2019 Annual Report of Accomplishments and Results

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I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

1. Executive Summary (Optional)
Please note that our critical issues are the same as was listed in the 2017 Plan of Work, but we have provided updates to some of the descriptions and also significant updates to other sections of the Plan in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.

Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates
1. The Merit Review Process	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.
2. The Scientific Peer Review Process	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.

II. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.
2. Methods to identify individuals and groups and brief explanation.	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.
3. Methods for collecting stakeholder input and brief explanation.	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	We have made significant updates to this section in our 2021 Plan of Work in order to more directly respond to the information requested by NIFA. Please refer to our 2021 Plan of Work for all updates.

III. Planned Program Table of Contents

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name/No.
1.	**Colorado 4-H Horseback Riding Safety**	Horseback riding has been identified as a higher-risk activity than automobile racing, motorcycle riding, football, and skiing. Head injuries account for an estimated 60% of deaths resulting from equestrian accidents, and helmets can reduce head and brain injuries by 85%. The Horse project, in which young equestrians participate in horseback riding and learn life skills, has been a historically large 4-H project in Adams County. The Adams County 4-H Horse program recently expanded their helmet requirements to require all members to wear helmets anytime they are on a horse at an Adams County 4-H event. In an attempt to help members and parents better understand the importance of helmet use when riding a horse, and why ADCO 4-H is supporting helmet use, an educational helmet clinic was developed. The clinic educated participants about the statistics related to equestrian helmet use and utilized Extension-developed materials to explain the importance of helmet use. Demonstrations with helmets were also held during the clinic to demonstrate helmet effectiveness. All horse members were required to attend the clinic with at least one parent or guardian. The clinic ended with each 4-H member ordering a free helmet from the 4-H Office. Although helmet use by equestrians is a controversial subject with significant opposition, the clinic resulted in positive feedback by both parents, and 4-H youth. The number of youth stating that they wear or plan to wear a helmet every time they ride increased from 62% before the clinic to 74% after the clinic. 99% of youth reported that they learned why helmet safety is important when	4-H

		riding horses. After attending the clinic, the number of youth reporting that they felt unhappy about wearing a helmet decreased from 17% to under 5%. The number of adults who stated that they strongly agreed that they feel educated on the importance of helmet safety while riding horses increased from 36% to 83% after the clinic. After the clinic, 83% of the adults strongly agreed that they will encourage their child to wear a helmet while riding. 96% of adults stated they understood why ADCO 4-H is promoting equine helmet safety. Overall, in 2019 the state 4-H program had over 76,000 direct adult contacts and over 119,000 direct youth contacts. Over 4,300 educational events were conducted. 2,777 out of 2,820 (98.5%) adult volunteer survey respondents applied skills developed through Extension-provided training, supervision, and support to increase their effectiveness in positively influencing youth. 2,754 out of 2,835 (97.1%) youth survey respondents contributed to community improvement. 4,641 out of 4,684 (99.1%) youth survey respondents demonstrated their ability to work effectively in teams.	
2.	**Emergency Response – Wildfire in Chaffee County**	On September 8, 2019 a thunderstorm caused a small fire nine miles south of Salida, CO in northern Saguache County. The fire spread into adjacent Fremont County within two days, but was still in a remote wilderness area on national forest service property. Though it continued burning, it did not cross the mountain range into Chaffee County until September 30. In the very early morning hours of October 2, Chaffee County Sheriff John Speeze ordered the mandatory evacuations of numerous subdivisions south and east of Salida, CO. The fire made a significant run on October 12-13, causing additional mandatory and pre-evacuation notices to residents in western Fremont County. For approximately two weeks, the Decker Fire was the #1 priority fire in the United States. In Chaffee County, CSU Extension is the lead agency responsible for all agriculture-related disaster response (ESF #11) efforts, and is a support agency for human sheltering and recovery (ESF #4). At the onset of the evacuations, the Chaffee County Fairgrounds was used as the emergency evacuation center for humans and livestock. Companion animals were transported to the Arkansas Valley Humane Society and other shelters around Salida and Poncha	Community Development

		Springs. CSU Extension's response consisted of two main efforts: 1) sheltering livestock (ESF #11) and supporting the evacuations; and 2) later, supporting the TYPE I incident command team (ESF #4) after they moved into the fairground's facilities. The livestock-related emergency response included: preparation of facilities and equipment to house unknown quantities and types of large animals; securing feed donations for initial animals housed at fairgrounds; interaction with livestock owners to check on animals and animal health concerns; work with TYPE I security team to allow animal owners to visit livestock while under our care; and utilization of "Mental Health First Aid" techniques at two public meetings to assist residents suffering from anxiety of fire impacts. Supporting the TYPE I team included: preparing re-entry packets for evacuated residents with numerous fact sheets on "Emergency Resources" from CSUE; providing checklists of evacuation items from the Chaffee County Sheriff's command post for evacuees to know what items to bring with them during short re-entry trips; securing cold-weather sheltering options; training numerous camp crews on facility maintenance needs during fairgrounds management vacancy; and plowing snow during one significant snowfall event to keep firefighters and base camp personnel safe. The Decker Fire TYPE 1 team assumed command of the fire on October 3 through October 28, 2019. Weather events aided significantly in the rapid de-escalation of the severity of the fire with several snowstorms occurring during the last two weeks. Only one rustic cabin was lost in Chaffee County, and only one single-family residence was lost in Fremont County due to control and suppression efforts of the firefighters and support personnel. At one point, there were more than 1,000 personnel living and working out of the fairgrounds, necessitating additional efforts of all personnel who regularly worked out of the fairgrounds location.	
3.	**Family Leadership Training Institute**	The Family Leadership Training Institute (FLTI) is a 20-week nonpartisan leadership and civic engagement class that meets once a week in the evenings. It is designed to provide people with the knowledge and tools they need to co-create programs and policies that make communities stronger and safer. Each	Community Development

		accepted participant implements a civic project based on a community issue that is important to them. Sites involved for 2019 included Aurora, the Montbello neighborhood in Denver, Lafayette, Arapahoe County, Eagle County, Jefferson County, Larimer County, Montezuma/Delores Counties, Morgan County, Prowers County, and Saguache. FLTI had 179 graduates from these 11 communities in 2019, including 38 youth (11 – 17 years of age). Outcomes such as personal skills development, increased civic knowledge, increased civic engagement in communities, increased civic action knowledge, increased leadership skills were assessed by an independent researcher at CSU. But it is the stories of graduates that show the power of this program. For example, after earning a scholarship from Doris Buffett through the Sunshine Lady Foundation, Danielle, a single mother, relocated to Longmont in May 2016 to study political science and sociology at Front Range Community College (FRCC). During her sophomore year at FRCC, Danielle attended the Longmont/North Boulder County FLTI and was chosen by her peers to be one of two participant-speakers at their graduation in 2018. This past year, after transferring to Metropolitan State University (MSU) in Denver and while completing her junior year there, Danielle worked as an intern at the OUR Center, a family resource center and the host organization for the Longmont/North Boulder County FLTI. As an intern, Danielle launched the OUR Center's first ever Participant Advisory Committee (PAC), which allows lower income participants (clients) to have more of a voice in how the OUR Center is managed and the type of services it offers. She also worked hard over the past year to advocate on behalf of affordable transportation and housing needs at multiple Longmont City Council and RTD regional meetings. Danielle has used the tools and skills learned in FLTI to find her voice and use it for the better good of the community. As she finishes her undergraduate degree, Danielle was just recently elected student body president at MSU of Denver. After graduating from MSU, Danielle plans on going to law school and continuing to advocate for social justice issues. In another example, FLTI graduate Lara Van Matre of Lafayette, Colorado designed a project to help bridge the digital divide for lower income families in	

		Boulder County. Her project involves training an army of grassroots technology promoters that will bridge the digital divide in Boulder County. She works with partnering non-profits and non-governmental organizations throughout Boulder County to provide affordable technology to low-income households, teach basic computer skills to individuals that need them, and to help partners who are already doing good work to further their missions and create a sustainable movement towards digital equity. After graduating from FLTI she applied to Google for a grant to fund her project and was recently awarded $100,000 to fund this unique project to serve lower income families. Sonia Mejia, and FLTI graduate in Eagle, Colorado is using her project to help diminish the social stigma for the Latinx community in regards to mental health assistance. She has successfully started a series of Mental Health First Aid classes in Spanish that have been well-attended by the Latinx community in Eagle County. An evaluation of participants in the Eagle County program showed a 1,083% increase in knowledge of how state budgets are made, a 389% knowledge increase of how state laws are made, a 132% knowledge increase of who are our state elected officials, and a 100% knowledge increase of who are our local elected officials. Overall, in 2019 the Community Development PRU had over 16,000 direct adult contacts. Over 450 educational events were conducted. 1,034 out of 1,080 (95.7%) surveyed businesses, non-profits, agencies, and community members increased links to resources and community assets.	
4.	**Labor Recruitment & Retention**	Labor recruitment and retention remains a key challenge for produce growers in Colorado. A 2019 survey was conducted by CSU Extension with 99 produce growers in the state responding. In the survey, respondents were asked to "select the top 3 labor issues/skills for [their] farm business" and the issue that was selected most frequently was "securing qualified, affordable labor" (selected by 68% of respondents). The second most frequently selected issue was "creating and managing an effective farm team" (selected by 40% of respondents). In response to the open-ended questions "What are emerging Colorado food system	Cropping Systems

		issues or trends you want us to be aware of?" and "What else should we know?", responses included: "labor is a challenge", "difficult to get good reliable labor", "the true cost of produce is about to jump in response to increasing costs of labor…", and "no viable farm labor supply". A 2018 survey conducted by the Colorado Fruit and Vegetable Growers Association (CFVGA) (n = 20) found that on growers rated "finding enough labor when you need it" as 4.25 on a scale of 1 as not important to 5 as extremely important. Looking further back in time, 79% Boulder County growers reported in a 2012 survey (n = 24) that recruiting and retaining quality farm workers is a moderate to extremely high business risk. For most, these labor challenges have not improved since 2012. In an improving economy, Colorado workers are finding other jobs and the wages required to recruit and retain workers continue to increase. Many remark that domestic workers available are frequently unskilled for ag work, are not a great asset to their farm business, and quit during the season. As a key indicator of business impact, Sakata Farms of Brighton, Colorado made the hard decision in 2018 to stop growing sweet corn, its staple crop for 70 years, primarily due to an inability to secure a reliable workforce. Other produce growers remark anecdotally that the surge in hemp sector employment has syphoned off workers attracted to a higher wage in the seasonal hemp production cycle. Colleagues outside of CSU working directly with farm workers have noted a near cessation of migrant workers into Colorado from supply states like Texas, ostensibly due to increasing fears of immigration law enforcement when one or more workers in a group are undocumented or when concerns of harassment by law enforcement outweigh job prospects in Colorado. Increasingly, growers are utilizing or exploring options with temporary foreign ag workers through the H-2A guest worker visa program.	

		For 2019, CSU Extension collaborated with colleagues from other agencies and organizations to program the Dec 9-10 Colorado Agriculture and Farm Labor Summit in Denver. All of these colleagues are witnessing the cultural shift of an aging farm worker population yet have anchored their work in providing for seasonal and migrant farm workers. We think the supply of workers is bifurcating strongly into international workers with fewer domestic supplies and questionable long-term supply of US workers in ag. While there is no clear short term impact to this "wicked issue" of agricultural workforce, Extension will continue to raise awareness, explore innovative solutions (robotics, workforce sharing, housing options, etc.), and quantify the issue in Colorado for those who would use such information to advocate for change. This work will include working with the Colorado Department of Labor and Employment to promote its Ag Recruitment System to help find Colorado-based and migrant workers qualified for ag jobs and continuing with labor surveys.	
5.	**Increasing Resiliency In Water Limited Cropping systems**	Today, widespread recognition of the Ogallala aquifer's water quantity and quality declines is generating significant concern about the near- and long-term economic security and longevity of communities in the region. The Ogallala Water Coordinated Agricultural Project (OWCAP), led by Colorado State University, is focused on optimizing groundwater use in the OAR to sustain food production systems, rural communities, and ecosystem services. Our teamwork has been organized using four objectives: 1) Integrate hydrologic crop, soil, and climate models and databases; 2) Develop and improve understanding of successful field-based management across the spectrum from dryland to fully irrigated production systems; 3) Investigate socioeconomic factors affecting water use decision making and identify incentives and policies effective at increasing efficient water use while maintaining productivity and profitability; 4) Facilitate the adoption of tools and strategies that improve water use efficiency, water conservation, and farm profitability.	Cropping Systems

		The 70-member, multi-state OWCAP team has catalyzed new interdisciplinary understanding to identify and promote management practices, strategies, and policies that maximize the value of the scarce Ogallala resource and support the region's communities. They have: created a novel, integrated model that combines well-level hydrology with field-level economics and crop choices on a daily time step using historical weather data and future climate projections; generated new knowledge of the social values, attitudes and approaches of producers and groundwater management district managers towards water use and conservation; and fostered multiple new cross-state collaborations that led to the development and replication of innovative outreach activities, including the Testing Ag Performance Solutions programs, Colorado Master irrigator, and 8-state Ogallala summit conferences. This team's multidisciplinary research and formation of new transdisciplinary networks has led to measurable regional, national, and international impacts. This includes 64 peer-reviewed journal articles, which are showcased using easy-to-understand, lay-term summaries created for each publication on the project website (https://ogallalawater.org/). The team has produced over 100 other publications, including reports, contributions to meeting proceedings, fact sheets, resource guides, and decision-support tools (several hundred users) an eNewsletter (256 subscribers), Twitter (1,040 followers with an average of 30,000 impressions annually), Facebook (135 followers), YouTube channel (351 views), public-facing webinars (reaching more than 200 attendees), and more than 300 presentations. The team's in-person outreach resulted in more than 25,000 interactions within and beyond the aquifer region, including overseas. The 2018 Ogallala Aquifer Summit held in Garden City, KS, brought together more than 200 water management leaders from all eight Ogallala states to discuss farm practice, science, and policy, catalyzing new programs and legislative proposals across participating states. An Ogallala region producer survey, gathered producers' perspectives on the value of groundwater and water conservation, with participation of more than 1,100 producers from the six states that utilize the aquifer, with data featured in peer-reviewed publications and a project resource guide. The program also a instituted a 7-state Master Irrigator meeting in Dumas, Texas, to initiate ongoing multi-state discussions regarding replication of the successful Master Irrigator Program	

		operated by the Texas North Plains Groundwater Conservation District. This led to the development and launch of the Colorado Master Irrigator program in February 2020, with an initial class cohort of 25 participants. These participants manage more than 20,000 acres in Colorado's Republican River Basin. The multi-state relationships built by the Ogallala Water CAP team resulted in new networks, programs, and initiatives that will persist beyond the current grant period. Examples of continuing efforts include expanded use of the team's data portal through a USGS grant, continued application of the integrated model, and a proposal to establish a multi-state extension and research project through the Agricultural Experiment Station Association to continue the team's research and stakeholder engagement. Overall, in 2019 the Cropping Systems PRU had over 11,700 direct adult contacts. Over 200 educational events were conducted, 95 peer-reviewed publications were created, and 93 research & assessment projects were conducted. 391 out of 434 (90.1%) surveyed agricultural producers utilized business planning and management strategies to reach their business goals, improve farm management, and/or improve business economic sustainability	
6.	**Partners in Energy Program**	CSU Extension in Arapahoe County has been supporting Xcel Energy's Partners in Energy (PiE) community program for the past four years. Staff have been involved PiE community programs in Littleton, Englewood, and Centennial, CO. PiE, which engages communities in energy assessments, energy efficiency initiatives, and renewable energy programming, has several ongoing programs in Colorado and Minnesota. Working in tandem with Xcel Energy Specialists, CSU Extension has found an excellent entry point to engage energy stakeholders in all three communities. These stakeholders include municipal leaders, commercial employees, and residential action groups, all interested in energy efficiency and renewable energy development. Each PiE community first conducts a thorough energy use assessment. This includes Xcel's consumption data (both electricity and natural gas), and an inventory of energy efficiency program enrollment in Xcel's many consumer and business rewards programs. The stakeholder group formulates energy efficiency	Energy

		goals in a one, three, and five-year timeframe for residential, commercial, and municipal consumption scenarios. The framework for each community program is an Energy Action Plan and, in some instances, a Climate Action Plan, that fosters reduced energy consumption and a smaller carbon footprint for each community moving forward. Each segment (residential, commercial, and municipal) has a team leader that focuses on that segment, and the various programs that are employed to teach community residents and local employees and leaders about efficiency measures they can each employ to save energy. They also publicize and use Xcel's rewards programs to encourage constituents to lower their energy consumption. All three PiE communities Extension has worked with are meeting their efficiency goals. According to energy consumption data across two years (provided by Xcel), Littleton has reduced municipal energy consumption by 10% from 2014 levels and has over doubled participation in both residential and commercial demand side management programs. Residential accounts yielded 230,426 kilowatt-hours saved. In Englewood, commercial/residential/municipal accounts combined energy use decreased 1.6% annually during the PiE program (4.63 million kwh saved and 23,916 therms saved). Overall, in 2019 the Energy PRU had over 2,900 direct adult contacts. 263 educational events were conducted. 667 out of 670 surveyed program participants reported increased understanding of sustainable energy measure costs and benefits.	
7.	**Colorado Beekeeping Mentorship Program**	The past decade has shown significant changes in beekeeping. In 2006, the beekeeping industry was alerted to Colony Collapse Disorder, a mysterious disorder in managed hives where 30-90 percent losses were reported (Kaplan, 2012 as reported in Breece & Sagili, 2015). Through reporting of these large colony losses in the popular media, the public became even more aware of the importance of pollinators in our food supply and ecosystems. A new generation of hobby and part-time professional beekeepers was born. The number of new beekeeping clubs and individual memberships in state beekeeping associations continues to grow nationally including in Colorado. At a beginning beekeeping class in February, 2016 co-sponsored by the Central Colorado Beekeepers Association and Colorado State University Extension,	Environmental Horticulture

		there was an overwhelming response of novice beekeepers who attended (85 participants). On a signup sheet distributed during the one-day class, there were 52 participants who indicated they would like to be assigned an experienced beekeeper to serve them as a mentor. On a separate sheet, only 4 people indicated they were confident they could serve as a mentor to a beginning beekeeper. The obvious disparity between the demand for beekeeping education, and the ability to deliver this education was apparent. Previous research reports have shown the importance of education on honeybee survivability. In one study in Idaho, researchers reported an increase of 14 percent colony survival in beekeepers who took an integrated hive management class over those who did not in the same geographic area (Findlay, Eborn, and Jones, 2015). Intuitively, having educated beekeepers available to serve as mentors for novice beekeepers helps to ensure success and hopefully limits disease pressure for professional and hobby beekeepers through early detection and mitigation. In response, Chaffee County Extension Director Kurt Jones created an official volunteer program entitled the Colorado Beekeeper Mentorship Program with the aim to recruit and train a cadre of volunteers who could work with novice beekeepers and promote scientifically-based beekeeping and integrated hive management principles. Volunteers were selected based on an application and screening process which included reference checks, criminal and motor vehicle histories, interviews, and beekeeping experience. This program was pilot-tested for two years in Chaffee County prior to being offered statewide in 2019. Researchers, extension specialists, extension agents and experienced beekeepers taught classes aimed at mentoring novice beekeepers. Subjects included starting the apiary, equipment needs, safe handling and establishment of bee hives, disease recognition and abatement, bee nutritional needs, high altitude plants, seasonal management needs, and the art of mentorship. The Colorado Beekeeper Mentorship Program was offered in Adams, Archuleta, and Chaffee counties, as well as two sessions in the Golden Plains area, and via webinar to Colorado Department of Corrections employees in its Sterling, Arkansas Valley, and Buena Vista complexes for training offenders in 2020.	

		Evaluations of the CBMP showed significant knowledge gained in the areas of honeybee development, colony establishment, bee nutritional needs, high altitude plants, adult bee diseases, brood diseases, varroa mite management, and queen management. Other topics showing knowledge gained (but not as significant) were equipment needs for novice beekeepers, colony activities, and apiary site evaluation. This is not surprising as each of the volunteers accepted in the CBMP were experienced beekeepers and came to the course with a lot of knowledge in these areas. Program participants also reported that they intend to implement some of the concepts learned in this program; specifically evaluating varroa mite populations in their own hives and teaching others how to do this as well. Each of the volunteers also mentioned their desire for additional educational opportunities for themselves and for other beekeepers in the area. In a five-month evaluation following the conclusion of the Adams County program, volunteers had reached 5,996 additional contacts and had volunteered back more than 206 hours in direct outreach at that time. Respondents also reported knowledge gained in each of the factors measured based on concepts taught in the classes. Additional impacts of Beekeeper Mentorship work this year include presenting peer-reviewed posters (American Beekeeping Research Conference, Tuscon, AZ in January, 2019, and a presentation at the National Association of County Agriculture Agents in Fort Wayne, IN in September. Research conducted in January/February, 2019 was also published in the Journal of NACAA (Jones, et al., 2019). Overall, in 2019 the Environmental Horticulture PRU had over 66,000 direct adult contacts. 966 educational events were conducted and 20 peer reviewed journal articles were published. Over 58,000 volunteer hours were contributed. 1,456 out of 1,860 (78.2%) surveyed program participants reported using or intention to use new horticulture technologies or best management practices in their landscapes, businesses and/or communities. 156 out of 175 89.1%) surveyed Colorado Master Gardener volunteers reported increased competence in educating the public.	

8.	**Preserving Arthropod Diversity for the Land Grant Mission**	Performing integral functions of the Land Grant mission, the C. P. Gillette Museum of Arthropod Diversity (CSUC) (https://agbio.agsci.colostate.edu/gillette-museum/), is dedicated to excellence in teaching, research, and extension. The 3.5 million-specimen collection is used to train undergraduate and graduate students in systematics, a crucial basic aspect of all biological sciences and the CSUC resources are used to support undergraduate and graduate courses. The CSUC serves important roles in outreach/extension, making available the understanding of the remarkable biodiversity of insects to K-12 programs, 4H, and the general public. Additionally, the CSUC is a vital resource in the identification of arthropods of concern to Colorado Extension. A primary objective of the CSUC is the taxonomic determination of arthropod species that are considered concerns of human health, agriculture, horticulture, and recent or potential invasive species, and making identifications and other information available. CSUC performs an integral function in teaching, surveillance and monitoring efforts for exotic pests. For example, Bark beetles are the most important of all wood destroying insects, killing trees by direct feeding and introducing fungal pathogens. They have ravaged 85,000 square miles of forests in Colorado and throughout the Western United States. The CSUC's international bark beetle expert has identified CSUC bark beetle specimens resulting in one the most important holding in this region. These specimens have used to produce keys and screening aids, which is a major contribution to rapid identifications of this destructive insect. Additionally, the CSUC routinely identifies two other invasive insects having great potential impacts on the health of Colorado forests, the Emerald Ash Borer and the European Wood Wasp. Routinely, thousands of specimens of suspected Emerald Ash Borers are screened for positive identification. Additionally over 600 samples of other important pests trapped by the Colorado Department of Agriculture and USDA were examined last year that pose a risk to fruit, vegetable, and ornamental plants. Increased public awareness of nature and biodiversity is another objective of the CSUC. The CSUC is the fourteenth largest collection affiliated with a university in the United States. The CSUC serves as the window to the past and vistas on the future, especially being important in the rapid changing landscapes	Environmental Horticulture

		of Colorado. This repository represents a baseline of (historical) diversity information, in which species and genetic diversity are catalogued and stored. Collections like the CSUC are also irreplaceable reservoir of untapped information for future studies. For example, more than 30,000 selected specimens in the collection have been DNA barcoded for the DNA barcode library for eukaryotic life. The CSUC is considered one of the most valuable resources for DNA material by the primary institution involved in the establishment of a DNA barcode library, the Biodiversity Institute of Ontario, University of Guelph, because of the large amount of recently collected material and the fact that a large percentage of it has been expertly identified. As one of the oldest established collections, the native and introduced insects and other arthropods are documented in the CSUC since the 1890's. This information is crucial for efforts directly related to Colorado agricultural including identification of pests (e.g. Russian wheat aphid) and biocontrol releases and successes. Additionally, the holdings of Lepidoptera (butterflies and moths) serves as one of most important national DNA repositories for learning the evolutionary history of butterflies and selected genera including pest species. The collection is also the primary repository for regional biodiversity studies or surveys undertaken by Colorado Heritage Program, Colorado Division of Wildlife, Colorado State Forest Service, units of Colorado State University, and National Park Service. The CSUC was visited by more than 200 scientists and 300 other interested persons in 2019. The third objective of the CSUC is providing broad support for public education programs. The Museum serves as the focus of engagement for the public interested in insects and other arthropods, enthusiastically contacting more than 4,000 K-12 students and parents in 2019. The Museum directly facilitates teaching both undergraduate and graduate students as an extension of the classroom and a facility for independent studies. The Museum has initiated a successful endowment program to support high quality museum and outreach activities. The CSUC makes available its collections and libraries to Colorado Heritage Program and other biodiversity concern state agencies on a routine basis. The fourth objective is training undergraduate and graduate students in systematics with typically one or two master's and PhD students engaging in	

		taxonomic studies with guidance in these studies, using museum resources. Additionally, 6,000 specimens from the CSUC are loaned to researchers throughout the world. An average of 8-10 peer-reviewed research papers are produced by CSUC staff and students annually.	
9.	**Produce Safety Education**	Produce safety is widely acknowledged across the industry as a public health concern. In 2011, Colorado experienced one of the most deadly foodborne illness outbreaks in U.S. history, one whose impact stretched over 28 states, with 33 deaths attributed to eating fresh cantaloupe from southeastern Colorado. This outbreak occurred six and a half months after the federal Food Safety Modernization Act was signed into law, and it highlighted the importance of creating and extending targeted food safety education and outreach toward Colorado produce growers. Colorado's produce industry is transforming. At $307 million, the nominal value of annual sales from fruits and vegetables in Colorado remained relatively unchanged from the 2012 Census of Agriculture to the 2017 Census; however, the number of farms has increased by 23%, to 1,814. This is much more significant than the national level, where the number of produce farms increased by only 4%. The increase in produce-growing operations signifies that Colorado produce safety educators have to broaden their outreach and increase the number of educational events offered to intersect new growers coming into business. Produce safety education is vital for helping growers enter and remain competitive in diverse markets. In response, Colorado educators formed a Produce Safety Collaborative to coordinate education and outreach across the state, coalesced by Colorado State University Extension, in conjunction with the Colorado Fruit and Vegetable Growers Association, Rocky Mountain Farmers Union, Fort Lewis College, and the Colorado Department of Agriculture. As a joint education and outreach team, the Collaborative has been dedicated to increasing the produce safety knowledge of Colorado's fruit and vegetable producers, as well as their ability to apply that knowledge on their own farms. To date, Colorado's produce safety education team has trained 353 fruit and vegetable growers and 68 ag professionals for a total of 421 trained.	Food Systems

		A 2018 survey of Colorado growers revealed that 85% said food safety was very important to extremely important on their farms, 55% felt that creating an on-farm food safety plan was very important to extremely important for their operations, and 60% felt that understanding how the FSMA Produce Safety Rule would affect their operations was very important to extremely important for their operations. An important way of bringing this knowledge directly to growers is to offer relevant and easily accessible training. The Collaborative began offering one-day Produce Safety Alliance grower training courses throughout Colorado in attempt to extend this knowledge to all scales of producers, in all of the state's produce-growing regions. Following each of 17 workshops conducted by the Collaborative, growers evaluated what they learned from the training that specifically addressed seven areas of produce safety risk. On a scale of 1 to 5 (with 5 being greatest degree of confidence), they ranked their ability to implement practices to address food safety risks related to worker health & hygiene at 4.47; postharvest handling and sanitation (4.44); soil amendments (4.34); postharvest water (4.31); wildlife and domesticated animals (4.28); food safety plan development (4.24); and agricultural production water (4.17). Ninety-four percent of participants reported that the level of FSMA Produce Safety Rule information provided during the training was sufficient, and 91% indicated that they were committed or very committed to implementing produce safety practices on their farms. Overall, in 2019 the Food Systems PRU had over 9,500 direct adult contacts. 312 educational events were conducted. 10 peer-reviewed publications were created. 35 out of 47 (74.4%) surveyed food businesses reported having accessed financing and other resources, and used them to develop their businesses.	
10.	**Market Days for Older Adults**	Market Days! for Older Adults was a pilot program in 2019 at the Larimer County Farmers' Market. The goal was to provide low income older adults with an opportunity to purchase fresh fruits and vegetables (using "Produce Bucks"), while decreasing social isolation by attending the market. Individuals often fell into the "SNAP gap", where they may not qualify for assistance, but are still in need of obtaining fresh produce to increase nutrition.	Individual, Family, & Community Well-Being

		This program was a partnership with CSU Extension in Larimer County, the Partnership for Age-Friendly Communities (PAFC), Senior Access Points, the CSU Department of Health and Human Studies, and the CSU Department of Nutrition. We obtained funding from CSU, AARP, and private donations. A few of the successes of this program were: • 185 new vouchers redeemed; a value of $3,700 • 132 returnees, a value of $2,640 • Fruit and vegetable vendors had an additional $5,693 in sales • $647 went unspent (just 10%) Combining efforts with our other programs targeted for low income audiences to purchase fruits and vegetables (Double Up Food Bucks), it was a total of $13,187 for our produce vendors (or about 1.5% of the market's total gross sales). Market Days! customers shopped with 24 unique fruit and vegetable vendors during the summer The top three vendors to collect Produce Bucks were Miller Farms, Ela Family Farms, and Hoffman Farms; Ela Family Farms is an organic fruit grower from Hotchkiss--proving that buying organic IS an option if you are on a limited income. Depending on the vendor, Produce Bucks attributed up to 5% of some vendor's total sales for the season. The Larimer County Farmers' Market as a whole (run by CSU Extension), has its greatest season in its 44 years of operation, with gross sales topping $850K. In addition, we found the following from our participants: • People experienced more socialization by attending and shopping at the LCFM • There was a significant increase in post-fruit and vegetable consumption by participants; many went from eating zero or 1 portions of fruit/vegetables each day to 3-4 portions • There was a 35% increase in individuals who started eating fruits or vegetables every day (7 days per week)	

		Overall, in 2019 the Individual, Family, & Community Well-Being PRU had over 4,800 direct adult contacts. 314 educational events were conducted. 4 peer-reviewed publications were created. 825 radon kits were provided to Colorado residents. 856 out of 856 (100%) of survey respondents applied one or more best practices after completed Extension financial programming.	
11.	**Citizen Science for Public Land Management**	A key component of economic sustainability for ranchers in western Colorado is the opportunity to operate on a mix of state and federal lands. The reality of mixed land ownership can provide challenges. Ranchers must manage for ecosystem health and habitat values per agency guidelines. They also operate in areas where recreation, hunting, and other uses occur. In this complex picture, federal land managers and ranchers do not always agree on the trajectory of the landscape or have adequate information to make data-driven decisions. In our situation, the US Forest Service and a group of ranchers disagreed on the trajectory of the landscape in a recent Environmental Assessment in southwestern Colorado. While long-term data existed in the area, it was not set up to address the current disagreement and the origin of the methods and monitoring locations lacked transparency. Without agreed-upon methods, and transparent analysis and interpretation of data, the potential for continued disagreement among these entities was high, there was little current data to inform decisions, and ranchers felt their voices were not heard within the US Forest Service processes. In response, CSUE formed a collaborative team comprised of the US Forest Service range conservationist, several ranchers, and CSU Extension (regional range specialist and the county ag agent) to cooperatively monitor the allotments using agreed-upon methods and a transparent process. We applied for and received funding in 2018 through a Citizen Science Grant from the US Forest Service. To undertake this project, we hosted a meeting among several ranchers, the US Forest Service, and Extension to agree on a resource issue of mutual concern that could be addressed through data collection. We decided on a monitoring protocol and experimental design (using the CSU Statistics Lab) to address the question. In summer 2019, we collected data led by a trained professional in range management, with each rancher joining for a least a half-day of monitoring on their allotment. In fall 2019, the CSU Extension regional range specialist analyzed the data. Finally, in December 2019, we hosted a joint-	Livestock & Range

		interpretation session with the whole group of ranchers, the US Forest Service and community members to reflect on the data analyses. Over the course of this project, we involved 20 individuals, for a total of 257 hours of volunteer time (time spent by ranchers away from their businesses and in meetings or in the field). Further, our project did succeed in generating data that was based on a question identified by ranchers, the US Forest Service and CSU Extension. We also succeeded in facilitating a process to decide on a question, a monitoring approach, some joint monitoring, and finally, a shared interpretation of results among CSU Extension, ranchers, and US Forest Service staff through several meetings and field days. We decided to use a simplified but still quantitative monitoring approach. In addition, we surveyed ranchers who participated in our final wrap-up meeting and presentation to get their feedback on whether or not our goals were accomplished. Among respondents, there was general agreement that the project generated useful data. There was some agreement that monitoring protocols on the project were understood, that ranchers would apply the monitoring protocol used on the project on their own, and that ranchers now have a stronger grasp on data collection, analysis, and interpretation on rangelands. Most responding ranchers agreed that the analyses presented were reliable. Thirty seven percent of respondents indicated they'd like to see further monitoring, and a few ranchers plan to mark the plots permanently to continue monitoring. Finally, all permittees and US Forest Service staff plan on continued engagement, specifically a field day in summer 2020 to look at the data in the field and discuss it as a group. Overall, in 2019 the Livestock & Range PRU had over 8,000 direct adult contacts. 393 educational events were conducted. 29 peer-reviewed publications were created. 669 out of 681 surveyed livestock and rangeland managers applied newly gained information, technology, or skills to improve animal health and/or animal production. 16,480 acres had improved rangeland health.	
12.	**Adaptive Management in Rangeland Decision-Making**	Little is understood about how ranchers and rangeland managers make rangeland and ranch management decisions, individually or collectively, or the role of intersecting social identities, including race, ethnicity, gender and class,	Livestock & Range

		in such decision-making. In addition, social research on rancher decision-making is rarely linked to the ecological, economic and social outcomes of decisions. Instead, it is often assumed that particular decision-making styles or choices to apply specific practices or technologies result in desired outcomes. Understanding how and why rangeland stewards make the decisions they do, and the ecological, social and livelihood outcomes of these decisions, is critical to designing effective outreach, engagement and support strategies that are relevant, used, and lead to improved ecological, social and economic outcomes for rangelands and rangeland users. Further, by assuming that all ranchers are white and male, as most current rangeland social science and outreach do, we overlook the potentially unique knowledge and capacities of women and marginalized ethnic groups such as Hispanic/Latinx ranchers. We also ignore the ways in which gender, race, ethnicity and class may intersect to create barriers to resource and information access, and participation in decision-making, in turn affecting environmental and social conditions. The primary goal of this project was to increase understanding of human dimensions of rangeland decision-making, engage historically underserved rangeland decision-makers and stakeholders, and enhance capacity for collaborative and adaptive rangeland management, through integrated research and outreach activities. By building an evidence based framework about rancher and rangeland decision-making, its outcomes, and the role of intersecting social positions in shaping decisions, this research supported more inclusive and effective outreach, engagement and decision support for all ranchers and range managers that may improve social, ecological and environmental outcomes for Colorado's rangelands and ranching communities. By training graduate students in an interdisciplinary environment that includes mentoring and practice in transdisciplinary research and communication, this project produced graduates with essential skills for the scientific workforce of the future. To help build this framework, the project interviewed 32 producers from Larimer and Weld Counties in 26 semi-structured interviews in the summer and fall of 2018 and 2019. In the summer of 2018, graduate students also participated in the daily tasks on some ranches.	

		Additionally, a field day for the Collaborative Adaptive Rangeland Management (CARM) experiment, which and was attended by over 75 participants. The main findings were that ranchers face formidable social and ecological change, creating a need to respond and adapt through livelihood strategies and producers interrelate the following seven key factors to develop livelihood strategies: 1. Social: family, community, etc. 2. Natural: land, forests, water, etc. 3. Financial: cattle, home equity, etc. 4. Human: labor, knowledge, etc. 5. Physical: infrastructure, equipment, etc. 6. Cultural: heritage, way of life, family history, etc. 7. Political: access to or service as elected officials, political influence, etc. This framework was published in two peer-reviewed research articles which describe a) how collaborative adaptive management advances science-management partnerships, and b) linkages between rancher decision-making and grazing strategies and their ecological outcomes. These results were also summarized in a factsheet informing survey participants and other stakeholders on the results. Ranchers utilize these results to develop new livelihood strategies to improve their well-being through increased subjective, material, and/or relational outcomes. These well-being outcomes, in turn, feedback to reinforce livelihoods factors.	
13.	**Wildfire Mitigation in Mountain Communities**	With the growing threat of wildfire to human homes in the mountain west, Summit County Extension has played a lead role in facilitating defensible space through wildfire mitigation efforts. These efforts are funded by a 2009 voter-approved tax measure that allocates $500,000 annually, including $20,000 for outreach and education administered by CSU Extension. Efforts include hazardous fuel reduction, implementation of community wildfire protection plans, and chipping. Since 2010, 87 fuel reduction projects have been completed, covering 1,365 acres at a cost of $2,856 per acre. Twenty six wildfire protection plans have ben implemented, covering 65 acres. Six chipping programs have been completed, covering over 11,000 homes. With only 18,000	Natural Resources

		single family homes in the County, this means that over 60% of all homes have participated in the chipping program. Overall, in 2019 the Natural Resources PRU had over 28,700 direct adult contacts. 518 educational events were conducted. Over 6,200 volunteer hours were contributed. 28 research & assessment projects were conducted, and 12 peer-reviewed publications were created. 594 out of 699 (85.0%) surveyed program participants reported implementation or intent to implement animal/wildlife-related conservation practices (i.e. improved manure management, livestock emergency preparedness, attracting pollinators, enhancing wildlife habitat, deterring unwanted wildlife, etc.). 3,245 out of 3,466 (93.6%) surveyed program participants reported implementation or intent to implement plant-related conservation practices (such as active weed management, pasture management techniques, grass stand establishment, planting windbreaks, planting native plants, and/or active forest management). Over 14,000 acres were impacted by this program.	
14.	**Cottage Food Safety**	The Colorado Cottage Food Act requires producers to attend an approved food safety class before starting their business. The act also states that the training needs to be comparable to, or given by Colorado State University Extension Service, or a state, county or district health agency. The Colorado Department of Public Health and Environment and most local health departments do not offer training to meet the needs of cottage food producers. In response, CSU Extension developed and regularly updates a food safety-training program for Colorado cottage food producers. The CSU Extension Cottage Food Safety training provides small food production businesses with a required food safety certificate and resources to become successful entrepreneurs. Post evaluations and test scores show that CSU Extension program participants understand food safety principles and practices, can recognize multiple food safety risks and can apply these principles to the unique challenges of operating a home based food business. Participants report increased knowledge and confidence that their business will comply with food safety best practices and existing Colorado cottage food laws. Many graduates have been successful in creating cottage food businesses. These businesses provide income to families, foster connections to local producers and support local economic development. Some participants have been so successful that	Nutrition, Food Safety, & Health

		they have gone on to become commercial food production businesses, providing employment to others in their communities. Participant evaluations indicate the training and materials are very comprehensive and crucial for starting a food business. The CSU Extension Cottage Food Safety class is currently the only food safety class offered in Colorado that includes food safety information about products and procedures specific to eligible cottage food products. In 2019, 18 agents provided Cottage Food Safety training in 21 Colorado counties. Sixty four separate CSU Extension Cottage Food Safety trainings were delivered and 747 individuals were trained, passed a knowledge exam, and received a CSU Extension certificate of completion. Overall, in 2019 the Nutrition, Food Safety, & Health PRU had over 19,300 direct adult contacts. 1,106 educational events were conducted. Over 400,000 website page views were made to the PRU's websites. 403 out of 445 adult EFNEP survey respondents reported improvement in one or more nutrition practices. 1,965 out of 1,990 (98.7%) surveyed adult program participants (non-EFNEP) reported adoption of a learned food safety practice (i.e. safe food preservation techniques, food or refrigerator thermometer usage, proper sanitizing of food contact surfaces, etc.). 813 out of 913 youth EFNEP survey respondents showed improvement in diet quality (eating vegetables and fruits, choosing healthy snacks, eating breakfast).	
15.	**Community Food Alliance for Education and Hunger Relief in Western Colorado**	The lack of healthy food has profound effects on physical and mental health, educational attainment, and self-sufficiency. Inconsistent access to healthy food, or food insecurity, is a public health issue. Accordingly, federal, state and community based programs comprising our food safety net are committed to providing access to food that supports active, healthy lifestyles. One in 10 adults and 1 in 6 children in Colorado experiencing food insecurity. To address this need, the mission of the Community Alliance is to improve the health of our community by increasing access to fresh produce for individuals experiencing food insecurity.	Nutrition, Food Safety, & Health

		As a program of Colorado State University Agriculture Experiment Station and Colorado State University Extension, the Community Alliance designs programs with double impact on both food insecurity and education. Specifically, the Community Alliance works collaboratively with our community to: • increase the access to healthy food by producing and distributing fresh fruits and vegetables through the community food system; • raise awareness of food insecurity in our community and support the implementation of the Colorado Blueprint to End Hunger, which lays out the vision, goals, and strategies needed so that all Coloradans have access to affordable and healthy food in their communities; • integrate civic service with hands-on learning in agriculture, life sciences, food systems, food insecurity and nutrition for people of all ages; and • provide post-secondary students hands-on learning in large scale agriculture and community-nutrition. All of the surplus orchard fruit from the Orchard Mesa and Rogers Mesa research centers is harvested by volunteers and donated to hunger relief organizations. In addition, the Community Alliance grows vegetables at the Orchard Mesa and Fruita sites for distribution to schools and hunger relief organizations in Western Colorado. In support of this work, we offer hands-on service learning for K-12 students and learners of all ages in local agriculture, food systems, nutrition and food insecurity. The direct impacts of this program to the Western Colorado Community include: **Healthy Fruits and Vegetables** - Within food banks, fresh produce is among the most requested, but most difficult product to provide. Through the Farm-to-Foodbank program the Community Alliance grew and donated 97,244 pounds of fruits and vegetables (30 different varieties) for hunger relief.	

		Raising Awareness - Volunteerism is an effective way to engage people to identify, understand and solve problems. Volunteers gave 900 hours of service through our program in 2019. **Post-Secondary Education -** With our unique combination of mission, facilities, faculty and staff, Community Alliance provided participatory and engaged learning opportunities to help train the next generation working in food and agriculture. They have provided 2,430 hours of paid hands on internship experience to post-secondary students in the past two years. **K-12 Education** - Pairing meaningful service of growing and giving food to others enhances the learning experience for 800 K-12 students and youth organizations who have come to the research center to plant, harvest and learn. The Community Alliance has taught 2,145 hours of student-learning in the fields and classrooms in to this audience. This effort was recognized by the Colorado Department of Education as a best practice for partnership between a community organization and school district in providing opportunities for participatory learning.	