

2012 Annual Report





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Extension in Colorado continues to provide research-based information from Colorado State University, despite continued budget cuts. The past six years have seen our field staff numbers diminished, even while the need for information has grown. Doing more with less means our personnel are stretched thin. Ascertaining the needs of local residents for information and education that will help them succeed in their business and home ventures is an important component of what we do.

We learned this firsthand this past month along the Front Range and Northeast Colorado as the evolving weather situation and flooding required often quick property and safety decisions; recovery efforts, meanwhile will be often slow. Extension offices provided information and education in various formats to those facing loss of home, property, crops, livestock and businesses amidst on-and-off rain forecasts and rapidly shifting conditions along Colorado's Front Range. The range of topics covered everything from family and business financial concerns, crop and home garden produce food safety, agricultural and residential soil and water issues, pest problems due to flooding and livestock and pet evacuation concerns. Extension agents from all areas—agriculture, horticulture, family and consumer sciences, community economic development, 4-H youth development, animal and veterinary sciences—stepped in where needed to provide a robust clearing house of information to those in need.

This year's annual report contains Impact Reports and Success Stories from a variety of projects throughout the state. It is, however, by no means a reflection of all the outreach and engagement efforts of field staff in their local community.

Over the years Extension in Colorado and land-grant universities nationwide have used many taglines to capture the essence of who we are and how our outreach efforts are shaped. Among them:

- Making Science Useful
- Knowledge to Go Places
- Your Front Door to the University
- Building a New Foundation
- Resources to Build With
- Information You Can Trust
- Putting Knowledge to Work

Today as in the beginning we continue to develop educational programs that bring the research generated at Colorado State University to local communities through non-formal education. We started with face-to-face meetings (and still do those today) but today we've expanded even more to the online world.

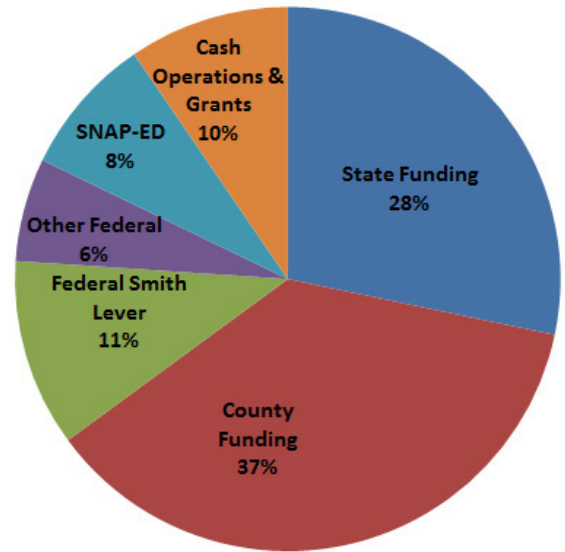
Please take a few minutes to read about the work being done by Extension agents, specialists, support staff and volunteers throughout the state. I welcome your comments and suggestions for our future work.

A handwritten signature in black ink that reads "Louis E. Swanson".

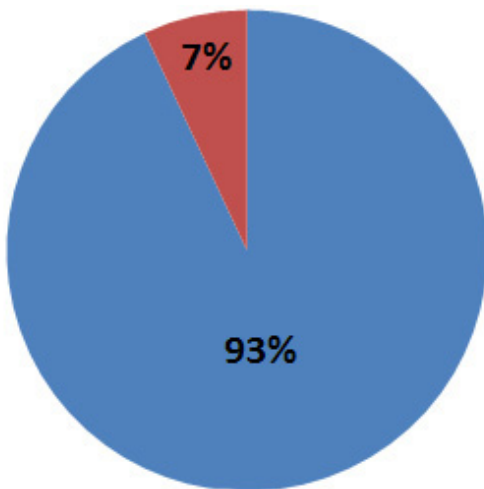
Louis E. Swanson
Vice President for Engagement and Director of Extension

Facts and Figures

Extension FY 2013 Funding Sources (\$27.6M)

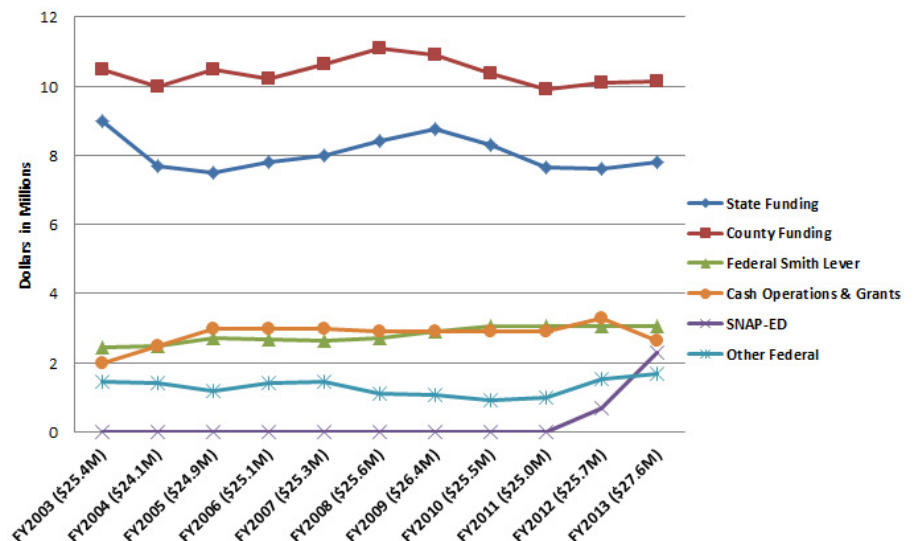


Actual Expenditures



- Salary & Fringe
- Other Operating & Travel

Historical Funding



Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

Community development through local food

Emphasis on local food production and food access has created a broad community development platform that is generating both economic and social benefits.

Issue

La Plata County citizens are committed to increasing the health, wellness, and prosperity of the region's people and communities. Educational programs and events that develop new opportunities for learning about active lifestyles, local foods, and regional food security have proved successful in achieving these goals.

Extension's Response

For nearly a decade, Colorado State University Extension in La Plata County has promoted community development by increasing awareness of and access to local foods. Darrin Parmenter, La Plata County Extension director and horticulture agent, Wendy Rice, family and consumer science agent, and Greg Felsen, 4-H youth development agent, have all created programs that support this goal.

La Plata County Extension has partnered extensively with *Healthy Lifestyle La Plata*, *Growing Partners of Southwest Colorado* and *The Garden Project of Southwest Colorado* to address issues of food security and promote local foods and healthy lifestyles (see page 2). Recent La Plata County Extension programs—some affiliated with one or more of the organizations mentioned above—include:

- Annual 'agritainment' events: *Tour de Farms*, a daylong bike tour of local farms and gardens; *Iron Horse Chef*, a cook-off series featuring local chefs and Farmers' Market produce; and *Homegrown Apple Days Festival*, a fall harvest and cider-making celebration.
- Produce Bounty: A new initiative that provides federal food assistance participants (SNAP-ED) with fresh, donated garden produce and cooking demonstrations.
- Backyard Food Production: An annual series of CSU Extension classes on growing and preserving food.
- Colorado Building Farmers: A bi-annual farmer education program that teaches the business side of successful farm operations.
- Neighborhood Days: Annual 4-H-sponsored community gatherings that feature local foods.
- Increased use of local meat and produce at the 4-H BBQ fundraiser, an annual county fair event.
- Colorado Master Gardener (CMG) help develop and maintain school and neighborhood gardens, and develop garden-related K-12 curriculum.



The Bottom Line

- La Plata County has become a statewide leader in promoting healthy lifestyles, local foods, and regional food security. The United States Department of Agriculture (USDA) defines food security as the ability by all people at all times to have access to enough food for an active, healthy life.
- CSU Extension and its partners have created a broad community development platform that is generating social and economic benefits.

By the Numbers

- La Plata County population: 51,655
- Percent of Durango School District K-12 schools with salad bars that offer local produce: 100
- Calculation of annual revenue that would be generated locally if every county household spent \$10/week on local foods: \$7.5 million

Impact

La Plata County has become a statewide leader in promoting healthy lifestyles, local foods, and regional food security. Educational programs and events developed by La Plata County Extension and more than 20 partner organizations have led to this leadership role. Together, they have created a broad community development platform that is generating social and economic benefits:

Increased self-sufficiency

- Extension-led programs in backyard food production and food preservation—along with Colorado Master Gardener volunteer efforts to establish community and school gardens—provide county residents with the knowledge and skills to have more control over what they eat and when they eat it.
- Extension partners with *Cooking Matters*, a nonprofit organization teaching families how to make healthy and affordable meals.
- 4-H youth programs develop agricultural and business literacy. Members interested in livestock and food production learn the economics behind selling, marketing, and distributing to local buyers.

Improved access to healthy and local foods

- *Produce Bounty*, which launched in fall 2011, expanded community efforts to increase healthy, local food access to low-income individuals and families.
- *Backyard Food Production*, *Iron Horse Chef*, *Homegrown Apple Days Festival*, *Tour de Farms*, and *Cooking Matters* combine to raise community awareness about the social and economic benefits of growing and purchasing healthy and local foods.
 - Since 2007, more than 4,000 people have participated in these programs and events.
 - 77 percent of respondents to a 2011 *Iron Horse Chef* survey said they were more likely to try a recipe that included healthy local foods as a result of the event; 90 percent said they were more likely to go to a restaurant that highlighted healthy local foods.

A robust local food system that is contributing to regional economic development

- La Plata County Extension developed '*Local Food Connection*' in partnership with *Growing Partners of Southwest Colorado*. The meet-and-greet event helps farmers, ranchers, and commercial food buyers form potential business relationships.
 - As a result of this event, Durango School District 9-R now buys 100% of their ground beef from a local, organic producer which means that local money stays local. The school district has become a state leader in the farm-to-school movement.
- *Colorado Building Farmers* teaches beginning, direct market farmers how to identify appropriate markets, evaluate financial needs of production plans and address risks; this know-how helps growers increase sales, expand operations, and succeed.
- 4-H projects help youth contribute to the local economy by increasing their business and agricultural production skills, and developing an entrepreneurial spirit.

Colorado State University Extension, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. July 2012. Written by Carol Busch.

“It has been important for La Plata County Extension 4-H to be a part of the promotion of local foods and healthy lifestyles. Our youth are seeing how gaining skills in agricultural, business and other 4-H projects fosters an entrepreneurial spirit and can build our local economy.”

– Greg Felsen, La Plata County Extension
4-H youth development agent

Partners in Community Development

La Plata County Extension has partnered with organizations and coalitions to address food security and promote local foods and healthy lifestyles. Here's a small sample of the partners who have made a difference:

- *Healthy Lifestyle La Plata*—This *LiveWell Colorado*-funded coalition of nonprofit organizations and agencies has advanced local foods, active lifestyles, and worksite wellness. Extension has been a partner from the beginning. The program sunsets in 2013.
- *Growing Partners of Southwest Colorado*—A group of nonprofits and service agencies dedicated to sustainable local food programs. www.growingpartners.org
- *The Garden Project of Southwest Colorado*—A nonprofit that promotes community and youth development through gardening. www.thegardenprojectswcolorado.org

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

Growing a healthier lawn

Front Range homeowners learn how to make better lawn care decisions through Extension's on-site lawn diagnosis program.

Issue

Lawn problems rank among the top three homeowner landscaping concerns brought to Colorado State University Extension offices in urban and suburban counties. While some lawn problems can be diagnosed by phone or email, most require a site visit to confirm the cause of the lawn problem.

Extension's Response

To address the need for specialized skills and knowledge in diagnosing lawn problems, in 2006 horticulture agents Carol O'Meara (Boulder County), Carl Wilson (Denver County) and Colorado State University Extension turf specialist Tony Koski developed *Lawncheck*. The program was developed with a dual purpose: train horticulture agents in research-based diagnostic skills and knowledge, and create an on-site, fee-for-service lawn diagnosis program that helps county Extension offices cover training and travel costs.

In the program's first two years, Koski and CSU Extension turf and ornamental plant disease specialist Ned Tisserat provided Front Range Extension agents with lectures and labs on grass and weed identification, turf disease, and pest symptoms. Training also included field visits to homeowners associations (HOAs) and urban parks where agents applied and refined what they learned in class. Once armed with diagnostic knowledge and skills, agents can more readily assess turf diseases, pests, brown spots, irrigation problems and other residential lawn-related issues.

In 2007, horticulture agents—with oversight by Koski—began conducting *Lawncheck* site visits in several Front Range counties including Boulder, Denver, Jefferson, and Larimer. Two years later, Colorado Master Gardeners (CMGs) interested in lawn diagnostics were invited to attend trainings and assist with site visits.

During a site visit, horticulture agents—often accompanied by CMG volunteers or Koski—discuss lawn and irrigation problems with the homeowner, evaluate treatment solutions, and provide CSU Extension fact sheets that cover the problems and treatments addressed. The process can take one to two hours.

Each participating county manages its own *Lawncheck* program. Fees vary by county, although most charge \$75, which covers travel expense, agent time, and materials. The program is offered in Arapahoe, Boulder, Denver, Douglas, Jefferson, Larimer and Weld counties, and is expanding. In 2011, 188 *Lawncheck* visits were conducted.



The Bottom Line

- *Lawncheck* is the only service in Colorado that provides homeowners with unbiased, research-based, on-site turf consultation and diagnostics.
- *Lawncheck* helps customers learn how to adopt sustainable lawn care practices that not only improve the look and health of lawns, but also save money.

By the Numbers

- Average return on investment for every \$1 put into landscaping: \$1.35¹
- Annual amount homeowners spend on lawn care in the U.S.: \$6.4 billion
- Amount of water Kentucky bluegrass weekly needs in spring and fall: 1 inch

Impact

Lawncheck is the only program of its kind in Colorado that performs on-site turf consultation and diagnostics that help customers (homeowners, HOAs, businesses and more) learn how to improve their lawn care practices. These might involve: making changes to their watering, mowing and cultural practices; repairing malfunctioning sprinkler systems; selecting different turfgrass species; controlling weeds; decreasing pesticide use; and many others.

The program has accrued many benefits for the public as well as Extension volunteers, including:

Improved lawn quality through unbiased, reliable information

- According to Koski, people turn to CSU Extension for *Lawncheck* because they've been told one thing by a lawn service company and want a second opinion. "They really trust us for the right information," Koski says. "We have saved people from making very expensive decisions like re-sodding their lawn, or using a lawn service company, or spraying fungicide—all when they don't need to."
- Clients have reported greener, thicker grass, reduced necrotic ringspot disease, and regrowth of dead and bald spots after overseeding.

Potential reduction in water and pesticide use

- According to Koski, water management issues, such as overwatering and faulty sprinkler heads, are the most common source of residential lawn problems.
- A large proportion of landscape irrigation water is directed to lawns making them an easy target for criticisms of landscape water waste. The majority of site visits includes recommendations to water more efficiently, use fewer pesticides, and fine-tune the type and amount of fertilizer applied, and its timing. Reduced inputs save money.
- According to Boulder County Extension agent Carol O'Meara, these behavior changes can lower phosphorous run-off into local watersheds and help conserve municipal water supplies.

Improved Colorado Master Gardener curriculum & confidence

- As a result of increased interest in turf/lawn diagnostics, the overall CMG volunteer training curriculum has been expanded to address symptoms and solutions to residential lawn care problems.
- Experienced CMGs may also participate in advanced plant diagnostic training that extends beyond lawn issues to include disease and pest issues associated with trees, shrubs and other common residential plants.

¹ Figure reported by Associated Landscape Contractors of Colorado, as appeared in Journal of Environmental Horticulture (2010).

"Lawncheck can help homeowners save money, but, perhaps more importantly, it helps them come away with a much better understanding of how to sustainably care for their lawn."

— Carol O'Meara
Boulder County Extension horticulture
and entomology agent

"The neighbors come to me for advice because I had such dramatic improvement in the appearance of my lawn. As a result, our neighborhood has learned a lot about proper watering and fertilization."

— *Lawncheck* client

"I think that confidence has filtered down from agents to our volunteers. As a result, everybody is more confident about diagnosing turf problems."

— Tony Koski
CSU Extension turf specialist

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Sharing the difference CSU Extension makes in people's lives and their communities.

On the trail of foodborne illness

Colorado-grown cantaloupe contaminated with Listeria caused a deadly outbreak in 2011. CSU Extension responded immediately with unbiased information, targeted education, and responsive research.

Situation

Seven cases of listeriosis—a foodborne illness that can be life-threatening for people with compromised immune systems—were reported to the Colorado Department of Public Health and Environment (CDPHE) in early September, 2011. Everyone who became ill had eaten cantaloupe. Within three months 30 people nationwide had died from the disease.

Extension's Response

The Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) coordinated an investigation with Colorado public health officials to determine how and where the listeriosis outbreak occurred. Colorado State University Extension specialists and agents on both sides of the food safety continuum—from the farm to the table—responded with immediate information and outreach that targeted public health agencies, cantaloupe growers, mass media outlets, and consumers.

CSU Extension specialist and research scientist Mike Bartolo helped investigators understand how farmers grow and process cantaloupe. Bartolo manages the Arkansas Valley Research Center and has developed many of the production practices they use today. He connected investigators to all cantaloupe growers in the region and was often the media spokesperson about cantaloupe production and processing. During this difficult time Bartolo also helped Rocky Ford farmers navigate both the negative effects of the outbreak on consumer confidence surrounding 'Rocky Ford' melons, and their options for protecting the future of the Rocky Ford melon brand.

Consumer and on-farm food safety were immediate concerns among growers, CSU Extension agents, consumers, and public health agencies. The CSU Extension food safety education work team response to the outbreak, coordinated by Marisa Bunning, Extension food safety specialist and Colorado collaborator for the national [Good Agricultural Practices](#) (GAPs) network (see page 2), included:

- Helping CSU Extension agents deliver educational programs on food safety and GAPs in Otero and Pueblo Counties. Jennifer Wells, Southeast Area Director was instrumental in organizing this effort;
- Release of CSU Extension Fact Sheet #9.383, Listeriosis in October 2011;
- Distribution of 'Melon Food Safety Resources for Producers and Consumers' to 350 melon growers via [Colorado Market Maker](#) and the CSU Extension website; and,
- Distribution of food safety information cards for farmers' market vendors to offer customers. These were piloted at the Larimer County Farmers' market in the fall of 2011.



The Bottom Line

- CSU Extension helped mitigate the economic and social consequences of the Listeria outbreak by providing producers and consumers with the resources they needed to make informed decisions, protect their business interests, and stay healthy.
- CSU Extension leads the state in farm-to-table food safety research, education and outreach.

By the Numbers

- Percent of Colorado cantaloupe planted in the Rocky Ford region: More than 70
- Percent decrease in Rocky Ford Cantaloupe™ production from 2011: 70
- Number of Rocky Ford Growers Association members: 14
- Value of 2011 cantaloupe crop: \$9.2 million

Results

The 2011 food-related disease outbreak is now the second deadliest in the United States. Pending lawsuits and a significant decrease in consumer confidence may adversely impact Colorado crop sales and farm income for years to come. However, CSU Extension has played an important role in mitigating the economic and social consequences of the *Listeria* outbreak. Extension specialists and agents provided producers and consumers with the resources they need to make informed decisions, stay healthy, and protect their business interests. Their contributions resulted in:

Rapid, expert and multi-disciplinary response

- Bartolo's agricultural expertise was instrumental in helping state and federal public health agencies identify where and how the outbreak occurred.
- CSU Extension's food safety team, which focuses on the safety of locally grown foods, led by Anne Zander, Elisa Shackelton, and Mary Schroeder, collaborated to immediately distributed print and web-based food safety information and resources targeting both growers and consumers.
- Colorado Extension collaborated with the Colorado School of Public Health's proposed Center for Food Safety and Prevention of Illness to host 'Lessons Learned from the *Listeria* Cantaloupe Outbreak: Moving from Response to Prevention,' which brought together 40 state experts in food safety.
- Responders to the outbreak came from Colorado Agricultural Experiment Station experiment station researchers, field agents, and campus specialists from across multiple disciplines, including the Departments of Agricultural and Resource Economics, Animal Sciences, and Food Science and Human Nutrition. Extension personnel focused their expertise and attention on helping growers rebound from the outbreak, ensuring food safety in the field and at home, and preventing future outbreaks.
- Students enrolled in AGRI 547: Delivery of Cooperative Extension Programs, helped develop and present the 'Fundamentals of Creating a Colorado Farm Food Safety Plan' webinar (March, 2012) for Colorado producers.

Business and economic development

- As a result of the outbreak, Colorado cantaloupe growers are changing their practices. With facilitation support from CSU Extension, they formed the Rocky Ford Growers Association to strengthen and protect the reputation of the now trademarked Rocky Ford Cantaloupe™. The contaminated melons that caused the *Listeria* outbreak were traced back to Jensen Farms, located more than 90 miles east of Rocky Ford and its immediate growing area. Farmers can only label their melons Rocky Ford Cantaloupe™ if they are association members, grow within a designated region, and adhere to strict on-farm food safety standards. Learn more at: www.rockyfordgrowersassociation.com.

Cutting-edge research

- An interdisciplinary team of CSU researchers, including Bartolo and Bunning, is investigating the movement of *Listeria* through irrigation water and soil, on-farm washing and packing, farm equipment, and consumer handling, including melon washing, drying, cutting and storage. Outcomes of research have the potential to change producer and consumer practices, resulting in improved public health and increased consumer confidence. University-wide research is being funded with seed money from the Colorado Agricultural Experiment Station and will continue through 2012.

Good Agricultural Practices

In response to an increasing number of disease outbreaks related to fruit and vegetable contamination, the Food and Drug Administration began developing 'Good Agricultural Practices' (GAPs) in the late 1990s. GAPs are not regulatory measures but voluntary guidance documents that recommend best practices for reducing microbial risks before planting, during production and during post-harvest handling. "Food Safety Begins on the Farm," one of many educational resources available on the GAPS web site, outlines these practices. Marisa Bunning, CSU Extension food safety specialist, is the Colorado collaborator for the national GAPs Network for Education and Training. Learn more: www.gaps.cornell.edu.

What is Listeriosis?

Listeria monocytogenes is a widely distributed bacterium that can cause listeriosis, a foodborne disease that can be life-threatening for people with compromised immune system, such as infants, pregnant women and the elderly. The FDA identified packing facility design, along with unclean processing equipment, as factors which most likely contributed to *Listeria* contamination at Jensen Farms. There was no evidence of *Listeria* in the field.

Farm to Table Food Safety Resources

Colorado Farm to Table:
<http://farmtotable.colostate.edu>

Colorado Farm to Market:
<http://cofarmtomarket.com>

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Success Stories

Sharing the difference CSU Extension makes in people's lives and their communities.

Gardeners turn to Planttalk Colorado™

Concise and reliable answers to frequently asked gardening questions are the goal of the program coordinated by CSU Extension, the Denver Botanic Gardens, and Green Industries of Colorado.

Situation

When is the best time to divide perennials? What insects are beneficial? Do upside-down tomato containers actually work? Many homeowners routinely ask these types of questions of local garden center employees, Colorado Master Gardeners, and other gardening experts. Successful gardening in Colorado's diverse climate depends on consistent, accurate, and research-based information.

Extension's Response

Answering the same questions over and over again prompted the creation of coordinated messages. In the fall of 1997, Jim Klett, CSU Extension specialist in landscape horticulture, initiated a partnership with the Green Industries of Colorado and the Denver Botanic Gardens to develop an on-demand information service called Planttalk Colorado™. Klett is the program's organizational lead.

With nearly 200 topics, Planttalk was the first of its kind to offer Colorado gardeners instant access to basic gardening information, 24/7, through a toll-free telephone service. Program developers collectively selected topics, wrote scripts, and reviewed and approved content before having them recorded. Agreement from all partners guaranteed that information shared around the state was unified and consistent.

In the program's first year, brochures announcing the toll-free service were distributed at ProGreen EXPO (an annual trade show for green industry professionals), through municipal water bill mailers, and at garden centers.

Consumer use of Planttalk Colorado™ steadily grew as changes in technology expanded and improved access to Planttalk information:

- **Website Migration:** In 2001, Planttalk also became an online information source. More than 400 topics were updated and added to the CSU Extension website. In 2002, www.planttalk.org was launched. In 2007, the telephone service was eliminated.
- **Language Translations:** In 2004, Spanish translation of more than 100 of the most frequently accessed topics was accomplished and made available through the phone system and online.
- **Social Media:** Many scripts are now available as podcasts and are distributed through an RSS feed. Several videos have been developed that are posted on YouTube (www.ext.colostate.edu/ptlk/youtube.html).

Comprehensive publicity has steadily increased consumer use of Planttalk Colorado™ within CSU Extension at the county level via brochures, bookmarks, pull-up banners and table top displays as well as through green industry partners and events. In 2012, for example, Planttalk Colorado™ plant tags were placed in potted plants that were sold at garden centers across the Front Range.



The Bottom Line

- Planttalk Colorado™ is the only on-demand access source to unbiased, science-based information that is concise, easy to understand, specific to Colorado gardeners, and vetted by CSU Extension and other leading horticulture experts in the state.
- For more than a decade, CSU Extension has ensured the growth and development of Planttalk Colorado™ by keeping pace with changes in technology and user preferences.

By the Numbers

Reported in 2012:

- Number of Planttalk Colorado™ tags placed in potted plants sold at garden centers: 34,000
- Total number of Planttalk Colorado™ scripts: more than 600
- Total web hits as of September 2012: 20,298,537

Results

Planttalk Colorado™ is the result of green industry partners identifying a need to provide answers to frequently asked gardener questions that are simple, consistent, and easily accessible. Although the general public can ask gardening questions of CSU Extension county agents and Colorado Master Gardener volunteers, Planttalk Colorado™ offers what neither of these information outlets can: instant access from anywhere with easy-to-use platforms. Since going live with the 24/7 automated toll-free phone service in 1998, partners have increased the number of informational bulletins that gardeners access by more than 300 percent.

Planttalk Colorado™ has stayed relevant to users over the years by keeping pace with technology, user needs, and preferences. The migration of Planttalk from the phone to the Internet took place when the older technology (toll-free telephone line) became significantly less used and less cost-effective. A need for gardening information by Spanish-speakers led to the translation of Planttalk scripts into Spanish. A specific Spanish-language marketing brochure supported this effort. Scripts remain available through the Planttalk website, RSS feeds, podcasts, and YouTube videos. The format in which Planttalk information is shared will continue to evolve with changing technologies.

These efforts have resulted in a significant use of Planttalk Colorado™ information.

- Website statistics from 2011 and 2012 show that:
 - as of September 2012, www.planttalk.org receives nearly 70,000 average hits each month. This is a 20 percent increase over the 2010 monthly average. Since the website launched, it has tallied more than 20 million hits;
 - a comparison of monthly website hits by Colorado county shows that Denver County hits surpass the total of any other county by more than 25,000;
 - monthly podcast hits from the first nine months of 2012 average 21,950, a figure that is more than twice the average monthly hits for the same timeframe in 2011 (9,694 hits);
 - Spanish Planttalk website hits currently average nearly 6,000 per month.

“Extension is very experienced in getting gardening information to outlying areas of Colorado. Extension also has a wealth of experience in providing service and information to all our community.”

– Beth Zwinak
Manager, Tagawa Gardens

“Through Planttalk Colorado™, 70,000 people each month are getting the CSU Extension name in front of them. We’re providing unbiased information that’s agreed upon by three entities that are among the best sources of information in the state. I don’t think you have anything like that anywhere else.”

– Jim Klett
CSU Extension specialist in landscape horticulture

Planttalk Colorado Partners

- Green Industries of Colorado is an alliance of eight trade associations representing all facets of the state’s horticulture and landscape industries. Planttalk Colorado™ scripts are scrutinized by those with Green Industries’ expertise in consumer-based marketing and communications.
- Denver Botanic Gardens has a strong education program that connects people with plants, many from regions similar to the Rocky Mountains and from around the world.

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

New technologies boost crop yield, save money, time and resources

Innovations in precision agriculture help farmers adopt productive, profitable, efficient and sustainable production strategies.

Issue

Crop yields fluctuate across agricultural fields due to variations in soil types and changes in topography. Despite this, growers often approach crops with a one-size-fits-all approach by planting seed and applying water, nutrients, pesticides and other crop inputs at a uniform rate. This practice has the potential to not only waste time and resources but have negative effects on soil and water quality, crop productivity and often may not address landscape variability.

Extension's Response

CSU's multi-disciplinary program in precision agriculture was established in 1999 by Raj Khosla, Colorado State University Extension specialist in the department of crop and soil sciences. Since then, Khosla and his research team have fine-tuned strategies that help Colorado farmers make better soil, water and crop management decisions. These techniques, developed specifically for Colorado conditions on the farm equipment used here, have shown to increase crop productivity, profitability, input use efficiency and sustainability of farming systems.

Over the years, Khosla and his team have used geographic information systems (GIS) to analyze data—generated by farm machinery equipped with global positioning systems (GPS) and sophisticated sensors—and map site-specific management zones. These zones are defined by topography, historical yield data, farmer's experience of the field, and bare soil imagery using geostatistics. More recently, his research is helping farmers improve nitrogen use in irrigated corn cropping systems. Khosla and his team use collected data to develop algorithms that interact with equipment-mounted sensors that tell variable rate applicators how much seed or nutrient is actually needed. This information helps farmers better understand that consistent low yield due to poor soil cannot be overcome by just adding more nutrients. Over time, instead of saturating inherently low-producing areas, they can maximize the potential of high-producing areas by reallocating inputs.

Khosla has led nearly 40 on-farm trials since coming to CSU. In addition to bringing farmers new precision agriculture technologies through on-farm trials, Khosla conducts field days, farm tours and Extension workshops. Additionally, as global food security becomes an increasing concern, Khosla's expertise is extended to developing countries that need sustainable, cost-effective precision agricultural strategies.



The Bottom Line

- CSU Extension is helping farmers adopt precision agriculture strategies and technologies that maintain or even increase crop productivity, save time, increase financial returns and benefit the environment.

By the Numbers

- Colorado acres impacted by extension education in precision agriculture: 600,000
- Average size farm, in acres, using precision agriculture: 2,200
- Percent of Colorado farmers who report using auto pilot systems: 60
- Year that the first autopilot systems were sold: 2004

Impact

CSU Extension, through Khosla's on-farm trials, have shown farmers how precision agricultural strategies and technologies can maintain or even increase crop productivity, save time, increase financial returns and benefit the environment. Based on data collected from post-workshop evaluations, precision agriculture extension activities have impacted over 600,000 acres of production agriculture in Colorado.

Khosla's combined research and extension have shown that farmers who adopt precision nitrogen management generate significant financial gains for compared to farmers who uniformly apply nutrients to fields. On farm research has shown that farmers who use precision nitrogen management alone have reported increased net returns that vary from \$17 per acre to \$54 per acre.

Returns on precision agriculture investments differ greatly from operation to operation and partly depend on the amount of acreage in production. In fact, not all farmers can afford to purchase the equipment and devices that make precision agriculture possible. Nor are they interested in learning the skills required to implement precision agriculture technology. However, Khosla's work has shown that precision agriculture can improve production systems and bottom lines. For instance:

- Variable rate application of seed and nutrients, based on inherent soil properties, can increase yield in high producing areas, maintain yield in low producing areas, and reduce costly inputs.
- Auto pilot guidance systems and accurate placement of crops can reduce the number of overlaps tractors make across the land.
- Production management efficiencies, particularly auto pilot guidance systems on tractors, reduce fatigue and labor costs and can expand hours of operation.

Precision agriculture also generates several environmental benefits. According to Khosla, precision nitrogen management can balance soil nutrient content, preventing unwanted nitrate leaching that can impair surface and ground water quality. The same applies to reduced pesticide use.

In 2011, Khosla was appointed by National Aeronautical Space Administration (NASA) to serve on the U.S. Presidential Advisory Board for Space Based Policy. In 2011 he also:

- Expanded his international Extension work to India and China through a three-year USDA-funded project to study their production systems, identify gaps, and disseminate technology that is mutually beneficial.
- Received the International Service award from the Colorado Zeta Chapter of Epsilon Sigma Phi, the Extension Professional's Organization.

Khosla is the 2012 Jefferson Science Fellow with the U.S. State Department. (See www.news.colostate.edu/Release/6180.)

“We in agriculture are among the people who use the highest resolution GPS systems. The only other industry that does is construction.”

– Raj Khosla, CSU Extension specialist in precision agriculture

“Many farmers are recognizing the yield robbing impact of weed, plant disease, and insect pests as well as the soil environmental constraints limiting their crop yields and quality through their yield monitors. Some of these are taking the additional step of creating yield maps to document these changes by year over several years of production.”

– Bruce Bosley, CSU Extension cropping and natural resources agent in Logan and Morgan Counties

Trimble Partnership

Colorado farmers aren't the only beneficiaries of Khosla's research and extension. In 2011, Trimble, the world's largest navigation equipment company, struck a partnership with CSU to base a national training center for dealers of its precision agriculture equipment at CSU's Agricultural Research, Development and Education Center (ARDEC). Dealers learn about Trimble's sensors, auto pilot systems, variable rate controllers and display modules which have been installed on more than a dozen ARDEC tractors, implements and other machinery. Khosla's students now apply precision agriculture strategies at ARDEC's fields with Trimble's latest precision technologies.

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Sharing the difference CSU Extension makes in people's lives and their communities.

Small acreage landowners learn to improve water use

Irrigation audits help small acreage landowners take steps to improve management of irrigation water while conserving natural resources.

Situation

Colorado's small acreage landowners, new to farming and ranching, tend to overwater their fields and pastures due to aging, incorrectly installed and mismanaged irrigation systems. These often lead to excessive soil saturation and unwanted ponding or runoff. Overwatering can also cause weed infestations and increase mosquito outbreaks. In parts of the Western Slope, including the Grand Valley, excess irrigation also impairs downstream water quality and harms aquatic life by leaching salt and selenium out of the region's alkaline shale soils and into its rivers.

Extension's Response

Colorado State University Extension launched the Small Acreage Irrigation Ambassador program in 2010 in the Grand Valley and surrounding Mesa County. The program identifies the source of irrigation inefficiencies, makes recommendations for improved irrigation management, and helps landowners better understand how plants, water, soil and weather interact.

Denis Reich, CSU Extension Western region water resources specialist, originally created the free service to reduce water waste (the amount of water that is not actually being used by crops), increase crop yields, control weeds and reduce the amount of selenium and salt leached by excess water. After successfully piloting the program two years ago, mosquito outbreaks were also identified as a common symptom of over-irrigation.

In 2011, CSU Extension expanded the program by partnering with the Mesa Conservation District, which received grant funding to hire a dedicated small acreage irrigation ambassador. Grantors included the Colorado Basin Roundtable (a branch of the Colorado Water Conservation Board), Grand River Mosquito Control District, Grand Valley Irrigation Company and Grand Valley Water Users Association. Reich continues to oversee the program.

The program runs April through October. Interested landowners schedule a visit with the ambassador during, or immediately following irrigation. During the audit, the ambassador looks for signs of excessive watering and records soil type, soil moisture, crop health, type of irrigation system, irrigation 'set length' (the amount of time water is applied to a field) and frequency. Within two weeks of the audit, landowners receive a report that details collected data and recommended next steps.

In 2010, Reich conducted 14 irrigation audits. In 2011 year, the ambassador visited 57 small acreage properties; 44 received audits.



The Bottom Line

Helping small acreage landowners on Colorado's Western Slope learn how to improve their irrigation water management practices means they can:

- save time, money and resources;
- grow healthier and more abundant crops and pasture;
- keep mosquito populations in check; and,
- reduce the amount of salt and selenium that overwatering leaches into rivers.

By the Numbers

In 2011

- Total landowner calls: 100
- Total ambassador visits: 57
- Total audits conducted: 44
- Total acres visited: 276.8
- Total acres audited: 212.2

Results

To date, the Small Acreage Irrigation Ambassador program has provided 58 landowners with onsite feedback. For example, landowners using furrow irrigation systems might learn that water is not actually coming out of the pipe gates at a high enough flow rate to effectively water fields. Or they might learn that they have two soil types in different areas that absorb water at different rates, or that a blocked culvert is preventing sufficient field drainage. Audit reports detail these findings and help landowners understand how much water should be applied to their fields based on their irrigation system, soil type and crop or grass variety.

In early 2012, Reich derived a classification system to compare the irrigation water management practices of the 212 acres audited in 2011. The classification ranks how effectively, efficiently and uniformly irrigation water has been charging the soil.

Classification	% of audited acres	Indication
Poor	9	Excessive soil saturation and visible, unwanted runoff/ponding
Needs improvement	42	Excessive soil saturation or unwanted runoff/ponding
Adequate	38	Some excessive soil saturation with minimal unwanted runoff/ponding
Excellent	10	Good soil moisture and no unwanted runoff

Throughout 2012, CSU Extension and the Mesa Conservation District will assess the potential and actual management changes that landowners have made. Funding from the original CWCB-Colorado Roundtable grant plus additional contribution from partners will cover costs through the end of the year. Funds have also supported the production of a promotional video that can be accessed at: www.ext.colostate.edu/irr_assess/sm_acre.html.

Improved irrigation water management benefits individuals, the community and the environment in several ways:

- Proper irrigation saves time and money spent controlling weeds and managing water problems. Neighbor disputes in small acreage communities are often over water. Reducing the amount diverted and applied can often improve the rural life experience for both parties.
- Hay, pasture and crops are more productive when evapotranspiration is kept in balance. Temperature, relative humidity, precipitation and other weather factors affect how much moisture evaporates from the soil and how much water plants transpire during photosynthesis.
- Reduced ponding limits the number of mosquito breeding sites. A potential reduction in mosquito populations increases the quality of life for area residents.
- Reducing excess runoff lessens the amount of salt and selenium, as well as unused nutrients and fertilizer that are transported into rivers. In furrow and flood irrigation, much of the unneeded water percolates below the root zone, mobilizing potential contaminants.

“Roots need to respire when the sun goes down. If you’re water-logging the root system then you’re just stressing the plant. If you can help landowners feel OK about putting less water on, then they’re often relieved to learn they can spend less time irrigating with better results.”

—Denis Reich, CSU Extension western region water resources specialist

“From our perspective, the Small Acreage Irrigation Ambassador program has been a real success. We’ve instituted the program as part of our integrated pest management process. We would much rather deal with mosquito control from a water standpoint than through pesticides.”

—Zane McCallister, manager, Grand River Mosquito Control District

Salt & Selenium

The transport of salt and selenium into the Colorado River watershed is a big concern for Western water resource stakeholders. Irrigation leaches these highly concentrated and naturally-occurring minerals out of the soil. Over-irrigation compounds the problem. Salinity is mostly a concern for downstream agricultural users because of the ways it decreases crop yields. Selenium is a problem for local endangered fish species.

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Sharing the difference CSU Extension makes in people's lives and their communities.

Pueblo County Master Gardeners: From the Ground Up

Expanded presence of county-based Colorado Master Gardener volunteers means timely and relevant horticulture information is delivered to more people.

Situation

In Pueblo County, city-driven beautification projects, native plant and Xeriscape demonstration gardens and tours—along with other public horticulture projects—have sparked interest in residential water-wise landscaping and home-grown food production. As a result, county residents have expressed the need for timely and relevant horticulture education and technical assistance.

Extension's Response

To meet the increasing interest, Linda McMulkin, Colorado State University Extension horticulture coordinator in Pueblo County, has expanded the role and presence of Colorado Master Gardeners throughout the county. McMulkin works closely with Elizabeth Catt, Pueblo County Extension's horticulture assistant, to match volunteer interests with rewarding opportunities.

Colorado Master Gardener volunteers participate in community education and outreach as their payback for the horticulture training they receive. Volunteers field questions through the county Extension office, provide education at events and venues and assist community organizations with horticulture education and special projects.

The top ways that Pueblo County Extension and its CMG volunteers support the city and county include:

- Maintaining a demonstration garden on the Colorado State Fairgrounds and helping maintain gardens at the Southeast Colorado Water Conservancy District grounds, the Pueblo Zoo, and Cattail Crossing fishing pond. They also plan and deliver educational programs for the annual Pueblo Xeriscape Garden Tour.
- Providing educational programs and technical assistance to three community and 17 school gardens funded by the Urban Gardens Approach to Reduce Disease and Empower Neighborhoods and Schools (UGARDENS), a project of the Pueblo City-County Health Department.
- Contributing research-based content to Pueblo County Extension's quarterly newsletter, 'From the Ground Up.' McMulkin also writes a gardening column for the Pueblo Chieftain newspaper and volunteer Marilynn Chambers writes a weekly gardening column for the Pueblo West View.
- Organizing and running the bi-weekly Pueblo Farmer's Market through the Farmers' Marketeers, a nonprofit that turns market revenues into college scholarships for Pueblo County youth. CMGs have run the market for more than 30 years.



The Bottom Line

- Pueblo County Extension has significantly expanded its Colorado Master Gardener outreach and is serving more county residents than ever before with reliable, unbiased horticulture expertise.
- Pueblo County Extension collaborates with many organizations to educate residents on resource-appropriate horticulture choices that save money and are visually appealing
- Volunteers support interest in the local food movement by teaching community members to grow their own food.

By the Numbers

From 2011

- Colorado Master Gardener volunteers: 54
- CMG volunteer hours: 3,014
- Direct contacts: 12,230
- Print media contacts: 1,182,000

Results

Pueblo County Extension horticulture staff and Colorado Master Gardener volunteers have increased the recognition of CSU Extension's expertise and involvement throughout the city and county. Volunteers contribute to more community-based projects and are educating more residents on regionally-specific gardening solutions than ever before.

The research-based horticulture expertise that volunteers are trained to provide has become more socially and environmentally relevant as the region's semi-arid climate increases interest in water-wise landscaping and native plants. Throughout the region, volunteer-led xeric demonstration gardens and tours—as well as native plant education—are helping residents learn how to save money by using less water.

Master Gardener involvement in community and school gardens also contributes to many potential social, environmental and economic benefits. According to the Pueblo City-County Health Department UGARDENS website, community and school gardens:

- Improve quality of life
- Provide a catalyst for neighborhood and community development
- Stimulate social interaction
- Encourage self-reliance
- Beautify neighborhoods and preserves green space
- Produce nutritious food
- Reduce family food expenses
- Provide opportunities for recreation, exercise, therapy, and education
- Create opportunities for intergenerational and cross-cultural connections.

The Health Department says it expects to see positive health behavior changes among more than 4,000 individuals as a result of an increase in community and school gardens, new and strengthened partnerships between neighborhoods and schools, and school nutrition policy changes.

Through community development projects, such as UGARDENS, it's clear that Pueblo city-county residents are seeking horticulture information that creates a sense of place, conserves resources and promotes healthier lifestyle choices. In addition to helping residents develop resource-appropriate gardens by increasing access to water-wise landscaping information, volunteers also help residents learn to grow their own food, spend time outdoors, and exercise.

Colorado Master Gardeners are also uniquely positioned to offer educational experiences that promote positive youth development. For example, CMG guidance and horticulture expertise was critical in the success of the Lake Pueblo State Park rain water harvesting and native plant garden that was created and installed by members of the Pueblo West High School science club. Ultimately, the project created a new model for community service with the local school district's International Baccalaureate program.

“It was so wonderful to watch the students build the garden, and when they got their hands dirty is when they finally got it. There's such a difference between talking all winter about native plants or biomes to actually getting out there and digging out, carving, shaping and re-shaping the plot—that's when they got really happy, and really into it.”

—Elizabeth Catt, Pueblo County Extension
horticulture assistant

Tried and True

Colorado Master Gardener (CMG) volunteers assist local CSU Extension horticulture staff in delivering gardening information to the community that fosters successful home gardening practices. For over 30 years, volunteers in Pueblo County have answered homeowner horticulture questions at the Pueblo County Extension office and organized and managed the Pueblo Farmer's Market, currently held at Midtown Shopping Center. This is one of the few markets in Colorado that is entirely run by CMG volunteers.

Horticulture Partners

City of Pueblo
Colorado Parks & Wildlife
Colorado State Fair
Lake Pueblo State Park
Local greenhouses and garden centers
Mountain Park Environmental Center
Pueblo City-County Health Department
Pueblo City-County Library
Pueblo Zoo
School Districts
Southeast Colorado Water Conservation District

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

Interactive training teaches 4-H youth how to care for livestock

A new, interactive and self-directed training is improving how 4-Hers learn and retain the 'meat quality assurance' standards they need to understand for proper animal care and food safety. This in turn leads to a future of safe food production practices as youth become agricultural producers.

Issue

Since 1995, Colorado 4-Hers enrolled in livestock projects have been required to attend Meat Quality Assurance (MQA) trainings. Colorado State University Extension 4-H and livestock agents began presenting the MQA curriculum via classroom-based PowerPoint presentations. However, this format didn't actively engage youth. In particular, younger members often failed to retain important skills and information.

Extension's Response

In 2006, Colorado State University Extension 4-H agents piloted 10 interactive and self-directed MQA trainings in Northeast Colorado counties. The revised MQA training uses interactive, topic-based learning stations and forgoes classroom teaching. Each station integrates one or more visual learning tools, such as models, displays, hands-on activities and digital picture frames that show the right and wrong way to handle and care for livestock. Participants go at their own pace from station to station, completing activities and answering questions on a companion worksheet.

Following the pilot trainings, youth and parent feedback indicated that the new learning format was more interesting, fun and helpful than classroom instruction. Based on this success, the Northeast Colorado MQA team acquired funding to create more stations, standardize the curriculum for all counties and agents, and offer the program regionally. In 2009, the Northeast Colorado MQA team turned the interactive MQA training into a mobile learning lab that features 14 stations and travels March through mid-May. Stations cover:

- evaluation of facilities
- animal identification
- health issues
- injection site determination
- proper drug and biological product use and storage
- nutrition
- feed manufacturing
- animal handling skills

Youth pay a one dollar re-stocking fee to participate. All first year 4-H members and all first year senior members who are enrolled in livestock projects must attend MQA trainings, although these requirements vary from county to county.

In 2011, 2,400 youth from 35 counties attended one of 44 mobile MQA trainings. CSU Extension agents logged 7,500 miles traveling the length of Eastern Colorado to the San Luis Valley, Western Slope, Yampa Valley and along the Front Range. Even so, the learning lab cannot serve all Colorado counties due to time and distance constraints.



The Bottom Line

- Extension's interactive mobile MQA learning lab does a better job teaching 4-Hers how to produce a safe, wholesome and nutritious product than lecture-style instruction.
- The new MQA training format has increased parent involvement. More parents attend MQA trainings than ever before.
- Parents who farm and ranch often change production practices to align with what their children learn through MQA.
- CSU Extension's interactive MQA format is designed to engage multiple learning styles and all ages.

By the Numbers

From 2011

- Number of interactive MQA trainings: 44
- Number of youth trained: 2,400
- Total trailer miles traveled: 7,500

Impact

In 2009, 706 Colorado 4-H members from 18 counties were surveyed after attending an MQA training. In the study, 323 youth from five counties attended MQA trainings delivered in the self-directed, hands-on format and 383 youth from 13 counties attended MQA trainings delivered in the lecture-style format.

All youth completed an eight-question knowledge survey. Results showed significantly higher knowledge gains among hands-on learning versus classroom instruction in some areas: antibiotics, animal identification, and the labeling and administration of prescription medication. This is the only survey to date that compares knowledge gains between learning formats. According to Mick Livingston, Golden Plains Area Extension 4-H agent, future MQA evaluation will continue measuring the difference between the two learning formats.

In the meantime, follow-up evaluation data from subsequent MQA trainings reinforces the effectiveness of the hands-on learning format. The 2011 MQA survey asked participants to rank their knowledge gains relative to information presented. The survey also asked participants to rate the likelihood that they will properly care for and handle animals, make ethical decisions, be more careful about storage of medications and ask others for help. As a result of attending the workshop:

- 94.5 percent report that they already do, or always will use proper animal care and handling.
- 93 percent report that they already do, or always will be more careful about medication storage.

Youth evaluation responses indicate that interactive learning has a positive impact:

- *I liked the stations instead of the lecture.*
- *I learned more from MQA. It was fun.*
- *More exciting and fun to learn than last year.*

Many parents had similar comments, including:

- *I liked the hands on. My son got a lot more out of it.*
- *I think the hands-on (approach) did a better job of keeping their attention.*
- *Really like this new program with hands on instead of reading and testing.*

Livingston says parent involvement in the interactive MQA training is a strong improvement over classroom instruction. "Parents used to just drop the kids off and come back at the end. Now they stick around and go through the training with their kids," he says. "I even have parents telling me that they are going to have to change the way they do things at home because of what their kids have learned and shared."

To cut down on travel miles and expense, CSU Extension 4-H agents from Western Slope counties are developing a second mobile MQA learning lab that will primarily serve Mesa, Delta, Montrose, Gunnison and San Miguel counties. It will be available for use anywhere in the state.

"It's great to see the excitement as the youth go through the various stations, from feed to medications to ethics. We knew we developed a teaching model that works."

– Mick Livingston
Golden Plains Area Extension 4-H agent

What's Inside

Each of the MQA mobile lab's 14 stations covers one of the 'Ten Good Production Practices' developed by the pork industry in the 1990s and the foundation for 4-H MQA in Colorado. The 10 practices are:

1. Establish and implement a herd health management plan;
2. Use a veterinarian/client/patient relationship as the basis for medication decision-making;
3. Use antibiotics responsibly;
4. Identify and track all treated animals;
5. Maintain medication and treatment records;
6. Properly store, label, and account for all drug products and medicated feeds;
7. Educate all animal caretakers on proper administration techniques, needle-use procedures, observance of withdrawal times, and methods to avoid marketing adulterated products for human food;
8. Follow appropriate on-farm feed processing and commercial feed processor procedures;
9. Develop, implement, and document an animal caretaker training program; and,
10. Provide proper animal care to improve animal well-being.

Sponsors & Partners

CHS Inc.
Colglazier Livestock

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

Learning about native plants supports natural resource conservation

Extension's Native Plant Master® education program encourages Coloradans to adopt landscaping practices that help save water, money and time.

Issue

Colorado's growing population puts increased demand on limited natural resources, especially water. Urban gardens and landscapes are often planted with water-hungry, non-native species. At the same time, non-native noxious weeds invade natural landscapes and pose a threat to native ecosystems. Residents and landowners—as well as green industry and land management professionals—seek landscaping solutions that conserve natural resources.

Extension's Response

Colorado State University Extension created the Native Plant Master (NPM) education and volunteer program 15 years ago, to raise awareness about native plants, sustainable landscapes and threats to native ecosystems, including invasive weeds.

Jefferson County Extension launched the state's first NPM training in 1997. Today, 14 Extension offices around the state offer hands-on courses taught by county agents and other NPM trainers. Each course is divided into three sessions which cover:

- Plant identification using a key along with a botanical field guide;
- Ecological relationships between noxious weeds, native plants and insects, birds and wildlife;
- Landscape and other human uses for Colorado native plants.

Native Plant Master instructors teach courses on trails in local open space parks and other public lands. This means participants see firsthand the plants inhabiting the ecosystems and life zones that are unique to the area. Field learning is supplemented by CSU Extension's online Colorado Plant Database (<http://coloradoplants.jeffco.us>) which provides research-based information on more than 1,000 Colorado plants.

These courses are open to the general public; volunteer certification is optional. To earn certification, participants must pass three courses and make at least 60 educational contacts from leading nature walks as a docent at a natural area and educating customers to talking with neighbors about native and non-native plants.

The education program has continually attracted a broad range of individuals—from homeowners, garden center employees, landscape architects and open space planners—to natural area docents, government employees and small acreage landowners. In 2011, 926 individuals were trained in NPM courses and special classes. That same year, a total of 395 volunteers reported 17,901 educational contacts using information they learned from the program.



The Bottom Line

- In 2011, for every dollar Extension spent on non-personnel program costs in Jefferson County, NPM participants quadrupled that in self-reported savings from sustainable landscaping and weed control efforts.
- Extension's Native Plant Master® education program encourages Coloradans to adopt sustainable landscaping practices while enhancing the job performance of many program participants.

By the Numbers

- Reported statewide economic impact: \$95,395¹
- Reported acreage impacted statewide: 164,526
- Reported Cost/Benefit of NPM in Jefferson County: \$1 = \$4.06
- NPM Revenues: \$24,942
- NPM Volunteers: 395
- NPM Participants: 926
- Direct educational contacts: 17,901

Impact

The Native Plant Master education and volunteer program has become a state leader in training people about the relationship between water conservation, native plants, alien invasive weeds and sustainable landscapes. The program is coordinated by the CSU Extension Native Plant Education team, which received the 2011 Extension Team Distinguished Service Award.

Thousands of Coloradans are annually educated by a few hundred NPM volunteers. The team annually measures this impact through a survey asking program participants to report on sustainable landscaping and weed mitigation projects they complete. In 2011, volunteers from across the state reported a combined savings of \$44,920 from reduced landscape inputs such as water, pruning and pest control as a result of planting native species on more than 85,000 acres of public and private land.

Volunteers also reported a combined \$50,475 in savings from improved grazing, crop output, ornamental landscapes, wildlife and tourism, and beginning or increasing weed control efforts of non-native plants—on more than 79,000 acres of public and private land. These figures indicate that CSU Extension has found a cost-effective way to increase the sustainability of Colorado's public and private landscapes while reducing invasive weeds.

Additional results from the 2011 statewide NPM survey highlight many of the program's benefits to both participants and the people they contact through volunteer and paid work. Survey respondents reported that:

- 96 percent increased their native and non-native plant identification skills;
- 92 percent increased their awareness of the impact of alien weeds and the importance of controlling them;
- 89 percent increased awareness of the use of native plants for sustainable landscaping.

Sixty respondents reported that taking the NPM program helped them retain their current job or get a new one. This happens across vastly different fields of both paid and volunteer work as shown by these quotes from the survey:

- *I took two NPM classes prior to applying for a position on with the city's ecological restoration crew. I was told that my experience identifying native and invasive plants was a deciding factor in my selection.*
- *I worked for two golf courses and thanks to this program I was able to change landscaping on the courses into more native areas, reducing labor, and water and chemical use. This helped save the golf course's money and helped me retain my job.*
- *I was campaigning for elected office by canvassing the neighborhoods in my district. I used the knowledge I gained from the Native Plant Master courses to speak to voters and constituents about their lawns and sustainable gardens.*

Native Plant Master Mission

To educate the public about native plants in order to foster stewardship, sustainable landscaping and management of weeds that threaten native ecosystems.

¹ Economic impact stems from self-reported savings related to improved grazing, crop output, ornamental landscapes, wildlife habitat, tourism, and reduced landscape inputs such as watering, pruning, pest control, etc., as a result of alien weed control and planting natives.

"It is the best educational experience I have had through my local Extension office. It is outside, hands-on, taught by passionate, intelligent people, and has real world applications."

– Native Plant Master program participant

"I have used my identification skills to educate my crew mates about what plants to collect for restoration projects, what plants to leave alone, and what plants to remove during invasive plant control efforts."

– Native Plant Master program participant

Native Plant Master County & Area Partners

Boulder
Custer
Douglas
Eagle/Garfield
Golden Plains Area
Jefferson/Gilpin/Jefferson
Larimer
Logan/Morgan
Montezuma/Dolores/La Plata
Pueblo
San Miguel/West Montrose
Summit
Teller
Tri-River Area

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

Rocky Mountain Conference on Aging

Professionals who support older adults at work, home, and in health care settings learn the skills and tools they need for successful communication.

Issue

Today's older Americans are working and living longer than previous generations. By 2030, it's estimated that almost one in every five U.S. citizens will be 65 years or older. Professionals who work directly with older adults are important links in the prevention and intervention of personal and family issues.

Extension's Response

In 2007, Colorado State University Extension family and consumer science specialists and agents developed the annual Rocky Mountain Conference on Aging (RMCoA). Each year the program is designed to share research-based information to support older adults in the workplace and during challenging life issues. Faculty from CSU's Department of Human Development and Family Studies and Department of Psychology, along with partners from the University of Northern Colorado, and the Denver District Attorney's Office joined this effort.

Five conferences have been presented since 2007. The first two emphasized issues regarding aging in the workforce; the next two focused on prevention and intervention strategies related to financial abuse and exploitation. The most recent focused on the challenges grandparents face when they become the primary or sole caregiver of their grandchildren.

Conference themes are continually updated and selected from research, focus group interviews and post-conference participant surveys. They include:

- Aging in the Workplace: Maximizing a Valuable Human Resource
- The Changing Workforce: Challenges and Strategies for Success
- Financial Abuse and Exploitation: Prevention Strategies & Tools
- Elder Financial Exploitation: Investigation and Intervention Tool
- Strengthening Practices and Systems to Support Grandfamilies

Almost 500 people have attended one or more Rocky Mountain Conference on Aging. Each year a combination of grant funding, registration and exhibitor fees, sponsorships and in-kind gifts has meant that the conference could continue another year.



Conference participants learn to Walk in Older Work Shoes as they experience "instant aging."

The Bottom Line

- Entering its sixth year, the Rocky Mountain Conference in Aging (RMCoA) is a primary Northern Colorado training resource that provides professional development for the human resource, legal, financial planning, health and human service, and faith community representatives who work one-on-one with older adults.
- The RMCoA has elevated the reputation and awareness of CSU Extension as a go-to resource for quality education on relevant and current family and consumer issues.

By the Numbers

- Total RMCoA attendees since 2007: 478
- Total generated conference sponsorship: \$15,750
- Total generated registration fees: \$27,960

Impact

Through the Rocky Mountain Conference on Aging, CSU Extension and its partners provide the latest research and information to address current aging issues. Entering its sixth year, the Rocky Mountain Conference in Aging (RMCoA) is a primary Northern Colorado training resource that provides professional development for the members of human resource, legal, financial planning, health and human service, and faith communities, who often work one-on-one with older adults.

Several positive outcomes have emerged from the Rocky Mountain Conference on Aging:

- Conference sessions have dealt with sensitive topics, such as intergenerational communication, universal design (designs to accommodate people with disabilities), ageism, Americans with Disabilities Act, and cultural implications around family communication and money decisions. According to program committee members, these sessions have helped conference participants understand the perspectives of older adults, practice strategies to overcome attitudes and social barriers, and discover solutions that honor diversity.
- CSU Extension forged a new relationship with the University of Northern Colorado through up-to-date research based information related to aging. Partnerships with Colorado AARP and the Area Agencies on Aging were renewed.
- The conference has become financially self-sustaining. Relevant conference topics attract the conference's target audience. The program committee established a fair registration fee that takes into consideration all program costs from promotional expenses and handouts to presenter fees and catering costs. Sponsor revenues help cover program costs.

According to post-session surveys from the 2012 conference, participant learning on a '1' (Disagree) to '7' (Agree) scale ranked high, as shown in the following responses. The Rocky Mountain Conference in Aging:

- Increased my knowledge about practices and systems to support grandfamilies (77.6%)
- Added to my understanding of the challenges and complexities of grandfamilies (81.7%)
- Provided me with useful information about programs and tools to support grandfamilies (79.6%)

After the 2012 conference:

- 79.6% reported being better able to recognize the issues and complexities facing grand families
- 67.3% have a better understanding of the tools and programs available to support grandfamilies
- 79.6% feel more confident in their ability to support grandfamilies

Overall, post-conference surveys indicate that the Rocky Mountain Conference on Aging has raised the reputation and awareness of CSU Extension as a go-to resource for quality education on relevant and current family and consumer science topics.

The Rocky Mountain Conference on Aging won the Epsilon Sigma Phi 2011 Zeta Chapter and 2012 Western Region Distinguished Service Team Award. The conference has qualified to provide continuing education credits through the Human Resource Certification Institute, American Association of Family and Consumer Sciences, and the Colorado Continuing Legal Education process.

Colorado State University Extension, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. August 2012. Written by Carol Busch.

"This was a well-designed conference balancing research, best practices and theory as well as engaging organizations, community members, educators, extension and their applied professions."

– RMCoA program participant

"I now have additional tools (questions) to ask grandparent clients in order to get a more complete picture of their challenges. As a result, I can provide more comprehensive and targeted support and resources."

– RMCoA program participant

Calling all professionals

Conferences, located in Loveland, Colorado, at The Ranch Events Complex, include breakout and plenary sessions, key note speakers, and panel discussions. Conferences target professionals who have direct contact with older adults, such as representatives of legal, financial, health, human service, and faith communities. Conference presenters are recruited locally and nationally and include subject matter experts from businesses, other land grant universities, local governments, and nonprofits. For information on upcoming conferences, contact CSU Extension in Larimer County at (970) 498-6000.

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Impact

Colorado State University
Extension

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A network of STEM specialists enrich learning opportunities

More Colorado youth and educators are learning about and engaging in Science, Technology, Engineering, and Math (STEM) through 4-H science inquiry-based programs.

Issue

Throughout the nation and especially in Colorado, the need for a workforce with strong STEM skills is being addressed. One of the ways Colorado 4-H has responded to the national 4-H challenge was through the STEM initiative to reach youth with hands-on learning experiences that encourage discovery.

Extension's Response

Almost three years ago, Colorado State University Extension followed the lead of the national initiative by hiring a state STEM specialist and four regional STEM specialists. Regional STEM specialists support both statewide and local inquiry-based STEM learning opportunities. They provide educational support for county 4-H agents, volunteers, youth, and classroom teachers by:

- developing or enhancing STEM-related curriculum, activities, and kits, such as robotics, GPS, water resources;
- customizing STEM learning for school enrichment, out-of-school programs, and 4-H clubs;
- producing STEM trainings for agents, leaders/volunteers, teachers, and youth;
- working with underserved and under-represented youth;
- procuring \$273,000 in grant funds to support STEM-related 4-H initiatives.

Throughout the state, STEM specialists have collectively developed or expanded signature programs, such as Robotics, Tech Wizards, MetLife teacher trainings, and STEMasters. STEMasters, which piloted in Summit County in spring 2012, trains local adult and youth volunteers as well as teachers to lead STEM activities both in- and out-of-school. Grants from J.C. Penney and FIRST Robotics helped regional specialists expand 4-H participation in robotics through clubs, projects, and competitions. A \$15,000 MetLife Foundation afterschool training grant allowed specialists to provide more than 300 teachers and out-of-school educators—through nine separate trainings—with STEM-enriched 4-H curriculum.

Regional STEM specialists have also developed many local STEM learning opportunities that reflect the strengths and interests of regional communities. The bimonthly STEM newsletter details these efforts. For more information see recent newsletters at: www.colorado4h.org/stem/stem-newsletters.php.



The Bottom Line

- Since 2011, approximately 9,400 youth have participated in STEM-related programs and projects.
- Regional STEM specialists have made this possible by developing STEM programs that meet the specific needs and interests of communities around the state.
- 4-H STEM programs, such as robotics and GPS, provide youth new opportunities to participate in Colorado 4-H.

By the Numbers

- Grant dollars raised by 4-H STEM (2 ½ years): \$492,737
- Youth served STEM education programs (2012): 4,777
- Training provided to educators, agents, and volunteers (2012): 1,728
- Indirect support and outreach efforts across Extension: Upwards of 10,000 (youth and adults)

Impact

The Colorado 4-H regional STEM specialist team has significantly increased opportunities for youth around the state to engage in inquiry-based STEM learning experiences that enhance positive youth development. Christy Fitzpatrick, Front Range region STEM specialist based at the CSU Northeast Regional Engagement Center in Sterling, believes that the combination of STEM learning with positive youth development gives kids the skills they will need to excel professionally. “They need to do more than just be good at math and science,” Fitzpatrick says. “They need to be good at teamwork and communication and many other life skills that 4-H teaches.”

Regional specialists also have created new avenues for county agents to reach youth who are new to Colorado 4-H, including a wide range of school enrichment and out-of-school resources—curriculum, kits, and activities. They have also supported an expansion in the number of robotics programs around the state. Regional STEM specialists work closely with 4-H agents to support their communities’ STEM activities, trainings, and special programs to help meet the needs and interests of local youth. Collaboration has resulted in diverse STEM programming across the state, along with increased 4-H participation including:

- Western Region (Southwest Colorado): Ute Mountain Middle School students are designing and building a community satellite over a series of weekend camps;
- Front Range Region (Urban Corridor): Hispanic, Asian, and Somali youth are gaining life skills through Tech Wizard programs that focus on acquiring knowledge and skills specific to GPS, GIS, robotics, videography, and photography;
- Northeastern Regional Engagement Center (Eastern Plains): Robotics programs are reaching parents and youth who wanted to be involved in 4-H but didn’t have a means to participate in traditional agriculture projects;
- Peaks & Plains (South Central): Water education programs through the WRECKing Crew (Water Resource Education Curriculum) where three high schools are participating.

In addition to helping youth gain life skills, 4-H STEM activities are helping youth develop an interest in lifelong learning related to STEM. Specialists have also designed career fairs to provide a hands-on means by which middle and high school students can learn from professionals about how STEM knowledge can lead to a meaningful career.

Career fairs will also link students to campus admissions representatives from colleges around the state, helping students make a connection between their STEM interests, the realities of a career, and the education it takes to get there. Some 4-H youth are getting a head start in applying their STEM knowledge and skills. The STEMasters program in Summit County motivated high school youth participants to develop and lead an afterschool robotics team at the middle school.

Colorado 4-H STEM specialists will continue to develop and expand STEM initiatives, resources, and activities by:

- expanding STEMasters to other Colorado communities and develop new modules;
- enhancing the 4-H STEM website with more information, resources, and links to activities, such as participating in 4-H’s National Youth Science Day;
- developing STEM programs, activities, and kits that support 4-H programs and projects.

Colorado State University Extension, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. March 2013.

“You need to do more than just be good at math and science. You need to be good at team work and communication—the life skills we focus on in 4-H.”

– Christy Fitzpatrick
4-H STEM specialist, Northeast Regional
Engagement Center

“4-H STEM programs teach youth 21st Century Skills, which meets their needs and the needs of our nation too.”

– Claire Dixon
4-H STEM specialist, Front Range region

“We are asking STEM professionals to share a hands-on activity with students and to discuss what they do.”

– Barbara Shaw
4-H STEM specialist, Western region

Learn More

Connect with the Colorado 4-H STEM program online: www.colorado4h.org/stem

Regional STEM specialists:

- Anne Casey (Peaks & Plains Region)
- Claire Dixon (Front Range)
- Christy Fitzpatrick (Northeastern Regional Engagement Center)
- Barbara Shaw (Western Region)

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A treasure of a garden

With support from the town of Windsor, Colorado Master Gardener (CMG) volunteers have turned a vacant field into a thriving community demonstration garden.

Situation

The unique growing conditions of the High Plains led to the creation of a demonstration garden in Windsor. Master Gardener volunteers in Weld County helped to establish this easily accessible venue.

Extension's Response

In 2008, Windsor-based Colorado State University Extension CMG volunteers approached town officials about establishing a demonstration garden on town-owned land. The Windsor Parks, Recreation, and Culture Department approved the idea and proposed the use of a vacant field that was once farmed. The one-acre site is adjacent to the much-traveled Poudre River Trail and has good access to non-potable water.

Once the town of Windsor and Weld County Extension signed a formal partnership agreement, the Treasure Island Demonstration Garden was established. In addition to donating land, the town of Windsor provides and maintains the garden's water supply and irrigation infrastructure. It also provides wood mulch, top soil, trees, garden signage, and an annual budget up to \$1,000 for purchasing materials, equipment, and plants. CMG volunteers and other community volunteers (they collectively call themselves the DiGGers—Demonstration Garden Group) provide the vision, planning, labor, and expertise needed for cultivating and maintaining the garden.

In 2009, the garden became one of the nearly 90 Plant Select® demonstration gardens located throughout the Rocky Mountain and High Plains regions. Plant Select® is a nonprofit collaboration with Colorado State University, Denver Botanic Gardens, and partner growers. "The objective of Plant Select® is to come up with a palette of plants that do well growing in this climate," says DiGGER volunteer Bill Pratt. The program annually provides the Treasure Island Demonstration Garden with dozens of plants that are evaluated for durability, reliability, and cold hardiness. Plants are interspersed throughout the garden.

In five growing seasons, the garden has evolved far beyond the wildflowers, miscellaneous plant cuttings from volunteers' gardens, and dozens of pumpkin plants that the volunteer garden group originally established. Treasure Island now includes several flowering plant communities—unique varieties of annual and perennial ornamentals, low-water, xeric rock gardens, irises, and phlox and lavender gardens—as well as pathways, benches, and other landscaping materials and art donated by volunteers and local businesses.

Volunteers have also transformed the pumpkin patch into a large and thriving vegetable garden. This past year the vegetable garden received dozens of donated bedding plants and many packets of vegetable seeds. While many of these donations came from the Plant Select program and CMG home gardens, others were contributed by the community. The garden donates 100 percent of the food it grows to the Windsor Food Pantry—more than 2,300 pounds in 2011 alone.



The Bottom Line

- The Treasure Island Demonstration Garden in the town of Windsor is a community asset that provides food, teaches the public about best gardening practices for the local climate, beautifies public spaces, and attracts a wide range of dedicated volunteers.
- The garden exists because of a strong partnership between the Town of Windsor, the Weld County Extension CMG volunteers, and the DiGGers volunteers.

By the Numbers

- Approximate number of volunteers at the garden: 20 CMGs and 10 community volunteers
- Number of CMG volunteer hours in 2012: 1,140

Results

Weld County Extension CMGs created a community asset by establishing the Treasure Island Demonstration Garden in partnership with the town of Windsor. Before the garden existed, the Poudre River Trail curved through an empty field that was farmed years before. Over the years, trail users have witnessed CMG and community volunteers transform the uncultivated land into a thriving garden that generates many community benefits, including public enjoyment, awareness, education, increased volunteerism, and beautification.

Demonstration gardens show people what they can grow in their own climate, under specific conditions, and how. The Weld County Extension CMGs have volunteered hundreds of hours developing different garden areas and beds that reflect the diversity of plant communities that can thrive in the High Plains. Volunteers who work in the vegetable garden conduct irrigation experiments to determine the best method for the highest yield. Volunteers share the lessons they learn with visitors through education classes and informal discussions in the garden. “We interact daily with cyclists and pedestrians who stop to read informational signs, observe the plants, and ask questions—mostly about their own gardens,” says Pratt.

Volunteers have also repurposed materials—decking lumber, wine bottles, horseshoes, bed frames, and more—to build bed borders, pathways, benches, sculptures, gates, and transition zones. These creative touches show visitors the limitless ways in which they can landscape and garden. “I was out here an hour and there were 30 people wandering around, taking their time, and pointing out what they like to each other,” said CMG volunteer Janene Willey.

Roughly one third of the Treasure Island Demonstration Garden volunteers are not CMGs. When Sunita Noronha saw an article in the local paper about getting involved with the demonstration garden, she called immediately and became a dedicated volunteer. According to Pratt, who has been at the forefront of the garden’s development, the garden offers everyone a chance to get their hands in the dirt, make new friends, work toward a common goal, and feel more connected to their community. “Volunteers come from all over,” Pratt says. “Kersey, Firestone, Greeley, Johnstown, Eaton. We all get something out of it.”

The town of Windsor has been an invaluable partner to the Weld County Extension CMG program. The town’s material and financial support has allowed volunteers to expand the garden’s boundary, make irrigation more efficient, and become a more self-sustaining entity. Each year DiGGers sell iris bulbs during an iris grab and pumpkins to local businesses. Revenues from these efforts are processed through the Community Foundation Serving Greeley and Weld County and then reinvested in the garden, which has become the town’s flagship horticultural project.

“They are so much behind us,” Willey says of the town officials who made the garden possible. “Treasure Island supports the town’s goal to help residents enjoy and develop an appreciation for open spaces, gardens, and parks.”

“I love coming here to volunteer. I enjoy the quiet time that you spend with yourself and with your fingers in the ground, listening to the sounds of birds around you. It’s that feeling of being alone with nature.”

– Sunita Noronha
Treasure Island Demonstration Garden volunteer

“We’re hot and sweaty (from working in the garden) and want to go home, but then somebody stops and says, “What a beautiful garden... I love coming by here... I stop here once a week.” After comments like that I’m good for another couple of hours. That’s what the reward is—hearing the appreciation from other people.”

– Bill Pratt
Weld County Extension CMG volunteer

Visit the Garden

The Treasure Island Demonstration Garden is located off of South Seventh Street in Windsor, about a half mile south of the intersection of Seventh Street and Eastman Park Drive. Turn into the garden at Laku Lake Road.

Volunteer-led gardening classes are held the second Saturday of each month from April through September.

Volunteers actively work the garden on Tuesday and Thursday mornings from April through October. To volunteer call (970) 686-7319 or (970) 686-2999 or simply appear at the garden on a work day with gardening tools.

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Impact

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Partners in Colorado wheat development

Improved wheat development, variety adoption, and agronomy practices are yielding high returns for Colorado's \$600 million wheat industry.

Issue

Colorado State University develops locally adapted wheat varieties that thrive despite Colorado's extreme environmental conditions, unpredictable weather, and daunting pests. Developing a superior performing wheat variety requires university-wide research and outreach.

Extension's Response

Colorado State University Extension specialists from the College of Agricultural Sciences are integral to the University's wheat development. Specialists conduct research and outreach in plant pathology, entomology, soils, irrigation, precision agriculture, crops production and integrated pest management. They work closely with Scott Haley, director of CSU's wheat breeding and genetics program. It takes an average 8 years for this team—which includes several other agricultural research, industry and grower partners—to develop and release a new variety.

Post-release, Extension agents work closely with crops production specialist Jerry Johnson and wheat growers across Colorado to help growers maximize yield by adopting proven, high performing varieties. They do this through:

- Annual variety performance trials: methodical comparison of more than 40 varieties of experimental, new, and established public and private wheat at 14 locations across Eastern Colorado.
- [Collaborative On-Farm Testing \(COFT\)](#): More than 30 wheat growers test the same five or six new and established varieties using their own management practices, resources and equipment.
- Wheat Field Days: On-farm visits, held annually in 11 Eastern Colorado locations in June, provide farmers with firsthand knowledge of new and established varieties.
- Wheat Planting Decision Meetings: Johnson, Haley and Colorado wheat industry representatives deliver a series of presentations every August to showcase variety trial and COFT plot surveys results.
- Publications: Individual trial results are posted online within several days after harvest. Results from multiple years and locations are published in the High Plains Journal and in a technical report (also posted online) that is distributed to Colorado wheat producers.

CSU Extension also provides growers the latest, best production practices for improving soil composition, water application, and weed, insect, and plant disease management.



The Bottom Line

- Wheat development at Colorado State University is a highly integrated process that has resulted in Colorado growers adopting new varieties of wheat faster than growers in any other state.
- The rapid adoption of new, superior yielding and high quality wheat varieties developed at CSU generates extraordinary economic return for growers. Analysis of just three CSU varieties planted in the 2010 crop produced an estimated \$18,000,000 impact.

By the Numbers

For the 2011 wheat crop

Estimated total acreage seeded: 2.5 million

Percent seeded with CSU varieties: 65

Percent of crop exported: 80

Value of Colorado's 2010 bumper Crop:
\$600.6 million

Impact

Since 1963 Colorado State University has developed and released more than 30 varieties of superior yielding, high quality wheat. CSU Extension specialists and agents have significantly contributed to the development and adoption of these varieties, as well as the overall sustainability of Colorado's wheat industry. This has resulted in:

Locally-adapted varieties that get results

- CSU wheat varieties are specifically bred to withstand regional altitude, dry conditions, high temperatures and erratic weather, as well as disease and pest concerns. This has resulted in Colorado growers making substantial yield gains. According to the Colorado Wheat Research Foundation (CWRF), the benefit of locally-bred wheat varieties was clear in 2010, when Colorado growers set a record yield of 45 bushels per acre.

Widespread adoption and use of CSU-developed varieties

- 'Hatcher', released in 2004, has become the most planted wheat variety in Colorado. In 2011, Colorado growers seeded 30.3 percent of an estimated 2.4 million acres in 'Hatcher.' In 2012, seven of the top 10 varieties most seeded were developed by CSU.
- Colorado wheat growers who responded to a 2010 CSU Extension survey ranked COFT trials as the most important source of information for wheat variety selection.
- According to Darrell Hanavan, Executive Director of the Colorado Wheat Administrative Committee and CWRF, Colorado wheat growers adopt new wheat varieties faster than growers in any other state.

Positive economic impact for Colorado's wheat industry

- The rapid adoption of improved wheat varieties increases the returns of Colorado growers. According to Jay Parsons, CSU agricultural economist, three CSU varieties—'Hatcher', 'Ripper' and 'Bill Brown'—resulted in a positive \$18,000,000 economic impact to Colorado's wheat industry, in 2010 alone.
- In a 2010 wheat grower survey conducted by CSU Extension, 92 percent of the 297 growers who responded reported that CSU varieties increased yield by three to more than five bushels per acre. Bruce Bosley, CSU Extension agent in Logan and Morgan counties, says this increase represents an economic gain of \$25.20 per acre—for those respondents.
- A unique partnership between CSU and CWRF supports the ongoing development of locally-adapted wheat varieties. Since 1995, CWRF has provided nearly \$1.4 million in royalties from the sale of certified seed to support continued wheat research and breeding at CSU.

Sustainable production practices

- Colorado wheat farmers are adopting new wheat-based, no-till cropping systems that lead to improved soil health and water conservation, as well as practices that minimize wind and water erosion and build organic soil matter.
- A growing number of Colorado farmers are practicing precision agriculture, such as air-seeding, that allow producers to plant the precise amount of seed to the right place. Equipment also delivers the precise amount of essential plant nutrients, improves wheat stands without wasting seed or fertilizer, and helps control pests.
- Reduced tillage and integrated pest management help growers increase their yields and the quality of Colorado produced wheat.

"Colorado wheat producers are smart and conscientious. They adopt new practices that are economically sound. Many producers sacrifice time and effort for their common good to participate in wheat grower organizations. They are good stewards of the land. It seems like we learn as much or more from farmers as we teach."

— Jerry Johnson

CSU Extension crops production specialist

Colorado's Wheat Industry

Wheat breeding at CSU would not be possible without the support of Colorado's wheat industry. In 2010-11 alone, the Colorado Wheat Administrative Committee and Colorado Wheat Research Foundation (CWRF) provided nearly \$800,000 to support CSU wheat breeding and wheat-related research. CSU transfers ownership of new cultivars to CWRF, which works with the Colorado Seed Growers Association to produce and distribute certified seed. CWRF collects royalties on the sale of certified seed and returns a net amount to CSU for wheat-related research. The Colorado Agricultural Experiment Station also provides more than \$1.5 million annually in state, federal and grant funds to advance wheat development and production.

Learn More

Visit <http://wheat.colostate.edu>

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Role of local weather data evolves with changing times

Improving the accuracy and usability of data recorded by a statewide network of agriculture weather stations is the continual goal of CoAgMet.

Issue

Research shows that producers can conserve water and increase crop yields by improving their irrigation management practices. However, this requires access to details such as soil moisture, plant water use, and current weather information. Timely access to weather and crop water use data allows producers and agricultural consultants to make informed irrigation management decisions that can save time, money, and resources.

Extension's Response

In the early 1990s, Colorado State University Extension plant pathologists and the USDA Agricultural Research Service (USDA-ARS) Water Management Unit established the Colorado Agricultural Meteorological Network (CoAgMet). The network collects detailed weather data that is used for a variety of purposes, from estimating crop water use to forecasting pest and disease outbreaks.

CoAgMet began with a handful of weather stations located on irrigated farmland across the state. As the network grew, CSU's Colorado Climate Center (CCC) got involved. The CCC built a web interface that links to the weather data it now manages. CSU Extension and USDA-ARS remain key partners. CSU Extension specialists and agents contribute expertise to the development, usability and deployment of CoAgMet data.

CoAgMet currently consists of 66 weather stations that are located on both irrigated and non-irrigated farmland. Station instruments collect air temperature, precipitation, relative humidity, wind speed and direction, and solar radiation data that are uploaded daily to the CoAgMet website: www.coagmet.colostate.edu.

The network's main purpose is to estimate crop and turf (lawn) water use, expressed as evapotranspiration (ET). Crop ET, expressed in tenths of inches per day, is an approximate calculation of how much moisture has evaporated from the soil, and transpired through plant stomata. Once ET is known, an informed decision can be made about the amount of water that crops actually need.

Over the years CSU Extension specialists have made usability improvements to the CoAgMet website, based on producer feedback. Today, users can view ET rates through a variety of filters: weather station, planting date, crops such as alfalfa, corn, onion, and potato, and turf. Users can also review monthly and daily ET summaries for a specific station and a given day. But producer usage via computer is limited since they are often busy in the field. To solve this dilemma, CSU Extension specialists are currently developing text-messaging strategies and smart phone applications that can deliver customized CoAgMet data.



The Bottom Line

- The Colorado Agricultural Meteorological Network generates and distributes crop water use data that has far reaching applicability, from guiding irrigation scheduling and monitoring drought to determining Colorado's compliance with interstate water compacts.
- CSU Extension ensures that CoAgMet generates accurate and reliable data and continuously improves data delivery so that users get the information they need, when and how they need it.
- CoAgMet is held together with a resilient patchwork of local, state and federal funding sources that come and go.

By the Numbers

- Number of CoAgMet weather stations: 66
- Annual cost to maintain CoAgMet: \$2,000

Impact

The Colorado Agricultural Meteorological Network is a powerful management and support tool that has evolved in scope and use throughout its nearly 20-year history. Today, CoAgMet data has broad relevance and application for many users directly and indirectly engaged in production agriculture.

For those directly engaged in farming, several benefits can accrue from improving irrigation water management. According to CSU Extension water resources specialist Denis Reich, optimal irrigation water scheduling that is based on crop ET can decrease water use and increase crop productivity. CSU Extension water quality specialist Troy Bauder says it can also save time and money and conserve resources.

“It costs to pump and run your pivot,” Bauder says. “If you surface irrigate, you’re paying someone to do it, or you’re doing it yourself. If you let the ground get drier than it should, you’re costing yourself some yield. If you over irrigate, the excess can percolate into the groundwater. If you apply only the water that crops need, you can reduce possible environmental impacts, such as nitrate leaching.”

It turns out, however, that agricultural users may not be the number one CoAgMet audience. Nolan Doesken, Colorado State Climatologist, and Thomas Trout, research leader for the USDA-ARS Water Management Unit, estimate that CoAgMet is currently used by more water consultants, engineers and attorneys than agricultural producers or consultants. Doesken says that the complexities of Colorado water law, which demand a high quality, respected data set, have driven this surge in use. It has also focused educational efforts for this key audience. In fact, in March 2010 and 2012, USDA-ARS and CSU Extension hosted an ET workshop designed specifically for water consultants.

The Colorado Division of Water Resources (DWR) relies on CoAgMet data to estimate crop water use in key water basins. The Colorado Office of the State Engineer uses CoAgMet data in the management of the Arkansas River Compact (1948) between Colorado and Kansas. In support of this need, CSU Extension, in collaboration with the Colorado Agricultural Experiment Station and DWR, conducts extensive crop water use research at the Arkansas Valley Agricultural Experiment Station. Overall, research ensures that the equations used to generate ET are as accurate as possible for the crops grown in the Lower Arkansas River basin.

CoAgMet data is also used by scientists, CSU Extension agents, agricultural consultants, lawyers and homeowners to:

- Research nitrogen deposition and distribution from feedlots.
- Document drought/lack of precipitation for crop insurance on both crop failure and prevented planting. High use of this by CSU Extension occurred in 2002, 2003 and 2004.
- Count growing degree days to determine when insect pests will hatch. This tells consultants and growers when they should begin scouting.
- Complement weather data collected by agricultural consultants using their own regional weather stations.
- Schedule residential irrigation of cool season grasses.
- Provide documentation for lawsuits. CSU Extension has used weather data—rainfall, frost events, heat and wind—in lawsuits where it has been called in as an expert witness.

“If you want to stay relevant with irrigation water management, CoAgMet is one of your more cost effective tools that’s publicly available. Optimizing water use can contribute significantly to bottom-line improvements via increases in productivity and reduced labor input. The profit improvement potential this represents means incorporating CoAgMet into your irrigation enterprise is worth the time.”

– Denis Reich, CSU Extension water resources specialist

Keeping CoAgMet Alive

In the beginning, CoAgMet had solid funding. Today, many of the network’s 66 stations are kept active with sponsor dollars. Water conservation districts, individual producers, county Extension offices, agricultural experiment stations, the Colorado Division of Water Resources and many other donors support CoAgMet by purchasing weather stations (each costs \$7,000) and maintaining them annually (a \$2,000 per station cost). Perry Cabot, CSU Extension water resources specialist, encourages CoAgMet partners to find a way to generate money from data that users now get for free. “These stations do a great thing,” Cabot says. “A tremendous amount of technical expertise has gone into developing the validity and value of CoAgMet data.” In the meantime, CoAgMet continues to seek new sponsors, add new stations, and generate high quality data that has found significant use all over the state.

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Impact

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Building capacity, building community

Beginning farmers around the state are learning to identify appropriate markets, develop plans for their new businesses, and build critical networks through a leading-edge program that gets results.

Issue

The number of small farms and ranches is growing throughout Colorado with many producers selling their vegetables, fruit, flowers, dairy, meat, and other food products directly to consumers, retail, and wholesale customers. Many of these producers have limited agricultural business experience or may have training in general business topics only.

Extension's Response

Colorado Building Farmers (CBF) was developed in 2007 to help beginning farmers with zero to 10 years of experience learn to strategically develop a business and manage its risks. It was first offered in 2007 and 2008 in Boulder County. The organizing team included Adrian Card, Extension agent in agriculture and natural resources, Dawn Thilmany, professor and Extension agribusiness economist, and Martha Sullins, Extension specialist in agriculture and business management. A Boulder County advisory committee provided guidance.

In 2009, the 8-week program expanded to two additional locations in Colorado, with grant funding from the Western Center for Risk Management Education. Since that time, CSU Extension agents have offered the program in Boulder, Chaffee, Delta, Denver, La Plata, Larimer, Pueblo, and San Miguel counties.

Each course is designed to help beginning farmers succeed by 'building community and building capacity.' Around the state, every class begins with a shared meal and peer-to-peer networking, followed by a presentation from one or more guest speakers, who either address the program's core curriculum—strategic business planning, marketing, enterprise budgeting, and record keeping—or discuss specialty subjects that reflect the business and enterprise interests of area participants. County Extension agents choose specialty subjects with input from a local advisory committee (composed of local farmers, ranchers, and agricultural professionals) who know area issues and limitations. Examples have included:

- Risk management, insurance and managing labor, legal, and financing issues—various counties;
- Urban agriculture, volunteer management and recruitment, and city zoning—Denver County;
- Regional food distribution, land links, food safety, and dairy production—Chaffee County;
- Agritourism, value-added processing, and networking—La Plata County.



The Bottom Line

- CSU Extension is training a growing segment of market farmers and ranchers on how to strategically develop a business, manage its risks, and succeed in diverse markets.
- *Colorado Building Farmers* is becoming an important incubator for Colorado's local and regional food production and marketing systems.

By the Numbers

- Total farmers trained since 2007: 310
- Percent of farmers who would recommend class to others: 100
- Percent of farmers who increase their farming networks: 98
- Cost to participate: \$90 - \$220

Impact

CBF is helping new and beginning farmers assess their ability to start and maintain a new farm operation or expand and improve an existing one. Throughout the program, participants learn critical business planning and assessment skills, while gaining access to producer networks for agricultural inputs, financing, technical support, marketing insights, as well as land and water resources. As a result, CBF is becoming an important incubator for Colorado's local and regional food production and marketing systems.

Completion of the program includes presentation of a business plan; beginning farmers then may apply for the program's mentorship program that pairs them with experienced farmers for one planting and growing season.

Evaluation results indicate that CBF is building new capacity in more localized systems that complement more traditional food distribution. Every CBF participant takes one pre- and one post-course assessment. The pre-course survey asks participants to gauge their readiness to operate a farm or ranch business based on specifics, such as:

- current or planned agricultural production;
- current or anticipated sales outlets for their products;
- their knowledge, skills, and attitudes about managing production and business risks;
- their knowledge of where and how to obtain land, labor, credit, equipment, and services, such as technical advice and business and marketing support.

Post-course surveys require participants to revisit these questions and indicate how their intentions, knowledge, and skills may have changed by taking the course. Some specific evaluation measures include gains in knowledge, changes in their attitudes and behavior about planning for an agricultural business, use of new professional community networks, and access to on-farm learning.

Aggregated pre- and post-survey results from 2011-12 programs in Boulder, Denver, Larimer, and Chaffee counties show that:

- many aspiring producers take the course before investing in their operations;
- participants in every county increased their knowledge of business management practices, such as developing a business plan, pricing products, implementing pricing strategies, complying with regulatory issues, and accessing local resources and technical support;
- ninety-eight percent of participants increased their network of farming colleagues and can draw on them for information/resources;
- nearly one-third of all participants plan to apply for a mentorship with an established farm operator. Card says that the community of producers who mentor, apprentice, and guide new farmers/ranchers strengthens the overall food system and better serves the needs of the local buying public;
- one hundred percent of participants would recommend the course to other farmers or potential farmers.

Data from a longitudinal survey of Boulder County program participants show that the program is also providing direct-market farmers with the skills, resources, and confidence they need to improve their business management practices and decision-making. Boulder County participants from 2007, 2008, and 2009 report that the program has helped them improve their production and management skills as well as develop new and diverse market outlets.

Colorado State University Extension, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. January 2013. Written by Carol Busch.

“This course is a highly effective way to communicate key information to people so they can reduce the amount of valuable resources wasted on false starts. This class is an inoculant against failure!”

– Denver County participant

“The Building Farmers course was just what I needed to help me go from being a serious ‘hobby’ gardener to actually starting a business. The information presented and contacts I made have been invaluable.”

– Jonathan Hart
Chaffee County CBF participant

“I had a participant who was already farming and stopped for a year because they realized they were burning capital. That was an enormous success for them to say, ‘I’m going to take an entire year off to focus on this planning.’”

– Blake Angelo
Urban Agriculture Extension Coordinator,
Denver County

Building Farmers in the West

Based on the success of *Colorado Building Farmers*, a three-year \$748,000 grant from the USDA Beginning Farmer and Rancher Development Program launched *Building Farmers in the West*, to train producers in Colorado, Idaho, Oregon, New Mexico, Nevada, and Washington.

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Impact

Sharing the difference CSU Extension makes in people's lives and their communities.

From garden surplus to community hub: Larimer County Farmers' Market

More than 30 years after opening, a market established and maintained by volunteers has increased awareness of small farms, grown sales for local foods and become a business incubator.

Issue

In the mid-1970s, finding a way to help backyard gardeners sell surplus produce was top priority for Larimer County Extension Colorado Master Gardeners (CMGs). This volunteer group approached their county Extension office with the idea of starting a local market. More than 30 years later, volunteers remain the backbone of the market—now one of the most successful volunteer-managed markets in the state.

Extension's Response

Larimer County Extension originally supported the market by funding the construction of a CMG information booth, establishing operating policies and managing finances. Larimer County CMGs organized and managed all other aspects of the market. Volunteers can now choose the market, from many options, as their payback for the horticulture training they receive.

Extension's fiscal and administrative oversight has increased as the market's season, vendor numbers and community interest has grown. Alison O'Connor, Larimer County Extension horticulture agent, has learned to sustainably increase and develop the market with help from Martha Sullins, CSU Extension regional agriculture and business management specialist. O'Connor says veteran market volunteers have also been an invaluable resource in directing market growth. In 2009, O'Connor hired a market assistant, Jean Reeder, to support continued expansion.

Today, the market is open Saturday mornings, in downtown Fort Collins, from May through October. Each week up to 75 vendors sell their products in the Larimer County Courthouse parking lot. Vendors primarily include local and direct market farmers, as well as value-added food producers and artisans. Both CMGs and Larimer County Extension Master Food Safety Advisors staff the Larimer County Extension information booth to answer customer questions about growing, using and preserving food.

Each week six CMG volunteers set up and take down the market under the direction of one 'Market Master' and one 'Assistant Market Master.' During the market, volunteers also assist customers purchasing Supplemental Nutrition Assistance Program (SNAP) benefits coupons or same-as-cash 'Market Bucks.' At the end of each market, volunteers collect taxes (city and state) and fees (six percent of sales) from vendors.

In 2006, market sales totaled \$222,307 and by 2011, market sales had increased 50 percent to \$453,353.



The Bottom Line

Larimer County Extension and its Colorado Master Gardener volunteers have created a business asset that is a benefit to the community on many levels by:

- Serving as a small business incubator for direct market farmers
- Expanding regional food security and food safety
- Promoting agricultural literacy, local foods and community development

By the Numbers

- 2011 market revenue: \$453,353
- Larimer County Extension's revenue: \$27,000
- Volunteer hours needed to run each market: 32
- 2011 Value of volunteer time: \$21.62/hour

Impact

As sponsor of the Larimer County Farmers' Market for more than three decades, Larimer County Extension and its Colorado Master Gardener volunteers have created a community asset that benefits the public on many levels. Specifically, the market:

- Serves as a small business incubator for direct market farmers.
 - Extension's Colorado Building Farmer's program (CBF) trains farmers how to create business plans and sustainably develop their operations. The market provides a low-risk retail venue for putting those plans in place. Nic Koontz, co-owner of Native Hill Farm with Katie Slota, took CBF in 2009 and 2010. The program taught him to make an informed and realistic business plan. "It has enabled us to move our business forward to a point where we are both full time farmers," says Koontz. Native Hill is one of the market's top selling producers.
 - Larimer County Extension offers affordable access to the local market place. Cost to apply: \$50. Cost to participate: weekly sales tax and percent of revenue fee. Financial accessibility promotes diverse participation, from new to well-established regional growers, and offers producers the chance to compete, grow and diversify.
- Expands food security and food safety.
 - The Larimer County Farmers' Market is the county's only summer market to accept electronic benefit transfers from SNAP. This expands access to the purchase of fresh, nutritious and locally-grown food, regardless of income level. Use of SNAP Benefits Coupons has increased 77 percent since first introduced in 2007.
 - Most vendors donate unsold produce to the Larimer County Food Bank.
 - Immediately following the 2011 listeria outbreak, Master Food Safety Advisors gave customers and vendors responsive, current and science-based information.
- Promotes agricultural literacy, locally grown foods and community development.
 - The Larimer County Farmers' Market is a dynamic venue for educating the public. Vendors refer customers with gardening questions to CMG volunteers. Master Gardeners likewise refer customers back to vendors for pricing and food availability, as well as information on difficult-to-grow and unusual vegetables.
 - Mary Miller, market manager for Ela Family Farms, says market customers continue learning about local foods and agricultural production. "We give customers real time information and education about fruit, the farm, and the seasons, so that customers can expand their knowledge and awareness of what it takes to bring a piece of fruit to market," Miller says.
 - The market has become a community hub linking consumers and producers through business and social relationships.
 - Fees from vendor sales fund all of the market's operating costs and support the CMG program in Larimer County.

According to O'Connor, Larimer County recognizes these many benefits and is proud to partner with CSU Extension in providing this community asset. In 2012, the market will expand from 17 to 24 weeks. Farmers can now grow more food earlier in the year due to season extension measures. The Larimer County Farmers' Market is a volunteer project that exists due to CMG commitment. According to O'Connor, it would not exist without the CMGs.

"You see a little tent here, but there are hundreds of people behind it."

—Denise Culver, CMG volunteer on the Larimer County Extension market booth

"Having the CMGs involved makes our program stronger because they have integral roles in keeping this market operational. In a way they are like 'employees'—extremely dedicated employees. Without them, there would be no market—we don't have the funds to run this market without the help of the volunteers."

—Alison O'Connor, Larimer County Extension horticulture agent

"The level of community that is present in the old town market is unprecedented. It isn't a bunch of discreet patrons; the market is a hub of community."

—Mary Miller, vendor, Ela Family Farms

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Sharing the difference CSU Extension makes in people's lives and their communities.

Igniting interest in Science, Technology, Engineering and Math

Students raising baby chicks from eggs receive hands-on, standards-based lessons in life science.

Situation

Interest in science, technology, engineering and math (STEM) subjects starts early in a child's education. However, budget constraints and assessments often limit elementary school teachers from providing enriching and memorable science-based lessons.

Extension's Response

For more than a decade, Colorado State University Extension 4-H youth development agents have introduced students to the life sciences through the fostering of eggs, hatching, baby chick growth and development. Since 2003, Larry Hooker, CSU Extension 4-H and youth development agent in Arapahoe County, has enriched classroom learning through embryology outreach using a curriculum that supports 4-H's STEM initiative and meets state department of education science standards.

Hooker typically provides teachers with an incubator, fertile eggs, and the equipment needed to care for newly hatched chicks: a brooder for raising chicks, heat lamp, feeder, feed, shavings and water container, teacher's manual, instruction sheets and three classroom visits. For 21 days, fertilized eggs grow in an incubator until baby chicks hatch. Once hatched, chicks remain in the classroom for approximately a week before they return to the farm they came from, or are adopted as 4-H poultry projects.

During incubation, students explore embryo development by 'candling' eggs—a process that involves shining a very bright light through eggs to see if embryos are alive and well. Students work in teams or as a class to make sure incubator conditions are just right. Incubators must be kept at incubator temperature (99.5 degrees F) and monitored on a daily basis. Students also keep track of the number of days that go by so they know when to expect hatching to begin.

The cost to participate depends on the level of involvement. Arapahoe County Extension rents incubators for \$25.00 each plus \$1.50 per student. Fertile eggs cost \$20.00 per dozen. Hooker encourages teachers to participate at whatever level works for them. According to Hooker, some teachers have their own incubators and only want fertilized eggs. Others want incubators and eggs and no presentation. Most teachers want incubators, eggs and a presentation.

During the 2010-11 school year, Hooker provided embryology outreach to 1,362 students and 112 teachers from 24 schools throughout the county. While outreach revenue generated \$2,091 that money is reinvested in supplies and equipment, such as maintaining, repairing or replacing any one of the 22 incubators which make the program possible.



The Bottom Line

Elementary students introduced to the life cycle through the 4-H baby chick embryology outreach program learn more than basic science information. Overall they:

- Become excited about science
- Gain knowledge of life science and are able to use scientific terminology

Many students:

- Become more responsible during the project
- Are immersed in their learning
- Learn respect and compassion

Results

For the past nine years, Arapahoe County Extension has engaged a total of 5,491 elementary school students in embryology outreach. Verbal and written evaluation testimonials conducted by Hooker report knowledge gains.

In 2010, 84 percent of teachers who returned post-program evaluation forms indicated their students increased their scientific knowledge as a result of participating in an embryology program. Specifically, students learned about genetics and embryonic development: chicks take 21 days to hatch and come in many colors, just like people. Students also learned that roosters are necessary for fertile eggs, that chick development requires heat and moisture, and that candling eggs shows chick development.

Teacher responses also showed that embryology outreach not only increased student scientific knowledge but also helped students develop life skills. Specifically, students learned:

- how to deal with death (many of them have never lost anyone close to them);
- to appreciate little animals and nature;
- the importance of sharing; and,
- how happiness and joy exist alongside disappointment and sadness.

The 4-H embryology curriculum also allows classroom teachers to integrate other disciplines, such as technology, math and interpersonal communications through the use of computer presentations, writing and other skills.

Beyond science and technology, embryology projects teach students how to cooperate as they develop citizenship and leadership skills. "Embryology gives the inner city youth a great opportunity to experience life," Hooker says. "They begin to understand what life means and have a little different outlook on what is going on in their lives; this shows me this program has an impact on their lives."

"We have done this program since the very beginning (2003) and would never go without it. It brings about a special excitement and a hunger to learn. Even those students that are a bit withdrawn seem to connect better with what is going on."

—Teacher, Dry Creek Elementary

"We love this program, but this year things were different. We had two chicks die and that really made the class think. Life is precious and I think some of them know that now."

—Teacher, Village East Elementary

Enhancing State Standards

To be competitive at home and abroad, Colorado needs a workforce that is strong in science, technology, engineering and math (STEM). Only 32 percent of current college graduates earn STEM degrees compared to 66 percent in Japan and 59 percent in China. 4-H youth development nationwide has set a goal to prepare one million new youth to excel in STEM fields by 2013. 4-H science-based, school enrichment programs help to meet this goal. In particular, hands-on classroom science projects, such as embryology, can enhance state curriculum standards, reinforce student learning and keep costs low.

To learn about statewide embryology efforts, visit: www.ext.colostate.edu/impact/embryology_statewide_ss.pdf

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