

Call to Action

Colorado Farmers and Ranchers are Committed to a Sustainable Future

Colorado farmers and ranchers are committed to producing the world's food, feed and fiber in a sustainable way. For decades, Colorado's farmers and ranchers have pushed past the boundaries of innovation by investing in agricultural research and adopting practices that improve productivity, generate clean and renewable energy, and enhance the sustainability of our food supply.

Colorado's diverse agricultural industry plays a critical role in the state's economic vitality, contributing \$47 billion annually to Colorado's overall economy. 31.8 million acres of private land is used for farming or ranching, comprising 48% of Colorado's 66.3 million acres. Another 20 million acres of federal and state land is typically used for grazing, pushing the total acreage to 51.8 million acres and the percentage of Colorado land used for agriculture to more than 78%.

Farmers and ranchers are essential stewards of the Colorado landscape. Prior to Colorado statehood, farmers and ranchers have been working to promote soil health, conserve water, improve wildlife habitat, efficiently use nutrients and care for livestock. Amidst increasingly severe weather events, increased pressure for land development, and an ongoing pandemic threatening our food supply, this work is now more important than ever.

No sector of our economy is more vulnerable to climate change than farmers and ranchers. And no one can do more, in less time, to mitigate and adapt to climate change than farmers and ranchers. Other than forestry, agriculture is the only industry capable of extracting greenhouse gases from the atmosphere. (Mitloehner, 2020) In the face of these rising pressures and a worsening climate crisis, it is critical that policymakers support the leadership of Colorado's farmers and ranchers in adapting to these changes and mitigating their causes. Colorado farmers and ranchers have a key role to play in developing climate crisis solutions that recognize both agriculture's contribution to and potential to mitigate the problem.

Livestock and crop production are the backbone of Colorado agriculture, and ensuring its sustainability is critical for future success. Colorado farmers and ranchers have already embraced technologies that reduce emissions and increase efficiency. The trends illustrated by the 2017 Census of Agriculture — conducted every five years by the USDA — show increasing adoption of important conservation practices that sequester and store carbon, the growth of on-farm renewable energy generation, and other practices that improve our sustainability and resilience. Supportive policies at the state and federal levels could enable us to greatly expand these efforts.

In general, we support the guiding principles put forth by Farmers for a Sustainable Future (<https://www.fb.org/land/fsf>):

- ***Incentivizing innovation:*** Voluntary, incentive-based programs that enhance farmer and ranchers' profitability and production methods, which have already allowed agriculture to achieve significant sustainability gains.
- ***Reducing barriers:*** The improvement of existing state and federal programs to identify efficiencies, reduce regulatory obstacles, and streamline program delivery.
- ***Science-based research:*** The development of new technologies and practices to help farmers and ranchers achieve greater efficiencies and enhance sustainability.

- **Resilient infrastructure:** Initiatives to maintain and improve infrastructure capacity to support farm and ranch operations, rural communities, and related agricultural businesses.
- **Focusing on outcomes:** Market-based solutions, led by farmers and ranchers, that improve rural communities while recognizing the diversity of agricultural practices, climates, challenges, and resources needs.

Farmers for a Sustainable Future members include National Farmers Union, American Farm Bureau, National Association of Wheat Growers, National Corn Growers Association, National Cattlemen’s Beef Association, National Milk Producers Federation, National Pork Producers Council, American Sheep Producers Association and United Egg Producers.

Recommendations made by the Food and Agriculture Climate Alliance (FACA) are incorporated into the following climate change mitigation solutions. FACA developed 40 recommendations to guide the development of federal climate policy which are based on three principles: agricultural and forestry policies must be built on voluntary, incentive-based programs and market-driven opportunities; they must promote resilience and adaptation in rural communities; and they must be science-based. (https://aqclimatealliance.com/files/2020/11/faca_recommendations.pdf)

FACA is co-chaired by the National Farmers Union, American Farm Bureau, National Council of Farmer Cooperatives and the Environmental Defense Fund and also includes the National Association of State Departments of Agriculture, The Food Industry Association, National Alliance of Forest Owners and the Nature Conservancy.

The following sections illustrate key examples of existing efforts, opportunities, and needs in specific areas of agricultural innovation and adaptation. Building upon our strong foundation of voluntary stewardship investments and practices, we look forward to working with policymakers to further advance the successful sustainable practices already used by Colorado farmers and ranchers.

Climate Change Mitigation Solutions: Resiliency and Climate Adaption Begins With Us

1. **Agricultural Productivity/Profitability:** Colorado and U.S. farmers and ranchers today produce more with fewer acres and livestock. Technological advancements through concerted public and private efforts and the increasing availability of inputs such as biotechnology, genetics, precision farming, sustainable farm operations, fertilizers, pesticides, herbicides, feed additives and other innovations have led to significant improvements in productivity, while reducing agriculture’s environmental footprint. According to the latest USDA data, U.S. farm output grew by 170% between 1948 and 2015 – at an average annual rate of 1.48% while total input use (including capital, labor, land, agricultural chemicals and energy) rose only 7% over the same period – at an average annual rate of 0.1%.

It required 33% fewer acres to produce corn and 17% fewer acres to produce wheat in 2018 than it did in 1990. USDA statistics show there were 140 million head of beef cattle in 1970 compared to 90 million today but producing the same amount of beef (24 million tons). U.S. dairy farmers are producing almost three times more milk with about half the number of cows compared to 1960, thus reducing the total amount of feed, water and space needed, and resulting in less manure.

According to USDA, average yields for corn under both irrigated and dryland production are projected to decline as a result of climate change as early as 2020 and by 8.1% by 2040,

relative to projected yields assuming no climate change. USDA also projected that 20% of Colorado's corn acreage was planted to genetically engineered and conventionally bred drought-tolerant corn varieties in 2016, which can reduce yield losses under mild-to-moderate droughts.

A unique public-private, world-class and highly successful wheat research program at CSU has been and remains invaluable in helping Colorado wheat farmers adapt to the challenges of climate change and improve productivity and profitability. The partnership between CSU and the Colorado wheat industry provides collaboration and funding from a combination of state and federal funds provided by the Colorado Agricultural Experiment Station, the Colorado Wheat Administrative Committee (CWAC) and the Colorado Wheat Research Foundation (CWRFF). Program objectives are to increase producer profitability, grain yield, yield stability (heat & drought), disease (wheat streak mosaic & stripe rust) and insect (Russian wheat aphid, wheat stem sawfly & wheat mite) resistance and improved end-use quality. CSU-developed wheat varieties are currently planted on more than 80 percent of Colorado's 2,300,000 acres of annual winter wheat production and are higher yielding and higher quality than previously developed and commercialized varieties. These new varieties have significantly contributed to increased yields (output) while lowering total inputs necessary for production.

We recommend:

- Increase state and federal funding for CSU Agricultural Experiment Station to conduct science-based research into the development of new technologies and best practices to help Colorado farmers and ranchers achieve greater efficiencies, adapt to climate change and enhance sustainability.
- Create a state-funded grant program to support Colorado farmers and ranchers in utilizing the technologies and best practices developed by CSU and other agricultural innovation programs.
- Support and collaboration and partnership with companies (such as Bayer, Syngenta, General Mills, Cargill, McDonald's, etc.) and organizations (such as the Field to Market Alliance for Sustainable Agriculture) who are promoting and incentivizing farmers and ranchers to advance sustainable farming and ranching practices that improve soil health practices such as reduced and no-till, nutrient management, water use efficiency and integrated crop-livestock systems.

2. **Soil Health:** Soil can remove more CO₂ from the atmosphere than it releases, making it a natural carbon sink. Colorado agriculture has the potential to offset its own GHG emissions and become a net carbon sink and be a crucial part of the climate solution. Increasing the amount of carbon in soil also makes it more productive for farmers and ranchers. Approximately, 11.1 million acres, or 17% of Colorado's land area is cropland used for production of corn, wheat, hay, millet, grain sorghum, barley and potatoes, etc. Nearly 29 million acres, or 43% of all Colorado land is used for pastureland/grassland for livestock (see the contribution of grasslands in section 6. Livestock and Grassland Management and Integration below). Climate smart stewardship practices such as no-till and reduced tillage (conservation tillage), planting cover crops, crop rotations, adaptive grazing management and improved nutrient management increase carbon sequestration in roots and soils and reduce GHG emissions. According to the National Academies of Science many of these climate-smart land management practices "are sufficiently mature, both scientifically and in practice, to materially increase carbon storage if widely deployed in the U.S. and globally. Regenerative agriculture can also contribute significant emissions reductions and CO₂ removal, as well as

improve soil health. The conservation management practices referred to as “regenerative agriculture” include: 1) maintaining (to the degree possible) continuous vegetation cover on the soil, 2) reducing soil disturbance, 3) increasing the amount and diversity of organic residues returned to the soil, and 4) maximizing nutrient and water use efficiency by plants. The field experimental evidence that regenerative agricultural practices can significantly increase soil C stocks is unequivocal (Paustian et al. 2020). CSU scientists report that “no-till practices permit cropping intensification resulting in more residue biomass return to the soil organic matter pool, and coupled with greatly reduced soil disturbance, we can potentially sequester increasing amounts of soil C.” (Peterson, Westfall, Schipanski, Fonte 2020) “Our estimate of C sequestration due to (cropping) intensification alone as of 2016 is roughly 0.32 MMTCO_{2e} year, the equivalent annual emissions of roughly 70,000 passenger vehicles. These C sequestration rates contribute over 3% emissions reductions in the agricultural sector of Colorado. The theoretical C sequestration rate of 100% continuous crop represent emissions reductions of 0.82 MMTCO_{2e} year above today’s levels, which is almost a tenth of the greenhouse gas emissions in the agricultural sector of Colorado.” (Rosenzweig, Schipanski 2019)

Colorado farmers are proactively managing and preserving their soil by using more conservation tillage methods and planting more cover crops. Tillage has been used to control weeds, incorporate crop residue, and prepare land for planting but results in the loss of its original organic carbon content. Conservation tillage is critical to improving soil health and increasing carbon storage. Cover crops have the potential to provide multiple benefits in a cropping system. They can prevent soil and wind erosion, improve soil’s physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water and break pest cycles along with various other benefits. Financial and technical challenges can be barriers for farmers and ranchers implementing these practices on their agricultural operations.

From 2012 to 2017 in Colorado, according to the 2017 Census of Agriculture:

- No-till acreage increased 5.0%, from 2,760,309 to 2,899,356 acres
- Reduced tillage acreage increased 38.4%, from 1,888,607 to 2,613,722 acres
- Traditional “intensive tillage” land management decreased by 21.3% from 1,826,497 to 1,437,566 acres

Overall, sustainable soil use and resource conservation efforts increased by 699,500 acres, or 7.8%. These practices include no-till, reduced tillage, conservation easements, cover crops, and tile and water management. These practices help to conserve soil, preserve and increase nutrients, improve water quality, trap excess carbon in the soil and reduce greenhouse gas (GHG) emissions.

The Colorado Collaborative for Healthy Soils (CCHS) is a diverse group of voices of the Colorado farming and ranching community coming together to provide input to the Colorado Department of Agriculture (CDA) on a proposed Soil Health Program. CCHS convened to ensure there is adequate funding for soil health activities across the state (including the new CDA program) and to provide a forum for participants to learn about related initiatives across the state. The Collaborative draws from traditional and nontraditional land stewardship practices by farmers and ranchers to manage and improve the healthy soil function. These practices minimize input costs, provide drought resilience, conserve water, reduce erosion, increase yields, improve wildlife habitat and sequester atmospheric CO₂ as soil organic matter. The Soil Health Partnership (SHP) is a farmer-led initiative that promotes the adoption

of soil health practices for economic and environmental benefit. A program of the National Corn Growers Association (NCGA), the partnership extends to more than 200 working farms in 16 states, but does not include Colorado yet.

CSU in collaboration with the USDA Natural Resource Conservation Service (NRCS) developed COMET-FARM, a whole farm and ranch carbon and greenhouse accounting tool which evaluates potential sequestration and greenhouse gas reductions from adopting NRCS conservation practices. The tool guides producers through their farm and ranch management practices including future management scenarios. Once complete, a report is generated comparing the carbon changes and greenhouse gas emissions between current and future scenarios.

Recent studies show that the adoption of conservation agriculture can reduce mechanization costs up to more than 50% in the case of no-till farming of corn, and by more than 75% for wheat, due to the reduced fuel consumption and labor costs. The resulting savings on diesel fuel has been conservatively estimated at two gallons of diesel per acre for the year. This represents significant savings for a producer's bottom line, which simultaneously reduce agricultural GHG emissions.

We recommend:

- Create a voluntary, incentive-based Soil Health Program for the Colorado Department of Agriculture to provide grant funding for farmers and ranchers to adopt voluntary practices to improve the health of their soil and increase agricultural productivity. Such a program would also help to sequester carbon, reduce greenhouse gas emissions, and conserve water and energy.
- Support application for funding through the USDA-NRCS Regional Conservation Partnership Program (RCP) to bring the Soil Health Partnership to Colorado farmers and ranchers.
- Direct the RCP to prioritize project applications that list carbon sequestration and GHG reductions as a natural resource priority to be addressed.
- Expand the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) to increase regenerative practices such as no-till farming, cover cropping, prescribed grazing and riparian buffers that sequester carbon in soils.
- Direct the Conservation Technical Assistance Program (CTAP) to assist producers in understanding the numerous agronomic and ecological benefits of healthy soils and how to access NRCS and other programs that offer financial assistance for implementing soil carbon-building practices.
- Direct the Agricultural Conservation Easement Program (ACEP) to prioritize easements for eligible partners that demonstrate the potential to increase soil carbon and reduce GHGs in the land under consideration.
- Expand USDA resources, research and partnerships to provide more education, outreach and technical assistance to agricultural producers.
- Increase funding for the Conservation Innovation Grants (CIG) program and other USDA NRCS programs, which fund soil health programs such as "Farmers Advancing Regenerative Management Systems," a Colorado Conservation Tillage Association project to support farmers by providing incentive payments to create and implement comprehensive Soil Health Management Plans.
- Prioritize focus on the on-farm trials in the CIG program that evaluate agriculture practices that sequester carbon in soils.

- Increase funding for CSU Agricultural Experiment Station and the USDA-Central Great Plains Research Station at Akron, CO to develop new soil health technologies and practices to help farmers and ranchers achieve greater efficiencies and enhance sustainability.
- Support public and private research and development to increase the level of carbon transferred from root systems to soil in the most common row crops and the most common cover crops.
- Ensure that EPA's GHG inventory and accounting systems correctly assign agriculture's carbon sequestration efforts to the agriculture sector since the contributions to GHG emissions would be significantly lower.
- Support the development of a reliable, accurate and cost-effective science-based measurement, monitoring and verification system for carbon storage to promote best practices that maximize soil carbon sequestration and to understand the impact of these practices on farm/ranch profitability and crop nutrition.
- Support and monitor the Soil Health Institute (SHI) initiative to develop and integrated soil carbon measurement and monitoring system called the DeepC System to provide standardized carbon sequestration monitoring needs for carbon markets in agriculture.
- Study feasibility of domestic climate change policies to promote soil C sequestration on agricultural lands (cropland and grazing land) at provincial and national levels in Australia and Canada.
- Study and support private initiatives such as Indigo Agriculture's Terraton Initiative designed to accelerate carbon sequestration from agricultural soils on a massive scale by creating a marketplace with financial incentives for farmers/ranchers to implement regenerative farming/ranching practices that reduce or remove carbon from the atmosphere.
- Support federal passage of the Growing Climate Solutions Act, which will break down barriers for farmers and foresters interested in participating in carbon markets so they can be rewarded for climate-smart practices. (The bill has the support of the American Farm Bureau Federation, National Farmers Union, National Corn Growers Association, National Milk Producers Federation, National Association of State Departments of Agriculture)
- Support federal passage of the Cover Crop Flexibility Act of 2020 to permanently remove the prohibition of harvesting or grazing cover crops on prevented acreage, allow USDA to include cover crop seed and grazing related costs and direct USDA to conduct a study to examine the extent that cover crops reduce risks. (The bill has the support of American Farm Bureau, National Farmers Union, National Cattlemen's Beef Association, National Milk Producers Federation, National Corn Growers Association, and National Association of Wheat Growers)
- Facilitate much needed changes to USDA Risk Management Agency policies to ensure that federal crop insurance programs do not penalize farmers for planting cover crops, which maximize conservation benefits, crop resilience and increase management flexibility.
- Study feasibility and funding options for concept of a state program similar to those in Iowa and Illinois that promote planting additional acres of cover crops by offering a federal crop insurance discount.

FACA Recommends:

- Support a one-time payment for early adopters of soil health practices with eligibility contingent upon participation in a new, USDA-approved incentive program or an existing conservation program to ensure continued sequestration efforts and promote additionality.
- Support passage of the Growing Climate Solutions Act to serve as a base for setting standards and certification criteria to help foster the growth of private-sector carbon markets.
- Support increase in NRCS funding to reflect program needs and enhance work on GHG mitigation and adaptation.
- Enhance conservation technical assistance related to soil health and climate resilience and reducing net GHG emissions.
- Streamline the NRCS conservation practice and approval process.
- NRCS should conduct a science-based, comprehensive review of existing conservation practice standards to evaluate their effectiveness on climate mitigation and resilience.
- NRCS should establish a process for proactively investigating and implementing new conservation practices and technologies including those in the suite of conservation practices available to producers.
- NRCS should incentivize contracts that improve soil health by prioritizing new applications and existing Conservation Stewardship Program (CSP) and Environmental Quality Incentives Program (EQIP) contracts that result in demonstrated positive soil health, carbon sequestration and resilience outcomes where appropriate and in line with local conservation priorities.
- Establish a USDA grant program to help states improve soil health on agricultural lands with eligibility limited to states or tribes that have enacted and are currently funding a state or tribal soil health program.
- Direct USDA to conduct a data-driven study (in consultation with growers and industry representatives) on the interaction between crop insurance and soil health practices to review the impact of soil-improving practices on crop productivity and on crop insurance coverage, liabilities and premium rates to identify potential policies or modifications to crop insurance to accelerate the adoption of climate-smart farming practices.
- Support a performance-based tax credit for carbon sequestration modeled after 45Q which provides a tax credit on a per-ton basis for qualified carbon dioxide. (We recommend that producers be limited to participating in one of two federal policy mechanisms – performance-based tax credit or CCC carbon bank)
- Support a USDA-led Commodity Credit Corporation (CCC) carbon bank to establish a price floor for carbon sequestration and GHG reductions contingent upon a significant increase in CCC borrowing authority to ensure that the establishment of such a bank would not impede critically important ongoing operations of the CCC, including farm programs, crop insurance and mandatory conservation programs. (We recommend that producers be limited to participating in one of two federal policy mechanisms - performance-based tax credit or CCC carbon bank)
- Direct USDA's Agricultural Research Service (ARS) to develop protocols for climate research trials to research questions around regional and crop-specific measures to adapt, mitigate and become more resilient to climate change and help create universal standards for measurement protocols.

- Provide NRCS funding to expand the number of soil sampling reference sites to 5,000 - 7,000 sites as recommended by the National Academies to provide an ongoing, statistically relevant data stream that could be used to inform carbon markets, as well as farm planning and decision-making.
- Provide NRCS funding to improve USDA's COMET Tool to improve systems integration with existing data sources and models and make other improvements based on the latest data and science to ensure greater accuracy.
- Establish a competitive grant program (modeled after Conservation Innovation Grant on-farm trials) to promote demonstration of new technologies and practices that will allow the private sector and nonprofit organizations to partner with farmers and ranchers to try out new practices to reduce GHG emissions and sequester carbon.
- Formally codify and provide mandatory funding to USDA's Climate Hubs that engage in regular stakeholder engagement to drive research in various regions and across all sectors and establish a new field experiment network through the hubs to evaluate and further develop region-specific best management practices for soil carbon sequestration and net GHG reduction in agriculture.
- Better resource and integrate private sector partners such as agricultural retailers, cooperatives, seed and feed companies with agricultural extension and link Extension with the Climate Hubs to better connect farmers, ranchers and on-the-ground decision-makers with usable climate science that will assist in planning and application.
- Support for providing USDA's Office of the Deputy Secretary with the authority and responsibility to coordinate climate issues across the agency and serve as USDA's climate representative at all interagency climate-related meetings.

3. Climate Smart Precision Agriculture: "*Precision Agriculture*" is a management strategy that uses temporal and spatial data to improve sustainability of agricultural production. In simple terms, Precision Agriculture can be expressed in five "R"s: applying the Right input, at the Right Time, in the Right Amount, at the Right place, and in the Right manner. Though the concept is simple, the five R strategy is a paradigm shift from traditional management.

For centuries, in traditional farming systems, farmers have managed inputs on their farms and farm-fields with an average approach: applying fertilizer, water, and seeds uniformly, in a "one size fits all approach."

Yet in reality, crop fields show so much variability and heterogeneity in both space and time that using an average application of any farm input leads to over-and under-application across the entire field. Data analysis has shown that uniform application of farm inputs may lead to missing the target >90% of the time. Even though fields are managed by the average, the area represented by the average only exists in a few sparse locations across a field.

CSU scientists have been working on developing and evaluating precision nitrogen management strategies for the past two decades. With precision management, farmers can continue to maintain or increase their current level of productivity while reducing their nitrogen footprint on farm fields.

CSU has modeled the influence of precision management on nitrous oxide (N₂O) emissions, a major contributor to climate change. Their findings indicate that compared to the traditional practice of uniform nitrogen fertilizer application, precision management leads to a 50% or

more reduction in N₂O emissions. This shows that through precision management, farmers can produce more with less inputs, while simultaneously decreasing their N₂O emission footprint.

What could this mean for Colorado? With 1.1 million acres of corn in the state, industry-wide adoption would mean a reduction of 2,750 MT of N₂O emissions per year—the equivalent of eliminating 173,256 vehicles from the roads.

These projections offer a potential solution to addressing negative impacts of emissions from agriculture, while also improving overall production. The next generation of digital agriculture will embrace the complexity of input management while simplifying the decision-making process for farmers, enabling them to produce more while reducing their environmental footprint.

We recommend:

- Expand the CSU Extension program, to specifically educate farmers and ranchers on principles of precision agriculture and to support the adoption of these techniques.
- Create and fund technology transfer programs, to support the transfer of new technologies and innovations from their inventors to the farmers and ranchers who can deploy them.
- Create and fund cost-sharing programs for farmers and ranchers to purchase precision agriculture technology.
- Support the development of rural broadband infrastructure and the development and adoption of digital Next Generation Precision Agriculture technologies.

FACA recommends:

- Support expanding broadband access, which is necessary for using climate-smart precision technologies to reduce emissions from and the overall environmental impact of U.S. agriculture.

- 4. Agricultural Energy Efficiency:** In 2013, according to a report by the Colorado Energy Office (CEO), Colorado farmers and ranchers faced direct energy expenses of more than \$400 million annually. Since CEO's initial report, direct energy expenditures have remained consistently high, topping \$430 million in 2017 (2017 USDA Ag Census), with dairy and pumped irrigation operators accruing the highest annual energy costs. Improved energy efficiencies and increased on-farm renewable generation can significantly reduce producers' costs of operating, while also reducing greenhouse gas emissions.

Opportunities for achieving greater energy efficiency and implementing renewable energy systems in Colorado agriculture include increasing the overall efficiency of pumps, motors, HVAC and refrigeration, lighting, buildings, vehicles and other equipment; reducing consumption of fossil fuels (diesel, gasoline, natural gas and propane) in equipment and structures when possible; converting pumps/motors, space heating and water heating from fossil fuels to efficient electric-powered equipment; and coupling energy use on farms and ranches to on-site renewable energy generation, including anaerobic digesters, wind energy, small hydropower and solar photovoltaic, and solar thermal, that can be used to provide distributed on-farm energy production.

The key barrier for farmers and ranchers to overcome to capture these opportunities is the upfront investment associated with identifying efficiency opportunities and the extensive requirements associated with securing federal grant funding. Many farmers and ranchers are hesitant to invest their profits in identifying energy efficiency projects, let alone installing

recommended equipment especially in a business environment with unpredictable risks (i.e., weather) that can impact their margins from year to year.

The CEO's Agricultural Energy Efficiency (AgEE) Program looks to eliminate potential barriers for producers by providing them with a no-cost, turnkey approach to increasing on-farm energy efficiency and renewable energy adoption. Through no-cost energy audits, preliminary renewable energy assessments, and technical assistance, producers can examine and apply for energy project funding assistance (funding sources include utility rebates, CDA ACRE3 grants, CEO rebates, NRCS EQIP grants, REAP grants, C-PACE financing & private loans). Over the past five program years, this initiative has led to the conduction of over 260 audits spanning 40 Colorado counties. These audits and the program's subsequent technical assistance offering have helped producers save over 2.4 million kWh annually, and have led to the identification of over 14 million+ kWh in additional possible savings that could be achieved with additional project financing support.

Since its formation, the program has developed a close partnership with CDA's ACRE3 program, working together to help producers leverage ACRE3 project funding support to increase on-farm energy efficiency and renewable energy project implementation.

We recommend:

- Expanded funding for the CEO Agricultural Energy Efficiency Program and CDA ACRE3 Program to assist Colorado farmers and ranchers in identifying and achieving greater energy and economic efficiencies.
- Expanded funding for USDA EQIP and REAP programs to assist Colorado farmers and ranchers in achieving greater energy efficiency and the implementation of renewable energy systems to increase economic and environmental sustainability.
- Increase in workshops and seminars co-hosted by the CDA, CEO and local Extension, Conservation Districts and NRCS offices throughout Colorado, to promote and support implementation of on-farm energy efficiency and renewable energy programs.
- Improved access to agricultural loans for renewable energy projects and energy efficiency improvements.

FACA Recommends:

- Increase the USDA REAP cost-share to no less than 30% and increase the cap to \$650,000 for bundled renewable energy/energy efficiency projects.
- Require USDA's Rural Development to coordinate with NRCS to develop an application that is streamlined for farmers and ranchers, allowing them to apply for renewable energy, energy efficiency or bundled projects and to incentivize farmers and ranchers who are planning to install renewable energy systems to simultaneously reduce energy use by making efficiency improvements.
- Establish a pilot program that would expand eligibility to third parties such as states, nonprofits and other entities to apply for grant funding (not loans) for energy efficiency and renewable energy projects similar to the Regional Conservation Partnership Program (RCCP); and increase funding to meet demand to address high demand, increase cost-share for bundled projects and account for the new pilot program.
- Establish a rural/agriculture/forestry advisory committee at DOE modeled after EPA's Farm, Ranch and Rural Communities Committee (FRRCC) to provide independent policy advice and recommendations to the Secretary of Energy on energy efficiency, renewable energy, biogas production and biofuels.

5. Renewable Energy: Colorado farmers and ranchers contribute to reducing GHG emissions by producing renewable fuels and energy through growing feedstocks used for biofuels or installing or leasing out land for wind turbines and solar panels, which reduces the GHG emissions generated from burning fossil fuels for electricity, heat, and transportation. Colorado farmers and ranchers are adopting and investing in renewable energy.

From 2012 to 2017 in Colorado, according to the 2017 Census of Agriculture:

- The number of Colorado farms and ranches that included renewable energy production systems increased by 129%, from 2,013 to 4,609
- Farms and ranches with solar panels increased by 130%, from 1,636 to 3,768
- Farms and ranches with wind turbines increased by 85%, from 339 to 627
- Farms and ranches with geothermal/geoexchange systems increased by 186%, from 153 to 438
- Farms and ranches with small hydro systems increased by 66%, from 47 to 78
- Farms and ranches that lease their wind rights to others increased by 77%, from 353 to 626

In 2019, Colorado had 2,275 wind turbines with a total generating capacity of 3,762 megawatts mostly located on Colorado farms and ranches. Wind projects with 969 megawatts of generating capacity are under construction in 2020. Rural counties that have wind farm installations are benefiting from the improved tax base and indirectly all county taxpayers are benefited. The construction phase is an economic boom and afterwards the support staffing provides good salaries and benefits to local communities.

Investments in wind turbines, solar panels, and other renewable energy systems can also build economic resilience while eliminating the GHG emissions generated from burning fossil fuels. Wind farms offer one of the lowest environmental impacts of energy generation on agricultural land. Agricultural production and energy generation can occur simultaneously as wind farms have small structural footprints on the ground, occupying no more than 1 percent of the cropland or rangeland they sit on. In March 2019, Smithfield Foods, Inc., the world's largest hog producer and pork processor, signed an agreement with United Wind to power dozens of Smithfield Foods hog farms in Colorado with 3 megawatts (MW) of on-site wind energy.

Colorado farmers and ranchers are already improving their bottom line and reducing emissions by producing renewable energy through growing feedstocks used for biofuels. Three ethanol plants in Colorado – Colorado Agri-Products in Sterling and Yuma, and Front Range Energy, LLC in Windsor, use approximately 50 million bushels of corn, or 32 percent of the state's average annual corn production. The USDA has found that corn ethanol reduces greenhouse gas emissions by 43 percent compared to conventional gasoline, could further reduce greenhouse gas emissions by 50 percent by 2022, and has the potential to reduce emissions by as much as 76 percent when accounting for advancements in production efficiency techniques and sustainable agricultural practices. Nationally, the use of ethanol and biodiesel in 2018 reduced GHG emissions equivalent to taking 17 million gasoline cars off the road.

Colorado farmers and ranchers primarily receive their electricity from rural electric associations (REA's) whose main source of electricity generation is Tri-State Generation and Transmission (Tri-State). In January 2020, Tri-State adopted a "Responsible Energy Plan" to add 1 gigawatt of wind and solar power and close all coal-fired plants by 2030. By 2024, Tri-State plans to double renewable electricity generation to 50% and set goal of 100% clean energy in Colorado by 2040.

We recommend:

- Expansion of the CEO Agricultural Energy Efficiency and CDA ACRE3 programs, and the NRCS EQIP and REAP programs. *(see details in Agricultural Energy Efficiency, above)*
- Support for community solar gardens in rural areas served by Rural Electric Associations to allow Colorado farmers and ranchers to benefit from affordable, locally generated renewable energy.
- Support the development and deployment of agrivoltaics.
- State and federal funding for extension education and technology transfer programs.
- Consideration of a Low Carbon Fuel Standard (LFS) similar to California that requires the use of crop-based alternative fuels such as ethanol and biofuels to reduce the carbon intensity of fuels used.

FACA Recommends:

- Direct the EPA, in consultation with USDA, to review and update their life cycle analysis of GHG emissions under the Renewable Fuel Standard to reflect the latest science, such as efficiency gains associated with updated farming and production practices.
- Support the Thune-Shaheen bill which would streamline EPA's renewable fuel pathway approval process.
- Codify and provide mandatory funding for a renewable energy infrastructure program that builds on the Biofuels Infrastructure Partnership (BIP) and the Higher Blends Infrastructure Incentive Program (HBIIIP) to provide grants for connecting agricultural renewable energy sources to distribution.
- Direct USDA to conduct a study of on-farm energy initiatives to examine the status of on-farm energy efficiency adoption, rural renewable energy production and biofuels deployment and to identify barriers and opportunities to increase on-farm energy initiatives and scale renewable fuels production.
- Expand USDA's Section 9003 program eligibility to allow for alternative, non-digester manure management projects (since digester projects are currently considered eligible).
- Establish a rural/agriculture/forestry advisory committee at Department of Energy (DOE) modeled after EPA's Farm, Ranch and Rural Communities Committee (FRRCC) to provide independent policy advice and recommendations to the Secretary of Energy on energy efficiency, renewable energy, biogas production and biofuels.

- 6. Livestock and Grassland Management and Integration:** Livestock accounts for 70% of Colorado agricultural sales, and nearly 29 million acres – 43% of all Colorado land – is used for pastureland/grassland for livestock. Grasslands are one of the most stable carbon sinks when left undisturbed and properly managed through grazing. Along with forestry, agriculture is the only industry capable of extracting greenhouse gases from the atmosphere. (There are approximately 24.5 million acres of forest landscape in Colorado). Forests and pastureland/grassland play an important role in sequestering and protecting CO₂ making grasslands an important nature-based solution in the fight against climate change. Maintaining grasslands is among the most cost-effective and scalable land management solutions to mitigating climate change according to a recent study titled: *Natural Climate Solutions for the United States*. The study found there are a number of relatively cheap and easy solutions to mitigate climate change, such as maintaining and restoring grasslands and forests that are win-wins for producers and land managers as well as society and the environment. Avoided conversion of grassland to cropland retains soil C and provides provision of multiple other ecosystem services. Another recent study from the University of California, Davis, found that grasslands and rangelands are more resilient carbon sinks than forests in 21st century California. Unlike forests, grasslands sequester most of their carbon

underground, while forests store it mostly in woody biomass and leaves. When wildfires cause trees to go up in flames, the burned carbon they formerly stored is released back to the atmosphere. When fire burns grasslands, however, the carbon fixed underground tends to stay in the roots and soil, making them more adaptive to climate change.

Research is showing promise for beef/dairy production to mitigate GHG emissions and improve carbon storage in soils through additional genetic improvements, adaptive grazing management and improved dietary strategies. Pastureland/grassland presents substantial carbon sequestration potential. Adaptive grazing management of cattle is proven to help protect and restore grassland (thereby sequestering carbon), disrupt the lifecycles of pests, promote stable production in poor growing conditions (especially drought), yield higher quality forage, decrease weed and erosion problems, and help ensure more uniform soil fertility. According to the Census of Agriculture, 6,538 of 12,407 Colorado farms/ranches – more than half – practiced some form of adaptive grazing management in 2017.

A 2017 study published in the Proceedings of the National Academy of Science – “Nutritional and greenhouse gas impacts of removing animals from U.S. agriculture” – supports and expands on evidence that livestock is responsible for a relatively small piece of the GHG pie in the United States. The study demonstrated that eliminating *all* animal protein would lead to a reduction of a mere 2.6% in GHGs throughout the United States, this included removing animal protein from even our pet’s diets – a completely vegan system. According to the study’s authors, “Removing animals from U.S. agriculture would reduce agricultural GHG emissions, at the same time creating a food supply incapable of supporting the U.S. population’s nutritional requirements.”

Beef production, including the production of animal feed, is responsible for only 3.3% of greenhouse gas emissions in the U.S., according to a new study titled “Environmental Footprints of Beef Cattle Production in the United States.” This is dramatically lower than the global livestock figure of 14.5%. Furthermore, through continuous improvements in production practices, U.S. beef farmers and ranchers have avoided 2.3 gigatons of carbon emissions since 1975.

Finally, new research published by Oxford university argues that while, CO₂ and N₂O are “stock gases” that once emitted will continue to build up in the atmosphere, biogenic CH₄ emissions (which is produced through the rumination process of beef and dairy livestock) is a “flow gas.” Biogenic CH₄ is removed from the atmosphere at a more rapid pace than CO₂ or N₂O. Oxford scientists have proven that the lifespan of CH₄ in the atmosphere is approximately 12 years which impacts the environment for a duration that is nearly 100 times shorter than the stock gas CO₂. It is important to note fossil CH₄ impacts the climate differently than biogenic CH₄. Biogenic CH₄ from beef and dairy livestock is part of a natural carbon cycle, where after about 12 years it is oxidized and converted into CO₂ and removed from the atmosphere. These carbon molecules are the same molecules that were consumed by beef and dairy livestock in the form of plants. As part of the biogenic carbon cycle, the carbon originally utilized by the plant is returned to the atmosphere, contributing no net gain of CO₂. University of Colorado (CU) researchers have created a new, cost-effective instrument (“CU mobile Solar Occultation Flux) and technique to efficiently measure CH₄ emissions from the ground and the air above to determine exactly where they are coming from. A study using the instrument found oil and natural gas operations were responsible for most of the CH₄ produced in the Denver-Julesburg Basin, with agricultural sources providing an important but minor source. (Killis, Chia, et al 2019)

The U.S. dairy industry recently announced efforts to address climate change, boldly aiming for carbon neutral or better (net zero climate impact) by 2050. (Innovation Center for U.S. Dairy, 2020). Smithfield Foods, the largest pork producer in Colorado and the U.S. aims to be the first carbon-negative meatpacker by 2030. Smithfield has created its own biogas program that uses anaerobic digesters to breakdown hog manure on its farms (and claims their method of capturing manure and transforming it into renewable natural gas removes at least 25 times more GHG emissions from the atmosphere than are released). A 2019 report by the California Department of Food and Agriculture stated that over the last five years alone, California has reduced livestock and dairy methane emissions by 25% via a combination of improved efficiency and incentives for anaerobic digesters, alternative manure management practices and other technologies as part of the state efforts to reduce methane by 40%. Anaerobic dairy digesters provide the largest GHG reduction of all investments in California's climate action portfolio and the digester grant program is the second most cost-effective of 68 climate programs, providing one ton of GHG reduction (CO₂e) for every \$9 invested by the state. More than 100 California dairy farms are currently developing digester projects that will also create carbon-negative fuel to replace the use of diesel in heavy duty trucks.

Colorado is already leading the way in advancing the effectiveness and use of these methods. CSU has created the first-of-its-kind Sustainable Livestock Systems Collaborative to bring animal health experts together with industry, government and other stakeholders to support profitable, sustainable and healthy livestock production. The Collaborative includes the Colorado Beef Council, Colorado Cattlemen's Association, Colorado Farm Bureau, Colorado Livestock Association, Rocky Mountain Farmers Union as well as the Warner College of Natural Resources, the School of Global Environmental Sustainability, and CSU Extension.

The Colorado Coalition to Enhance Working Lands (CCEWL) is a coalition of over 40 organizations working together to address the challenges facing those working to enhance the health and productivity of Colorado working lands. CCEWL focuses on key issues and programs to maximize the resources in Colorado to improve soil health, biodiversity, water, and rural businesses and communities. CCEWL's goals are to acknowledge and support the good work being done by land managers and agricultural producers as well as the organizations supporting them, develop funding opportunities, and provide professional development and networking opportunities.

We recommend:

- Expanded resources to support participation in the Sustainable Livestock Systems Collaborative and other programs to develop innovative livestock management techniques and a system's approach to GHG reductions.
- Support the acceptance and codification of Global Warming Potential* (GPW*) when evaluating emissions of methane by the relevant bodies for assessing science related to climate change, including the U.S. Environmental Protection Agency (EPA) and the Intergovernmental Panel on Climate Change (IPPC).
- Increase federal research funding to improve understanding of how to accurately measure and quantify GHG emissions — and possible reductions — from livestock production.
- Continue to expand the credibility and validity of the Life Cycle Analysis of the beef value chain and the livestock production system through regional data collection, periodic updates and re-certification of the primary data.
- Oppose regulation of methane emissions from livestock or any other legislative vehicle.

- Study feasibility and funding options for concept that provides financial assistance for the installation of anaerobic digesters and alternative manure management program that provides financial assistance for the implementation of non-digester management practices which will result in reduced GHG emissions.
- Increase program funding for EQIP and CSP for grazing practices that sequester and protect carbon in soils.
- Prioritize focus on on-farm trials in the CIG program that evaluate grazing practices that sequester and protect carbon in soils.
- Support expanded funding of the USDA-ARS Rangeland Resources & Systems Research Unit to support research to determine the potential for adaptive grazing management to enhance beef production, vegetation heterogeneity, grassland bird conservation, carbon/energy/water balance and soil health in western Great Plains rangelands.
- Support adequate funding for USDA NRCS research in soil, water, plant and wildlife science (i.e., assessing accurate data for Total Maximum Daily Loads) and technical assistance to meet science-based, ecologically and economically sound conservation needs.
- Encourage USDA NRCS to continue investigating current research and models used to calculate carbon sequestration on rangeland and pastureland in order to provide a factual and reliable estimation of carbon sequestration at various management levels and rangeland conditions to facilitate the free exchange of environmental credits; and encourage NRCS to research and investigate the marketability of implementing carbon sequestration practices on range and pastureland.
- Support efforts to maintain and enhance EQIP at a greater allocation for livestock-related applications implementing sound conservation practices on rangeland.
- Provide practice-based incentive payments for conservation based on developing, implementing and maintaining a comprehensive conservation plan over a ten-year contract period.
- Provide tax incentives and other benefits to those farmers/ranchers actively working to benefit the environment.
- Establish short courses for both producers and NRCS personnel in soil, water, plant, livestock and wildlife management.
- Allow grazing within the CRP grasslands program while maintaining important grasslands.
- Educate the public regarding the environmental benefits associated with grazing and rangeland agriculture.

FACA Recommends:

- Provide adequate technical assistance and support updated conservation practices by streamlining a forward-looking conservation practice approval process.
- Utilize Department of Energy (DOE) technical expertise and funding for methane digesters under the Renewable Energy and Efficient Energy Loan Guarantee Program and support adding a partner grant program for digesters to finance up to 25% of the project.
- Incentivize methane digesters through a production tax credit for the sequestration, reduction or destruction of GHG emissions modeled after Internal Revenue Code Section 45Q.
- Support for the Agriculture Environmental Stewardship Act that would make methane digester systems eligible for a 30% investment tax credit to help farmers and wastewater treatment facilities offset the upfront costs associated with installing a digester system.

- Expand Rural Energy for America Program (REAP) eligibility to include cooperatives to increase the number of methane digester and renewable energy projects operated and financed through farmer-owned cooperatives.
- Support DOE including renewable natural gas from biogas as a clean energy option for research and development in the Vehicle Technology Office's partnerships and research programs where applicable, such as in the Clean Cities Coalition and National Clean Fleets Partnership.
- Support the transfer and funding for the AgSTAR program from the EPA to the USDA. (AgSTAR is a collaborative program sponsored by EPA and USDA that promotes the use of biogas recovery systems to reduce methane emissions from livestock waste).
- Expedite Food and Drug Administration (FDA) feed additive approvals and prioritize additives that have climate and digestive efficiency benefits.
- Provide a risk- and science-based regulatory pathway to streamline the animal biotechnology approval process to help livestock producers adapt to a changing climate and help reduce emissions.
- Create NRCS conservation practices focused on nutrition management and genetics /breeding management and provide adequate technical assistance.
- Expand support for conservation planning and technical assistance in order to optimize livestock management and land stewardship for climate adaptation and mitigation.
- Support additional resources to enable all technical advisers, including technical service providers (TSPs) to work with livestock producers through nutrition and genetic/breeding planning to reduce emissions; and third-party TSPs should receive funding to work with livestock farmers and ranchers to develop new nutrition and genetic plans focused on efficiency, animal health and reduced emissions.
- Support the creation of conservation practices to reflect feed management, genetics and nutrition planning to reduce emissions.
- Ensure feed, genetics and nutrition management are eligible under the Conservation Innovation Grant (CIG) On-Farm Trial Program and support an increase in funding to accommodate the additional categories which will provide additional means for farmers and ranchers to test out the newest technologies to ensure they work in their operations.
- NRCS should identify regions and practices with the greatest potential for carbon sequestration and methane emissions reduction, and should support research, development and widespread use of decision-support tools for climate and land stewardship outcomes.
- Adjust NRCS state office priorities for providing technical assistance to grazing land managers in high-priority regions in coordination with the National Grazing Lands Coalition.
- Provide mandatory funding at the authorized level of \$60 million per year for the National Grazing Lands Coalition and amend the program purpose to add soil health and grazing system resilience to support voluntary technical assistance and expanded grazing lands research and education.
- Initiate research and development efforts to improve enteric fermentation/forage intake estimation models.
- Expand capacity and increased funding support for technical assistance, including the technical service provider program, to ensure conservation planning and climate-beneficial practices are accessible to all grazing lands managers, and to increase adoption of such practices.

- Expand research and development to improve and expand use of tools like COMET-Farm, COMET-Planner, LandPKS, Rangeland Analysis Platform and CART that support farm and ranch management for soil health, carbon storage/sequestration and other conservation outcomes.
- Support and expand practices that have demonstrated emission reductions capability.
- Direct USDA's Agricultural Research Service (ARS) to develop protocols for climate research trials to research questions around regional and livestock-specific measures to adapt, mitigate and become more resilient to climate change and help create universal standards for measurement protocols.
- Establish a competitive grant program (modeled after Conservation Innovation Grant on-farm trials) to promote demonstration of new technologies and practices that will allow the private sector and nonprofit organizations to partner with farmers and ranchers to try out new practices to reduce GHG emissions and sequester carbon.
- Formally codify and provide mandatory funding to USDA's Climate Hubs that engage in regular stakeholder engagement to drive research in various regions and across all sectors and establish a new field experiment network through the hubs to evaluate and further develop region-specific best management practices for soil carbon sequestration and net GHG reduction in agriculture.
- Better resource and integrate private sector partners such as agricultural retailers, cooperatives, seed and feed companies with agricultural extension and link Extension with the Climate Hubs to better connect farmers, ranchers and on-the-ground decision-makers with usable climate science that will assist in planning and application.
- Support for providing USDA's Office of the Deputy Secretary with the authority and responsibility to coordinate climate issues across the agency and serve as USDA's climate representative at all interagency climate-related meetings.

- 7. Conservation and Wildlife Habitat:** Approximately 18% of Colorado's 32 million acres of total farm and ranch land is used for conservation and wildlife habitat efforts. Farmers and ranchers already implement conservation, resource-saving and wildlife-based practices through a variety of federal and taxpayer-assisted conservation programs. These include the federal Conservation Reserve Program (and Conservation Reserve Enhancement Program), Conservation Stewardship Program, Environmental Quality Incentives Program, Agricultural Conservation Easement Program and Voluntary Public Access and Habitat Incentive Program (and Wildlife Habitat Incentive Program).

Across these programs, approximately 5.7 million acres of farmland in Colorado are currently receiving conservation-related financial and technical assistance from the federal government to install resource and wildlife preservation practices. As evidenced in the participation across these programs, Colorado farmers and ranchers have long contributed to preserving and saving natural resources, including water and soil, while also capturing carbon in the soil through the use of cover crops and no-till soil practices. As development pressures on agricultural land continue to increase, these programs will become even more essential for improving producers' bottom lines by rewarding them for maintaining and protecting these working landscapes.

We recommend:

- Increase access to the Conservation Reserve Program (and Conservation Reserve Enhancement Program), Conservation Stewardship Program, Environmental Quality Incentives Program, Agricultural Conservation Easement Program and Voluntary Public

Access and Habitat Incentive Program (and Wildlife Habitat Incentive Program) to support conservation, resource-saving and wildlife-based practices.

- Expand the Conservation Reserve Program to increase the acreage enrollment cap, raise rental payments made to farmers and ranchers and promote regenerative practices including holistic grazing.
- Expand the Agricultural Conservation Easement Program to increase the acreage farmers and ranchers place into agriculture conservation and wetlands easements.

Climate Change - We're all in this Together

- No sector of our economy is more vulnerable to climate change than agriculture.
- Agriculture is part of the solution – not the problem.
- No one can do more, in less time to mitigate and adapt to climate change than farmers and ranchers.
- Other than forestry, agriculture is the only industry capable of extracting GHGs from the atmosphere.
- Soil can remove more CO₂ from the atmosphere than it releases and is a natural climate change solution.
- Approximately 51.8 million acres (78%) of Colorado land is used for agriculture which gives Colorado agriculture the potential to offset its own GHG emissions and become a net carbon sink and be a crucial part of the climate solution.
- Grasslands and rangelands are more resilient carbon sinks than forests since the carbon is fixed underground tends to stay in roots and soil making them more adaptive to climate change.
- Maintaining grasslands is among the most cost-effective and scalable land management solutions to mitigating climate change. (nearly 29 million acres – 43% of all Colorado land – is used for pastureland/grassland for livestock)
- Social politics in agriculture are important since they influence how farmers and ranchers operate and adapt to farming/ranching changes (or respond to climate change).
- Communication is essential.
- Science-based education is a must.
- Voluntary, incentive-based programs and carbon markets are critical to reward farmers and ranchers for climate-smart practices.

Colorado Farmers and Ranchers are Committed to Producing Food Sustainably

The following farm/ranch and commodity organizations support the guiding principles and climate change mitigation solutions included in this document.

Note: This draft paper was authored by John Stulp and Darrell Hanavan. Stulp is the former Commissioner of Agriculture under Governor Bill Ritter, Water Policy Advisor to Governor John Hickenlooper and a wheat and cattle farmer/rancher. Hanavan is the former Executive Director of the Colorado Wheat Administrative Committee, the Colorado Association of Wheat Growers and the Colorado Wheat Research Foundation and is a partner in Hanavan Farms, LLC which raises dryland wheat, irrigated corn and cattle (cow-calf).