™ website in 2006. There were approximately 2,862 calls in 2006 and over 900,000 world-wide web hits. (Plant*talk* Colorado is approaching 6.0 million web hit mark).
- Steven Newman: 35 Telephone based consultations with individuals primarily seeking information on a specific greenhouse production problem or an individual seeking advice on establishing a greenhouse business. 155 e-mail responses to specific requests for greenhouse crop diagnostics, questions about establishing a greenhouse business, and information about the Colorado greenhouse industry. This also includes broadcasts to individuals that subscribe to the Greenhouse Extension Listserv. This also includes e-mail messages to legislators relating to green industry concerns towards immigrant labor policy. 65 responses to AnswerLink questions as well as reviewing agent responses.
- David Whiting: Colorado Master Gardner training - In 2006, CMG/CGC training continued in 25 counties with classes in 13 locations. A growing challenge facing the program was offering classes in rural communities where staff time, winter travel hazards, and low student enrollments make the face-to-face instruction impractical. For 2007, we will pilot distance delivery to the Southwest Counties

(Archuleta, La Plata, and Montezuma) and the Mountain Communities (Chaffee, Fremont, Gunnison, Routt, and Summit Counties). The entire CMG curriculum was reviewed and improved suitable for distance delivery.

C. Participation in state, national and international committees, programs and task forces:

1. Yaling Qian: Served as a liaison to the Joint Reuse Committee of Rocky Mountain Section of American Water Works Association and Rocky Mountain Section of Water Environment Association (RMSAWWA/RMSWEA); Served as an advisor for the salinity subcommittee under the Joint Reuse Committee; Worked with several water entities in Colorado to develop guidance documents for recycled wastewater users and treaters.

2. Harrison Hughes: Served as Co-Chair of the opening scientific session of the Third International Date Palm Conference in Abu Dhabi, UAE held February 19-21, 2006; Served on the Scientific Committee of the conference.

3. Brad Goetz: Serves as Board Member and Secretary for the Historic Fort Collins Development Corporation; Coordinated lectures/workshops in the Landscape Architecture Series sponsored by SCASLA.

4. Zach Johnson: Responsible for project design, coordination and oversight of installation for the First International Alternative Spring Break, Achiote, Panama. Project promoted eco-tourism through landscape design and construction.

5. Jim Klett: a) Coordinated horticultural and extension displays at ProGreen Expo (January 2006), organized and installed horticulture education component at Colorado Garden and Home Show (February 2006) and was awarded Award for Best Educational Garden; b) Plant Select Program Co-Chair with Denver Botanical Gardens and Chair of Advisory, Plant Propagation and Marketing Committees for Plant Select; c) Hosted IR-4 Region Minor Crop Pesticide Workshop and organized tour in October 2006 in Denver, CO; d) Served on the following committees and boards: Associated Landscape Contractors of Colorado - Board of Directors and Education and Membership and Planning Committees; ASHS Landscape Management, Nursery, and Teaching Working Groups; Colorado Nursery and Greenhouse Association - Board of Directors and Certification and Education Committees; Garden Centers of Colorado - Board of Directors and Education Committee; GreenCO Foundation - Board of Directors; GreenCO Management Committee – Cooperative Extension Representative; Green Roof Subcommittee for EPA Building in Denver; ISA – Rocky Mountain Chapter – Education, Organizational and Marketing Committees and Representative to International Board; Pi Alpha Xi National - Fellow Selection Committee; ProGreen Expo Trade Show and Educational Committee; and U.S.D.A. National Germplasm Woody Plant Sub-committee.

6. Tony Koski: Crop Science Society of America, Board of Directors; Division C5 (Turf Science) Extension Education Committee; Golf Course Superintendents Association of America, Committee member and reviewer for Environmental Steward Award; Sports Turf Managers Association of America, Certification Committee member; RMRTA, Board of Directors and Representative to GreenCo.

7. Elizabeth Mogen: Serve as a member of the Advisory Board for the Front Range Community College (FRCC) related programs and oversee several programs – the post secondary Architectural, Engineering and Construction program, the Computer Aided Design program, and the secondary Architecture and Landscape Design program.

8. Steve Newman: Developed 2 workshops with the Colorado Retail Florists Association and Teleflora. For the American Society for Horticultural Sciences, served as Past Chair of the Commercial Horticulture Extension Working Group and member of the Certified Horticulture Advisor *ad hoc* Committee.

9. Jorge Vivanco: Meeting organizer for the Second International Symposium on Plant Neurobiology, Beijing, China, May 22-27, 2006.

10. David Whiting: Coordinated the Composing Colorado Landscapes Conference which introduced Colorado Master Gardner volunteers and home gardeners to landscape design theory and plant selection. 200 CMG volunteers and gardening public participated; National and regional committee work consists of serving as Western Region Representative (elected by peers in western states), eXtension Consumer Horticulture Community of Practice Team; Horticulture Program Advisory Committee, Front Range Community College; Board of Directors and member of the Education, Marketing, Membership and Annual Conference committees for the International Society of Arboriculture, Rocky Mountain Chapter.

External Linkages:

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Steve Wallner
Steering Committee Chair: Tony Koski
Steering Committee Members: Joe McGrane (HLA), Zach Johnson, (HLA), Patrick Martin, (HLA), David Whiting (HLA), Jennifer Bousselout (HLA), Irene Shonle (CSU Extension), Bill Bauerle (HLA)

A. Agricultural and Resource Economics
Faculty: Jennifer Keeling, Catherine Keske, Dawn Thilmany, Steve Davies

B. Horticulture and Landscape Architecture
Faculty: Jim Klett, Brad Goetz, Harrison Hughes, Elizabeth Mogen, Steve Newman, Merlyn Paulson, Yaling Qian, Jorge Vivanco, Christine Dianni,
Post Docs: Dayakar Badri, Mohamed Shahba
Admin. Pro. Dana Christensen, Elie El Kassis, Omer Falik, Victor Loyola-Vargas, Kathi Nietfeld, Naira Quintana, John Ray, David Staats,
Tiffany Weir, Sarah Wilhelm, Emily Wartman-Wunder

C. Extension Agents: Ed Page, Mike Tupa, Kipp Nye

D. Non-College of Agricultural Sciences faculty and staff: Dave Theobald (WCNR)

Annual Report
2006-07

Science and Management of Pest Insects, Plant Pathogens and Weeds

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research, and outreach in entomology, plant pathology, and weed science; be recognized as a primary source of pest management expertise in Colorado and the Mountain West region; and be recognized internationally for research and graduate education in genetic determinants of host plant resistance, fundamental mechanisms of biological invasions, and ecology, bioinformatics, genomics, and population genetics of pests. Undergraduate education will include contributions of courses to undergraduate agricultural degrees and introductions to plants, insects, and agriculture to the university's core curriculum. Graduate education and research will provide fundamental and applied science regarding pest species (their taxonomy, genomics, population genetics, and ecology) and pest management that is environmentally sound and economically effective. Outreach will include applied research and education relevant to emerging issues of Colorado's agricultural industries, including biosecurity, safe and effective pesticide use, and implementation of effective pest management strategies that do not rely on pesticides, as well as providing the primary source of pesticide applicator training in Colorado.

Purpose: Management of weeds, insect pests and plant pathogens is one of the most costly inputs that clientele in agriculture, the green industry, and consuming households must finance every year in Colorado. A diverse and expanding pest complex requires enhanced management skills that often increase production costs. A conservative loss estimate of 5 to 10% due to plant pests could cost Colorado producers in urban and rural settings $50 to $100 million annually. There is a long-term need for a comprehensive, high quality, integrated pest management system encompassing the disciplines of entomology, plant pathology and weed science. Pest activity and severity are dynamic and thus demand for management education and a systems approach will be ongoing. Integrated Pest Management (IPM) is the application of disciplinary, scientifically-based knowledge to profitably solving practical problems related to management of pests in agricultural and non-crop systems and landscapes in environmentally sound ways. Special emphasis within the Pest Management Team is placed on generating and providing information related to science-based policy, pest activity, pest diagnostics and identification, pest management recommendations, pest forecasting, safe and effective pesticide use, restoration ecology, integrated vegetation management, and the appropriate relationship of pest activity to pesticide use, pesticide alternatives, and pests versus profitability. New targets for IPM programs arise constantly as exotic, invasive species are creating unanticipated challenges in both agricultural and non-agricultural environments; combined with potential biosecurity breaches and mitigation. At the undergraduate level, the Department of Bioagricultural Sciences and Pest Management offers two minors (Entomology and Plant Health). However, a much more important aspect of the department's undergraduate program is targeted at providing educational opportunities to students in majors in the College of Agricultural Sciences and across the campus in entomology, plant pathology, weed science, and pest management. In addition, the department's faculty are very active participants in the Life Sciences program (teaching sections of LSCC 102 Attributes of Living Systems and BY 320 Ecology), and in several large enrollment courses taught under the "A" designation.

Strategic Actions:

- Coordinate applied efforts in pest management across research and extension.
- Enhance applied research and teaching facilities and graduate student recruiting.
- Add faculty strength in Integrated Pest Management of invasive species, vegetable crops, specialty crops, organic and sustainable agriculture.
- Take the Bioagricultural invasions (insects, plant pathogens, and weeds) research and graduate degree program worldwide.
- Secure placement of the Gilette Museum in renovated/new building space.
- Develop MS degree (non-thesis) in Integrated Pest Management (modern diagnostic techniques).

Critical Resource Growth Needs:

- Renovate space for the Gillette Museum of Arthropod Diversity ($1.8 million).
- Secure at least one endowed faculty chair(s) in the area and first year graduate stipends.
- Renovate or build new office and research laboratory space for two new faculty positions.

Accomplishments

1. Tamarisk Research Conference
   Tamarisk trees are invading western rivers and are a major concern in Colorado. This non-native species is displacing native vegetation, altering stream and river flow patterns and uses more water than the native vegetation it displaces. In fall 2006, scientists from the College of Agricultural Sciences hosted and organized a meeting on the biology and management of Tamarisk. This meeting attracted over 250 scientists, resource managers, and policymakers from 14 western states. Colorado State University is leading the development of appropriate and environmentally-friendly management approaches for this noxious weed.

2. National Science Foundation Network
   Colorado State is the home of a National Science Foundation supported Research Coordination Network that brings together about 40 scientists from all over the world with the goal of integrating the ecology and evolution of Bioagricultural invasions to produce a predictive framework. This network focuses on developing a fundamental understanding of Bioagricultural invasions and has clear implications for developing sound management strategies. The first meeting of the network was held in Fort Collins in August 2006 and had approximately 40 attendees.

3. Addressing Rural–Urban Water Needs
   A 14 member team, including several members of this planning study, is addressing the needs for a new rural-urban water model. The study will develop and investigate cropping system options - techniques in crop planting and watering - to determine how much water can be saved. The water saved can be made available for possible urban use while at the same time sustaining viable economic returns to the agricultural and rural communities. Cropping system options include rotational cropping (fallowing of a portion of the land); deficit and partial season irrigation (applying less water, but gaining maximum yield from the water applied); water conserving practices and drought-tolerant crop varieties; adoption of optimal irrigation technology; and alternative farming practices, crops and markets. The cropping system strategies will be studied from the perspectives of farm profitability and economic activity in the agricultural and rural communities, the amount of water made available for other uses and practical feasibility. Investigating the impact of insect pests, plant pathogens, and weeds in this system is a critical component. The planning study on managed ecosystems is also participating heavily in this effort. A major partner in the effort is the Parker Water and Sanitation District which has provided a grant to support the research, access to land for experimental purposes, and many other resources.

4. Invasive Weeds
   Recent research results indicate that Bioagricultural control of diffuse and spotted knapweed (highly invasive weeds in Colorado) need not be avoided because of concerns that feeding by Bioagricultural control agents (insects) increases the competitiveness of weeds. Previous results had been interpreted as indicating insect feeding increased the production of the chemical catechin in spotted knapweed and 8-hydroxyquinoline in diffuse knapweed as root exudates, and that these chemicals increased the ability of the weeds to invade plant communities. However, more recent results question the concept of the importance of "chemical warfare" as a factor in the success of invasive species in general and in particular show that the amounts of catechin and 8-hydroxyquinoline present in soils do not reach Bioagriculturally active levels. Bioagricultural control offers a cost effective tool for management of invasive weeds and this research shows that a suggested drawback to using this tool actually is not a concern. Therefore, developing and implementing Bioagricultural control of invasive weeds should not be curtailed. In other studies,

Bioagricultural control was shown to be more effective against invasive weeds in the presence of competing vegetation. This finding has implications for the integration of Bioagricultural control with other management tools such as grazing. Additionally, management systems that rely on Bioagricultural control and grazing together with herbicides have been shown to be very promising for management of invasive weeds, especially in low value land situations. These findings will be beneficial to land owners and managers in their efforts to combat weed invasions.

5. Invasive Forest Fungus
   White pine blister rust (an invasive fungus from Eurasia) may induce outbreaks of mountain pine beetle on limber pine. Predictive models that provide information on the relationship between blister rust, bark beetle damage, and dwarf mistletoe may become important tools for forest management. The goal is to equip forest managers with information upon which to make science based management decisions for ponderosa pine, now that white pine blister rust has become established as an additional factor in forest systems.

6. Resistance to Pathogens in Dry Bean
   Research on mechanisms of resistance for major pathogens provides Colorado State's breeding program with useful genes that reduce the cost of production and the impact of pests to the bean industry. Currently, cultivars released through this effort, having multiple pest resistance, are produced on approximately 40% of the acreage in Colorado and have increased yield by 5 to 10% over cultivars they replaced.

7. Onion Pest Management
   All registered insecticides for onion thrips have shown repeated control failures, thus threatening onion production. This is all the more critical because the newly immerging onion disease, Iris Yellow Spot Virus, is vectored by thrips. Because thrips control with insecticides is extremely problematic, other management tools are being explored. Resistant onion varieties, the use of straw mulches to reduce thrips numbers, and the use of other cultural practices to manage the disease all show promise. Together, these tools may become important keys to sustainable and profitable onion production in the region, but much research remains if these two pests are to be successfully managed.

8. Russian Wheat Aphid Management
   Russian wheat aphid is the major insect pest of winter wheat in Colorado. Russian wheat aphid resistant varieties, developed at Colorado State have allowed producers to grow wheat without insecticides. This past season roughly 25% of Colorado wheat acres were planted to resistant varieties, with this figure approaching 50% in areas with more consistent aphid infestations. The occurrence of a new biotype greatly diminishes the value of currently deployed resistant varieties, and it is unclear how long it will take to provide producers with new varieties resistant to both biotypes. Other approaches will be necessary to manage the new biotype. Effective chemical controls and guidelines for use are available. Efforts are being made to enhance Bioagricultural control through increased crop diversity and thus provide wheat growers with another economically and environmentally sound control for this important pest. Barley producers also need management options for this pest. A resistant variety holds promise for dryland producers. Thiamethoxam seed treatment seems to be a viable option for irrigated barley producers that is compatible with the management approaches recommended for the newly introduced cereal leaf beetle.

9. Weed Management in Wheat
   Above and Beyond Clearfield winter wheat varieties (developed and tested for effectiveness in collaborative projects at Colorado State) have been rapidly adopted by Colorado wheat producers because they facilitate effective control of jointed goatgrass, downy brome, and feral rye. Imazamox herbicide is very effective against these weeds, but also kills wheat. Above and Beyond Clearfield winter wheat varieties are resistant to imazamox, yet are very good varieties under Colorado conditions. These two varieties were planted on more than 10% of all Colorado wheat acres in the fall of 2006. As new double-gene Clearfield wheats enter the market, additional ability to control feral rye in wheat is anticipated.

10. Gene flow in Wheat and Jointed Goatgrass
    A major concern with transgenic crop varieties is that transgenes will spread through cross-pollination to conventional varieties of that crop or to related wild species. This may result in marketing problems for conventional wheat, or negative environmental effects if transgenes spread to wild species. Among reasons for pursuing this research is its importance to the development and deployment of wheats such as Above and Beyond, that are resistant to herbicides. A significant unknown factor is the level of cross-pollination that occurs at different distances in large-scale wheat plantings, both between different wheat varieties and between wheat and the related weed species, jointed goatgrass. Importantly, such information will help government regulators assess the environmental impact of transgenic wheat cultivars. An on-farm study of seed-mediated gene flow in wheat is underway. Current results indicate that seed can be a significant source of gene dispersal, both in certified and farm saved production systems. This information is important for risk assessment of and policy development for potential commercial release of transgenic wheat varieties and of the release of non-transgenic herbicide resistant wheats.

Internal Linkages:
This strategic Initiative has sought out members from many parts of campus. Within the College of Agricultural Sciences, the Departments of Horticulture and Landscape Architecture, Soil and Crop Sciences, and Agricultural and Resource Economics are included; and in the Warner College of Natural Resources, Department of Forest, Range and Watershed Stewardship were represented at the outset. (With the retirement of Wayne Leininger, there has not been representation on the Steering Committee from WCNR. However, there is a desire to reestablish this formal involvement.) All members of Colorado State University Extension's Pest Management Work Team are considered vital participants in the Outreach objectives of the Strategic Initiative. Specific efforts involving the work team are: prioritizing existing pest problems for research and extension efforts and identifying potential pest threats, and implementing appropriate management strategies.

Other efforts of the work team are integrated into many aspects covered elsewhere in this report.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. Financial Resources:

Faculty and staff representing the Bioagricultural Sciences and Pest Management, Agricultural and Resource Economics, Horticulture and Landscape Architecture, and Soil and Crop Sciences departments and the Agriculture Experiment Station dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**2004-05**	**2005-06***	**Change**	**2006-07****	**Change**
Resident Instruction	$529,271	$537,581	$8310 (1.57%)	$562,801	$25,220 (4.7%)
Ag. Exp. Station					
State	$1,222,679	$1,388,902	$166,223 (13.59%)	$1,282,718	-$106,184 (-7.6%)
Federal	$298,774	$327,453	$28,679 (9.6%)	$303,241	-$24,212 (-7.4%)
Extension					
State	$414,482	$436,465	$21,983 (5.3)%	$417,230	-$19,235(-4.4%)
Federal	$76,395	$80,220	$3,825 (5.0%)	$70,851	-$9,369 (-11.7%)
Grant/Contract	$1,610,626	$1,406,075	-$204,551 (-12.7%)	$1,493,812	$87,737 (6.2%)

Cash Accounts	$1,500	$185	-$1,315 (-87.67%)	$1,055	$870 (470.3%)
Gift	$421,574	$443,733	$22,159 (5.26%)	$529,356	$85,623 (19.3%)
Totals	**$4,575,301**	**$4,620,614**	**$45,313 (1%)**	**$4,661,064**	**$40,450 (0.9%)**

* 33.15 FTE **42.50 FTE

II. Refereed Journal Articles

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 41 total refereed journal articles were published. For 2006, 43 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased by 2 from calendar year 2005 to calendar year 2006.

III. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in approximately 249 workshops/presentations reaching more than 16,466 total number of participants.

B. Other highlighted examples demonstrating engagement and outreach in this strategic initiative include:

- Rick Zimmerman: provided insect identification to growers and homeowners; conducted calls to individual farms if a question cannot be answered over the phone or by an office visit; made pest management recommendations for area growers; and conducted workshops and presentations at area research centers and at society meetings.
- Howard Schwartz: Involved in the coordination of digitized collection of agricultural images (11,000 images); served as co-Leader of the Pest Management Work Team (within Extension); served as co-Leader of the Rocky Mountain Crop Biosecurity Center; served as Western Region Coordinator for the IPM Legume Pest Information Platform for Extension and Education [PIPE]).
- Frank Peairs: Extension teaching focused on the Russian wheat aphid biotype issue and the resurrected Crop Clinic series. This event was held in Sterling in early 2005 and again in December 2005 and 2006. It was well received by clientele. There is much interest among Extension field staff in continuing this type of educational program, because, in addition to its educational effectiveness, it potentially is a very efficient method of revenue generation. Developed educational materials for most of the pests in his sphere of responsibility. The publication of the High Plains Integrated Pest Management Guide was an important step towards regionalizing such recommendations. The update process has proved cumbersome, but moving the guide to the Web has been completed. Funding is being sought to further enhance the guide through a connection to AnswerLink, a LUCID "portal," and improved image services.
- Scott Nissen: Obtained a successful grant from the Agricultural Distance Education Consortium (ADEC), which provided $75,000 to develop online modules dealing with herbicide mode of action, weed ecology and herbicide resistant weed management. A group of weed scientists and education specialists from Colorado State University, University of Nebraska, Kansas State University, New Mexico State University and Oregon State University cooperated in the project. These Internet-based modules deal with applied and advanced biochemical information on herbicide mode of action. The modules were designed to be suitable for credit and non-credit offerings as well as providing computer animations that could be downloaded for classroom or outreach educations. A total of ten lessons were

developed covering 1) herbicide absorption, translocation and metabolism, 2) herbicide modes of action and 3) herbicide resistance.

- Ned Tisserat: Served as co-Leader of Rocky Mountain Crop Biosecurity Center; Director of the Great Plains Diagnostic Network resource for Colorado (provides diagnostic support for Colorado's involvement in the national IPM Legume PIPE).
- Whitney Cranshaw: Provided Introductory Master Gardener training (6 hours) at 10 locations throughout Colorado.
- County Extension Personnel (through the Extension Pest Management Work Team) are involved in the following:
  - Participated as members of the Legume PIPE
  - Contributed to pest surveys coordinated by BSPM and the Colorado Department of Agriculture
  - Heavy involvement in Master Gardner IPM training (in collaboration and coordination with campus-based faculty)
  - Played important roles in diagnosing plant pathogens, pest and beneficial insects, and weeds
  - Involved in planning and implementing many other programs

C. Participation in state, national and international committees, programs and task forces:

1. Cynthia Brown: Helped organize and moderate the Tamarisk Research Conference, October 3-4, 2006, Fort Collins, Colorado; Worked with a group of international scientists to identify critical gaps in knowledge and develop collaborative research projects addressing the ecology and evolution of Bioagricultural invasions at the Global Bioagricultural Invasions Research Coordinating Network. August 15 – 17, 2006. Armstrong Hotel, Fort Collins, Colorado.

2. Bill Jacobi: Organized and hosted the Central Rocky Mountain White Pine Health Working Group and Monthly Colorado Forest Health Discussion Group; and managed the National Elm Trial.

3. Andrew Norton: Chair and Member, Organizing Committee, 2006 Tamarisk Research Conference: Current Status and Future Directions, October 3-4, 2006, Fort Collins, CO.

4. Rick Zimmerman: Participate in national working groups such as the Curly Top Virus working group.

5. Howard Schwartz: Member of the Central High Plains Bean & Beet Group representing Colorado; serve as liaison with the Colorado Onion Association and Colorado Dry Bean Administrative Committee; national organizer of the multi-state research project W 1008 – Iris yellow spot virus (IYSV) and thrips; organized special symposium on Onion IYSV and thrips at the December 2006 National Allium Research Conference held in College Station, TX.

External Linkages:

This Strategic Initiative has numerous external linkages at the local, state, and national level. The entities with which the Initiative has the strongest linkages can be grouped under the following categories: State and Federal Agencies, Industry, Commodity Groups. State and Federal Agency personnel who are Affiliate Faculty in BSPM are listed below. Linkages with these personnel involve both research and outreach collaborations. Strong linkages are with the Colorado Department of Agriculture, USDA ARS, USDA APHIS, USDA Forest Service, USDI National Park Service, USDI Geological Survey, USDI Bureau of Land Management, USDHHS Center for Disease Control. Industry linkages are primarily with agrichemical and seed companies. These linkages allow the Initiative to investigate and provide to Coloradoans the latest information on product performance under Colorado Conditions. Examples include: Syngenta Crop Protection, Micro Flo Company LLC, Monsanto Company, Nufarm Americas Inc., BASF, Bayer CropScience, UAP- Loveland Industries, Inc., Valent Agricultural Products, J.R. Simplot Company/Plant Health Technologies, Wilbur-Ellis Company, Wilco

Distributors, Inc., Chemtura Corporation, Rhodia Inc., E.I. DuPont de Nemours & Company, Albaugh, Inc., Colorado Water Garden Society, Colorado Turf Grass Foundation, Dow AgroSciences, LLC, Helm Agro US Inc. The most active linkages with organized commodity groups are with those representing the following: wheat, onion, dry bean, corn, potato, turf, and other "green industries."

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor and Steering Committee Chair: Tom Holtzer
Steering Committee Co-Chairs: Howard Schwartz, Andrew Norton
Steering Committee Members: Tony Koski (HLA), Frank Peairs (BSPM), Ned Tisserat (BSPM), Sarah Ward (SCS), Thad Gourd (CE), Cynthia Brown (BSPM), Scott Haley (SCS), James Pritchett (DARE), Scott Nissen (BSPM)

A. Bioagricultural Sciences and Pest Management

Faculty:	George Beck, Louis Bjostad, Stephen Chisholm, Whitney Cranshaw, Joseph Hill, Ruth Hufbauer, Bill Jacobi, Dennis Knudson, Boris Kondratieff, Jan Leach, John McKay, Paul Opler, Phil Westra, Robert Zimdahl, Rick Zimmerman
Res. Assoc.:	Galen Brunk, Matthew Camper, Janet Hardin, Justin Herman, Michael Koch, Rhonda Koski, Jillian Lang, Mark McMillan, Clark Oman, Kristen Otto, Terri Randolph, Jeffery Rudolph, James Sebastian, Tara Steinke, Cynthia Walker
Research Sci.:	Sandra McDonald, David Walter, Rick Zimmerman
Post Doc.:	Maria Diaz, Hiromichi Ishihara, Rebecca Kao, Harold Meimberg, Scott Merrill,
State Class.:	Judy Arnold, Janet Dill

B. Agricultural and Resource Economics

Faculty:	Craig Bond

C. Horticulture and Landscape Architecture

Faculty:	Robert Davidson, James Klett, Harold Larsen
Research Assoc.:	Teresa Dobson, Andrew Houser, Teresa Rivera, Mary Snell
Admin. Pro.:	Richard Haslar, Kent Sather
State Class.:	Deanna Brown

D. Soil and Crop Sciences

Faculty:	Mark Brick,

E. Agriculture Experiment Station

Research Assoc.:	Ramesh Pokharel

F. County Extension Personnel (through Pest Management Work Team)

Alan Helm (District Liaison)	
Frank Sobolik (District Liaison)	Robert Hammon (District Liaison)
Assefa Gebre-Amlak	Mike Bartolo
Bruce Bosley	Randy Buhler
Jim Conley	Wayne Cooley
Karen Crumbaker	Rob Davidson
Bill Ekstrom	Samuel Essah
Tom Hooten	Joe Julian
Dennis Kaan	Ernest Marx
Patrick McCarty	Ron Meyer
CJ Mucklow	Bill Nobles
Kip Nye	Carol O'Meara

Laura Pottorff
Irene Shonle
Curt Swift
Laurel Potts
Mary Small

G. Other non-College of Agricultural Sciences faculty and staff:
None at this time. However, individual collaborative relationships are strong among participants in the Initiative and faculty in the Department of Biology, the Department of Forest, Range, and Watershed Stewardship, and the NREL. Efforts will continue to involve personnel from these areas on a more formal basis.

H. Federal Agencies
The following are State or Federal Agency Personnel who are actively engaged in this Initiative and who are Affiliate Faculty in BSPM:

Daniel Bean (Colorado Dept of Ag)
Richard Hansen (USDA, APHIS)
Ann Lynch (US Forest Service)
Jose Negron (US Forest Service)
Gary Puterka (USDA ARS)
Dale Shaner (USDA ARS)
Terrence Walters (USDA APHIS)
Brian Geils (US Forest Service),
Linda Hanson (USDA, ARS)
Janet McAllister (CDC)
Lee Panella (USDA ARS),
Craig Ramsey (USDA APHIS)
Melinda Sullivan (USDA APHIS)
Lori Wiles (USDA ARS)

Annual Report
2006-07

Managed Ecosystems

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research, and outreach in the long-range adaptation of agriculture in the 21st century in response to changes in demography, water availability, water and agricultural policies, environmental and land use policies, demand for recreation, and national and international markets. Colorado State University will be recognized regionally, nationally, and internationally for modern crop, range, and livestock systems in semi-arid environments. This will include disciplinary and interdisciplinary work in crop and soil sciences, economics, animal sciences, pest sciences, landscape design and policy, range science, wildlife biology and ecology, forest science, and water sciences.

Purpose: The state of Colorado can be viewed as an ecosystem with its basic parts consisting of soil, air, water, plant life, animal life, and human inhabitants. The system components are highly interrelated and each is affected by the other, e.g., the dependence of humans on soil, water, plants and animals for food and the effects of humans on land use and water availability and quality through actions and policy. The Colorado ecosystem is shared by agricultural producers, a rapidly growing urban population, and wildlife. As competition grows for finite water, land, and air resources, and as agricultural and natural resource policies and international markets change, opportunities to maximize the economic value of agriculture in Colorado will change continuously. The complex relationships of ecosystem variables must be well understood to predict these opportunities. Colorado State offers BS degrees in Soil and Crop Science (49 majors and 11 secondary majors in fall 2006) and in Horticulture (56 majors and 1 secondary major fall 2006), including pest management courses in the Department of Bioagricultural Sciences and Pest Management, and MS and PhD degrees in Soil and Crop Science (25 students in fall 2006) and Horticulture (20 students in fall 2006). These college degrees prepare professionals to understand and manage economically important plants that depend on our soil and water resources. Twentieth century agriculture focused on mono-cultural production of commodity foods, however, 21st century agriculture will focus on a broader array of food products of higher value, differentiated in the marketplace and produced with much higher cost land and water resources in more crowded environments. Professional agriculturalists and agribusiness people will require much more education in overall ecosystem management. Colorado State University is in a strong position to assist with the economic development of Colorado's agricultural industries within the context of increasing population, higher competition for land and water, and changing policy environment by educating agricultural and resource industry professionals, researching technical and economic issues related to improved resource utilization, and enhancing international competitiveness by being actively involved with agricultural industries and governmental agencies to assure that the latest knowledge is incorporated in management and regulatory decisions which are important to sustain the agricultural industry with rapidly evolving competition for resources.

Strategic Actions:

- Establish a coordinated, integrated research, graduate education, and outreach program in long-range agro-ecosystem dynamics, led by a faculty steering committee, incorporating disciplines in the Colleges of Agricultural Sciences, Natural Resources, Engineering, and Natural Sciences.
- Develop an Environmental Chemistry program.
- Align research facilities for integrated plans and fill gaps in expertise through collaboration or new positions.
- Develop an Environmental Chemistry program.
- Continue to expand the newly created interdisciplinary program in Organic Agriculture Production and build the collaboration among the supporting departments.

Critical Resource Growth Needs:

- Assure adequate faculty staffing in rangeland, wildlife sciences and community development economics to support a comprehensive approach to the area.
- Develop additional, multi-disciplinary grant programs to provide research and travel support.
- Critical need to hire a Coordinator for the Organic Agriculture Production interdisciplinary program.
- Secure adequate lab/office space for new hires and potential future hires.

Accomplishments

General statement: Obviously ecosystem function in Colorado is highly controlled by water or the lack thereof. Therefore many of the accomplishments and impacts are linked to efficient use of water, whether it is dryland or irrigated agriculture.

Accomplishments:

The Dryland Agroecosystem Project has assisted in the adoption of no-till intensive cropping systems in Colorado and the Western Great Plains. The project has helped Colorado producers convert about 1,500,000 acres from the wheat-fallow system to a wheat-summer crop-fallow system. Adoption of these principles has increased annual net return by $22,275,000 in eastern Colorado alone and has also influenced farmers in adjacent states. Recent decreases in herbicide costs coupled with rising diesel fuel prices will further increase the profit margins of no-till systems relative to tilled fallow systems. Furthermore, these intensive cropping systems build soil organic carbon, improve soil quality, and improve both air and surface water quality because they reduce soil erosion by 80 to 99% relative to tilled wheat-fallow systems.

Precision agriculture research has improved the plant use efficiency of N fertilizer via the use of variable fertilizer application rate technology. Rates of N are altered for different management zones within a given field. CSU research has shown that net returns are increased by $12-30 per acre using site-specific N management. Continually rising fertilizer N prices will greatly increase the benefits of precise use of N fertilizers. In addition to economic returns, nitrate leaching can be reduced by 25%, compared to uniform N fertilizer management techniques.

Scientists in this group are developing methods to accurately inventory soil carbon sequestration and assess current and future emission and sequestration levels of carbon. These inventories will assist our nation in meeting international treaty obligations. They will also help design cost-effective future carbon dioxide mitigation policies. Information obtained from this work has been included in the US national communication to the UN Framework Convention on Climate Change (UNFCCC). Improvements in inventory methodologies will be used by most countries in the world for their reporting to the UNFCCC. USDA is now using the computing tools developed at CSU to guide decisions on conservation components of national farm policy, including how to allocate Conservation Security Program participation funds to agricultural producers, in Colorado and the rest of the US.

Scientists in the group are studying the importance of biological controls on silica cycling in terrestrial environment. Silica cycling is of fundamental importance in coupling terrestrial and oceanic carbon cycles. This work suggests that geochemical behavior as well as the variability of biogenic Si within grassland ecosystems has been historically linked to climate change and grassland productivity. Given that precipitation and temperature are being impacted directly and indirectly by human activities in grasslands worldwide, data generated by this research will facilitate more robust forecasts of human impacts on global-scale processes.
In the Arkansas River valley furrow and drip irrigation produced equal corn yields, even though 45% less water was applied with drip than with furrow irrigation. Drip irrigation of onions compared to furrow irrigation practices resulted in a water savings of 72%. This work demonstrates the feasibility of drip irrigation for corn and particularly onion production in the Arkansas Valley.

Subsurface drip irrigation produced comparable alfalfa hay yields to sprinkler irrigation in Southwestern Colorado. Drip tape lateral spacing of approximately 100 cm would ensure uniform water distribution and maximize hay production. Installation cost, maintenance requirements, and gopher control remain as challenges to the adoption of drip irrigation by alfalfa hay producers in southwestern Colorado.

Scientists in this group do nutrient-assessment research on biosolids application and have shown that biosolids can supply sustainable levels of plant nutrients while posing very small environmental threats. For dryland wheat in eastern Colorado, biosolids are an excellent source of plant-available N, P, and Zn.

Historically, the environmental risks associated with land-application of biosolids were largely considered to be over-application of phosphorous and heavy metals. We now know that antibiotics are not destroyed by waste water treatment practices and can be detected in biosolids materials. Application of biosolids to land introduces not only antibiotics, but antibiotic-resistant bacteria as well, to soil. A social impact could arise if humans come into contact with soil-borne bacteria carrying antibiotic resistance genes (either from direct contact with soil or from crops contaminated with soil and/or biosolids), or if antibiotic-resistant bacteria move from soil into water (surface runoff events or downward migration into groundwater) which is then consumed by humans. Managed Ecosystem scientists are currently conducting research to determine whether such risk concerns are warranted.

The amount and distribution of genetic diversity in yellow toadflax presents potential management challenges and may explain previous reports of limited control with herbicides. Current results do not show evidence of local adaptation having reduced or redistributed genetic diversity, but they do indicate that many yellow toadflax populations have the potential to evolve resistance to management strategies such as herbicide application. Reports from land managers of possible hybridization between Dalmatian and yellow toadflax have implications for bio-control strategies, since bio-control agents currently in use have species-specific feeding preferences, and it is not known how effective such agents would be on hybrid plants.

Internal Linkages

The Soil and Crop Sciences (SCS) Department has had a close linkage with the Natural Resources Ecology Laboratory (NREL) for about 25 years. The initial ties with NREL were created via the NSF funded "Great Plains Project" led by Dr. Robert Heil of the SCS Department, by Dr. Ted Elliott of the NREL, and by Dr. Vern Cole of the USDA-ARS. Currently Dr. Keith Paustian of the SCS Department works closely with NREL and is actually housed in their building. Interactions with the Department of Forest, Rangeland, and Watershed Stewardship have existed because of joint research projects over the past 20 years. Dr. Barbarick worked closely with Dr. Redente in reclamation projects involving the use of biolsolids, and Dr. Kelly works with Drs. Burke and Lauenroth in regard to the NSF funded Grass Steppe LTER project. Interactions with the Department of Civil and Environmental Engineering relating to salinity management in the Arkansas Valley of Colorado have been ongoing for over 10 years. New efforts are under way to create new relationships between SCS and Animal Sciences that relate to animal-plant production systems, particularly as related to dryland cropping systems.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic planning initiative.

I. Majors:

The following table illustrates the trend in the number of undergraduate majors for this strategic initiative:

Major (Fall Semester)	2005-06	2006-07	Increase/ Decrease	2007-08	Increase/ Decrease
Soil and Crop Sciences	64	60	-4 (-6%)	55	-5 (-8.3%)
Horticulture	60	57	-3 (-5%)	74	17 (29.8%)
TOTALS	**124**	**117**	**-7 (-5.6%)**	**129**	**12 (10.2%)**

* Includes secondary majors

The following table illustrates the trend in the number of graduate majors for this strategic initiative:

Fall Semester	2005-06	2006-07	Increase/ Decrease	2007-08	Increase/ Decrease
Soil and Crop Sciences	28	25	-3 (-10.7%)	30	5 (20%)
Horticulture	19	20	1 (5%)	24	4 (20%)
Totals	**47**	**45**	**-2 (-4.2%)**	**54**	**9 (20%)**

* includes MS and Ph.D. majors

II. Financial Resources:

Faculty and staff representing the departments of Agricultural and Resource Economics, Bioagricultural Sciences and Pest Management, Horticulture and Landscape Architecture, Soil and Crops Sciences and the Agricultural Experiment Station dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	2004-05	2005-06*	Change	2006-07**	Change
Resident Instruction	$444,456	$517,571	$73,115 (16.45%)	$557,703	$40,132 (7.8%)
AES					
State	$939,707	$938,635	-$1,072 (-0.11%)	$1,011,063	$72,428 (7.7%)
Federal	$289,838	$310,836	$20,998 (7.24%)	$320,021	$9,185 (3.0%)
Extension					
State	$180,467	$203,242	$22,775 (12.62%)	$210,920	$7,678 (3.8%)
Federal	$4,595	$0	-$4,595 (-100%)	$900	$900 (100.0%)
Grant/Contract	$2,303,277	$2,293,467	-$9,810 (-0.43%)	$2,467,782	$174,315 (7.6%)
Cash	$387,543	$448,006	$60,463 (15.6%)	$414,940	-$33,066 (-7.4%)
Gift	$18,831	$780	-$18,051 (-95.86)	$8,374	$7,594 (973.6%)
Totals	**$4,568,714**	**$4,712,537**	**$143,823 (3.15%)**	**$4,991,703**	**$279,166 (5.9%)**

* 34.05 FTE ** 45.93 FTE

III. Refereed Journal Articles:

Refereed journal articles published from faculty and staff dedicated to this strategic initiative were counted for calendar years 2005 and 2006. For 2005, 35 total refereed journal articles were published. For 2006, 25 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative decreased by 10 from calendar year 2005 to calendar year 2006.

IV. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with this strategic initiative participated in approximately 192 workshops/presentations reaching more than 9,164 total number of attendees and participants.

B. Highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- Reagan Waskom, III: Significant time was spent organizing Extension's response to the 2006 drought. This involved convening regular conference calls throughout the year with agents, handling media requests, developing resource materials and web resources, and representing the University on the State Water Availability Task Force: Worked with the Colorado Ag Council to organize and staff the newly formed Colorado Ag Water Alliance: Organized a team of Cooperative Extension agents to represent CSU at the HB1177 Water Roundtables around the state: Responded to a request by DNR to assist in putting together the Compact Commission Charter documents in collaboration with Lyn Kathlene of CIPP: Asked to serve on the IBCC Public Education Committee: Worked with NASULGC and Fleishman-Hillard to develop a LGU Water Seminar held in Milwaukee on Jan 1, 2006: Worked with scientists at Montana State University, Utah State University and the University of Wyoming on landowner issues relative to coal bed methane development: Developed a manual and training program for landowners: Worked with MSU and UC Davis faculty to organize an impaired water symposium at the Soil Science Society meeting in Indianapolis: Served as Regional Coordinator for the USDA CSREES Water Program providing leadership at the regional and national level for USDA and the LGUs. This role required me to join the other nine Regional Water Quality Coordinators on the USDA CSREES Committee for Shared Leadership for Water Quality, helping to set and implement the national agenda for USDA water related programs.
- Neil Hansen: Participated in a wide variety of outreach activities including field days, workshops, and seminars that reached more than 1,400 people including farmers, agricultural professionals, agency staff, water managers, students, and the general public.
- Raj Khosla: Conducted a few hands-on workshops for the farmers. Took 24 laptops from the College of Agricultural Sciences and spent a few hours to day-long hands-on workshops for farmers. This model of hands-on workshop has been well received by practitioners and farmers as indicated by the post-workshop evaluations. In 2006 the workshops impact was quantified as follows: Acres Impacted: Total: 321,000 Acres Crops Impacted: Alf-alfa, Corn, Potatoes, Beans, Sugarbeats, Wheat, Millet, Sunflower. Value of Workshop: Based on the (weighted average) written response on the post-workshop evaluation $667,320 (Overall Average**:** $2.07/acre in terms of value of workshop provided to farmers.)
- Keith Paustian: Service to EPA and USDA on development of National Greenhouse Gas Inventory Method; Service to USDA/NRCS on National Accounting Systems for Voluntary Reporting of Greenhouse Gas Emissions and Sinks; and service to State of Colorado in preparing carbon sequestration potential estimates for agriculture.

C. Participation in state, national and international committees, programs and task forces:

1. James Pritchett: Guided sessions, facilitated and served as session wrap-up speaker at the semi-annual, two-day training for Colorado Cooperative Boards of Directors; Facilitated and session wrap-up speaker for Colorado Council for Cooperatives, Director's Training, Tier 4.

2. Dana Hoag: Coordinated 2006 annual meetings for the Western Ag Econ Association and also serves as President of the organization.

3. Horst Caspari: Member of the Steering Committee for the National Grape and Wine Initiative; Member of Review Panel – Cultural Practices, USDA-Viticulture Consortium West (30 proposals).

4. Harrison Hughes: Served as Co-Chair of the opening scientific session of the Third International Date Palm Conference in Abu Dhabi, UAE held February 19-21, 2006. Served on the Scientific Committee of the conference.

5. Yaling Qian: Served as a liaison to the Joint Reuse Committee of Rocky Mountain Section of American Water Works Association and Rocky Mountain Section of Water Environment Association (RMSAWWA/RMSWEA). Served as an advisor for the salinity subcommittee under the Joint Reuse Committee. Worked with several water entities in Colorado to develop guidance documents for recycled wastewater users and treaters.

6. Steve Newman: Developed 2 workshops with the Colorado Retail Florists Association and Teleflora. For the American Society for Horticultural Sciences, served as Past Chair of the Commercial Horticulture Extension Working Group and member of the Certified Horticulture Advisor *ad hoc* Committee.

7. Danny Smith: Member, Statewide Water Supply Initiative – Phase II Panel: Alternatives to Permanent Agricultural Water Transfers.

8. Dwayne Westfall: WERA-103, "Nutrient management and water quality", CSU regional committee representative; Tear-down-the-walls regional dryland research planning committee; Committees - World Congress of Soil Science; and chaired project development committee for "Impact assessment of the prevalence and severity of agricultural drought on various spatial and temporal scales" for the US/India Agricultural Knowledge Initiative in New Delhi, India. Our project was ranked as number one in priority out of nine.

9. Mary Stromberger: Member, S475, Emil Truog Soil Science Award committee of SSSA (2006-07).

10. Gene Kelly: National Science Foundation Panel, Biological Sciences, Washington, D.C.; National Science Foundation Panel, Geological Sciences, Washington, D.C.; Technical Advisory Committee to the National Soil Survey Program, Washington, D.C.: Technical Advisory Committee to the National Soil Survey Center, Lincoln, NE; Soild Micromorphology and Soils and Geomorphology committee members, SSSA.

11. Jim Ippolito: State of Colorado Tri-Annual Review Biosolids Agronomic Rate subcommittee, 2005-2006; Presiding Officer, S11 Oral Session, Phosphorus Availability and Mobility in Land Applied Wastes, 2006; American Society of Agronomy Meetings, Indianapolis, IN; Undergraduate Research Poster Symposium Contest Judge, 2006; and American Society of Agronomy Meetings, Indianapolis, IN.

12. Jack Fenwick: Coordinator of State FFA Crops Judging Contest; State Committee on Ag in the Classroom; CSU representative to American Distance Education Consortium, ADEC; Denver International Airport project with G. Peterson. Meetings with DIA and farmers to establish best management practices on DIA owned land; American Society of Agronomy, Keim Fellowship

Selection Committee, A 449.6 Presentation Contest, Chair 04, 05, Western Regional representative to NACTA, CSSA GO Scholars Committee.

13. Greg Butters: Active member of Regional Research Committee W-1188.

14. Joe Brummer: Member of the Society for Range Management; Represented Colorado as a member of the planning committee for the Western Alfalfa and Forage Conference held in Reno, NV on December 11-13, 2006 and moderated one of the technical sessions at the meeting; Committees - Elected to the Board of Directors for the Colorado Section of the Society for Range Management (2-year term); Member of the Investment Committee for the Colorado Section of the Society for Range Management; Member of the High Altitude Revegetation Committee; Agreed to serve as co-editor for the proceedings in coming years; Member of the Western Coordinating Committee WCC-1002, agreed to chair this committee during the upcoming year (2007).

15. Ken Barbarick: American Society of Agronomy Editor-in-Chief, 2003-2008; Voting member of CSREES research committee W1170 (Waste Constituents in Soils); Chair, American Society of Agronomy Editorial Policy Committee, November 2003-2008; American Society of Agronomy Board of Directors, 2006-2008; American Society of Agronomy Book Committee, 2005-2008; American Society of Agronomy Budget and Finance Committee, 2006-2008.

16. Kevin Larson: NRCS Southeast Colorado Plant Materials Introduction Committee.

17. Ron Godin: Tri-Societies, committee on Organic and Sustainable Agriculture; Served on the Board of Directors for the Valley Organic Growers Association, Sept. – Dec. 2006.

18. Abdel Berrada: Member of W1128 (Regional research group on microirrigation); Committee Member of A-7 Award Selection Committee.

19. Keith Paustian: Climate Change Science Steering Group (Advises Fed. Agencies on CC research); State of the Carbon Cycle Report to US Global Change Science Program – Writing Team; Coordinating Lead Author – Intergovernmental Panel on Climate Change (IPCC) 2006 Revised Guidelines for National Greenhouse Gas Inventories; UN/Global Environmental Facility project in Brazil, India, Jordan and Kenya; USAID/EPA project in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

20. Raj Khosla: President of the Gamma Sigma Delta, CSU Chapter (completed my term in Jul, 2006); President of the Association of Agricultural Scientists of Indian Origin 2006-2008; Chair of the International Precision Agriculture Conference 2008 and 2010; Colorado Representative on the NCERA-180 North Central Region Precision Agricultural Committee; Appointed on USDA-OSQR (Office of Scientific Quality Review) Panel and reviewed USDA-ARS proposal in Beltsville, MD; Appointed Chair of the ASA J. Fielding Reed Scholarship Awards Committee; Invited to become part of the US-India Agricultural Knowledge Initiative. Participated in several conference calls, hosted by USDA-FAS, Washington D.C.

21. Neil Hansen: Member of Customer Focus Group, USDA-ARS Akron; Member of Advisory Committee, USDA-Great Plains Systems Unit; and "Tear Down the Walls" Regional Committee of Cropping Systems Scientist.

22. Reagan Waskom: USDA CREES Committee for Shared Leadership for Water Quality (Chair 06/07); Colorado Governor's Water Availability Task Force; Board of Trustees - Colorado Foundation for Water Education; Board of Directors - Colorado Watershed Network (President 06/07); NRCS State

Technical Committee; Chair of Education Committee for the Colorado Foundation for Water Education; Colorado AWARE Advisory Board; NASULGC Water Seminar Planning Team; Served on review panel for NRI Water and Watersheds; Lead CSU Delegate for UCOWR; Participated on CSREES review team for the Heartland Region Water Project; City of Fort Collins Water Board; Conduct ongoing programs with Colorado Dept. of Agriculture, Colorado Dept. of Public Health and Environment, Colorado Department of Natural Resources, USDA-NRCS, USGS.

23. Troy Bauder: Served on the planning committee for the 2006 South Platte Forum; Served on Colorado board for Certified Crop Advisor Program as chair of exam committee; Served on the Colorado Nonpoint Source Council; American Society of Agronomy – Certified Crop Adviser program, International Exam subcommittee.

24. Jerry Johnson: Nebraska Panhandle Research and Extension Center (Proso millet and oilseed testing); USDA ARS scientists in Fort Collins, Akron, and Colby, KS.

25. Jessica Davis: Organized the Agricultural Air Quality Workshop with the Colorado Livestock Association; Organized session on Nutrient Management with NRCS and CDPHE for the Rocky Mountain Ag Business Association; developed and organized 2-part symposium on Antibiotics and the Environment for the International Soil and Water Conservation Society's Annual Meeting; and served as a member of the program development team for the CAFO Roundtables, a national conference for state and federal CAFO regulators.

External Linkages

The Managed Ecosystems program is closely linked with three USDA-ARS units: 1) The Great Plains Systems Unit located in Fort Collins, whose leader is Laj Ahuja; 2) The Water Management Unit located in Fort Collins, whose leader is Tom Trout; and 3) The Central Great Plains Research Station located at Akron, CO, whose leader is Merle Vigil.

The Great Plains Systems unit has had cooperative agreements with the SCS Department continuously since 1985. These agreements have provided backbone financial support to the cooperatively operated Dryland Agroecosystems Project. This project has had significant impact on agricultural practices in the West Central Great Plains and is internationally recognized by scientific peers. The Water Management unit had a cooperative agreement with the SCS Department for a period of 5 years that emphasized Precision Agriculture. At present this ARS unit is forming a new cooperative agreement with SCS that involves water use in limited irrigation. The Central Great Plains Research Station has worked cooperatively with the SCS Department on a variety of dryland management projects over the past 40 years. All of their scientists hold adjunct appointments in the SCS Department. The SCS Department has worked cooperatively with USDA-NRCS for over 40 years in the state soil survey project.

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Gary Peterson
Steering Committee Lieutenant(s): Frank Peairs and Reagan Waskom
Steering Committee Members: Neil Hansen (SCS), Eugene Kelly (SCS), Mary Stromberger (SCS), Kraig Peel (AS), Bill Wailes (AS), Dana Hoag (DARE), Patrick Martin (HLA), Bruce Bosley (CE), Luis Garcia(Civ. Engr.), Lou Swanson (VPOSP), Del Benson (FW B), Mark Paschke (FRWS),

A. Agricultural and Resource Economics
Faculty: Marshall Frasier, Gorm Kipperberg, James Pritchett, Paul Huszer

B. Horticulture and Landscape Architecture
Faculty: Horst Caspari, Harrison Hughes, Steve Newman, Yaling Qian,
Admin. Pro.: Michael Bartolo, Mercy Essah, Samual Essah

C. Soil and Crop Sciences
Faculty: Allan Andales, Ken Barbarick, Thomas Borch, Joe Brummer, Greg Butters, Jessica Davis, Jack Fenwick, James Ippolito, Raj Khosla, Keith Paustian, Dwayne Westfall
Admin. Pro.: Saseendran Anapalli, Troy Bauder, Abdelfettah Berrada, Adriane Elliott, Ron Godin, Jerry Johnson, Kevin Larson, Matthew Neibauer, Kimberly Schultz, Timothy Shaver, Caroline Yonker, Mary Schumm, James Self

D. Agricultural Experiment Station
Faculty: Lee Sommers
Admin. Pro.: Mark Stack, James Valliant

E. Extension
Agents: Wayne Cooley, Alan Helms
Area Specialists: Merle Dillon, Joel Schneekloth

Annual Report
2006-07

Economics, Management, Policy and Trade for Agribusiness and Communities

Goal: Colorado State University will enhance its focus and depth in undergraduate education, graduate education, research, and outreach in the economic and business aspects of agriculture, its' business firms, industries and policy issues, and be recognized nationally for these contributions. This will include experiential learning in the BS degree in Agribusiness offered on its own or as a double major with agricultural sciences, natural resources, and human nutrition. Research and graduate education will focus on marketing strategy, financial and risk management, and firm responses to agricultural and trade policies. Moreover, the educational focus will be additionally on the role of natural resources in policy and agricultural performance. Outreach will include marketing, finance, risk and production management, and policy responses for agricultural input, production, and processing/merchandizing businesses of Colorado.

Purpose: Production agriculture is a $6 billion enterprise in Colorado and, with related input, processing, and merchandising support industries, agriculture is a $16 billion component of the Colorado economy. Production agriculture has changed over the years. Price and income supports are no longer the centerpiece of U. S. farm policy and with the new round of international trade negotiations, these supports likely will be of less value in the future. Agricultural producers now operate in a market-oriented, individual-responsibility environment. Producers, individually or in groups, are finding greater profitability in differentiated, consumer-oriented products requiring knowledge of supply and marketing chains, product differentiation, consumer product marketing, corporate accounting, and new risk and financial management tools. The newest themes for farmers, local commodity handlers, processors, and rural businesses are "total resource management" and "rural entrepreneurship." Also, the Census of Agriculture reports that there are decreasing numbers of mid- and large-sized farms and a significant increase in the number of small farms; the latter category of individuals frequently does not contain much agricultural business knowledge.

The Department of Agricultural and Resource Economics offers the B. S. in Agribusiness (130 majors in Fall 2006) and the B. S. in Agricultural Economics (17 majors in Fall 2006). With changes in curricula in the Equine Science and Animal Science majors, additional purposeful effort to develop secondary majors with Horticulture and Landscape Architecture and Forest, Rangeland, and Watershed Stewardship, and the recent growth in student interest in double majors, plus the differential tuition charges for courses in the College of Business, the demand for agribusiness courses is expected to grow rapidly. Colorado State University is in a strong position to assist with the economic development of Colorado's agricultural and rural industries and to enhance the viability of agricultural and rural business by educating professionals for the agricultural industries with knowledge of modern business practices, researching technical and economic issues related to differentiated agricultural products in the ever-changing domestic and international market place, and by being actively involved with agricultural industry personnel and governmental agencies to assure that land managers and communities can evaluate a broad range of opportunities to enhance viability.

Strategic Actions:

- Grow the faculty to reflect growth in student demand and increased university emphasis on economic development and outreach
- Strategically develop double majors with other disciplines and on-line courses (certification and degree completion).
- Host a high-profile policy conference attracting regional and national figures by 2010.
- Enhance the connection between the department and the Office of Economic Development, Colorado Institute of Public Policy, and the Community Development Core Area.
- Promote and enhance closer connections with the College of Business.

Critical Resource Growth Needs:

- Add three faculty positions in agribusiness (economic development identified as one) to reflect student demand, increased emphasis on economic development and outreach, and complement the graduate program with differentiated Ph.D. classes.
- Add a $100,000 annual fund to support graduate student first year stipends.
- Secure two endowed chair positions for the Department of Agricultural and Resource Economics.
- Enhance departmental operating support by $70,000 annually.

Accomplishments:

1. Beef and other livestock research and outreach

One of the key focuses of faculty is in beef and other animal systems. We do work on the supply chain, demand analyses, and agribusiness and policy analyses of main issues in animal agriculture. During the past year, a number of large projects have been completed. First, our faculty members were instrumental in editing a book on livestock insurance (Koontz, Hoag, and Thilmany, *The Economics of Livestock Disease Insurance: Concepts, Issues and International Case study*). Second, a very large USDA Livestock and Meat Marketing Study was mandated by Congress and funded through the USDA Grain Inspection Packers and Stockyards Administration. The $4.3 million project provided a comprehensive look at alternative marketing arrangements within the livestock and meat industry. (Koontz participated in this study). Third, two of our faculty members helped write chapters on Food Safety and Animal Health, and Consumer Demand and Issues, for the Farm Foundation's *Future of Animal Agriculture* project.

Faculty also played a role in the analysis of several major policy issues in the livestock system. Our faculty were nationally recognized in areas of animal traceability and ID issues, and related issues such as Country of Origin Labeling (COOL) and infectious disease outbreaks (Koontz, Umberger, Pendell and Parsons). Umberger has been working on the international dimensions of COOL this past year, while there has been extensive outreach and outlook analyses done (See http://www.lmic.info/memberspublic/animalID/AnimalID.htm). Also, Koontz presented numerous agricultural outlook presentations. Pendell also looked at the impact of one major policy in the livestock supply chain, that of mandatory price reporting. ("Impact of Mandatory Price Reporting on Fed Cattle Market Integration." *Journal of Agricultural and Resource Economics* Vol. 31, No. 3:568-579.)

A third dimension of the work has been in the area of demand analysis for beef attributes, and consumer willingness to pay for natural meat. A primary focus is on the potential for value-added agricultural economic development using natural meat marketing strategies based on consumer segmentation, and better pricing and marketing strategies based on consumer interest in attributes, including country-of-origin labeling, traceability and tenderness.

Some work has also been done on the supply side during the past year, as a large producer survey was finished this year with faculty at the University of Wyoming (with Frasier and Umberger). Also, the ABM team and Norm Dalsted do much work on the financial and profitability analysis of various livestock production and feeding options.

Finally, the *Fed Cattle Market Simulator* has been used for many years as role-playing exercise in seminars, classes and meeting settings with various groups and organizations. This program is national in scope and intensive two-day seminars have been conducted with agribusiness professionals across the country.

2. Other Agribusiness and Farm Production Research and Outreach

The department engages in on-ongoing work on a variety of industry studies, demand analyses and producer research and outreach activities. These are similar in nature to much of the work in the beef section, but are often related to other commodities and issues. The major areas of effort are listed below.

a. One substantial program is RightRisk, where approximately 20 programs were given during 2006. RightRisk has now been delivered in over 100 different programs in 12 states. This year, Dana Hoag, Catherine Keske, and Jay Parsons received funding to target women. The team was also invited to present the program to administrators at RMA and CSREES in Washington, D.C.
b. Marketing in nonconventional (organic, natural, humane) and local food systems: Faculty (Thilmany) provide presentations, programming and technical support to agricultural and specialty food producers in niche marketing, agribusiness management and distribution/retailing activities. These activities have increased our department's and Extension's impact among producers with non-commodity and alternative production and marketing interests, as well as professionals and businesses in specific segments of the broader food industry (chefs, small food processors, specialty retailers).
c. Consumer Demand for Alternative Food Product and Local Food Purchases: We have looked at consumer segmentation, relative importance of various product attributes and some willingness to pay assessments for a variety of organic and other crops. The primary focus for future work on value-added agricultural economic development is natural meat marketing strategies based on consumer segmentation, agritourism based analysis and studies of how different agricultural portfolios may affect the financial performance of Western US counties. We have done a number of feasibility studies on onion nuggets.
d. Organics: Dr. Thilmany's position as National Program leader for the USDA's Organic Program will lead to an exploration of some of the market forces, supply chain issues and marketing policy challenges facing this fast growing sector of the food industry. In the short term, it will likely be through conceptual pieces and organized Symposia at various national meetings.
e. International: Over time, we look to ongoing research relationships in Costa Rica, Brazil and Mexico in order to try to fill programmatic needs, as well as provide additional opportunities for faculty and foreign student recruitment in those locations. The USAID proposal with Antonio Kido is one step in that direction. Serving as host to Andre Moraes (Brazil) and signing an IMOU with EMBRAPA is another. Continuing to work on research projects with INCAE (and Stanford) personnel is a third investment in that future vision. And the USDA FEP ("Russia") program is an ongoing investment in international development work that may bear fruit for our students somewhere along the line.

3. Natural resources policy and valuation

Policy, economic and business development work done by faculty related to natural resources is presented in this section. The key resources of interest are the water, land and forest resources in Colorado, but also international dimensions, with both policy and business issues, are at times addressed. This area of focus is one of the largest and most productive. Over half of our journal articles, book chapters and contract dollars are in this area. Also, about half of the faculty members within this strategic initiative are in this area.

Our faculty makes a very significant contribution nationally in the area of valuation of a resource's attributes, ranging across methodological, empirical and topical perspectives. As examples, work has been done on: the value of prescribed fires on the urban wild land interface; the use and passive values in river and lake restoration; sea otter expansion in California; the passive use value for wild salmon; the value of ecological support functions of wildlife, among others (See Loomis and Seidl's work). Many papers have had a methodological contribution, as articles addressed issues such as the following: Adjusting for trip purposes in regional economic analyses of tourist destinations; contingent valuation and travel cost methods for multiple destination trips; issues of ethnicity and language in contingent valuation methods; question formats and valuation of environmental restoration in rural China.

Many policy and economic development issues naturally are linked in these kinds of resource studies. The value of agricultural land preservation has been investigated in detail in Routt County by faculty (Seidl and Loomis). The role of conservation easements in environmental control and economic development have also been a focus of faculty recently (Hoag and Keske). The Ford Foundation's Community Forestry project (Cheng, Fernandez and Seidl) led to significant outreach efforts in Delta and Montrose Counties. A lodging tax analysis, designed to assist growth in tourism, resulted in a ballot measure in Huerfano County, and a working

group to further investigate a ballot measure in Custer County (which has now been authorized by the County Commissioners in Custer County). The Huerfano measure passed with a 70% vote in favor, having lost with only 40% in favor just 2 years ago. Business technical assistance materials for agritourism enterprises emerging in the West have been developed by Thilmany and Onozaka, and this will be a growing area for outreach within the planning area. The socioeconomic evaluation of land use alternatives in the Little Snake Field Office of BLM has shown clear links between economic development and land uses such as agriculture, oil and gas activity versus recreation (Davies, Loomis and Seidl).

In the water area, the research has been varied as well and had significant links to agricultural production, water transfers from agricultural to urban uses, and environmental issues. Recent publications include an analysis of irrigation induced water logging and salinity on agricultural lands, the importance of institutional structures in controlling run off, and a meta-analysis of water pricing elasticities (Frasier, Schuck and Loomis). The department also figured prominently in the 2006 Nick Petry Workshop "Are Water Conflicts Inevitable?: Agriculture vs. Urban Colorado", which was sponsored by the Western Center for Integrated Resource Management (WCIRM) and the National Western Stock Show (NWSS) Frasier and Pritchett)). Pritchett also gave over ten presentations throughout the state related to water transfer issues and revised more than one million dollars in contracts and grants in this area. A new initiative, relating agribusiness to water, is found in a $200,000 contract with the Western regional Aquaculture Committee, led by Craig Bond, among others in the department.

Several other resources and environmental areas are being investigated as well. Demand studies of potential changes in visitations to recreational sites in the presence of climate change have been published and several papers looking at the effects of different tillage systems on carbon sequestration (Loomis and Pendell). Kipperberg has worked with the Seattle public utilities investigating many dimensions of household recycling options and values. This work has been circulated to European Union policymakers in their European Commission DG Environment News Alert project which aims at providing relevant scientific information to policy makers on a weekly basis. (http://ec.europa.eu/environment/integration/research/research_alert_en.htm).

Loomis data sets are being used in books on non-market valuation (Haab and McConnell book on Valuing Environmental and Natural Resource), by the U.S. Bureau of Reclamation (in training economists on CVM) and the US Forest Service (our recreation value studies are on their website).

Internal Linkages:
The strategic planning area currently interacts with many entities across campus. Faculties in the Departments of Agricultural and Resource Economics, Accounting, Finance and Real Estate, Natural Resources Recreation and Tourism, Economics, Soil and Crop Sciences, Horticulture, Food Science and Human Nutrition work together in support of this planning area. Also, faculty work closely with many business and financial applications in Extension through our close work and joint appointments with regional economists. We also have significant linkages between specialists and agents in Extension, as our agro tourism and land use planning areas include both agents and specialists in a long term and growing partnership. Personnel also work with many entities within the university. In fact, members work with most of the institutions assembled under the Office of Outreach and Strategic Partnerships. For the purposes of this area, CSU's Center for Public Policy, Extension, the Water Center of Colorado State University, and the Office of Economic Development are the main institutions with which we work. These efforts together suggest a number of multidisciplinary linkages. Three main linkages are strong: (1) linkages with water resources faculty throughout the university, and related linkages to crop production faculty and regional economics; (2) linkages to natural resources faculty and Extension specialists and agents working on land use policies; and (3) linkages with faculty and Extension specialists who are interested in marketers, restaurants and others in the food system. This has included links with meat science and faculty in the College of Applied Human Sciences.

Analysis of Outcome Measures

Outcome measures have been established to monitor the progress and growth of this strategic initiative.

I. Majors:

The following table illustrates the trend in the number of undergraduate majors for this strategic initiative:

Major (Fall Semester)	**2005-06**	**2006-07**	**Increase/ Decrease**	**2007-08**	**Increase/ Decrease**
Agricultural Business*	209	217	8 (4%)	223	6 (2.7%)
Agricultural Economics*	17	18	1 (6%)	16	-2 (-11.1%)
TOTALS	**226**	**235**	**9 (4%)**	**239**	**4 (1.7%)**

* Includes secondary majors

The following table illustrates the trend in the number of graduate majors for this strategic initiative:

Fall Semester	**2005-06**	**2006-07**	**Increase/ Decrease**	**2007-08**	**Increase/ Decrease**
Masters	11	18	7 (64%)	18	0 (0.0%)
Ph.D.	17	14	-3 (-18)	13	-1 (-7.1%)
Totals	**28**	**32**	**4 (14%)**	**31**	**-1 (-3.1%)**

II. Financial Resources:

Faculty and staff representing the Agricultural and Resource Economics department in the College of Agricultural Sciences dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07. Expenditures from resident tuition, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**FY 2004-05**	**FY 2005-06***	**Change**	**FY 2006-07****	**Change**
Resident Instruction	$477,810	$483,387	$5,577 (1.17%)	$551,056	$67,669 (14.0%)
Ag. Exp. Station					
State	$258,671	$250,403	-$8,268 (-3.20%)	$262,427	$12,024 (4.8%)
Federal	$110,389	$106,376	-$4,013 (-3.64%)	$114,187	$7,811 (7.3%)
Extension					
State	$181,827	$189,496	$7,669 (4.22%)	$231,472	$41,976 (22.2%)
Federal	$0	$0	$0 (0%)	$0	$0 (0%)
Contract/Grants	$230,702	$321,135	$90,433 (39.2%)	$608,270	$287,135 (89.4%)
Cash Accounts	$0	$0	$0 (0%)	$155	$155
Gift	$0	$0	$0 (0%)	$0	$0 (0%)
Total	**$1,259,399**	**$1,350,797**	**$91,398 (7.26%)**	**$1,767,567**	**$416,770 (30.9%)**

* 10.25 FTE ** 10.80 FTE

III. Refereed Journal Articles:

Refereed journal articles published from faculty and staff dedicated to this strategic initiative were counted for calendar years 2005 and 2006. For 2005, 10 total refereed journal articles were published and for 2006, 14 total refereed journal articles were published.

Analysis: Refereed journal articles published for this strategic initiative increased by 4 from calendar year 2005 to calendar year 2006.

IV. Outreach Activities:

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with this strategic initiative participated in approximately 65 workshops/presentations reaching more than 1,000 total participants.

B. Other highlighted examples demonstrating engagement and outreach in this strategic initiative include:

- Dana Hoag and Jay Parsons: Continued to provide RightRisk programs (20 presentations for 2006). RightRisk is an innovative agricultural risk research and educational program focusing on understanding, exploring and evaluating risk management decisions. Specifically, RightRisk helps farmers and ranchers better understand risks and liabilities to their profits as well as how their management decisions impact those risks, positively or negatively. The program uses creative approaches, such as a game called Farm and Ranch Survivor that teaches risk management to simulate real hazards while educating participants. The program can be and has been used as a model to address other risks for other groups of the population, such as simulating alcohol use risks to teens or the risks of water sales to rural communities.
- Marshall Frasier: Agricultural Adventure–a program that is offered to elementary students in northern Colorado. With the creation of the post of Vice Provost for Outreach and Strategic Partnerships, an explicit objective of connecting K-12 education with University outreach activities. The Ag Adventure program has been cited as a model for a well-crafted program that relies on a rigorous standards-based curriculum that promotes learning for students and connects with teachers.
- Dawn Thilmany: Economics of the Wine Industry in Colorado - This is complementary to the work being done in local food systems since it examines agriculture outside of its traditional, commodity framework, and because the importance of Colorado's unique consumers and geography make impact analysis and assessment of tourism potential specific to this state very important. As was the case with the green industry and golf reports, this report garnered lots of publicity for the industry (and CSU as a research partner) and has helped fund graduate students in our program.
- Craig Bond and James Pritchett: The limited irrigation project provides an excellent opportunity for agricultural/natural resource-based extension activities aimed at educating Colorado producers about options under scarce water supplies and strong municipal demand for the water resource. This project has an explicit outreach objective, including curriculum development and delivery for a pilot group of small and medium-sized farmers, farm-scale demonstration sites, and field days. Fact sheets and other extension/outreach publications are anticipated.

C. Participation in state, national and international committees, programs and task forces:

1. James Pritchett: Guided sessions, facilitated and served as session wrap-up speaker at the semi-annual, two-day training for Colorado Cooperative Boards of Directors; Facilitated and session wrap-up speaker for Colorado Council for Cooperatives, Director's Training, Tier 4.

2. Craig Bond: Moderator, AAEA Annual Meeting, "Sustainability and Wildfire Management of Forests"; Session Chair, Third World Congress of Environmental and Resource Economists, "Sustainable Development I".

3. Dawn Thilmany: Member, Colorado Dept of Ag, Markets Division Advisory Board; Member, Larimer County Ag Advisory Board; Member, Farm Foundation Future of Animal Agriculture, Food Safety Working Group; Member, American Agricultural Economics Association, Selected Papers Committee and Chair, AAEA Foundation, Programs Committee.

4. Dana Hoag: Coordinated 2006 annual meetings for the Western Ag Econ Association and also serves as President of the organization.

5. Jay Parsons: Serves as member of the NAIS Sheep Working Committee and Colorado Animal ID Working Committee.

6. Wendy Umberger: W-1177 Committee Chair and coordinated the January 2006 meetings; WEMC Chair; AAES Extension Section Western Director; Farm Foundation Executive Panel on the Future of Animal Agriculture; Served on expert panel for the GAO National Animal ID Systems.

7. Norm Dalsted: Advisory Committee member for the Western Center for Risk Management; Member of the Advisory Board, Northern Colorado Agribusiness Association, Inc.

8. Steve Koontz: Coordinated the NCCC-134 Project; Tactical Advisory Committee member, Livestock Marketing Information Center.

9. Catherine Keske: Board Member, Evergreen's Mountain Area Land Trust.

10. John Loomis: Science Review Panel Member, Lower Colorado River Water Project; Co-Chair, Regional AES W1133 Rechartering Committee.

11. Jennifer Keeling-Bond: Markets Board Member, Colorado Department of Agriculture; Advisory Board Member, Houghton Mifflin; Moderator, AAEA Annual Meetings (2); CSU representative to NCERA-194 and WERA-72; Organization Committee Member, Farmer Cooperative Conference.

External Linkages: Federal and State Agencies: The personnel associated with this strategic plan area are engaged with a number of Federal agencies. We have close connections with the USDA, as Thilmany has been the USDA Integrated Organic Program Grants Panel and National Program Leader and has been on the USDA Rural Development NRI and SBIR Programs. Loomis and Bond work with the US Forest Service, a part of the USDA. Hoag has worked with administrators at RMA and CSREES, groups within the USDA, in Washington, D.C. in the course of his RightRisk contract work. Loomis, Seidl and Davies also have links with the BLM. The Colorado Department of Ag, through a Federal State Marketing Improvement program grant, helped provide funding for a national market survey. Both Thilmany and Keeling-Bond sit on the CDA's Market's advisory board. Kipperberg has worked with the Seattle public utilities investigating many dimensions of household recycling options and values. The Ag Adventure program has been cited as a model for a well-crafted program that relies on a rigorous standards-based curriculum that promotes learning for students and connects with teachers in K-12 educational institutions.

Private sector, non governmental and external academic interactions: Faculty provide presentations, programming and technical support to agricultural and specialty food producers in niche marketing, agribusiness management and distribution/retailing activities. This year we presented Jerold Harris, CEO of US AgBank, with the College of Agricultural Sciences Distinguished alumnus award and feel that we are

making progress on working with the Farm Credit System. Two of our faculty members helped write chapters on Food Safety and Animal Health, and Consumer Demand and Issues, for the Farm Foundation's *Future of Animal Agriculture* project. Koontz has worked with the Livestock Marketing Information Center as a Tactical Advisory Committee member. Other non-governmental relations that are ongoing include Pritchett's work as session wrap-up speaker at the semi-annual, two-day training for Colorado Cooperative Boards of Directors, and presentations at the 2006 Nick Petry Workshop "Are Water Conflicts Inevitable?: Agriculture vs. Urban Colorado", sponsored by the Western Center for Integrated Resource Management (WCIRM) and the National Western Stock Show (NWSS) (with Frasier). Faculty in EMPTAC are also tied to external contacts via numerous academic contacts. Jay Parsons serves as member of the NAIS Sheep Working Committee and Colorado Animal ID Working Committee. Frasier and Umberger collaborated this year with faculty at the University of Wyoming in a large producer survey. Many of our faculty sat on regional research and Extension committees: Wendy Umberger was W-1177 Committee Chair and coordinated the January 2006 meetings, and she was also WEMC Chair and AAES Extension Section Western Director. Norm Dalsted was an advisory Committee member for the Western Center for Risk Management, and member of the Advisory Board, Northern Colorado Agribusiness Association, Inc. Steve Koontz coordinated the NCCC-134 Project annual meetings. Catherine Keske is a board member for Evergreen's Mountain Area Land Trust. Jennifer Keeling-Bond was CSU representative to NCERA-194 and WERA-72, and an Organization Committee Member, Farmer Cooperative Conference.

International: Over time, we look to ongoing research and exchange relationships with universities in Costa Rica, Brazil Mexico, and possibly Russia and Italy in order to fill a programmatic need, as well as provide additional opportunities for faculty and foreign student recruitment. The USAID proposal with Antonio Kido is one step in that direction. Serving as host to Andre Moraes (Brazil) and signing an IMOU with EMBRAPA is another. Continuing to work on research projects with INCAE (and Stanford) personnel is a third investment in that future vision. And the USDA FEP ("Russia") program is an ongoing investment in international development work that may bear fruit for our students somewhere along the line. With our new international faculty, we have had contacts with European Union policymakers through their European Commission DG Environment News Alert project which aims at providing relevant scientific information to policy makers on a weekly basis. **(http://ec.europa.eu/environment/integration/research/research_alert_en.htm**

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Steve Davies
Steering Committee Co-Chairs: Dana Hoag and Stephen Koontz
Steering Committee Members: DARE Executive Committee: Marshall Frasier, Stephen Koontz, James Pritchett, Andy Seidl, Dawn Thilmany, Steve Shulman, Bill Wailes (AS), Lisa Youngblade (FHNS)

A. Agricultural and Resource Economics

Faculty: Craig Bond, Norm Dalsted, Paul Huszar, Jennifer Keeling, Catherine Keske, Gorm Kipperberg, John Loomis, Yuko Onozaka, Jay Parsons, Dustin Pendell, Wendy Umberger

B. Extension: John Deering, Dennis Kaan, Rod Sharp, Jeff Tranel

C. College of Business: Sue Hine

Annual Report
2006-07

Sustainable Community Development

Goal: Colorado State University will enhance its focus and depth in graduate education, applied research, and outreach in analyses related to sustainable community development and be recognized by municipal, county, state, and federal agencies, nongovernmental organizations, and citizens as a leading source of information and analysis promoting community development. This will include community impact analyses of economic activity, community organization for progress, evaluation of the drivers of local development, and workforce professional and personal development.

Purpose: Colorado communities are changing rapidly as a result of external influences, like loss of agricultural water, influx of retirement populations, development and demise of mineral extraction industries, changes in military deployments, and changes in cultural composition of residents. Communities struggle to develop and maintain resources: human, financial, physical, social, environmental, and political. They also are challenged to provide the organizational capacity to assess, plan, and implement activities to address resource development and management. These issues especially are acute in smaller rural communities. Colorado's communities are relatively unique in terms of sparse populations, a high natural amenity and public lands base, a transitory population, and relatively low public service provision. People in rural areas tend to be older, poorer, more likely to be uninsured, and less educated than their urban counterparts. Communities require knowledge to evaluate their resource base, their economic and social service alternatives, and their futures.

Strategic Actions:

- Coalesce the personnel resources in the rural community development area to create significant programs in rural tourism, public and private land use, alternative energy systems, contributions of rural finance to economic development, and workforce professional distance education opportunities.
- Work with multi-county, rural regions to assess opportunities and organization for future development.
- Develop relationships with the Colorado State University's Office of Economic Development and the School of Public Health to provide an outreach component for these enterprises.
- Develop Strategic partnerships with various groups, i.e. legislative relationship with Salazar's office, Colorado Rural Development Council, etc.
- Develop a Center for Rural Development

Critical Resource Growth Needs:

- Generate small amounts of seed capital to initiate team efforts to assess opportunities and organization for rural regions.
- Assess best use of funds generated by community development research associate.
- Enhance grant resources in the areas of rural tourism development, and assistance and agency contracts for workforce development distance education.
- Develop in-service training for CE agents.
- Provide resources to enhance public finance expertise, secure faculty position (endowed chair) in Rural Finance or Regional Development and expand capability in assessing the role of rural finance to economic development
- Secure faculty position in regional/international development.

Accomplishments: Sustainable Community Development activities can be grouped into four different areas of impacts:

1. Land Use Planning and Evaluation: We have a full range of efforts in this area including:
   - The value of agricultural land preservation in Routt County (Seidl and Loomis), which led to a second place Graduate Student Extension Award at the 2007 American Agricultural Economics Association meetings in Portland
   - The role of conservation easements in environmental control and economic development have also been a focus of faculty recently (Hoag and Keske).
   - The Ford Foundation's Community Forestry project (Cheng, Fernandez and Seidl) led to significant outreach efforts in Delta and Montrose Counties.
   - A lodging tax analysis, designed to assist growth in tourism, resulted in a ballot measure in Huerfano County, and a working group to further investigate a ballot measure in Custer County (which has now been authorized by the County Commissioners in Custer County). The Huerfano measure passed with a 70% vote in favor, having lost with only 40% in favor just 2 years ago.
   - The socioeconomic evaluation of land use alternatives in the Little Snake Field Office of BLM has shown clear links between economic development and land uses such as agriculture, oil and gas activity versus recreation (Davies, Loomis and Seidl).
   - Our faculty make a very significant contribution in the area of valuation of a whole variety of resources that might not have markets. As examples, work has been done on the value of prescribed fires on the urban wild land interface; use and passive values in river and lake restoration; sea otter expansion in California; passive use value for wild salmon; value of ecological support functions of wildlife, among others (See Loomis and Seidl's work).

   Key Impacts: The lodging tax analysis has been a good example of analysis that can be used across the state. Based on the two success stories, we will distribute a general analysis to the Regional and County directors in Extension to see if there are other areas where these analyses would be useful.

   The BLM project has been noted by BLM personnel as "finally" providing a decent socio-economic analysis. They have furthermore inquired about our interest in conducting more sophisticated analyses.

   The land use group is becoming a truly engaged group across Extension and on campus specialists, having obtained a venture capital grant, and a contract with the Colorado Land Board.

2. Industry Studies
   - Economics of the Wine Industry in Colorado: The economic impact analysis of the Colorado wine industry examined agriculture outside of its traditional commodity framework. Because of the importance of Colorado's unique consumers and geography, the impact analysis and assessment of tourism potential specific to this state was very important. This report garnered lots of publicity for the industry (and CSU as a research partner). The project was modeled on an earlier golf industry study, as is the forthcoming aquaculture project (Bond, PI). We are thus building a good reputation around these projects.
   - Marketing in nonconventional (organic, natural, humane) and local food systems: DARE (Thilmany) provides presentations, programming and technical support to agricultural and specialty food producers in niche marketing, agribusiness management and distribution/retailing activities. These activities have increased our department's and Extension's impact among producers with non-commodity and alternative production and marketing interests, as well as professionals and businesses in specific segments of the broader food industry (chefs, small food processors, specialty retailers).
   - We have implemented a number of feasibility studies as well, including onion nuggets, tilapia, and many others through the EA 428 capstone course and Extension interactions (J. Bond).
   - Business technical assistance materials for agritourism enterprises emerging in the West have been developed by Thilmany and Onozaka, and this will be a growing area for outreach within the planning area.

3. Rural Banking and Economic Development: This year we presented Jerold Harris, CEO of US AgBank, with the College of Agricultural Sciences Distinguished alumnus award. We also have many undergraduates joining the rural banking sector and so our contacts grow in that sector consistently; we also run an agricultural lender's tour each fall. There has been, at the same time, analysis beginning on the role of rural banking and the challenges they face. We will be using these contacts and links to propose a Center for Rural Development.

4. Institutional contacts and support:
   - Office of Economic Development: Ballweber and others have worked with this group. Martin Shields is part of the "regional economists" group between DARE and the Economics Department.
   - Colorado Rural Development Council: This group is totally revising its approach, with CSU being part of this new view; CSU's liaison through Davies will help.
   - USDA:
   - USDA Integrated Organic Program Grants Panel and National Program Leader
   - USDA Rural Development NRI Program
   - USDA SBIR Program
   - *Economic Efficiency Analysis, (*Loomis presented to BLM Social & Economic Aspects of Planning, Boise, Idaho)
   - Managed Midwest Rural Development tour and Entrepreneurship conference for Farm Foundation
   - US Forest Service
   - Colorado State Patrol
   - Colorado Rural Development Council

Internal Linkages: The strategic planning area currently interacts with many entities across campus. Faculties in the Departments of Agricultural and Resource Economics, Natural Resources Recreation and Tourism, Economics, Soil and Crop Sciences, Horticulture, Food Science and Human Nutrition work together in support of this planning area. Also, expertise within this area in the sustainable community development area has begun with Cooperative Extension's Core Competency Area Work Team, and has been expanded through relationships with other university faculty. We also have significant linkages between specialists and agents in Extension, as our agro tourism and land use planning areas include both agents and specialists in a long term and growing partnership. Personnel also work with many entities within the university. We have interaction between specialists and the Extension/Department of Local Affairs Community Technical Assistance Program. The Office of Economic Development is working closely with Jeff Ballweber and Martin Shields who are members of the Steering Committee. In fact, members work with most of the institutions assembled under the Office of Outreach and Strategic Partnerships. For the purposes of this area, CSU's Center for Public Policy, Extension, the Water Center of Colorado State University, and the Office of Economic Development are the main institutions with which we work. These efforts together suggest a number of multidisciplinary linkages. Three main linkages are strong: (1) linkages with water resources faculty throughout the university, and related linkages to crop production faculty and regional economics; (2) linkages to natural resources faculty and Extension specialists and agents working on land use policies; and (3) linkages with faculty and Extension specialists who are interested in marketers, restaurants and others in the food system. This has included links with meat science and faculty in the College of Applied Human Sciences.

Analysis of Outcome Measures

Outcome measures have been established to determine the progress and growth of this strategic initiative.

I. <u>Financial Resources:</u>

Faculty and staff representing the department of Agricultural and Resource Economics dedicated time to this planning initiative (at varying percentages) during fiscal years 2004-05, 2005-06 and 2006-07.

Expenditures from resident instruction, state and Federal Agriculture Experiment Station, state and Federal Extension, grant/contract, cash and gift accounts associated with this strategic initiative were evaluated to determine the level of financial resources dedicated to this strategic initiative. The following table demonstrates the relevant activity within these areas:

Fund Type	**2004-05**	**2005-06***	**Change**	**2006-07****	**Change**
Resident Instruction	$101,868	$103,057	$1,189 (1.17%)	$107,475	$4,418 (4.3%)
AES					
State	$55,148	$53,385	-$1,763 (-3.2%)	$51,183	-$2,202 (-4.1%)
Federal	$23,535	$22,679	-$856 (-3.64%)	$22,271	-$408 (-1.8%)
Extension					
State	$38,765	$40,400	$1,635 (4.22%)	$45,145	$4,745 (11.7%)
Federal	$0	$0	$0 (0%)	$0	$0 (0%)
Grant/Contract	$108,619	$133,625	$25,006 (23%)	$220,985	$87,360 (65.4%)
Cash	$0	$0	$0 (0%)	$0	$0 (0%)
Gift	-$1,241	$5,500	$4,259 (343%)	$7,355	$1,855 (33.7%)
Totals	**$326,694**	**$358,646**	**$31,952 (9.78%)**	**$454.414**	**$95,768 (26.7%)**

* 4.25 FTE **3.65 FTE

II. Refereed journal articles:

Refereed journal articles were counted for calendar years 2005 and 2006 from faculty and staff dedicated to this strategic initiative. For 2005, 3 total refereed journal articles were published. For 2006, 6 total refereed journal articles were published.

Analysis: Total refereed journal articles published increased by 3 from calendar year 2005 to calendar year 2006.

III. Outreach Activities

A. Participation in Workshops and Presentations:

Based on reported activities and total number of participants for each activity, faculty and staff associated with the strategic initiative participated in approximately 18 workshops/presentations reaching more than 427 total participants.

B. Other highlighted activities demonstrating engagement and outreach in this strategic initiative include:

- Jeff Ballweber: Rural Economic Development-La Junta, Have had two meetings in La Junta with private interests and economic development organizations regarding organizing a New Generation Cooperative to provide approximately 500 jobs in the area related to pop corn and tortilla production. Accomplishments – worked with participants to develop a consensus on plans for the region and identified funding sources with USDA-Rural Development to implement those plans. Future plans, apply for funding. CSU Community Outreach Day, Prowers County, Lamar Food Safety Education – Planning Committee. Washington County Development, Together with Lou Swanson, Hunt Lambert and other CSU personnel, met with the Washington County Commissioners and other County stakeholders to discuss alternative economic development opportunities for the County San Luis, CO Development, At the request of Reagan Waskom, CO Water Resources Research Institute, followed-up on discussions with a private property owner in San Luis regarding defining and implementing a multi-faceted regional/county economic development initiative.

- Dawn Thilmany: Following the success of our niche beef marketing programs, I have helped to develop new program areas that draw from different elements of this curriculum. Martha Sullins, Yuko O. and I are in the midst of developing similar business technical assistance materials for the agritourism enterprises emerging in the West. The Colorado Department of Ag, through a Federal State Marketing Improvement program grant, together with Venture Capital funds secured from Cooperative Extension have provided the funding for a national market survey going out in early 2007. Through partnerships with a number of county Extension agents and community economic development staff, we did focus groups to develop the survey and plan to integrate market analysis and other community planning tools into the agritourism focus of the Community Resource Development team I'm on the leadership team of.
- Martha Sullins: **Agritourism, sustainable community development:** Consumer market survey development (to assess preferences, experiences and expenditures on agritourism activities in Colorado), survey discussion with focus groups (approximately 45 participants total), survey administered to 1003 participants in 4 states in early 2007. **Food Stamp, Nutrition Education:** three elements of participation-Team member with FSNE faculty and staff to develop an interactive geographic information system mapping program for use by Food Bank of the Rockies and other regional food banks to measure how well current food distribution is meeting client needs. We are starting with 5 pilot counties in Colorado and assembling map layers, and will then expand it to other counties as funding becomes available (we have an initial $5000 grant from Food Bank of the Rockies).
- Andy Seidl: The lodging tax work (with Sullins, Cline, and Davies) resulted in a ballot measure in Huerfano, a working group to further investigate a ballot measure in Custer County, a number of calls from neighboring jurisdictions on how lodging taxes and marketing districts might work for them, and about $12,000 in additional resources to the department. The Huerfano measure passed with a 70% vote in favor, having lost with only 40% in favor just 2 yrs ago.

C. Participation in state, national and international committees, programs and task forces:

1. Craig Bond: Moderator, AAEA Annual Meeting, "Sustainability and Wildfire Management of Forests"; Session Chair, Third World Congress of Environmental and Resource Economists, "Sustainable Development I".

2. Dawn Thilmany: Member, Colorado Dept of Ag, Markets Division Advisory Board; Member, Larimer County Ag Advisory Board; Member, Farm Foundation Future of Animal Agriculture, Food Safety Working Group; Member, American Agricultural Economics Association, Selected Papers Committee and Chair, AAEA Foundation, Programs Committee.

3. Dana Hoag: Coordinated 2006 annual meetings for the Western Ag Econ Association and also serves as President of the organization.

4. Catherine Keske: Board Member, Evergreen's Mountain Area Land Trust.

5. John Loomis: Science Review Panel Member, Lower Colorado River Water Project; Co-Chair, Regional AES W1133 Rechartering Committee.

External Linkages:

- Local government Interactions: The value of agricultural land preservation in *Routt County* has been a continuing interaction with a local government unit, as has the Ford Foundation's Community Forestry project, which led to significant outreach efforts in Delta and Montrose Counties. The lodging tax analysis, designed to assist growth in tourism, resulted in analyses for Huerfano County and Custer Counties. The Huerfano measure passed with a 70% vote in favor, having lost with only 40% in favor just 2 years ago. Ballweber had meetings in La Junta with private interests and local economic development organizations regarding organizing a New Generation Cooperative to provide approximately 500 jobs in the area related

to pop corn and tortilla production. With Lou Swanson, Hunt Lambert and other CSU personnel, he met with the Washington County Commissioners and other County stakeholders to discuss alternative economic development opportunities for the County.

- Federal and State Agencies: The personnel associated with this strategic plan area are engaged with a number of Federal agencies. We have close connections with the USDA, as Thilmany has been the USDA Integrated Organic Program Grants Panel and National Program Leader and has been on the USDA Rural Development NRI and SBIR Programs. We are looking for opportunities to work with USDA-Rural Development to achieve our SCD initiatives. Loomis and Bond work with the US Forest Service, a part of the USDA. Loomis, Seidl and Davies also have links with the BLM. Kip Nye, in Extension, work closely on training needs with the Colorado State Patrol. The Colorado Department of Ag, through a Federal State Marketing Improvement program grant, helped provide funding for a national market survey going out in early 2007. We also are developing a link with the Colorado Department of Agriculture Markets Division in the joint funding and promotion of a marketing tool, *Marketmaker*, developed by the University of Illinois Extension.
- Private sector and government interactions: The economic impact analysis of the Colorado *wine industry* examined agriculture outside of its traditional commodity framework. This report garnered lots of publicity for CSU as a research partner, and was modeled on an earlier golf industry study, as is the forthcoming aquaculture project (Bond, PI). We are thus building a good reputation with these industries from these projects. DARE (Thilmany) provides presentations, programming and technical support to agricultural and specialty food producers in niche marketing, agribusiness management and distribution/retailing activities. This year we presented Jerold Harris, CEO of US AgBank, with the College of Agricultural Sciences Distinguished alumnus award and feel that we are making progress on working with the Farm Credit System. We will be using these contacts and links to propose a Center for Rural Development. Ballweber entered discussions with a private property owner in San Luis regarding defining and implementing a multi-faceted regional/county economic development initiative.
- Non-Profit organizations: This strategic planning area also has significant links to non-profit groups interested in sustainable economic development. The Colorado Rural Development Council is is totally revising its approach, with CSU continuing to be a significant part of this new view. With FSNE faculty and staff, an interactive geographic information system mapping program for use by Food Bank of the Rockies and other regional food banks is being developed to measure how well current food distribution is meeting client needs. Thilmany is a member of the Farm Foundation Future of Animal Agriculture, Food Safety Working Group, Managed Midwest Rural Development tour and Entrepreneurship conference for Farm Foundation. Catherine Keske is a Board Member for Evergreen's Mountain Area Land Trust.

Faculty and Staff associated with the Strategic Initiative

Administrative Advisor: Steve Davies
Steering Committee Chair(s): Craig Bond, Andy Seidl
Steering Committee Members: Jeff Ballweber (CE/DARE), Dale Edwards(CE), Mike Tupa (CE), CJ Mucklow (CE), Dennis Kaan (CE), Lou Swanson (VPOSP), Lyn Kathlene (CIPP), James Pritchett (DARE), Martin Shields(OED/Economics), Dawn Thilmany (DARE), Stephen Weiler (Economics)

A. Agricultural and Resource Economics

Faculty:	Dana Hoag, Catherine Keske, John Loomis,
Admin. Pro.:	Nigel Griswold, Martha Sullins

B. Extension Agents: Deb Alpe, Jim Conley, Dan Hernandez, Kip Nye

C. Economics

Faculty:	Harvey Cutler