

The Colorado Blueprint of Agriculture and Food

Key assets, emerging issues, and shared
priorities for future investments in food
and agriculture around the state



COLLEGE OF
AGRICULTURAL SCIENCES
COLORADO STATE UNIVERSITY

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EXECUTIVE SUMMARY



Agriculture and the broader food system are major contributors to the Colorado economy. Yet, the vibrant commodities, industries, and communities that make up the state's food and agricultural system often do not recognize their linkages or communicate effectively with one another or the public. The Colorado Blueprint for Food and Agriculture emerged as an opportunity to build bridges and strengthen the food and agricultural sectors through robust data analysis, stakeholder conversations and mapping opportunities to support linkages, policies and programs that better our industry and its surrounding communities. Ultimately, this project, its process, and its resulting publications are all intended to support community and economic development.

THE THREE PARTS OF THE COLORADO BLUEPRINT FOR FOOD AND AGRICULTURE

This project of the 2017 Colorado Blueprint for Food and Agriculture updates the 2013 Value Chain of Colorado Agriculture, expanding its reach to include a broader set of information and stakeholders. Specifically, the 2013 Value Chain of Colorado Agriculture has been expanded to include:

- 1.** An update of the economic data and a deeper look at the Value Chain of Colorado Agriculture, including analyses of additional industry subsectors and a broader set of players that have various roles in the value chain of agriculture and food.
- 2.** An integration of results and insights from the 2016 survey on Public Attitudes about Agriculture in Colorado led by the Colorado Department of Agriculture (CDA)
- 3.** A synthesis of issues identified in a yearlong community engagement exercise of regional and industry town hall meetings, designed to catalyze discussion about how these data align with the opportunities, priorities, and concerns that are top-of-mind for Coloradoans.

MISSION AND OBJECTIVES OF THE COLORADO BLUEPRINT FOR FOOD AND AGRICULTURE

The mission of this Colorado Blueprint for Food and Agriculture project was to:

- Understand opportunities and challenges resulting from changing public attitudes;
- Assess opportunities for food system policy to address challenges and needs;
- Document, assess and highlight key linkages in the industry supply chain and infrastructure;
- Develop priorities for capacity building, investment and innovation across all of the state's agriculture and food stakeholders;
- Enhance Colorado State University's knowledge of Colorado-specific research and engagement needs, to support opportunities for all research and outreach units of CSU, both on and off campus.

From the perspective of the range of stakeholders in agriculture and food within the state of Colorado a broader set of cross cutting objectives were framed and explored in the Colorado Blueprint for Food and Agriculture:

1. Creating, retaining, and recruiting agricultural and food firms;
2. Developing workforce and youth to support agricultural and food sectors;
3. Promoting the Colorado brand, ensuring it reflects the unique qualities of the agriculture and food sectors;
4. Supporting a business- and consumer-friendly regulatory environment;
5. Addressing how scale impacts market performance, access, and opportunities;
6. Innovating and supporting new technology for agricultural and food businesses;
7. Improving access to resources and capital for agriculture and food firms; and,
8. Integrating agriculture and food with healthy, vibrant communities.

These broad objectives build upon a core set of six cross-cutting economic development issues that were laid out by the state's Office of Economic Development and International Trade (OEDIT) in its bottom-up economic development plan for the state known as the "Colorado Blueprint" and addressed for the key industry of food and agriculture in the 2013 Value Chain of Colorado Agriculture.

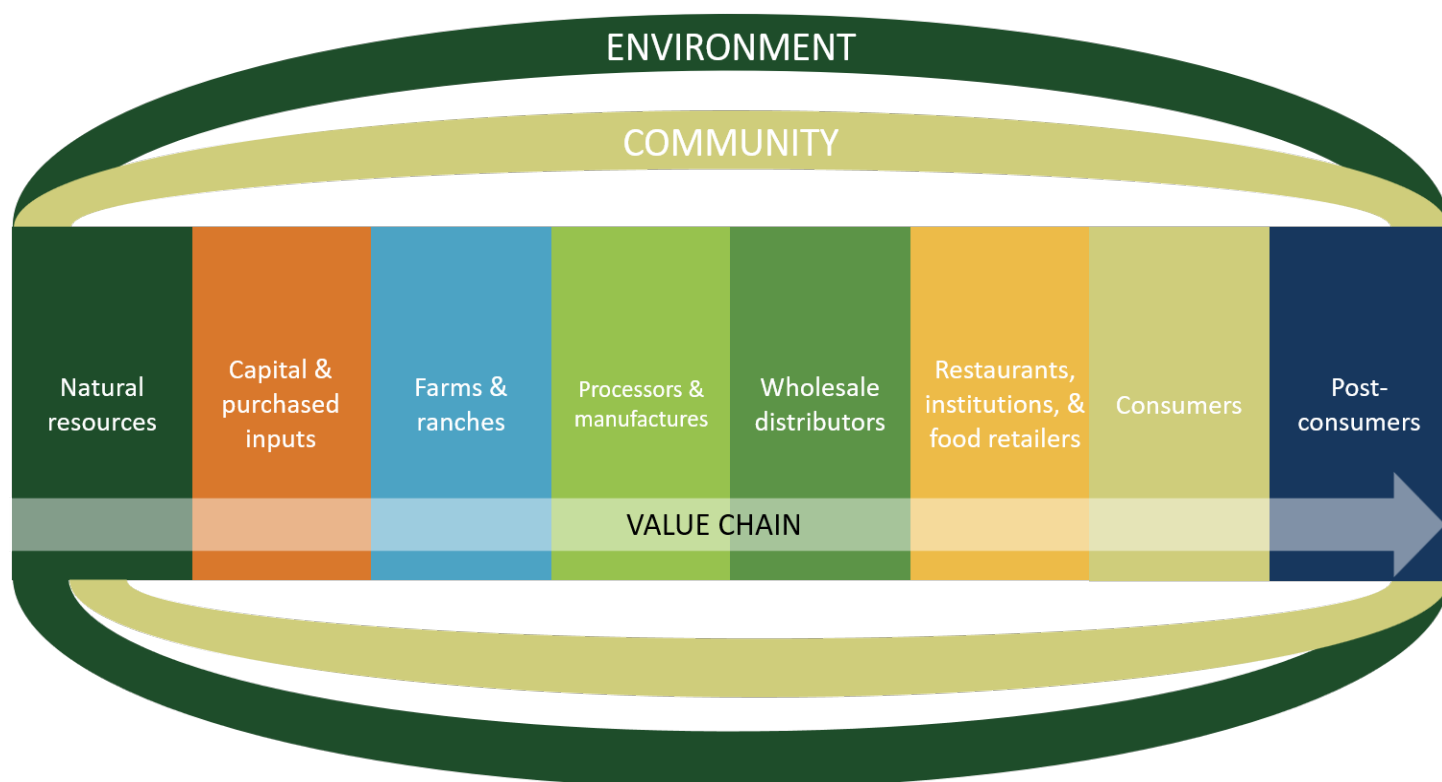
Looking at the value chain of Colorado agriculture in light of these broad economic and community development objectives reveals numerous challenges and opportunities overlapping across various industry sub-sectors. For example, in many parts of the value chain, the availability and quality of both wage laborers and skilled tradespeople is crucial to the workforce of the future. Colorado also has underexploited areas of excellence and global leadership in agricultural innovation, from applications of scientific research, to new models of business-to-business transactions, to value-based product development in emerging consumer markets. Further, Colorado's agriculture, food, and beverage sectors can play a pivotal role in establishing the state's image as a brand and a destination for healthy and active lifestyles.

COMMUNITY ENGAGEMENT OF THE COLORADO BLUEPRINT FOR FOOD AND AGRICULTURE

An essential component of the Colorado Blueprint for Food and Agriculture was an extensive community engagement process. In total, across the state, almost 250 people attended 13 regional town hall meetings, representing 158 organizations. In addition, four industry town hall involved over 110 attendees, representing 47 organizations. Throughout 2017, ten public presentations, each of which included 25 to 250 participants, helped to spread the word about the engagement process. As evidence of the interest in the project, 395 individuals asked to stay connected to what was happening with the Blueprint, 1,122 unique page views were recorded on the project website, with a total of 1,553 views between January and August. After the presentation of the draft report was made at the CSU Ag Innovation Summit in September, 554 more views have been recorded, with 74 community members providing feedback on the initial recommendations and priorities (see: <http://foodsystems.colostate.edu/research/colorado-blueprint/community-engagement/>).

DEFINING THE VALUE CHAIN OF COLORADO AGRICULTURE WITHIN THE CONTEXT OF COLORADO COMMUNITIES AND OUR SHARED NATURAL ENVIRONMENT

The idea of a value chain refers to the series of steps or linkages that turn raw materials and other inputs into final products or services delivered to end users. To expand on the 2013 Value Chain study, a broader set of linkages was defined for this Blueprint. The agricultural value chain is now defined as the flow of inputs, starting from the natural resources utilized by agricultural producers all the way through consumer household, and beyond, including how food waste is handled or packaging is recycled. This recognizes that agricultural producers and food enterprises are at the core of the value chain, but all are embedded within the communities and the environment of our state, acting as key stewards, employers and community leaders on a variety of public issues (see Figure).



NATURAL RESOURCES AND INPUTS TO AGRICULTURAL PRODUCTION

Inputs to agricultural production include productive capital—such as labor, land, water, equipment, genetics, and financing—as well as consumable inputs such as fertilizer, pesticides, electricity, and fuel. Annual expenditures by Colorado farms and ranches in each category represents an upper branch of the value chain, businesses and workers who create value by providing inputs to agricultural production.

USE OF CAPITAL: Payment of rent by Colorado farms and ranches to non-operator landlords for use of agricultural land was \$96 million in 2016. In recent years, annual fees paid by Colorado ranches to graze livestock on federal public lands are estimated at \$2 million per year. Annual rent paid by Colorado farms and ranches to non-agricultural water rights owners for use of their water is estimated to be at least \$53 million. In 2016, Colorado farms and ranches paid \$542 million in salaries, wages, and benefits to roughly 38,000 full time and part time on-farm employees. In 2016, agricultural equipment manufacturers sold an estimated \$236 million and farm and garden machinery dealers sold an estimate \$334 million representing investments by farm and ranch enterprises in their physical capital stocks. Also, in 2016, Colorado farms and ranches made interest payments of \$307 million (on principal of approximately \$4.5 billion) to maintain financing from private and public lenders.

ON-FARM INPUTS: Some inputs, such as seed, feed, or young livestock, are by their very nature produced on farms. Thus, the value of expenditure by the farm or ranch that purchases them also counts as revenues for the other farm or ranch that sells them. In 2016, Colorado farms paid seed farms and seed companies \$195 million for seed. In 2016, Colorado livestock operations paid farms and feed mills \$1.16 billion for feed. In 2016, Colorado livestock operations paid other livestock operations \$1.12 billion for live animals. Given the capacity of Colorado feedlots exceeds the supply of animals available from within the state, about two thirds of the cattle being placed on feed in Colorado are purchased from out of state and constitute “inshipments” to Colorado.

MANUFACTURED INPUTS: An additional class of purchased inputs consists of those originating from outside the farm sector, and thus suppliers of these inputs make up branches that are higher up the agricultural value chain. In 2016, Colorado farms paid \$241 million for fertilizers and \$169 million for pest control products. In 2016, Colorado farms and ranches paid fuel suppliers \$198 million for fuel and oil products, and they paid Colorado utilities and Rural Electric Associations \$105 million for electricity.

SERVICES PROCURED: Farms and ranches also procure services. They paid \$256 million in 2016, mostly to local businesses and contractors, for repair and maintenance services. They paid \$67 million for machine hire and custom work, largely to other farms and ranches, as well as to specialized local businesses and contractors. Colorado farms and ranches paid \$75 million to contract labor companies for contract labor services. Colorado farms and ranches paid \$183 million in transportation, storage, and marketing expenses to trucking companies, grain elevators, and other such service providers.

PUBLIC SERVICES: In order to support state and local services such as country roads, bridges, public weed and pest control, etc., taxes are assessed—in particular on those capital goods, such as land and vehicles that are associated with activities most likely to utilize and benefit from such public services. Thus, in 2016, Colorado farms and ranches paid \$146 million in property taxes and \$15 million in motor vehicle registration fees to county and state governments.

INSURANCE AND OTHER FARM AND RANCH EXPENDITURES: Finally, Colorado farms and ranches paid an additional \$709 million designated to other “miscellaneous expenses,” including expenditures on tools and supplies, miscellaneous livestock-related expenses such as veterinary care, business-related expenses,

and insurance. In 2015, premiums paid to insurance companies for crop and livestock insurance totaled \$173 million. Federal crop insurance subsidies paid \$104 million of that total. Colorado farms and ranches paid the other \$69 million. As well, in recent years, Colorado farm and ranch operator households spent between \$110 to \$178 million on health insurance premiums and between \$71 and \$114 million in out-of-pocket health care expenses.

AGRICULTURAL PRODUCTION

Sources of revenue for Colorado farms and ranches totaled close to \$7 billion in 2016. These vary significantly, but each represents a vertical branch down the value chain, as that particular output or service provides an input for manufacturing or is marketed to final users.



CROPS: The largest share of crop production in Colorado is devoted to crops intended for consumption by livestock. In 2016, Colorado farmers received \$920 million for such feed and forage crops. Of that, \$496 million was for corn, \$296 million was for hay, and approximately \$100 million was for sorghum, millet, barley, and oats combined. A significant share of the feed crop harvest never leaves the operation where it was grown, a portion is sold directly to neighbors, and some enters more formal marketing channels. The high level of demand by cattle feeding and ethanol production accounts for virtually the entire corn grown in Colorado plus an estimated 80 to 90 million bushels shipped into the state each year.

Wheat is the primary food grain grown in Colorado, and was worth \$294 million in 2016. Oilseed production is smaller: In 2016, Colorado farms received \$18 million for production of oilseed crops, primarily sunflower. Particular regions of Colorado have proven favorable for fruit and vegetable crops. In 2016, Colorado farmers received \$175 million for potatoes, \$71 million for other vegetables, and \$27 million for fruits: making a total of \$272 million for all fruits and vegetables combined. Historically, sugar beets and sugar processing have played prominent roles in the development of Colorado agriculture. In 2016, Colorado growers received \$46 million for their sugar beet crop. Greenhouse and nursery crops are typically raised for residential, recreational, and commercial landscaping, for gardening, or for indoor ornamental use. In 2012, the last year for which USDA reported data, Colorado greenhouse and nursery operations received \$254 million for production and sale of a variety of horticultural, landscaping, and ornamental plants. With recovery of real estate and construction, sales likely rebounded above \$300 million by 2016.



LIVESTOCK: Livestock production has historically been a major economic activity in Colorado, due to extensive rangelands across the high plains, the inter-mountain valleys, and the western slope. The livestock most commonly produced in Colorado is cattle, for both beef and dairy. In 2016, Colorado beef cattle operations received almost \$3.1 billion for marketing of beef cattle, and \$1.9 billion for harvested or “production” of beef. Dairies received \$655 million for milk production. Hog operations received \$182 million for marketings of hogs. Colorado is the leading U.S. state in production of sheep and lamb. In 2010 (the last year for which separate figures are available) Colorado sheep and lamb operations received \$111 million for sheep and lamb marketings and \$3.7 million for wool production. Other livestock include poultry production, with Colorado producers receiving \$101 million for sale of eggs and poultry in 2016. The equine industry still serves some roles in production agriculture, but raising horses for recreation is economically more important. In 2016, Colorado farms and ranches received about \$32 million for sales of horses. In Colorado, as a landlocked state, commercial aquaculture is not a major activity, but sold \$2.2 million of raised trout in 2016. Honeybees may be insects, but they produced honey worth \$2.8 million in 2016.



SERVICES PROVIDED: Farms and ranches also realize revenues from services provided. In 2016, Colorado farms and ranches received \$78 million for machine hire and custom work, largely provided to other farms and ranches. In 2012, according to the USDA Census of Agriculture, Colorado farms and ranches received \$28 million for providing agtourism and recreational services.



REVENUES FROM RISK MANAGEMENT SOURCES: Farms and ranches benefit from a range of risk management tools and strategies. Some risk management is provided by the federal government as part of U.S. public policy. These include commodity subsidies, conservation payments, and disaster payments, as well as premium subsidies to help farms and ranches purchase crop and livestock insurance coverage. Colorado farms and ranches received \$234 million from USDA commodity and conservation programs in 2016. On policies held by Colorado farms and ranches, crop and livestock insurance indemnities were \$106 million in 2015, given that the premium for these policies was partly subsidized by the federal government, this resulted in a net revenue of \$37 million in 2015.



OFF-FARM INCOME: Finally, it is important to consider that, in addition to income from their farm and ranch operations, households of Colorado farm and ranch operators had an estimated off-farm income of \$3.4 billion in 2016, from members of the household working in other sectors of the economy. In addition, households of Colorado farm and ranch operators enjoyed home consumption of about \$16 million worth of their own crop and livestock products in 2016. Colorado farm and ranch operator households realize a \$321 million value of farm residential dwellings in 2016. Finally, for those who live and work in agriculture there is a less tangible value of the agrarian lifestyle that comes with operating a farm or ranch.



WORKFORCE: Assessing the Colorado workforce engaged in production agriculture is challenging. There are roughly three categories of those working on farms and ranches: owner-operators; employees (full time and part time); and contractors (including both skilled contractors and contracted labor).

According to the 2012 Census of Agriculture, on Colorado's 37,054 farms and ranches, there were 59,479 primary operators. Of these, 23,705 describe farming as their primary occupation, while the remaining 35,774 have another primary occupation or are retired and work on the farm or ranch as part time operators. According to the Census of Agriculture, 7,393 of the 37,054 farms and ranches in Colorado hired at least one employee, including 15,454 as full time and 23,429 as part time employees. Machine hire and custom work, repair and maintenance, and veterinary services all represent services provided under contract. Those workers would be counted in their primary occupation elsewhere. Finally, no data was found regarding the numbers working as contract labor on Colorado farms and ranches. Other sources estimate that there were 28,000 jobs in production agriculture in Colorado in 2016. Annual job growth in the farm and ranch sector was fairly stagnant, at about 1 percent. Total workforce earnings were over \$1 billion.

DOWN THE VALUE CHAIN: MARKETING, PROCESSING, AND MANUFACTURING

The vast majority of agricultural products are sold to intermediaries in the value chain who are able then to create additional value with those products, either by transporting and marketing them, by processing them, or by manufacturing products that use them as inputs. Out of a total of \$16.9 billion in sales in 2016 by Colorado agricultural commodity marketing and food and beverage manufacturing, an estimated \$7.1 billion (42 percent) were sold in Colorado and an estimated \$9.8 billion (58 percent) were sold out of state; of those an estimated \$1.6 billion (10 percent of the total) were exported.

AGRICULTURAL COMMODITY MARKETING: Commodity merchants made an estimated \$216 million in sales in Colorado in 2016. In 2016, about \$1.6 billion worth of agricultural exports from the U.S. are estimated by the USDA to have originated from Colorado.

“The vast majority of agricultural products are sold to intermediaries in the value chain who are able then to create additional value with those products.”

CROP PROCESSING: Grain and oilseeds mills sold \$344 million in 2016. Colorado ethanol plants sold an estimated \$141 million in 2016. Colorado sugar beet refineries sold \$81 million of sugar and co-products in 2016. Manufacturers of animal feeds and foods sold \$1.2 billion in 2011. Of this, livestock feeds accounted for \$592 million and pet foods accounted for \$568 million. Fruit and vegetable processors in Colorado made sales of \$315 million in 2011.

ANIMAL PROCESSING: The sales of the animal slaughter and meat packing industry in Colorado were almost \$3.4 billion in 2011. Colorado firms produced only \$13 million of tanned hides and leather products in 2016. Dairy product manufacturing firms in Colorado accounted for \$2.3 billion in sales in 2016. Of this, cheese manufacturing accounted for \$1.9 billion.

OTHER FOOD MANUFACTURING: Colorado food manufacturers of baked goods and confections sold \$1.6 billion in 2016. Colorado food manufactures across the range of other product categories not already considered sold \$1.2 billion in 2016.

BEVERAGE MANUFACTURING: Colorado beverage manufacturers sold \$5.4 billion in 2016. Of that, beer was the largest beverage manufacturing sector, at \$3.9 billion in 2016.

WORKFORCE: Almost 35,000 were employed in agricultural commodity marketing and food and beverage manufacturing in Colorado in 2016. Employment was robust, with job growth in these sectors of 17% percent between 2012 and 2016, and with total earnings of almost \$2.1 billion.

WHOLESALE

Wholesalers are integral to the marketing and logistical functions of the value chain. Wholesaling involves the marketing arrangements as well as the storage, transportation, and distribution of agricultural and manufactured food products from suppliers or manufacturers to the retail outlets where they are offered for final retail. Food and beverage merchant wholesalers had estimated sales of \$3.7 billion in 2016, although this likely underrepresents the total wholesale activity within the agricultural value chain as many of the major retailers are increasingly vertically integrated up the value chain, handling their own distributions.

WORKFORCE: Over 20,000 were employed in the commodity marketing and wholesale sectors in Colorado in 2016. Employment in these wholesale sectors is very robust, with job growth of 19 percent between 2012 and 2016, significantly outpacing a job growth of 6 percent nationally. Wholesale has the highest average earnings per job, at over \$70,000, of all of the major segments of the value chain. Total earnings were \$1.1 billion in 2017.

COLORADO CONSUMERS AND THE RETAIL END OF THE VALUE CHAIN

Colorado consumers' retail food and beverage expenditures were estimated to be \$30.1 billion in 2016, split among three broad categories: \$13.3 billion on food consumed at home, \$13.7 billion on food eaten away from home, and \$3.1 on alcoholic beverages (both at home and away from home). The five largest food retailers nationwide—Walmart, Kroger (King Sooper and City Market stores), SuperValu (Albertsons stores), Target, and Whole Foods—accounted for an estimated \$320 billion in food sales, or 47 percent of the total \$685 billion estimated annual sales of U.S. food and beverage stores (U.S. Census, 2016). We can expect a similar share of retail by these big five in the state of Colorado. Given that these retailers source their food products from all over the country and even the world, it is only reasonable that in most product categories, the vast majority of goods sold in Colorado originate outside of Colorado.

FOOD AND BEVERAGE RETAIL: Extrapolating USDA national per capita food and beverage expenditure estimates to the Colorado population we calculate that Colorado consumers spent \$30.1 billion on food and beverage in 2016. Away-from-home expenditures on food and beverage were 53 percent of the total, meaning that Colorado consumers now spend more on food and beverage consumed away from home than on food and beverages consumed at home. Based on other data sources, supermarkets and other types of food and beverage retail stores sold an estimated \$13.6 billion in 2011. Food service establishments in Colorado were estimated to have sold \$14 billion in sales in 2016. Of that, full service restaurants accounted for just over half, at \$7.2 billion.

“Colorado consumers’ retail food and beverage expenditures were estimated to be \$30.1 billion in 2016”

GREEN INDUSTRY RETAIL: Colorado’s green industry reported \$2.1 billion in sales 2016. Since 2011, the industry has grown by 24%, outpacing the economic growth of the state during the same time period by 8%. Landscaping services contributed \$1.7 billion in sales. Nursery, garden center, and farm supply stores have a contribution of \$228 million in sales. Golf courses and country clubs accounted for \$525 million.

LOCAL FOODS: Direct sales of locally grown farm products in Colorado were estimated to be \$20 million in 2012 (according to the USDA Census of Agriculture). Intermediated direct sales—those made through established retail and food service channels—are estimated to be three times this amount, or about \$60 million, but cannot be measured directly. Both of these are expected to have grown significantly since 2002. Together, direct and intermediated retail sales of local foods are less than one percent of overall food retail for at home consumption.

WORKFORCE: Over 342,000 Coloradoans are employed in the food and beverage retail, green industry retail, and food service retail sectors in Colorado. Job growth in these sectors between 2012 and 2016 was a robust 15 percent. Total earnings in these retail sectors were over \$9 billion.

PLOTTING OPPORTUNITIES FOR COLORADO FOOD AND AGRICULTURE STAKEHOLDERS

Based on the combined findings from the updated Value Chain of Colorado Agriculture as presented in this report, the survey of Public Attitudes about Agriculture in Colorado, and the community and industry town hall meetings summarized in this report, several key themes and opportunities have emerged. A rich set of industry, community, government, non-profit and academic partners are engaging in both of the following:

- historically strong agricultural production activities;
- innovative and emerging markets that seek to integrate technology, consumer preferences, and strategies to ensure that quality of life continues to be enhanced by the presence of a strong natural resource base, agricultural sector, and food environment.

However, to maintain this strong position as a national leader in agriculture and food markets, policy and development, there are remaining opportunities to invest further in moving the sector forward in the future:

1. The Colorado ag and food economy will best thrive with targeted investments and innovative models of workforce and youth development that recognizes the strong employment and entrepreneurial opportunities that will demand high skill workers and managers.
2. A growing, engaged urban consumer base creates new opportunities throughout the industry's value chain for new businesses to pilot emerging market concepts while anchor agribusiness players pivot into additional segments for which Coloradans and trade partners signal growing demand.
3. Part of the opportunity to secure new markets and provide opportunities for future entrepreneurs (including the next generation of agriculture) is to assure there is adequate infrastructure to attain the efficiency and performance to thrive in competitive global and local markets.
4. New models and markets for agriculture and food will continue to require scientifically sound translational research and commercially competitive technology transfer to address the grand challenges of providing a healthful, bountiful, and safe supply of food to growing populations of local and global consumers, all with a limited set of natural resources.
5. Given the myriad opportunities presented by changing markets and given Colorado's unique position in several key sectors of the industry, it will only become more essential that there is collaboration and communication across the food system with respect for the varying needs of stakeholders, regardless of location, size, product focus, or values. No longer can the players in the agricultural and food value chain stay within their historically defined silos if we are to leverage the shared opportunities that the entire system offers.



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INTRODUCTION: A BLUEPRINT OF COLORADO AGRICULTURE AND FOOD

1.1 THE VALUE OF A VALUE CHAIN PERSPECTIVE

The agriculture industry in Colorado is so diverse that it can be hard to grasp its full scope. And, yet, what makes up agriculture—the food, the water, the culture, the history, the open spaces—is more important to Coloradans and their quality of life than most are aware. It can be easy to take these “essentials” of the Colorado economy and the Colorado way of life for granted. They have simply always been there. Add to that the fact that most Coloradans are separated from “living on the land” by at least two generations or have moved to Colorado from other states, and we can appreciate why most Coloradans do not have a realistic view of Colorado agriculture.

Those within the industry often really only know their own sector very well, and perhaps their suppliers and customers. An appreciation of the breadth, depth, and complexity of interconnections that make up Colorado agriculture and food is important for moving the industry forward, capitalizing on emerging trends, and addressing common challenges.

Value chain analysis is an effective approach to highlight the breadth of agriculture and food as it looks at the full range of economic activities—the household decisions about food consumption that drive the whole value chain, the people and the enterprises that are engaged in production and marketing, the resources and the capital they draw upon, and the value that they create. Value chain analysis draws them all together into a common framework. The intent of this value chain analysis, therefore, is to offer a fresh look at the current status and rates of growth as well as the structure of internal linkages of the different parts of the agricultural and food sectors of the state’s economy. It enables us ultimately to understand each part within the context of the whole.

This fresh look at Colorado agriculture and food can serve as a common starting point, a common framework, a reference, and a map of the industry. It can facilitate dialogue about common resource needs and investments. Moreover, it can help in the formulation of industry, workforce, and economic development strategies and in the framing of informed policy decisions.

1.2 WHAT IS A VALUE CHAIN?

The concept of an industry “value chain” is largely common sense. It refers to the series of steps or links that turn raw materials or other inputs into final products or services, delivered to end users (Porter, 1985). In agriculture, the value chain is often summed up in the phrase “farm to fork,” but it may be important to step back and consider even further: What resources are invested in agricultural production? What happens even before the farm? Historically, all of the raw materials and inputs for agricultural production could be sourced right on the farm, including land, labor, equipment, and breeding lines. Today, many inputs are purchased off-farm, and thus the value chain extends further up to include those businesses that create value by providing inputs or services to farms and ranches. Down the value chain, the situation is increasingly complex, as agriculture serves an ever broader set of customers with an ever broader set of products and services. The adage has long been that agriculture provides “Food, Feed, and Fiber”; today it is something more like “Food, Feed, Fiber, Fuel, and Fun” and that still misses some of the important aspects of what agriculture does for society.

As the numbers of inputs and outputs has increased and as the industry has undergone specialization and diversification, the industry value chain has come to look less like a simple chain and more like a web of market and community linkages. The key to understanding this industry lies in the structure of those connections. They are what hold the web together. This is the value chain of Colorado agriculture.

1.3 OUR APPROACH TO THE VALUE CHAIN OF AGRICULTURE AND FOOD

Our approach is to consider the broader sources of value to society alongside the traditional commercial core of the agriculture and food industry. In order to do so, we need to anchor the analysis in a definition of agriculture that everyone can agree upon. Although definitions of agriculture are numerous and varied, for the purposes of this analysis, perhaps the simplest is the best: Webster's Dictionary defines agriculture as "the science or art of cultivating the soil, crops, or livestock." Of course, all can agree that this includes the production and marketing of major crops like wheat, corn, soybeans, and potatoes. There is no question that ranching cattle or sheep also constitutes agriculture. However, there are some activities—for example, managing and harvesting lodge pole pine forests or hatching trout for stocking rivers and reservoirs—which not everyone might agree are "agriculture." So, to settle the question for the purpose of anchoring this analysis, we define Colorado agriculture as the population of enterprises reported among those identified as Colorado agricultural production operations in the 2012 USDA Census of Agriculture.

Throughout this exploration of the value chain, we highlight "the Players" and "the Flows". In each part of the value chain we identify and characterize the population of players that have a role. In section 2 we look at the central players at the core of the entire value chain, Colorado farms and ranches. However, we also consider many other players throughout the rest of the sections of the report. These include all of the other types of businesses that play a role in providing inputs, services or markets to producers. We also identify and characterize various supporting organizations, including public agencies, industry associations, and community organizations. We take great efforts to consider workforce and employees, whether working on the farm or ranch, or working for the many businesses up and down the value chain. Also, crucially, we consider the population of Colorado consumers, and more broadly, the Colorado public, those who ultimately do the "valuing" of the food and beverage products, of the services and experiences, and of the broader social and environmental benefits that ultimately come from agriculture.

We also quantify and characterize "the Flows" of value among "the Players". First, we trace the flow of value to Colorado farms and ranches from providers of capital and other inputs to agricultural production. We consider the flows of value among Colorado farms and ranches. Then we trace the flow of value moving off farms and ranches and on down the chain. We account for the value of outputs from Colorado farm and ranch enterprises, including both traditional crop and livestock products as well as from other products and services. The farm gate value of most of these outputs can be gathered from USDA state level statistics on farm sector cash receipts. Further down the value chain, we account for the value of marketing, processing, and manufacturing activities down each of the major "verticals" found within Colorado, such as meat, dairy, grains, fruits and vegetables, biofuels, as far as we are able to follow them. In each case where outputs are purchased and processed in state by an agribusiness sector, we consider the value of sales and their employment profiles and even wages paid. To make the link from manufacturing, we consider the wholesale sector, and we identify and characterize the population of Colorado businesses that engage in wholesale trade, including their value of sales and their employment profiles. Finally, we characterize the direct value of agriculturally derived products to Colorado consumers based on estimated expenditures on food and beverages. These are supplemented by statistics on retail businesses, across the range of grocery, pet food, wine and beer, food service, nurseries, florists, and landscaping services, as well as purchases by consumers directly from farms. For each retail sector, again, we include sales values, employment profiles, and wages.

In Section 8, we conclude with a discussion of "The Issues". We introduce and discuss a set of cross cutting challenges and opportunities for the entire value chain of agriculture and food. These reflect the dreams and aspirations of the industry seeking to grow and thrive, as well as broader community and economic development goals.

1.4 HOW WE MEASURE VALUE

If asked, “What is the value of that loaf of bread?” it is tempting to jump to the conclusions that the value is what the price tag says, “\$3.29.” Upon further reflection, however, something seems amiss, for the value of that loaf of bread to a starving person could be much, much higher than \$3.29 if they had cash on hand but that bread was the only food they have been able to obtain for days. Alternatively, the total raw material, labor, and transport costs that went into making that loaf of bread are less than \$3.29. So is the value of the bread higher, or lower, than its price? In the end, the price at which a product sells is only one measure of its value.

At its root, the word “value” is an action verb. It requires someone to do the valuing. And the value someone places on a good or service always depends upon his or her own point of view. When we tally up the total amount paid for the Colorado’s wheat harvest by the mills that purchase it, the value—from the mills’ point of view as businesses—is actually higher than the price they paid. The value of the raw wheat to the mills comes from their ability to process it into higher value products like flour, bran, and animal feeds. The value of their output thus encompasses and adds to the value of the grain as an input.

To analyze the value-added at each link in the value chain requires a comprehensive accounting of all inputs and outputs, and each of their prices, at each link. Unfortunately, this is not feasible for all of the various markets in the industry, even for just one state like Colorado. To simplify matters, we instead fall back on annual gross revenues or cash receipts from sales (or, conversely, expenditures for purchases) as a common measure of value at each link in the value chain. And, we report all amounts in nominal terms for each year, rather than trying to adjust for inflation.

1.5 OUR OBJECTIVES FOR THIS BLUEPRINT

The mission of this Colorado Blueprint for Food and Agriculture project was to:

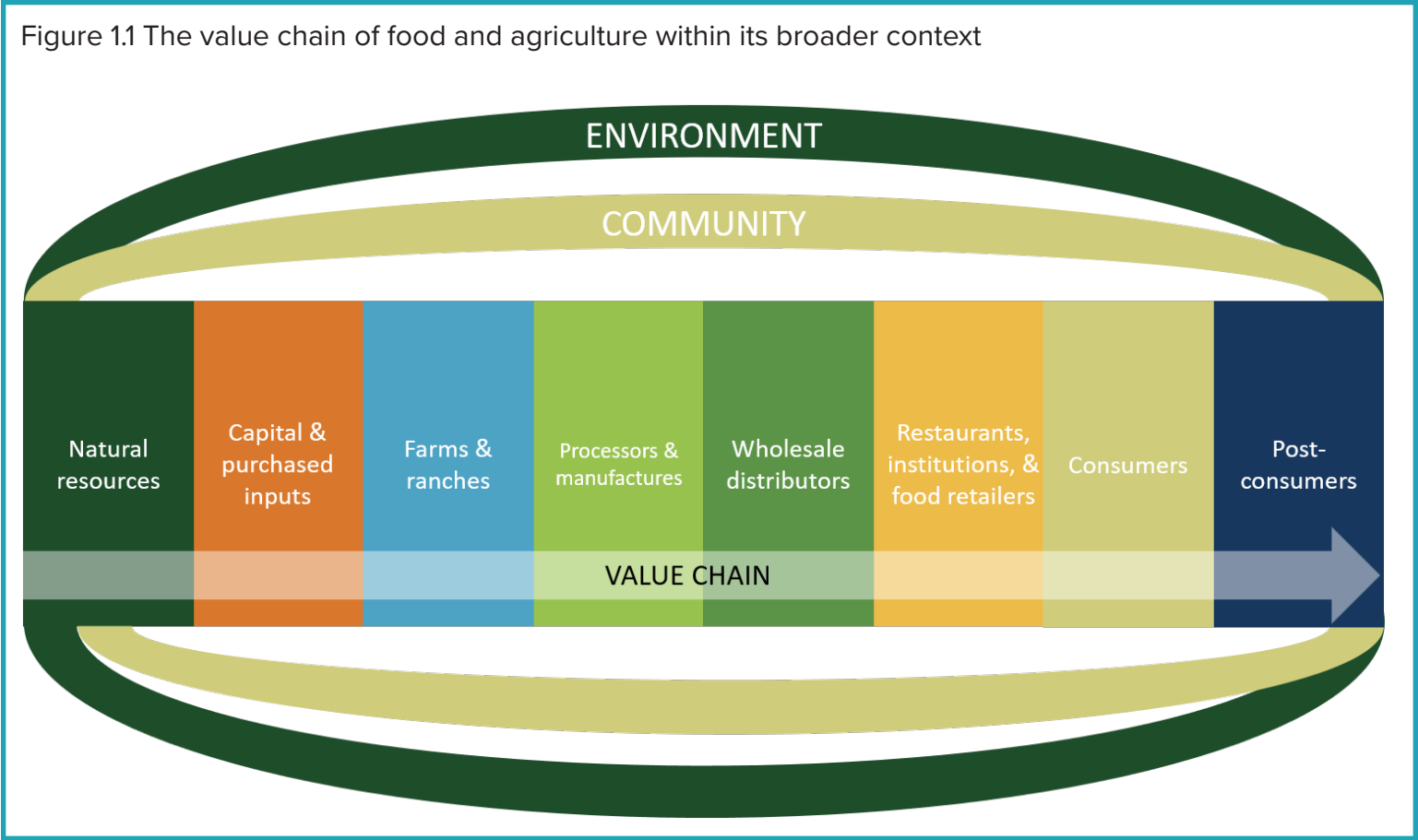
- Understand opportunities and challenges resulting from changing public attitudes;
- Assess opportunities for food system policy to address challenges and needs;
- Document, assess and highlight key linkages in the industry supply chain and infrastructure;
- Develop priorities for capacity building, investment and innovation across all of the state’s agriculture and food stakeholders;
- Enhance Colorado State University’s knowledge of Colorado-specific research and engagement needs, to support opportunities for all research and outreach units of CSU, both on and off campus.

From the perspective of the range of stakeholders in agriculture and food within the state of Colorado a broader set of cross cutting objectives were framed and explored in the Colorado Blueprint for Food and Agriculture:

1. Creating, retaining, and recruiting agricultural and food firms;
2. Developing workforce and youth to support agricultural and food sectors;
3. Promoting the Colorado brand, ensuring it reflects the unique qualities of the agriculture and food sectors;
4. Supporting a business- and consumer-friendly regulatory environment;
5. Addressing how scale impacts market performance, access, and opportunities;
6. Innovating and supporting new technology for agricultural and food businesses;
7. Improving access to resources and capital for agriculture and food firms; and,
8. Integrating agriculture and food with healthy, vibrant communities.

These broad objectives build upon a core set of six cross-cutting economic development that were laid out by the state’s Office of Economic Development and International Trade (OEDIT) in its bottom up economic development plan for the state known as the “Colorado Blueprint” and addressed for the key industry of food and agriculture in the 2013 Value Chain of Colorado Agriculture.

Looking at the value chain of Colorado agriculture in light of these broad economic and community development objectives reveals numerous challenges and opportunities overlapping across various industry subsectors.



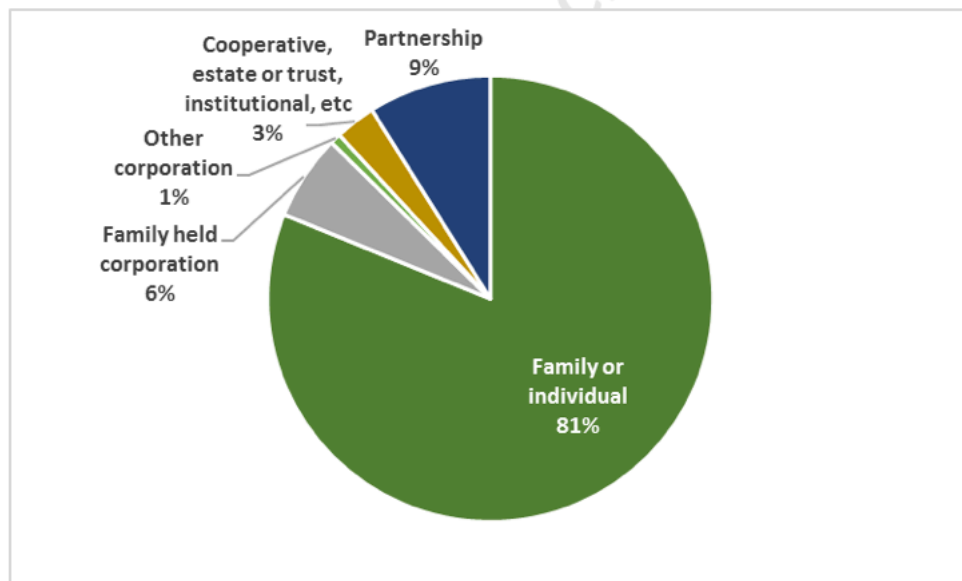
AT THE CORE OF THE AGRICULTURAL VALUE CHAIN: COLORADO FARMS AND RANCHES

At the core of agricultural value chain in Colorado are 36,180 agricultural production operations in the state—farms, greenhouse operations, ranches, and feedlots—identified in the 2012 USDA Census of Agriculture. Collectively we will continue to refer to these as Colorado’s farms and ranches. These operations define the value chain of food and agriculture, as we will be considering all of the sources of value for these businesses, in term of final products sold in the marketplace or the resources—the capital and inputs—that these operations uses in order to create products and services of value.

2.1 LEGAL FORMS OF FARM AND RANCH ENTERPRISES

Farm and ranch operations can be characterized according to type of legal or incorporated entity. The largest share of Colorado farms and ranches—87 percent—are owned and operated by families or individuals. Many of these are registered as family-owned corporations for tax and legal purposes. About nine percent of Colorado farms and ranches are registered as partnerships. Six percent are incorporated but are family held. The remaining 4 percent of operations are registered under other legal forms, such as co-operatives, trusts, or division of larger institutions, such as Colorado State University’s experimental farms (USDA-NASS, 2012 Census of Agriculture, 2013).

Figure 2.1 Legal organization of Colorado farms and ranches

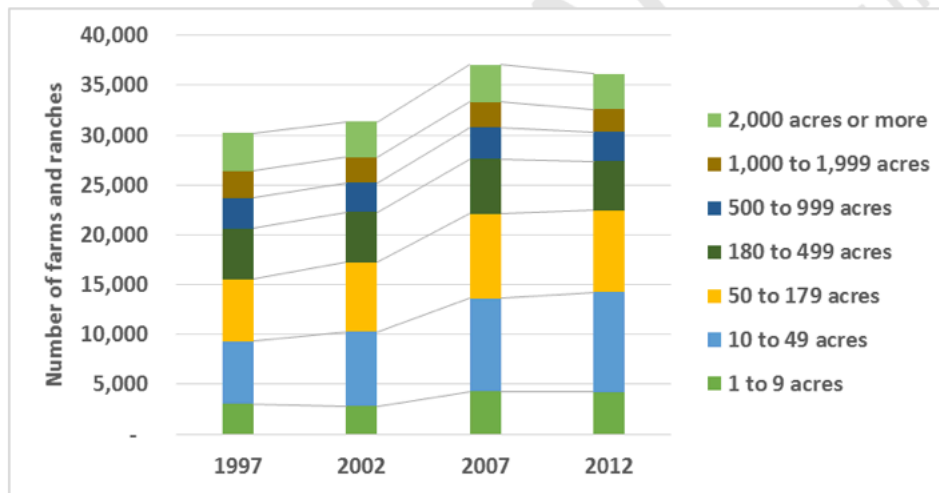


Data source: USDA NASS, 2012 Census of Agriculture, State Level Data, Colorado

2.2 NUMBERS AND SIZES OF COLORADO FARMS AND RANCHES

Colorado’s 36,180 farms and ranches work 31,886,676 acres of land (USDA-NASS, 2012 Census of Agriculture, 2013), which means that almost half (48 percent) of the state’s total land area of 66,624,000 acres is engaged in some kind of agricultural production. Colorado farms and ranches are large in terms of land by national standards: the average land size of Colorado farms and ranches, at 881 acres (up slightly from 852 from 2007), is more than twice the national average. It should be noted that the numbers of small and mid-sized operations (up to 180 acres) has increased continually from 1997 to 2012. However, overall farm num-

Figure 2.2 Number of Colorado farms and ranches by size class, 1997-2012



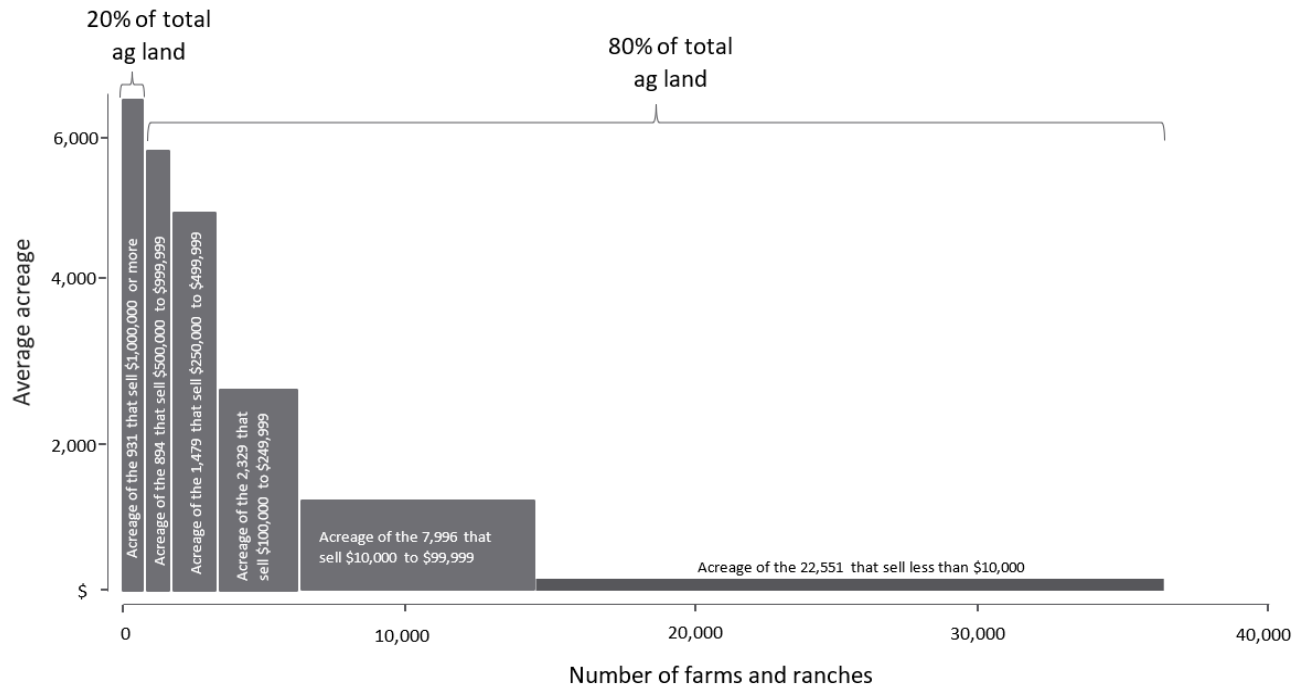
Data source: USDA NASS, 2012 Census of Agriculture, State Level Data, Colorado

bers contracted between 2007 and 2012. This recent contraction in overall farm numbers was entirely due to reduction in the numbers of larger operations (more than 180 acres) and illustrates these countervailing trends of fewer large operations alongside more small operations. Some of the implications of these trends become clear in the community conversations summarized later in this report.

Concerns are often voiced about the increasing consolidation of agricultural producers in the United States. In Colorado, there were 22,751 smaller farms with less than \$10,000 in sales in 2012, a modest increase over 2007. At the same time, the number of operations with 1,000 acres or more decreased by almost two hundred over the same period. While this is consistent with a nationwide trend toward fewer, larger farms, it is clear that smaller farms are certainly persisting in Colorado, albeit perhaps as lifestyle, retirement, or second-career options for those who see it contributing to their quality of life. Operators of these smaller farms and ranches most likely do not consider farming as full-time employment but are rather farming part-time for the lifestyle benefits. They are also more likely to be selling their produce locally, such as at farmers markets, or engaged in other revenue streams that are not as carefully measured and reported in the main agricultural revenue statistics, such as agritourism or venues for complementary enterprises such as craft trades or professional services.

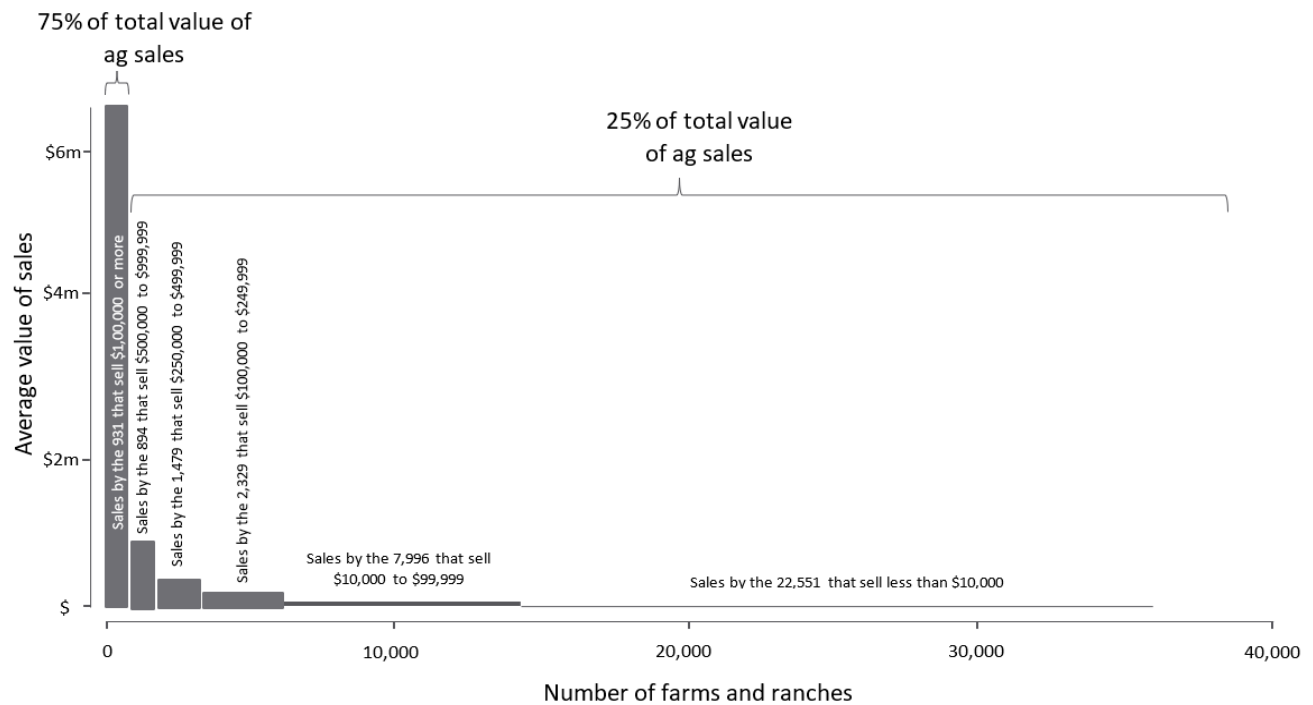
The picture comes more into focus if we look at the distribution of total acres of agricultural land and total agricultural sales across farms of different economic classes. Almost half of Colorado agricultural operations—22,551 out of the total of 36,180, or 62 percent—are very small businesses, with annual sales of less than \$10,000. These 62 percent of farms and ranches work just 13 percent of the total land in production. In between these extremes, there is a sizable middle spanning three income categories. This middle is made up of the 12,698 farms and ranches with sales greater than \$10,000 but less than \$1,000,000. Of these, 4,702 operations bring in more than \$100,000, a revenue level that is arguably large enough to make it a commercially viable business that involves at least one full time operator and able to support a typical household. A notable feature of these mid-size full-time operational categories (\$100,000-\$999,999) is that these categories utilize relatively large acreages relative to their revenue. For example, the 1,479 operations with sales between \$250,000 and \$500,000 together gross less than 1/10th of the revenues (at \$545 million) of the

Figure 2.3 Distribution of land across Colorado farms and ranches



Data source: USDA NASS, 2012 Census of Agriculture, State Level Data, Colorado

Figure 2.4 Distribution of total agricultural sales across Colorado farms and ranches



Data source: USDA NASS, 2012 Census of Agriculture, State Level Data, Colorado

largest 931 operations (at \$5.96 billion), but they utilize almost the same amount of land. Many of these operations in the middle range may be cow-calf operations, practicing extensive management on large expanses of grassland or shrub land, or they may be family farms growing large acreages of lower-yielding or lower-value dryland field crops.

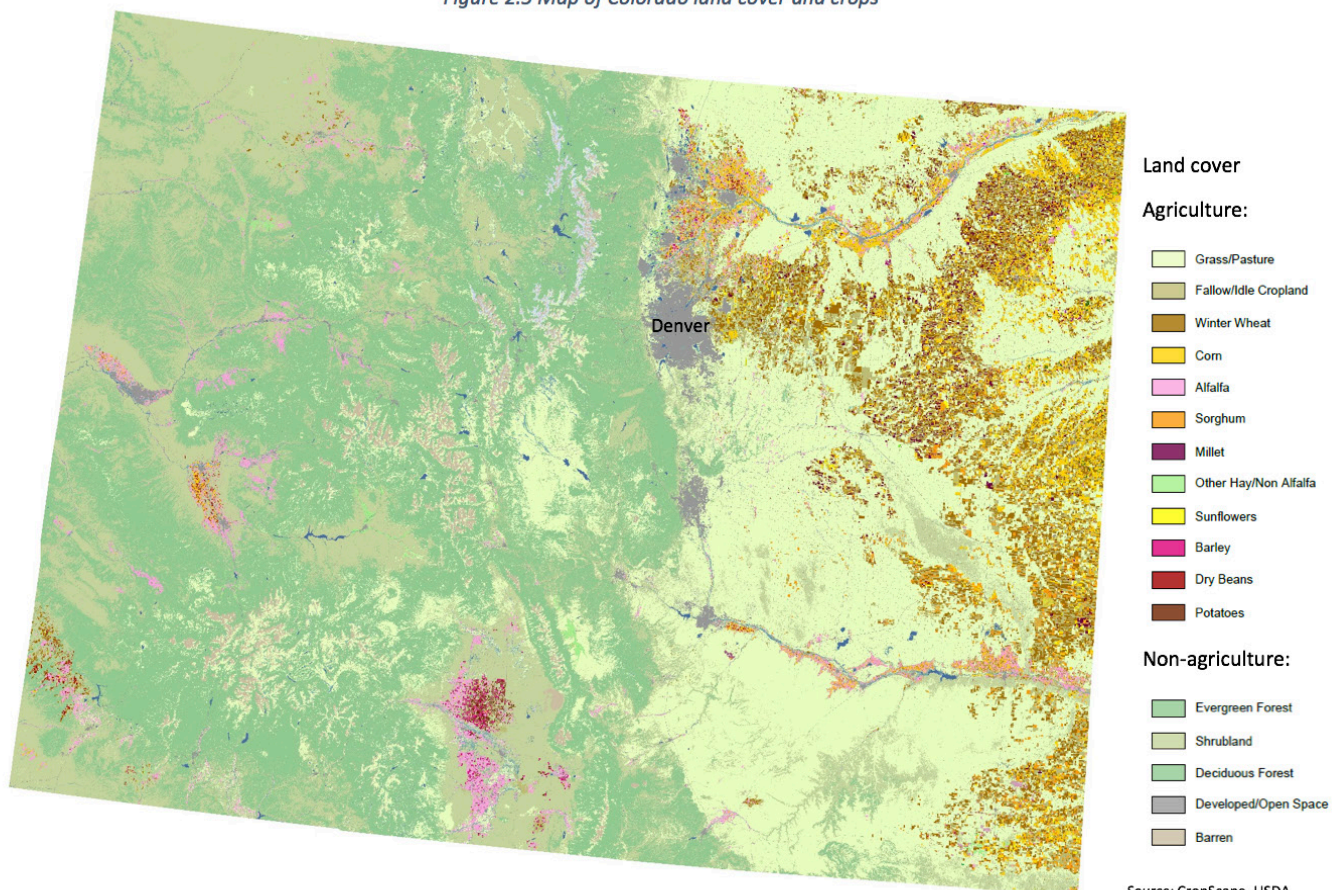
2.3 SPECIALIZATION AND LOCATION OF COLORADO FARMS AND RANCHES

Of the 37,054 Colorado agricultural operations, roughly 40 percent (about 15,000) are farms, engaged primarily in growing crops, and 60 percent (about 22,000) are ranches, feedlots, dairies, or poultry operations, engaged primarily in raising livestock or poultry.

Due to Colorado's highly variable geography and climactic zones, and particularly due to the location of water within the state's varied geography, different types of crop cultivation tend to cluster regionally within the state. Figure 2.5 illustrates quite graphically how most of the corn and wheat is cultivated along swaths of the eastern and north-central plains. Alfalfa and hay production occurs along the Platte and Arkansas Rivers valleys on the eastern plains, in the San Luis valley, along the Colorado River valley, and in other river valleys of the Western Slope and the southwest. Potato production's concentrated almost entirely in the San Luis Valley.

Cow-calf and small livestock operations are much more widely dispersed around the state, given that grasslands for grazing are abundant across the high plains, the Western Slope, and a number of the mountain valleys and high parks. Feeding and finishing of cattle is, however, concentrated near areas able to grow the necessary volumes of feed, fodder, and forage, such as along the Platte River in northeastern Colorado.

Figure 2.5 Map of Colorado land cover and crops



THE INPUTS TO PRODUCTION AGRICULTURE

What does it take to grow a crop or to raise an animal? A crop requires a field, or a greenhouse, some tools, perhaps some water to irrigate, some additional nutrients. An animal may require a pasture, fencing, shelter, water, and perhaps some additional feed. In both cases, it takes some human labor to do the work. In economic terms, all of these are considered “inputs” to production. They are valuable, and they help to create value.

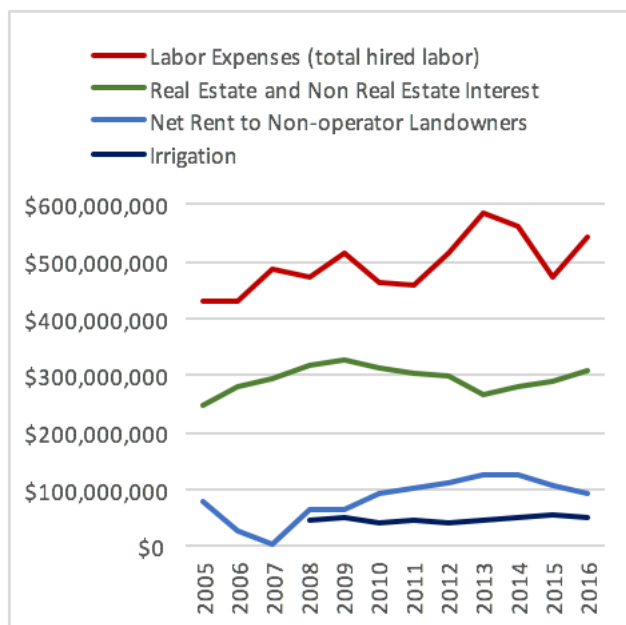
Inputs are typically categorized in a couple of different ways. Fundamentally, we can distinguish between “capital” and “variable” inputs. Capital consists of the fixed or durable things—like land or people—that may become engaged in production, but that is not consumed or used up in the process. They can be employed again next season. Variable inputs are those that get consumed in the production process, like fuel to run the tractor, or feed that the animals eat. Fresh supplies need to be procured each season.

One of the reasons we consider the “value chain” rather than the “supply chain” of agriculture, is because some inputs—both capital and variable—are not physical. We can also consider financial capital as an input, such as risk management financial mechanisms like crop insurance. Among variable inputs we can consider contracted services, such as business accounting, custom work, or transportation.

In this section we consider the source and value of each of these different types of inputs as utilized in production agriculture in Colorado.

3.1 CAPITAL INPUTS AND THE NATURAL RESOURCES WE DEPEND UPON

Figure 3.1 Payments by Colorado farms and ranches for use of additional capital, including wages for labor, interest payments on financing, and rents on land and water, 2000-2016



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

The fundamental ability of Colorado’s farm and ranch enterprises to create value derives from the capital that they employ. Capital consists of durable inputs, those things that are used, but not used up, in the process of creating value. Land, machinery, and workers are all examples. They may get tied up in producing a crop or collecting a harvest, but they are not used up. Agriculture is a very capital-intensive industry, and aspects of its capital base are quite unique relative to other industries. The human capital of agriculture has a high degree of specialization. Significant amounts of natural capital, including land and water, are required for agricultural production. In fact, the agriculture value chain can be defined as the flow of inputs and outputs that enable enterprises realize the value of this unique portfolio of capital.

Some of these capital inputs employed in agriculture—the human resources, the land, the water, and the equipment—are owned by the farm and ranch operations themselves. However, there is significant capital that is not owned by the farms and ranches that they employ in agricultural production.

Factor payments are expenditures made in order to use capital that one does not own. In this part, we considered capital owned by farms and ranches that they use in agricultural production, as well as expenditures made to access and utilize capital that they do not own. For example, if a farm operation does not own land, it can rent land to work. If an operation wants to employ someone to work, they pay a wage. If the operation needs more financial capital, they make interest payments. These are all considered factor payments.

For each of the capital inputs below, we will consider both that which is owned by Colorado farm and ranch operations, and that which is owned by others and utilized by Colorado farm and ranch operations in exchange for factor payments. We will then consider the

3.1.1 HUMAN CAPITAL

3.1.1.1 FARM AND RANCH OPERATORS

The knowledge, skill, and expertise of Colorado farmers and ranchers are perhaps the industry's single most valuable set of assets. The latest Census of Agriculture in 2012 counted 58,189 operators, including 36,180 primary operators supported by 19,104 secondary and 2,905 tertiary operators on Colorado's 36,180 farms and ranches. Of the primary operators, 17,962—or about 50 percent of the total—describe farming as their primary occupation. And, of the total 58,189 operators, 45,212 have been working their farm or ranch for at least 10 years (USDA-NASS, Census of Agriculture, 2013). These individuals thus have very deep knowledge of the land, the rhythm of the seasons, and all of the other factors that go into running a productive operation. They are the seasoned CEOs, the natural resource managers, and the master craftsmen of production agriculture. They make crucial investment, production, and marketing decisions, managing complex portfolios and operations in the face of considerable uncertainty. The experience and expertise of these individuals is what assures, more than anything else, the ongoing economic productivity and competitiveness of Colorado agriculture. Putting any sort of a dollar value on the human capital of Colorado agriculture is difficult, if not impossible. From a production point of view, the question might be framed in terms of how much it would cost to train and season another group of 58 thousand primary operators, or at least the 36 thousand full-time operators, to achieve a similar level of productivity from Colorado agriculture.

There are, however, additional potential returns that could be realized from investments in improving the human capital represented by Colorado farmers and ranchers. Much of the return on investment in human capital—whether it is public or private investment in the form of vocational training, higher education, extension services, or other forms of professional development—is typically captured by the individual. Yet, in farming or ranching the lion's share of training and professional development occurs on the job.

A LINK IN THE VALUE CHAIN

In 2016, Colorado farms and ranches paid \$542 million in salaries, wages, and benefits to roughly 38,000 full time and part time on-farm employees.

3.1.1.2 EMPLOYEES

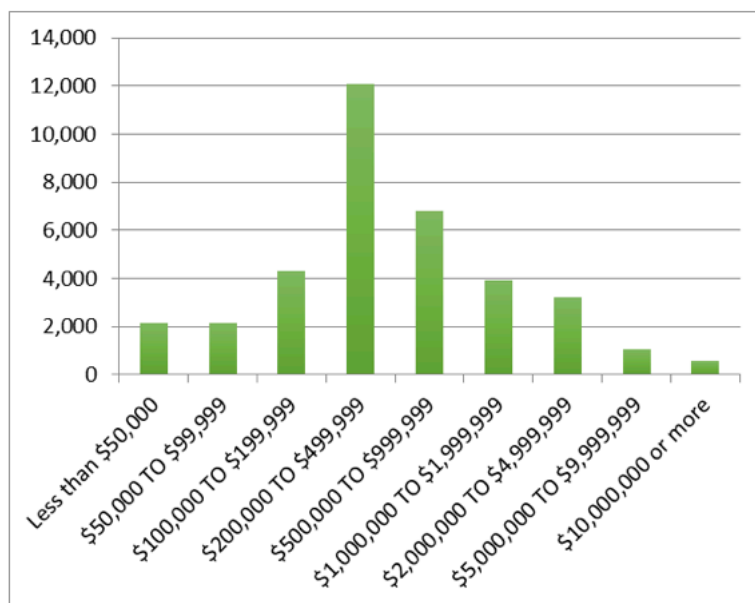
In addition to the primary operator(s) who own farms and ranches, a significant amount of additional management and labor is needed in agricultural production. Farms and ranches tap additional human capital, creating jobs in a number of ways. The most direct way is when farms and ranches hire professional operators or workers directly and pay wages and benefits to these employees. Benefits under employee compensation can include retirement savings, disability insurance, and health insurance. Thus, costs of providing these benefits can contribute to overall employee compensation.

Of the 36,180 farms and ranches in Colorado, 9,059 reported that they hire at least one employee. In fact, on 1,613 Colorado farms and ranches the primary operator is a hired manager. In the 2012 USDA Census of Agriculture, Colorado farms and ranches reported hiring 15,993 full time employees (greater than 150 days annually) and 22,026 part-time employees (less than 150 days annually).

Labor expenses make up the largest of so-called “factor payments” for use of capital owned by others (in this case human capital). The amount has increased steadily over the last decade, averaging about \$500 million (Figure 3.1).

Farms and ranches also hire contract labor via contracting services and hire specific professional services; however, since these are not considered employment relationships, they will be considered in more detail later as a category of expenditure on services.

Figure 3.2 Distribution of numbers Colorado farms and ranches by asset value of real estate owned



Data Source: USDA NASS, 2012 Agricultural Census, Value of land and buildings

3.1.2 NATURAL CAPITAL: LAND

Land is, by definition, at the very heart of agriculture. In 2012, a total of 31,886,676 acres of cropland and pasture was being used for agricultural production in Colorado. A total of 22 million acres, or 69 percent of the land in production, was owned by the farms or ranches that worked the land. An additional 9.7 million acres, or 31 percent of the land in production, was rented, and thus the asset was held by a non-operator landowner.

A LINK IN THE VALUE CHAIN: In 2016, net rent expenditures for use of agricultural land paid by Colorado farms and ranches to non-operator landlords was \$96 million.

3.1.2.1 LAND OWNED BY COLORADO FARM AND RANCH OPERATIONS

In 2012, the average value of agricultural land in Colorado was \$1,037 per acre, down slightly from \$1,046 per acre estimated in the 2007 Census of Agriculture. On a statewide basis, the average farm or ranch operation's value of land and building owned was \$1,128,277; however, the distribution of value by category reveals that the median value of land and buildings owned was less than half that, suggesting some very large operations skew the average number.

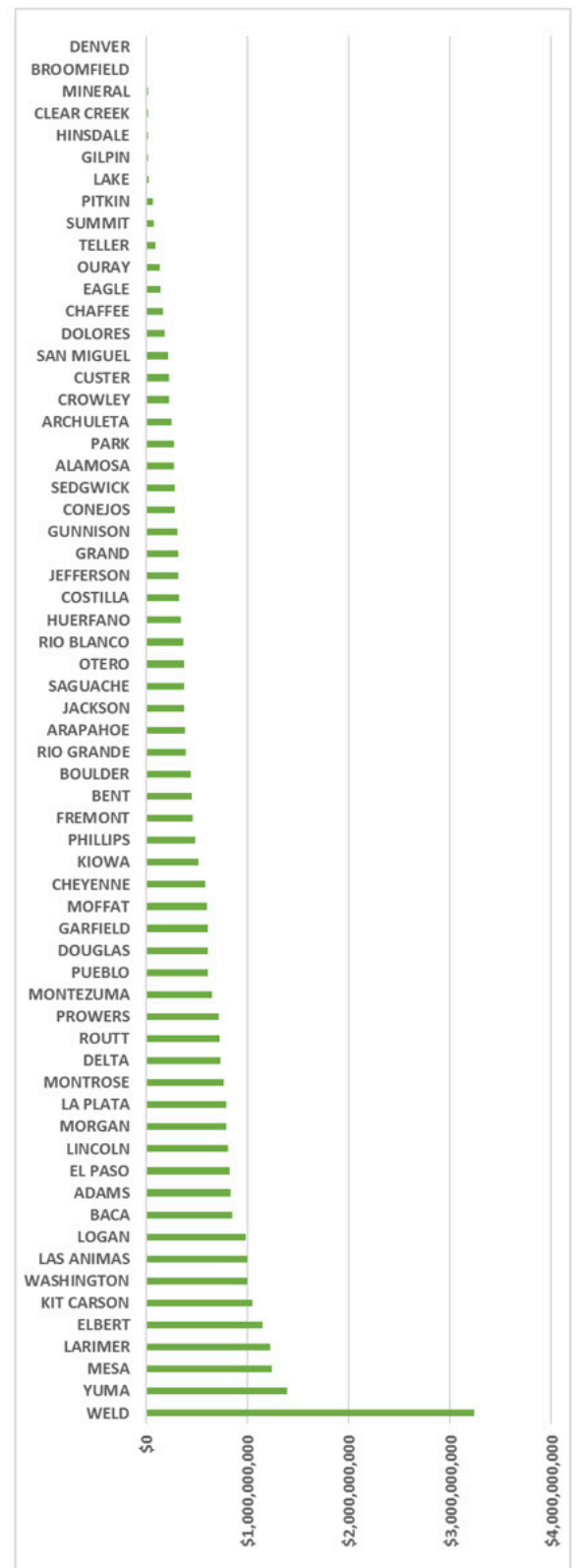
Total values of agricultural lands and buildings by county reveals that while farmland value is widespread, there is still an uneven distribution across regions because of the geographic size and different suitability for agricultural production. The highest value concentration of agricultural lands in the state by value are in Weld County, worth twice the land values in even the second runner up. At the other end of the spectrum, several counties have a very low value of land for agriculture. These include both highly urban counties (such as Denver and Broomfield) or highly mountainous wilderness regions (Mineral, Clear Creek, Hinsdale in the San Juan range in southwestern Colorado). The statewide total value of agricultural land and buildings owned by Colorado farms and ranches is estimated at \$40.8 billion (USDA-NASS, 2013).

3.1.2.2 RENTING LAND

Of the 31.7 million acres of crop land and pasture land used for agricultural production in Colorado in 2016, 9.7 million acres, or 31 percent, was rented from a non-operator by the farm or ranch enterprise that actually worked the land. These arrangements were made under seasonal or long-term contracts. As such, rent payments to non-operators are typically accounted for outside of net value-added by the agricultural sector. Net rent equals the gross rent paid to the landlord minus expenses paid by the landlord, and thus most accurately reflects the production value of the land.

Net land rental payments made by Colorado farms and ranches have averaged \$80 million over the last decade, but they have varied significantly, year on year (Figure 3.1). In 2015, net rent paid to non-operator landlords was \$106 million. This comes out to roughly \$9.60/acre, while average cash rent rates for all cropland in Colorado in 2015 were reported to be \$74.50/acre. These cash rent averages vary significantly however, from \$5.00/acre for pasture, to \$28.00/acre for non-irrigated cropland, to \$140/acre for irrigated cropland (USDA-NASS, Colorado Agricultural Statistics, 2017). This indicates that most land being rented from non-operator landlords was likely pasture.

Figure 3.3 Total value of agricultural land in Colorado counties, in rank order



Data Source: USDA NASS, 2012 Census of Agriculture, 2013

3.1.2.3 GRAZING ON PUBLIC LANDS

Federal agencies administer 24.1 million acres of federally owned land in Colorado, comprising 36 percent of the state's total land area. The two agencies responsible for the largest areas of land are the Bureau of Land Management (BLM), which administers 8.3 million acres, and the USDA Forest Service (USDA-FS), which administers 14.5 million acres in Colorado.

The primary commercial agricultural use of federal public lands is livestock grazing. Both of these agencies make land available for commercial grazing under permit. Grazing fees are set at a uniform rate nationwide by legislation and are based upon a measure called the "animal unit month" (AUM) which is the placement of one animal on the land for one month of grazing. Grazing fees have been set at \$1.35 per AUM since 2007 (Vincent, 2012).

Annual grazing fees from AUMs in Colorado, based on the most recent years that statistics are available from the respective federal agencies, are calculated to be about \$1.6 million (Table 3.1), for just over 1.1 million AUMs for cattle, sheep, and horses in Colorado. However, according to a recent analysis by the Congressional Research Service, total grazing fees collected are typically not sufficient to cover the agencies' administrative costs of the grazing program (Vincent, 2012).

Table 3.1 Grazing authorizations and animal unit months (AUMs) issued in Colorado by the U.S. Bureau of Land Management (BLM) and the USDA Forest Service, by livestock species, with calculated total grazing fees, for most recent years available

	Number of authorizations	Cattle, Yearling & Bison ^{1/} AUMs	Sheep & Goats AUMs	Horse & Burros AUMs	Grazing fees
BLM ^{2/}	1,286	279,807	61,419	3,479	\$582,551
USDA-FS ^{3/}	614	671,410	98,297	2,716	\$1,042,771
Total	1,900	951,217	159,716	6,195	\$1,625,323

1/ USDA-FS data only includes cattle

2/ latest data available is for fiscal year 2014

3/ latest data available is for fiscal year 2015

A LINK IN THE VALUE CHAIN: In recent years, annual fees paid by Colorado ranches to graze livestock on federal public lands is estimated to be \$1.6 million.

The grazing on federal lands in Colorado was conducted under 1,900 separate authorizations. It is common for one individual or one ranching operation to receive more than one authorization, thus somewhat less than 1,900 operations are utilizing public lands for grazing in Colorado.

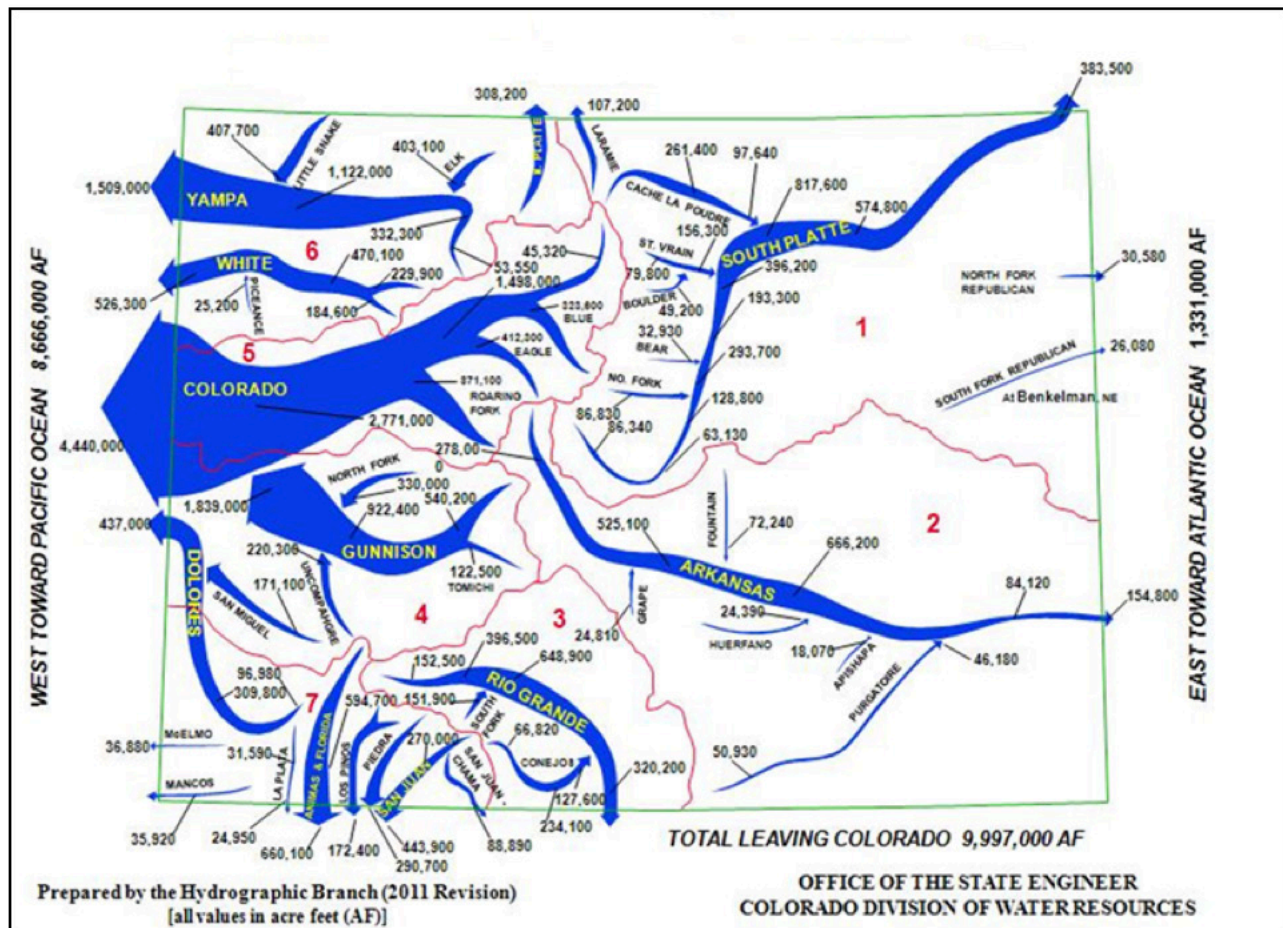
Payments of grazing fees by farm and ranch operations are entered in the USDA-ERS agricultural accounts under "miscellaneous purchased inputs." However, these payments are similar, in economic terms, to rent paid to utilize land owned by others. For this reason, we mention them here.

3.1.3 NATURAL CAPITAL: WATER

Water represents the other major type of natural-resource capital employed by Colorado's farm and ranch enterprises. In Colorado's semi-arid climate, agricultural land with only natural rainfall is not nearly as productive as irrigated land. Colorado farms and ranches have, for more than a century, invested in and benefited from diverting natural water flows to irrigate their lands, as well as from water made available because of public investment in development of water collection, storage, distribution, and irrigation infrastructure. Geographically Colorado does not receive any water flows from outside the state but, conversely, supplies water to a number of downstream states and even Mexico (Figure 3.4). Colorado is under legal obligation to allow a certain percentage of the water that originates in Colorado to leave the state for use by these others.

Of the share of annual stream flows that Colorado is allowed to use, access to water is managed within the state under a "first in time, first in right" prior appropriations system. This means that earlier claims on the water, based on the year those claims were made and/or registered with the state, have priority over claims made in later years, regardless of where along the watershed or in which watershed the claim is made. Under this system, water is held by individuals or enterprises as a usufruct right, something like a contract or an allowance to receive a specified amount of water subject to priority position, per year, in perpetuity. Given the variability of natural flows, in any year the actual fulfillment of water allocation is done in the order of historical priority of the rights. An important condition placed on a water right is that the water be put toward a designated beneficial use, and agricultural production is indeed deemed beneficial under state law. Importantly, under this system, water rights are separate from land title, and thus water rights can be sold to other users. Thus,

Figure 3.4 Map of Colorado's major river basins with historical average annual stream flows:
1. South Platte River, 2. Arkansas River, 3. Rio Grande River, 4. Gunnison River,
5. Colorado River, 6. Yampa and White Rivers, 7. Animas and Dolores Rivers



Source: Colorado Division of Water Resources, Maps and GIS Data

while deeded quite differently from land, water rights nonetheless represent an important related class of assets held and used by farms and ranches, albeit one over which property rights are not as strong or clearly defined as property rights over land.

3.1.3.1 WATER OWNED BY COLORADO FARM AND RANCH OPERATIONS

For many agricultural users in Colorado, water rights come in the form of shares in private water companies or ditch companies. The water company holds a set of prior appropriation water rights and thereby receives the amount of seasonal runoff those rights allow. Each of the shareholders in that water company then receives a proportion of the company's water allotment, according to the proportion of shares they hold in the company. For other agricultural users, water rights come in the form of well permits to pump ground water from beneath their land, under various conditions, including augmentation plans if withdrawals via those wells are deemed to affect downstream flows, and thus the water delivery to more senior downstream water rights.

Given that water rights, as a legal instrument, are in many ways different than land tenure property rights, and given that, fundamentally, water flows are transient and uncertain, water markets are more complex, less well-developed, and less transparent than markets for farm land. Also, since county property taxes are based on land values, but not on water value, data on the values of water transactions and water rights are not systematically collected in the same way as data on land sales and land values.

However, given that water is such an important contributor to agricultural productivity in Colorado, we explore three indirect ways that the value of water as an asset could be imputed, to provide some sense of the value of water as a form of natural-resource capital for Colorado agriculture.

For this study, three approaches are utilized to impute the value of water rights held by Colorado's irrigated producers. There are two sources of value for the water that irrigators own. The first is the value they could get from using water on the farm, referred to as the "use value." The second is the value they could receive by selling their water to cities, referred to as the "asset value." The first two approaches attempt to estimate the value of water rights when used in agriculture. They compare the value of the land when used for dryland farming versus irrigated farming. The third approach examines the value of water rights if producers were to sell their water to cities. The first two approaches impute the value of water rights from the effect they have on agricultural land values while the third accounts for the value of water on the water market resulting from municipal demand in addition to the effect it has on land values.

Approach 1. Land value comparison using land market sales: The first approach uses the value of irrigated and non-irrigated land as reported by USDA's National Agricultural Statistical Service (NASS), based on recent land market transactions. In this approach, the use value of water rights is identified by comparing the sales value of irrigated land to the sales value of dry land. This approach relies on the assumption that, on average, the difference between the value of irrigated and non-irrigated land is largely due to the value of water rights held by agricultural producers. In reality, reported land values likely reflect a variety of factors beyond the value of water used in agriculture, including differences in expectations associated with the development potential of the average irrigated acre compared to the average non-irrigated acre.

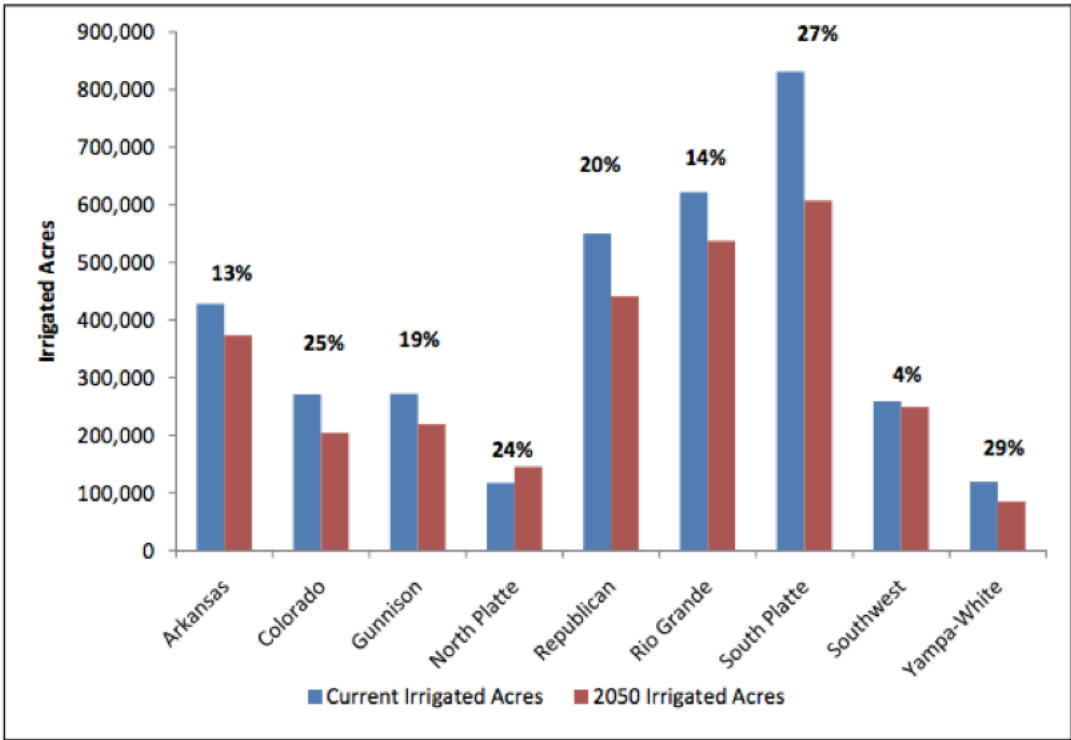
In 2015, the value of irrigated land in Colorado was \$4,650 per acre and the value of non-irrigated land was \$1,230 (USDA-NASS, Colorado Agricultural Statistics, 2016). To calculate the value of water rights in irrigation in perpetuity, we take the value per acre of irrigated land minus non-irrigated land for a value of \$3,420 per acre, resulting in a per acre-foot value of \$1,738 in perpetuity. Annualized values of water rights equal \$116 and \$59 per acre and acre-foot, respectively. Given a reported 2.5 million irrigated acres in Colorado, the use value of water rights in agriculture is \$8.6 billion.

Approach 2. Land value comparison using net landlord income: The second approach is based on a comparison of the difference between the estimated net landlord income of irrigated versus non-irrigated land. The estimates derived using this approach utilize commodity prices, 10-year average yields, soil type, land productivity, crop rotation, and carrying capacity to calculate the net landlord income earned by agricultural producers (Colorado Department of Local Affairs, Division of Property Taxation, Annual Report, 2015). This approach is intended to reflect differences in the potential productive value of the land due to irrigation and does not include any speculative value of the land, as might be included if one were to assess the value of land based on its potential price if it were to be sold for development. While this approach does not include those factors beyond the value of water rights used in agriculture, as were included in Approach 1, these values are based on estimates of productivity, as opposed to actual market transactions.

The average net landlord income of land per sprinkler irrigated acre is \$455, per flood irrigated acre is \$673, per orchard irrigated acre is \$1,010, and per dryland acre is \$103 (State of Colorado, Department of Local Affairs, Division of Property Taxation, 2015b). Estimates reflects a statewide average; in theory, if time/money was available one would calculate these estimates at the county level given the variation in values and acreage across Colorado. Similar to Approach 1, above, we take the net landlord income of irrigated land minus non-irrigated land to calculate the value of water rights used in irrigation. Resulting in a per acre value in perpetuity of \$352 for sprinkler, \$534 for flood, and \$907 for orchard, and per-acre foot values of \$179, \$271, and \$461, respectively. Annualized per acre value (and per-acre foot values) are \$12 (\$6) for sprinkler, \$18 (\$9) for flood, and \$31 (\$16) for orchard. Given a reported 2.5 million acres of sprinkler, flood, and orchard cropland in Colorado, the total use value of Colorado water rights held by agricultural producers is calculated to be \$1.1 billion.

Compared to Approach 1, the use value of water rights in agriculture is significantly lower, \$1.1 billion compared to \$8.6 billion. The smaller valuation resulting from this method, which is based on estimates of net landlord income across the two land categories, focus solely on the productive capacity of Colorado’s irrigated agricultural lands compared to the productive capacity of non-irrigated lands.

Figure 3.5 Comparison of irrigated acres in 2010 and estimated in 2050, by river basin in Colorado, with percent of estimated reduction (See Figure 3.4 for map of river basins in Colorado.)



Source: SWSI, 2011

Approach 3. Value of water rights on the market: Due to increases in population, a gap is forecasted between water demand for municipal and industrial use and available water supplies. In Colorado, population is projected to nearly double by 2050, requiring an additional one million acre-feet of water per year. Current forecasts of the Statewide Water Supply Initiative (SWSI) suggest that as much as 70 percent of the 2050 municipal and industrial water demand will be met by voluntary transfers from agriculture on the water market (SWSI, 2011).

In Approach 3, we first estimate the asset value of water rights currently in agriculture that municipalities are projected to purchase by 2050, and we then estimate the use value of the remaining water rights in agriculture based on their productive value in agriculture. The asset value of water rights held by agricultural producers today, but projected to be transferred, is based on what cities and developers are currently paying for water rights, capturing the market value of water rights including expectations of water use in urban uses. The use value of all remaining water in agriculture is based on its impact on land values following methods outlined in Approach 2 above.

Colorado's Statewide Water Supply Initiative (SWSI) estimates there are currently 3.5 million irrigated acres in Colorado. By 2050, water rights transfers, due to growth in municipal and industrial demand for water, irrigated acres in Colorado are projected to decrease by 17 percent to 2.9 million (Figure 3.4). With this, an estimated 270,000 acre-feet of water is projected to be permanently transferred out of agriculture, by 2050, to meet municipal and industrial demand (SWSI, 2011).

The current average price on the market for water rights was estimated in Colorado's Statewide Water Supply Initiative (SWSI, 2011) to be \$40,000 per acre-foot or \$78,696 per average irrigated acre, which converts to annualized values of \$1,353 and \$2,661, respectively. These values significantly exceed the productive value of water rights in agriculture found in Approach 2, above, because these market values largely represent municipal

water users' current willingness to pay for water rights, reflecting their expectations about future prices of water rights in the state of Colorado, especially along the urban corridor of the Front Range. Using this estimated market price, the total estimated asset value of the agricultural water rights projected to be sold on the market from agricultural to municipal and industrial uses by 2050 is \$10.8 billion. It should be noted that the actual prices of individual water rights vary greatly across the state, based on numerous factors including the relative flows of water in various basins (again see Figure 3.3), the relative locations of buyers and sellers, existing infrastructure, and the seniority of the water rights being bought and sold. Due to a lack of data on the actual variation in prices, we instead use the price per acre-foot estimated in Colorado's Statewide Water Supply Initiative as our best guess of an average price of water across the state.

The rest of the water projected to remain in agriculture by 2050 is assigned an asset value based on the use value of water rights as reflected in the prices of irrigated vs non-irrigated land, as in Approach 2 above. We assume the same proportion of water will come out of sprinkler and flood irrigated acres as are currently in production. Due to its much higher marginal value, we assume no water will come out of irrigated orchard acres. Per acre and per acre-foot values are defined the same as in Approach 2, with total asset value of water rights remaining in irrigated acres valued at \$270 million, for a total value of water rights in Colorado of \$11.2 billion.

Comparison and summary of the three approaches: A summary of results from all three approaches is presented in Table 3.1. The estimates derived from the three valuation techniques should be considered together—and compared—as there are clearly pros and cons associated with each approach. For each of the three approaches we present an estimate of the value of water on a weighted average basis, both per acre and per acre-foot. We also break out the annualized value and the total asset value in-perpetuity. Finally, we aggregate total asset value of water rights in Colorado agriculture associated with these three approaches.

TAKING STOCK: Our upper bound estimates place the total portfolio value of agricultural water assets at over \$11 billion.

The value of water based only on its estimated economic contribution to agricultural production (Approach 2) is just over \$1 billion. This provides a lower bound of the asset value of water rights currently in Colorado agriculture. In other words, this is what the value of those usufruct rights to future flows of water would be if the only opportunity were to keep all of the water allocated to agricultural uses. This might be a reasonable scenario if Colorado looked like other mountain west states, such as Wyoming or Montana, with small urban centers experiencing only modest growth. However, the Front Range is one of the fastest growing large metro areas in the U.S.; thus, it is not realistic to assume that water allocations will remain unchanged. This upper bound seeks to reflect a more probable pathway forward, with rights to about 17 percent of water currently in agriculture being sold by 2050 at market prices, and the remaining 83 percent valued based on its estimated economic contribution to agricultural production (Approach 3). With this transfer value, the total portfolio value

Table 3.2 Asset value of water in Colorado agriculture, estimated using three approaches

	Approach 1: based on difference in value of irrigated and non- irrigated land in recent land sales	Approach 2: based on net landlord income from irrigated versus non-irrigated land	Approach 3: approach 2 plus market value of projected ag to urban water right transfers
	<i>Annualized value</i>		
Value of water per acre	\$116	\$15 ¹	\$2,661 ²
Value of water per acre-foot	\$59	\$8 ¹	\$1,353 ²
	<i>Value in perpetuity</i>		
Value of water per acre	\$3,420	\$446	\$78,696
Value of water per acre-foot	\$1,738	\$227	\$40,000
Total value of agricultural water rights in Colorado	\$8.6 billion	\$1.1 billion (lower bound)	\$11.2 billion (upper bound)

of water assets is estimated at over \$11 billion. Our mid-level estimate, based on comparing sale prices of irrigated versus non-irrigated farmland (Approach 1), at almost \$9 billion, is closer to the upper bound. Markets valuing the water currently in agricultural production across the state of Colorado at about \$10 billion, or equivalent to about 25 percent of the value of agricultural land in agricultural production across Colorado.

3.1.3.2 RENTING WATER

Based on recent estimates of water withdrawals in Colorado, agriculture accounts for an estimated 91 percent of total surface and groundwater withdraws (Ivahnenko and Flynn, 2010) or 89 percent of consumed water in the state of Colorado. That, together with estimates that agricultural users own about 80 percent of the outstanding water rights in the state (Goemans and Howe, 2005), it follows that about 10 percent of the state’s water withdrawals may be used in agriculture under some sort of rental agreement with a non-agricultural holder of water rights.

A LINK IN THE VALUE CHAIN: In 2016, annual payments by farms and ranches for irrigation, including rent to non-agricultural water rights holders, was as much as \$53 million.

Payments of “irrigation water fees” enter the USDA’s national agricultural accounts as one of the “miscellaneous purchased inputs.” However, the largest portion of this cost likely consists of payments to use water owned by others which is similar, in economic terms, to rent paid to utilize land owned by others. Thus, we mention them here. To verify, we estimate, that the amount that Colorado farms and ranches may be paying to

rent water ranges from \$39 million a year to as high as \$114 million a year under varying realistic assumptions, with the true amount likely in the lower range, something on the order of one-third to one-half the amount paid to rent land.

3.1.4 PHYSICAL CAPITAL: EQUIPMENT AND INVENTORIES

Another major form of capital owned and utilized by Colorado farms and ranches in the course of production is physical capital, including agricultural equipment, livestock inventories, and crop inventories. Investment in physical capital can be thought of both in terms of adding or replacing units of capital (e.g. buildings, machines, head of cattle, etc.) and in terms of increasing the quality or productivity of capital. Important opportunities exist for improving the quality of the physical capital of Colorado agriculture in terms of ongoing technological upgrading of the machinery and equipment stock as well as the genetics of crop and livestock inventories. Such improvements are essential for keeping Colorado agriculture competitive in the global economy.

3.1.4.1 EQUIPMENT AND MACHINERY

Equipment and machinery asset values reported by Colorado farmers in 2012 were nearly \$3.95 billion, meaning that the average farm or ranch in the state of Colorado had about \$110,000 dollars' worth of machinery (USDA, 2012 Census of Agriculture, 2013). By 2016 the value was estimated as increasing to \$4.1 billion.

TAKING STOCK: Recent estimates place the value of equipment and machinery assets owned by Colorado farms and ranches at about \$4.1 billion.

3.1.4.2 EQUIPMENT AND MACHINERY MANUFACTURING, DISTRIBUTION AND SALES

Investment in agricultural equipment involves purchases, initially from dealers, of a manufactured good. This drives an entire branch of the value chain that includes equipment manufacturing, wholesaling, and dealers. According to industry sector estimates, irrigation system vendors, agricultural equipment manufacturers, and farm equipment wholesalers had an estimated \$697 million in sales in Colorado in 2016. They accounted for over 5,200 jobs and \$225 million in earnings in 2016. Not all of these sales necessarily went toward renewing the physical capital stock of Colorado's farm and ranches. A significant share of these equipment sales may have been made to a variety of other sectors including home gardeners, landscaping services, as well as commercial or public park landscaping.

3.1.4.3 CROP INVENTORIES

Crop inventories include crops currently in the field, thus representing forthcoming harvests, harvests held in storage for sales or delivery at a future date, harvests held in storage for use on farm as livestock feed, and seed stocks held in storage for replanting. Following Davies et al (2011) to estimate Colorado's share of national accounting of the total value of crop inventories held by farms and ranches in 2016 at \$1.1 billion. Purchases of seed and nursery stock—and the branches of the value chain providing these inputs to on-farm crop and livestock capital inventories—will be considered in greater detail later in this report.

TAKING STOCK: Recent estimates place the value of crop inventories owned by Colorado farms at about \$1.1 billion.

Table 3.3 Farm equipment manufacturing and sales: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
221310	Water Supply and Irrigation Systems	154	\$109,276,794	\$128,583,846	18%
333111	Farm Machinery and Equipment Manufacturing	16	\$141,100,641	\$126,259,742	-11%
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	2	\$95,333,364	\$108,130,669	13%
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers	184	\$224,637,630	\$334,368,084	49%
TOTAL		356	\$570,348,429	\$697,342,341	22%

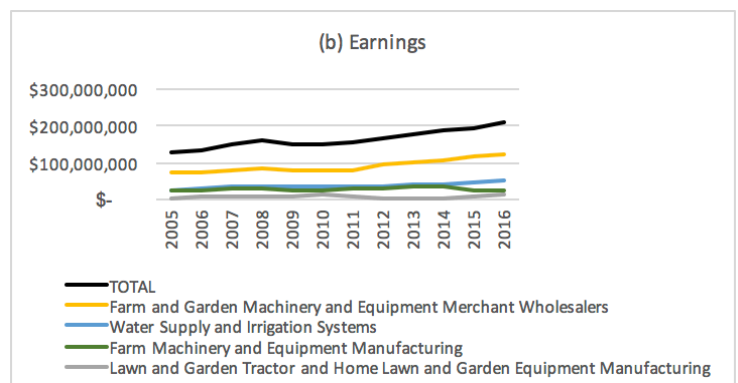
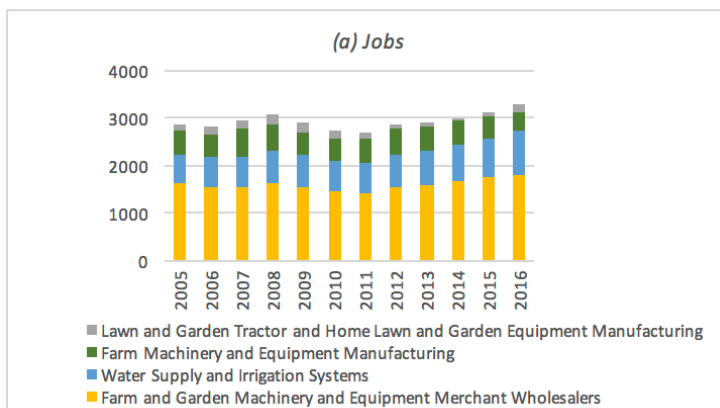
NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Total Earnings ^{/2}
221310	Water Supply and Irrigation Systems	1.14	912	\$64,083,661
333111	Farm Machinery and Equipment Manufacturing	0.39	415	\$25,224,206
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	0.43	134	\$12,099,254
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers	0.97	1,809	\$124,282,297
TOTAL			5,286	\$225,689,418

Data source: EMSI, 2018

^{/1} Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

^{/2} Total earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 3.6 Farm equipment manufacturers and distributors: (a) jobs and (b) earnings in Colorado, 2005-2016



3.1.4.4 LIVESTOCK INVENTORIES

Livestock inventories can also be considered a form of physical capital. Animals are, of course, able to reproduce, thus replenishing the productive stock. Inventory values as reported in or estimated from average prices in Colorado Agricultural Statistics (NASS, 2017) are as follows:

- Cattle: With 2.7 million cattle and calves (of which 5 percent are active milk cows and 33 percent are cattle on feed), at \$1,490 per head, total value of inventory is estimated at \$4.0 billion.
- Hogs and pigs: With 670,000 hogs in 2016, a total value of inventory is estimated at \$40 million.
- Sheep and lambs: With 435,000 sheep and lambs, at \$206 per head, total value of inventory in 2016 is estimated at \$90 million.
- Chickens: With 6.2 million birds of which 76 percent were layers, at \$2.50 per chicken, total value of inventory in 2016 is estimated at \$15.4 million.

Purchased animals, in-shipments from out of state, and the dynamics of herd populations will be considered in more detail in later sections of this report.

TAKING STOCK: Recent estimates place the value of livestock inventories owned by Colorado farms and ranches at about \$4.1 billion.

3.1.5 FINANCIAL CAPITAL

Financial assets and debt make up the final major class of capital held and utilized by farms and ranches. Financial investments and debt are not only a means for acquiring land or physical capital to be utilized in agricultural production, but they are, perhaps even more importantly, key components of an integrated strategy—alongside government programs, crop and business insurance, and careful utilization of purchasing and marketing contracts—for managing the financial risks of operating a business that is highly exposed to the vagaries of agricultural markets and natural conditions.

The financial assets of farms and ranches include accounts receivable, certificates of deposit, checking and savings balances, and other financial assets of the farm or ranch business. According to estimates Colorado farm and ranches held \$434 million in financial assets in 2017. Financial liabilities include real estate and non-real estate loans. According to estimates, Colorado farm and ranches held \$4.5 billion in debt in 2017, with a slightly greater share in real estate compared to non-real estate loans.

3.1.5.1 INTEREST PAYMENTS FOR ACCESS TO FINANCIAL CAPITAL: THE FARM CREDIT SYSTEM AND COMMERCIAL LENDERS

As in any line of business, farm and ranch operations may find it economically necessary and advantageous to borrow money to start a new business, to expand, or to make major capital investments to increase profitability. The United States has a well-developed system for providing credit to agricultural producers that recognizes the unique economic risk profile of farming or ranching as a business. The agricultural finance system consists of a blend of federal, state, cooperative, and private financial institutions.

TAKING STOCK: Recent estimates place the value of livestock inventories owned by Colorado farms and ranches at about \$434 million.

The Farm Credit System (FCS) in the United States consists of cooperatives that are owned by member farmers and operate under federal regulatory oversight and financial backing. In Colorado, lenders that are part of the Farm Credit System include American AgCredit (based in Santa Rosa, California, and serving farmers in six western states, including Colorado), Farm Credit of Southern Colorado (based in Colorado Springs, Colorado), and Premier Farm Credit (based in Sterling, Colorado). CoBank, based in Denver is one of the leading wholesale providers of financing to the Farm Credit cooperatives throughout the country. The Farm Credit System has a long history of lending to farms and ranches, but its share has grown since the farm debt crisis of the 1980s, and now holds about 40 percent of the farm sector's debt (Patrick and Kuhns, 2016).

Many commercial banks have agricultural lending divisions. Table 3.4 lists the largest nationally. These consist of three different types. First are very large national banks, including household names such as Wells Fargo, Bank of America, U.S. Bank, or Citibank. Their lending operations are very large, and therefore farm loans make up less than one percent of their loan portfolios. The second are specialized national agricultural lending institutions, including Rabobank and John Deere Financial. Given their specialization, farm loans make up 50 percent or more of their portfolios. The third are regional banks with substantial farm lending, such as Bank of the West, Bank of Colorado, and First National Bank of Omaha. Their farm loan concentration ranges between 5 and 25 percent, but some may go much higher. We do not have a breakout of lending activities within just the state of Colorado, these figures on the top private farm lenders for the nation should be representative of the top commercial agricultural lenders in Colorado. Nationally, commercial bank lending has held fairly steady, accounting for between 40 and 45 percent of the farm sector's debt over the last two decades.

Other sources of lending to farms and ranches include the Farm Service Agency (FSA) of the U.S. Department of Agriculture, which makes loans under a variety of programs, including ownership loans, operating loans, emergency loans, guaranteed loans, and targeted loans for beginning farmers, minorities, women, and youth.

Table 3.4 Top 20 private farm lenders in the United States by dollar volume, 2017

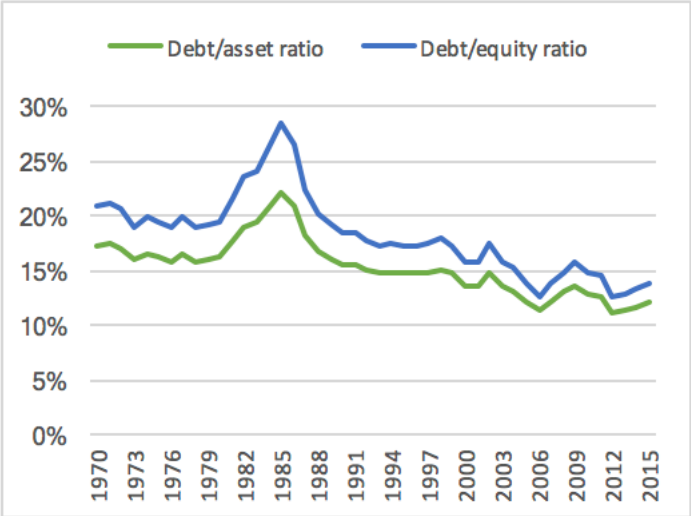
Bank	Headquartered	Total U.S. Farm Loans	Farm Loan Conc.
1. Wells Fargo Bank	Ogden, UT	\$7,772,000,000	0.8%
2. Rabobank	Roseville, CA	\$4,634,000,000	45.7%
3. Bank of the West	San Francisco, CA	3,879,440,000	5.3%
4. Bank of America	San Francisco, CA	2,713,000,000	0.3%
5. John Deere Financial	Madison, WI	2,286,248,000	80.4%
6. Great Western Bank	Sioux Falls, SD	2,174,049,000	23.7%
7. U.S. Bank	Cincinnati, OH	2,004,191,000	0.7%
8. Bank of Colorado	Fort Collins, CO	1,733,991,000	23.1%
9. First National Bank of Omaha	Omaha, NE	1,649,774,000	10.9%
10. BMO Harris Bank	Chicago, IL	1,282,246,000	1.8%
11. Bremer Bank	St. Paul, MN	1,204,351,000	14.8%
12. Citibank	Sioux Falls, SD	1,042,000,000	0.2%
13. FNB Bank	Danville, PA	931,167,000	5.9%
14. Dacotah Bank	Aberdeen, SD	901,395,000	45.6%
15. Chase Bank USA	Wilmington, DE	895,745,000	0.1%
16. Branch Banking and Trust Co.	Winston Salem, NC	887,000,000	0.6%
17. United Bank of Iowa	Ida Grove, IA	853,281,000	75.2%
18. KeyBank	Cleveland, OH	818,902,000	0.9%
19. Bank of Rio Vista	Rio Vista, CA	795,537,000	34.6%
20. Stockman Bank of Montana	Miles City, MT	744,130,000	31.0%

Data Source: American Banking Association, Top 100 Farm Lenders Ranked by Dollar Volume, 2017

The Colorado Agriculture Development Authority also has a beginning farmer loan program, run in conjunction with private lenders. These and other smaller lenders make up the remaining approximately 20 percent of farm sector debt.

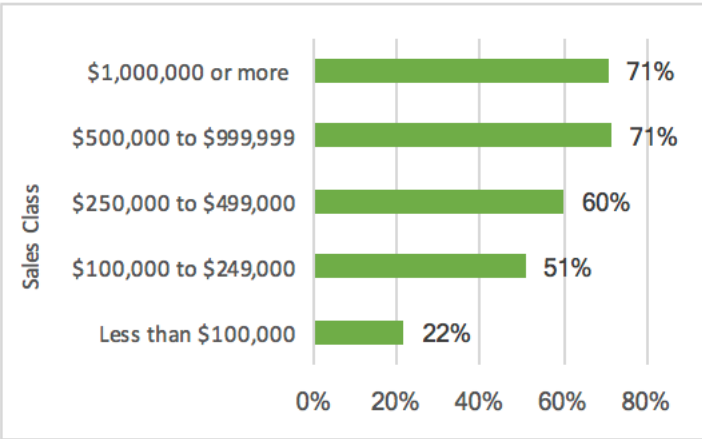
Nominally, the amount of debt held by farm and ranch operations has been increasing; however, according to analysis by the USDA Economic Research Service, nationally, farms and ranches are not overly indebted. In fact, under recent economic conditions the sector has had some of the lowest debt-to-asset and debt-to-equity ratios reported over the last half century (Figure 3.7). The distribution of farm debt is not uniform across sales classes of farm operations. Only 22 percent of farm and ranch operations with sales less than \$100,000 have debt, while 71 percent of operations with sales over \$500,000 have debt (Figure 3.8).

Figure 3.7 National farm sector financial ratios for the United States, 1970-2015



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Farm Sector Financial Ratios

Figure 3.8 Proportions of farm and ranch enterprises with debt, by income class, 2015



Data source: USDA, ERS ARMS Farm Financial and Crop Production Practices, Tailored reports: Farm Structure and Finance

Larger operations with a greater asset base and higher revenues have a larger debt repayment capacity and thus tend to acquire more debt. Operations that are more capital intensive, like dairy, poultry, and hog, also use a significantly higher amount of their debt capacity. The age of the operator and years on an operation are also key factors, being inversely related to the amount of debt taken on: The older the operator or the more years he or she has been with an operation, the less debt they tend to hold.

Colorado farms and ranches make roughly equal interest payments on debt secured by real estate and on debt not secured by real estate. While total amounts have fluctuated over the last decade, this 50-50 proportion has remained fairly stable. In 2016, total interest payments by Colorado farms and ranches were \$307 million.

A LINK IN THE VALUE CHAIN: In 2016, Colorado farms and ranches made interest payments of \$307 million (on debt liabilities of approximately \$4.5 billion) to private and public lenders.

3.1.6 THE BALANCE SHEET OF COLORADO AGRICULTURE

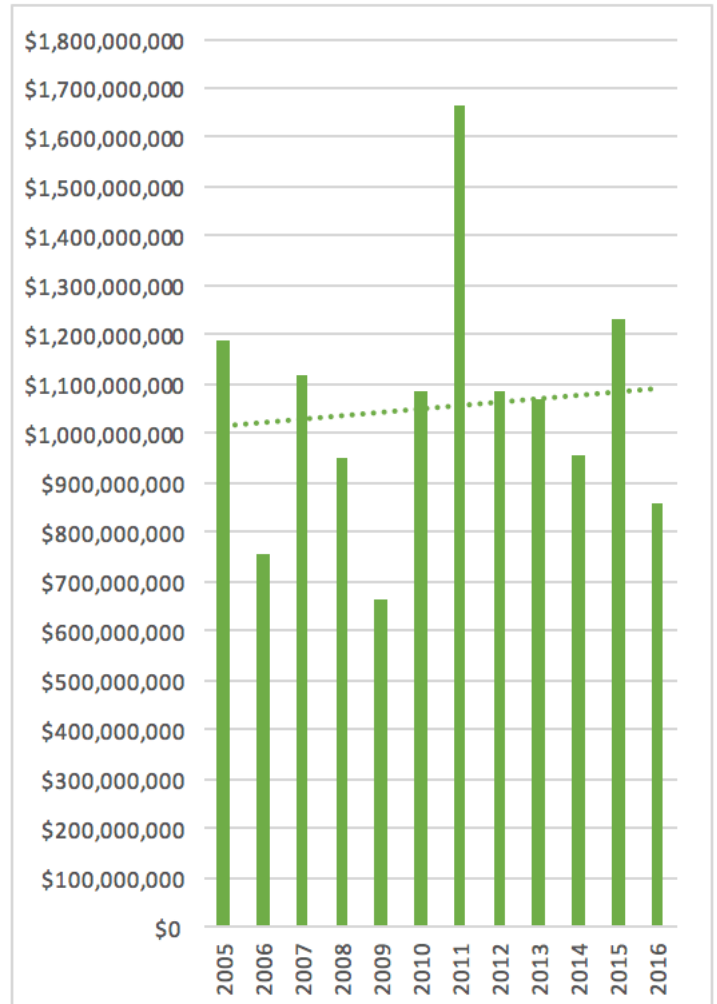
To summarize these asset and debt estimates from various sources, estimated for 2017 based on national level farm sector accounts from the USDA, we can piece together a balance sheet that gives a general snapshot of the financial health of Colorado's farm and ranch sector (Table 3.5).

Table 3.5 The balance sheet of Colorado farms and ranches

Category	2017 estimates	Asset and liability compositions
Farm assets ^{1/}	\$54,828,000,000	100%
Land and buildings ^{2/ 3/}	\$45,934,000,000	83.8%
Machinery and vehicles	\$4,100,000,000	7.5%
Livestock inventory ^{4/}	\$3,384,000,000	6.2%
Crop inventory ^{5/}	\$881,000,000	1.6%
Purchased inputs	\$96,000,000	0.2%
Financial assets ^{6/}	\$434,000,000	0.8%
Farm liabilities ^{1/}	\$4,524,000,000	100%
Non real estate ^{6/}	\$2,013,000,000	44.5%
Real estate	\$2,511,000,000	55.5%
Farm Equity	\$50,304,000,000	

1/ Commodity Credit Corporation crop loans were excluded from both assets and liabilities.
 2/ The value of operators dwelling and any associated liabilities were included if the dwelling was located on the farm.
 3/ The value of water rights are assumed to be fully capitalized into land prices. To the extent they are not, this is an underestimate of asset values.
 4/ Values are inflation adjusted using prices received by farmers for livestock and for crop inventories.
 5/ Includes accounts receivable, certificates of deposit, checking and savings balances, and any other financial assets of the farm business.
 6/ Non-real estate debt is all debt not secured by farm real estate, including loans for the purchase of machinery and livestock, and seasonal production loans.
 Data source: USDA-ERS, U.S. farm sector financial indicators, 2011-2017F; State specific shares adapted from Davies et al (2011).

Figure 3.9 Net returns to Colorado farm and ranch operators, 2005-2016, with fitted trend line



Data source: USDA-ERS, Farm income and wealth statistics, Returns to operators

TAKING STOCK: In 2017, farm equity for Colorado operations (assets net of liabilities) was estimated at \$50.3 billion. Annual net returns for the sector over the decade averaged just over \$1 billion.

3.2 VARIABLE INPUTS TO PRODUCTION AGRICULTURE

Colorado farms and ranches had almost \$6 billion in production expenses in 2016. These expenses vary significantly, but each area of expenses made by farms and ranches represents a branch of the value chain, into an area of economic activity that generates value for Colorado agriculture. While there is no reason to think that all of the expenses paid by Colorado farms and ranches stay in-state, given the geographical nature of agricultural production, there is high likelihood that many of the expenditures made by Colorado farms and ranches go for goods and services provided by businesses and individuals that are also located in Colorado.

The values reported in this section draw primarily from annual USDA estimates of farm cash receipts and production expenditures developed by the USDA Economic Research Service (ERS) based on data from the USDA National Agricultural Statistical Service (NASS). Various versions of the data series are available online, including the USDA-ERS Farm Income and Wealth Statistics data series and in the annual publication of Colorado Agricultural Statistics by the NASS Colorado Field Office in collaboration with the Colorado Department of Agriculture (USDA NASS, Colorado Agricultural Statistics, 2016).

3.2.1 AGRICULTURAL INPUTS PRODUCED IN THE FARM SECTOR

Some of the inputs used in agricultural production, such as seed, feed, or young livestock, by their very nature are produced on a farm or ranch. Likewise, some services, such as machine hire and custom work, are provided for hire by nearby farm operators. In such cases, the value of expenditures by the farm or ranch enterprise, making the purchase counts as the value of revenue to the farm or ranch selling the product or service. We will go ahead and account for such expenditures, but also, the corresponding revenues will be counted separately later on in order to trace when and where such value flows internally within the production agriculture segment of the value chain.

3.2.1.1 PURCHASED SEED

Depending upon the crop, seed may be saved from year to year, may be purchased new, or may be obtained through a combination of seed saving and purchases.

The state's seed certification program is intended to regulate the quality and genetic purity, and thus ultimately the productivity and value, of the state's seed stocks. Seed that is saved and used on-farm is typically considered to be of the lowest quality, and is thus considered uncertified seed. At a typically somewhat higher cost, farmers can purchase certified seed, which is produced under inspected conditions on a seed farm from more carefully controlled stocks of registered seed. Registered seed is produced and disseminated by seed companies or under contract by specialized seed farms from foundation seed, the genetic stock that constitutes and defines a given variety. (Erker and Brick, 2014.)

Whether a farmer saves some of the harvest from a previous year to replant depends upon the biology of the crop and other factors. According to Scott Haley, wheat breeder at Colorado State University, as much as two thirds of the annual Colorado wheat crop is planted with saved seed. When a farmer does decide to purchase new seed, it may be in order to achieve a variety of goals including: to adopt new genetic varieties, to improve the genetics in their inventory, or simply to save costs by purchasing fully conditioned and prepared seed rather than storing and preparing his or her own seed.

In some cases, seed companies have begun using sales contracts that bind farmers legally against replanting proprietary seeds. This is particularly true for biotech varieties like Roundup Ready soybeans or Bt corn. In some crops, biology simply dictates the purchase of new seed each year. If the crop is a hybrid variety (as is most corn) or does not produce viable seeds (as with some fruits and vegetables) farmers need to acquire

new seed each year. Virtually the entire Colorado corn crop is planted to hybrid seeds purchased each year. In most crops, the breeding and development of new varieties is done by specialized breeding programs. These may be in either the public sector or the private sector. For those markets in which farmers are more likely to save and replant seed, and therefore annual sales are smaller, breeding tends to be a public sector activity. For example, Colorado State University manages breeding programs to support both the wheat and potato sectors. For those markets in which farmers need to buy seed each year, and thus annual sales are larger, crop breeding and seed development tends to be done by private seed companies. For example, hybrid corn is almost entirely developed by private companies.

Seed for some crops are serviced by both public and private breeding programs. Regardless, today, the varieties resulting from both public and private breeding programs tend to be proprietary, in the sense that they are registered with the USDA's Plant Variety Protection office or they are patented. Only older varieties and some releases of foundation seed from public breeding programs in minor crops are truly "public" (i.e. non-proprietary) such that farmers may simply use and propagate them without any sort of royalty payments.

Seed farms specialize in growing and harvesting seed for sale to farmers. When farmers make payment for seed, some of the value goes to the seed farm that undertook production. If seed brokers or retailers are involved, they will take a share of the value as commission or fees. When seed farms grow and sell non-proprietary varieties, there are no additional royalty costs above and beyond their costs of production. However, when producing and selling proprietary seed varieties (i.e. those under Plant Variety Protections or patent), it is typically done under contract with varying degrees of control by the seed company or breeding program that developed and owns that variety. A portion of the value of the seed sale is paid back to the seed company that developed and registered the variety as royalties on their proprietary genetics.

A LINK IN THE VALUE CHAIN:
In 2016, Colorado farms paid seed farms and seed companies \$195 million for seed.

For over 50 years wheat varieties have been developed for Colorado wheat farmers by the Colorado State University Wheat Breeding and Genetics Program. Over 30 new varieties have been developed and released under this program. Today over 60 percent of Colorado's 2.6 million acres of wheat are planted to CSU varieties. Wheat varieties released by CSU are made available to farmers under a royalty collection partnership with the Colorado Wheat Research Foundation and the Colorado Wheat Board. The royalties collected help to underwrite to cost of the program at CSU. A recent analysis found that, overall, CSU wheat varieties have increased wheat yields by 7.33 bushels per acre and thereby contribute nearly \$15 million a year. Yet, the program only costs about \$3 million a year to run. (For more information see Mortenson, Pendell, Parsons, and Haley, An evaluation of Colorado State University's Wheat Breeding Program, 2012).

While most major seed companies are located outside of Colorado, several have operations located in Colorado. Cargill has an R&D center for its oilseeds business located in Fort Collins. Limagrain, a large European seed company, also has operations in Fort Collins. Crop Production Services (CPS), a subsidiary of Nutrien (formerly Agrium), with U.S. headquarters located in Loveland, Colorado, produce and market their own lines of corn, soybean, and wheat seeds in Colorado and across North America.

3.2.1.2 PURCHASED FEED

Many crops are specialized for use as animal feed, while others are used both for human and animal consumption, with certain varieties favored for certain uses. Most livestock producers and dairies grow at least a portion of what they feed their animals. Seldom, however, are they self-sufficient, nor are they neces-

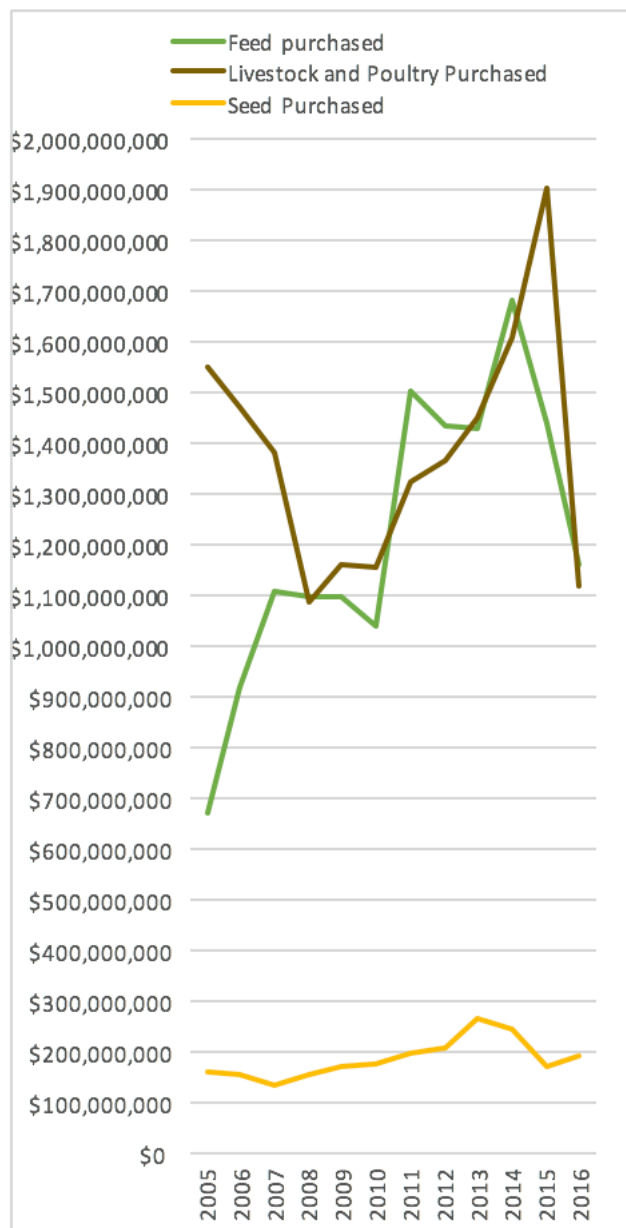


Figure 3.10 Farm and ranch expenditures on purchased goods produced in the farm sector, including feed, livestock, and seed.

Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

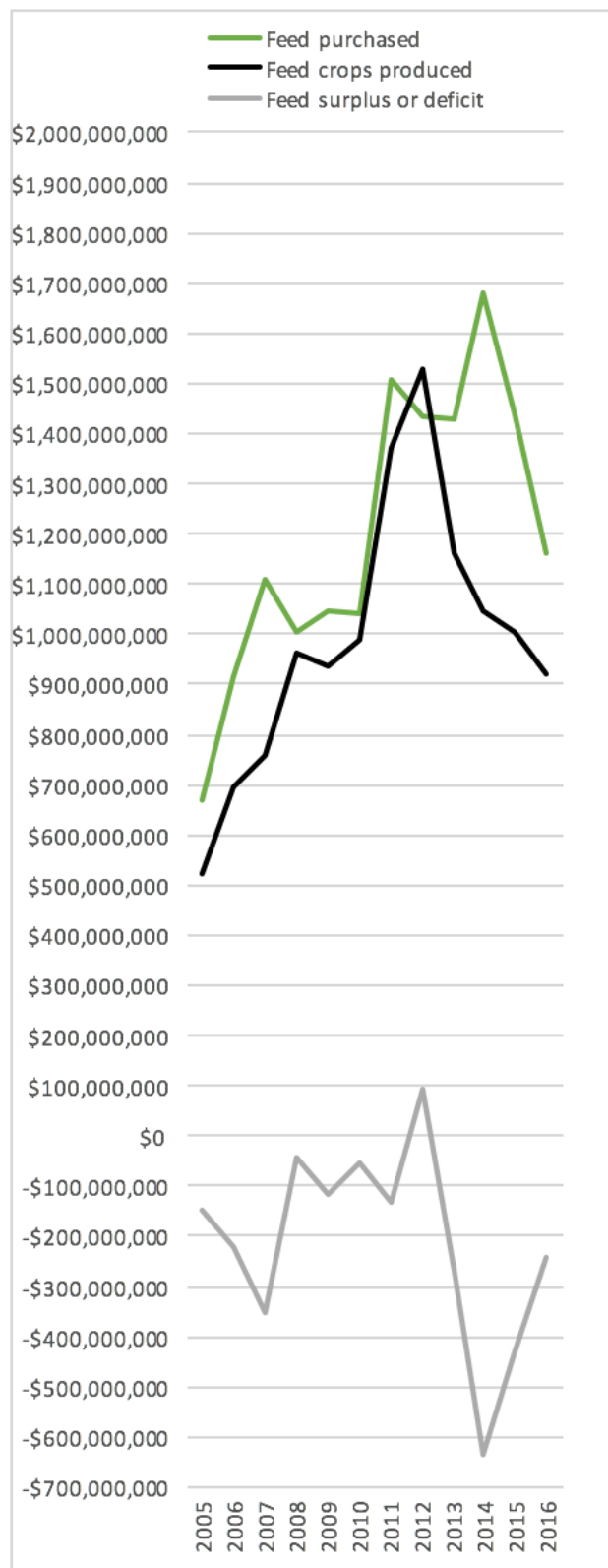


Figure 3.11 Difference between value of feed purchased and value of feed produced in Colorado

sarily able to competitively produce all of the nutritional inputs they need to keep their animals healthy and productive. Specialized livestock operations, including cattle feeders and poultry producers, may grow little or none of their own feed. Thus, livestock producers are one of the largest classes of buyers of crop commodities. Livestock feeding uses the following:

- The entire hay and alfalfa crops.
- All of the sorghum crop, as both silage and grain.
- In Colorado, 70 to 80 percent of the corn crop, as both silage and grain.
- Large shares of the barley, oat, and rye crops.
- Some of the wheat crop.

Given the size of Colorado's livestock sector, farms in the state simply do not produce as much feed as required. This is indicated by the historical difference between value of feed purchased and feed crops produced in the state (Figure 3.11). Some of this difference in value is, of course, due to middlemen such as brokers and auction houses taking a share of the purchase price as profits, commissions, or fees. Also, in some feed grain categories, value is added by feed processors or cooperatives that obtain the commodity from farmers at one price and sell a processed or blended feed product at a higher price reflecting its greater nutritional value as feed. However, these markups do not make up the full value difference between production and purchase.

Colorado's feed deficit is made up by purchasing feed from neighboring states such as Kansas and Nebraska. Feed costs continue to make up a large share of Colorado livestock producers' total costs. An underlying issue in expenditures toward feed and fodder has been volatility in commodity, and thus feed prices over the last decade. Drought was an important driver of the extreme jump after 2010. Longer-term trends in feed prices over the decade have been driven by a number of other forces including higher input costs and higher demand for exports and ethanol production.

A LINK IN THE VALUE CHAIN:
In 2016, Colorado livestock operations paid farms and feed mills \$1.16 billion for feed and fodder. Of that, an estimated \$195 million was from out of state.

3.2.1.3 PURCHASED ANIMALS

Another major category of purchased inputs that comes from off the farm or ranch are live animals. One characteristic of the livestock value chain is that there is significant degree of specialization by operation depending upon the life stages of the animal. Cow-calf operations, dairy nurseries, or poultry hatcheries specialize in reproduction, and sell young animals to producers who then specialize in feeding and maintaining them to optimize food production value—whether that is weight gain, milk production, or egg production. Other transactions of live animals are made in order to adjust the size or the genetic makeup of herds. Transactions of live animals can occur under contract, creating a more tightly integrated value chain. Or transactions may occur on spot markets, such as auction houses or directly between interested parties. Particularly in the category of cattle on feed, the capacity of Colorado feedlots exceeds the supply of animals available from within the state (see section on “Beef Production”). Thus, a large number of cattle being placed on feed in Colorado are purchased from out of state and thereby constitute “in-shippments” to Colorado.

3.2.2 MANUFACTURED AGRICULTURAL INPUTS

Manufactured inputs come from “off-farm” or, simply put, outside the farm sector. Suppliers of these inputs make up segments that are higher up the agricultural value chain, in the vertical sense of the industry’s organization. This group does not include capital expenditures, such as equipment or tools, which are durable goods used in production that were summarized earlier. Nor does it include services. Instead, this group includes only consumable inputs, purchased in variable amounts and used up in the production process, such as chemicals and energy.

Table 3.6 Fertilizer and agricultural chemical manufacturing and distribution: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
212391	Potash, Soda, and Borate Mineral Mining	0	-	-	
212392	Phosphate Rock Mining	0	-	-	
212393	Other Chemical and Fertilizer Mineral Mining	0	\$12,616,953	\$7,968,142	-37%
325311	Nitrogenous Fertilizer Manufacturing	5	\$5,930,107	\$18,482,227	212%
325312	Phosphatic Fertilizer Manufacturing	0	\$476,762	\$8,413,242	1665%
325314	Fertilizer (Mixing Only) Manufacturing	14	\$114,302,272	\$142,119,500	24%
325320	Pesticide and Other Agricultural Chemical Manufacturing	3	\$6,883,635	\$12,580,513	83%
424910	Farm Supplies Merchant Wholesalers	245	\$389,171,561	\$623,571,260	60%
TOTAL		267	\$529,381,290	\$813,134,886	54%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
212391	Potash, Soda, and Borate Mineral Mining	0.00	0	\$-
212392	Phosphate Rock Mining	0.00	0	\$-
212393	Other Chemical and Fertilizer Mineral Mining	0.05	10	\$2,623,779
325311	Nitrogenous Fertilizer Manufacturing	0.17	26	\$2,023,375
325312	Phosphatic Fertilizer Manufacturing	0.00	0	\$891,265
325314	Fertilizer (Mixing Only) Manufacturing	1.27	190	\$15,345,944
325320	Pesticide and Other Agricultural Chemical Manufacturing	0.09	21	\$1,694,678
424910	Farm Supplies Merchant Wholesalers	1.48	3,147	\$232,516,016
TOTAL			3,394	\$255,095,057

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector’s share of employment in Colorado is the same as the sector’s share of employment nationally. A value of 1.10 indicates that the sector’s share of employment in Colorado is 10% higher than the sector’s share of employment nationally.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers’ compensation.

It is not practical to single out energy providers, as oil companies or electric utilities are not specific to agriculture. Several subsectors within those sectors, however, including fertilizers, pesticides, and general farm supply businesses, are specific to agriculture.

Estimates of in-state activity in these sectors, derived from national input-output models (Table 3.6), suggest sales of over \$800 million, which concurs with USDA data on farm purchases of manufactured inputs. These input supply sectors account for over 3,000 jobs and \$255 million in payroll in the state of Colorado in 2016. Virtually all of that is by farm-supply merchant wholesalers.

3.2.2.1 FERTILIZERS

Chemical fertilizers are used in crop production to maintain soil fertility and thus crop yields. Nitrogen, in particular is a key component in the biological production of proteins, and thus is an essential element for plants to thrive and produce proteins. It is estimated that 40 to 50 percent of crop yields can be directly attributed to fertilizer inputs. For livestock production, fertilizers do not figure as a direct input and thus are not a major expense. In fact, livestock operations provide animal waste as a fertilizer option for crops.

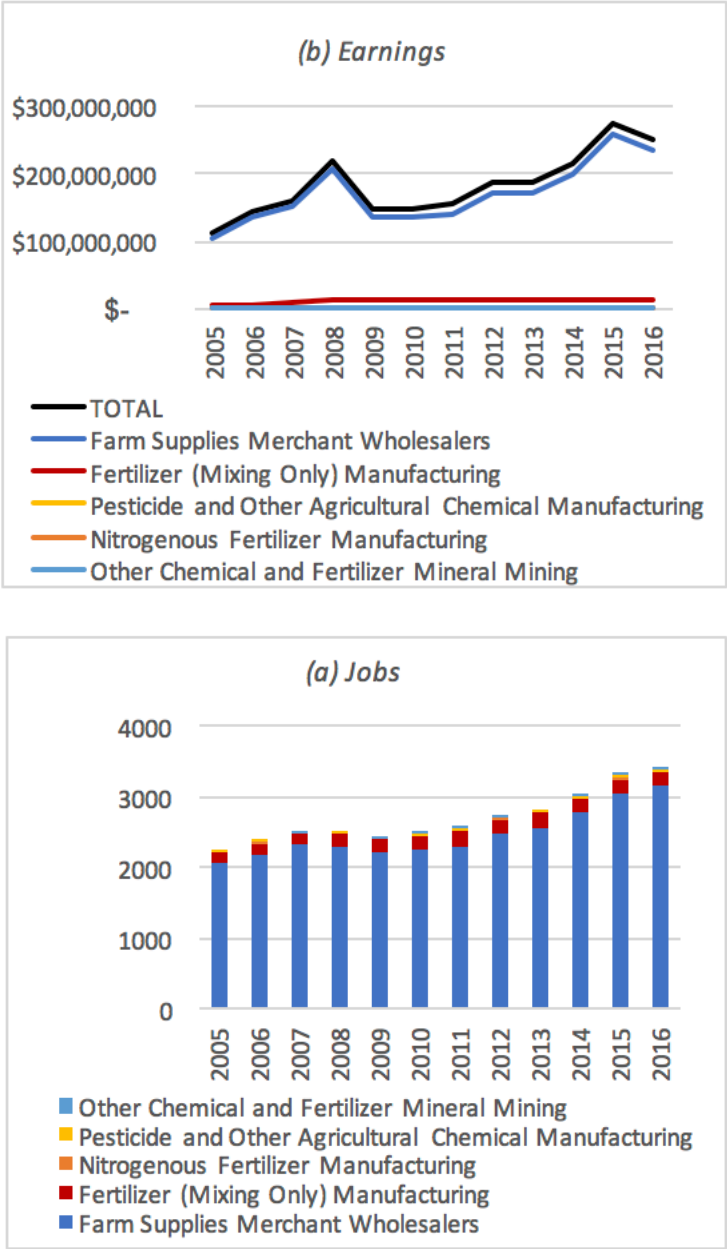
The majority of fertilizers purchased and utilized in crop production consist of chemical nitrogen (ammonium, or urea), phosphorus, and potassium (potash). Other micronutrients are important as well, and are available in various formulations. Lime is an important soil conditioner for adjusting soil pH levels and affecting the ability of crop plants to utilize the nutrients in the soil.

The mining of potassium and potash and the manufacture of urea are global industries, and products are sourced from all over U.S. and the world. According to the Economic Census (2010 County Business Patterns, U.S. Census Bureau) there are three fertilizer mining businesses and fifteen fertilizer manufacturing businesses in Colorado; however, eleven of these are only engaged in formulation mixing.

Natural gas is one of the major factors involved in nitrogen fertilizer production. It is the primary energy source used to fire the chemical process by which inert nitrogen gas from air is converted into

A LINK IN THE VALUE CHAIN:
In 2016, Colorado livestock operations paid other livestock operations \$1.12 billion in transactions for live animals.

Figure 3.12 Fertilizer and ag chemical manufacturing and farm supply merchandising: (a) jobs and (b) earnings in Colorado 2005-2016



biologically active ammonium and other related nitrogen rich compounds. Thus, the price of fertilizer is heavily influenced by the price of natural gas. This also dictates the strategic location of fertilizer manufacturing where natural gas is relatively accessible and thus inexpensive, including locations such as the Gulf coast in the United States or Norwegian oil and gas facilities in Europe. It also explains fertilizer price dynamics over the last decade.

Fertilizer expenditures by Colorado farmers more than doubled from \$144 million in 2006 to \$316 million in 2012 following the run-up in energy prices. Since then, with the easing of energy prices, fertilizer expenditures backed off, to \$241 million in 2016.

3.2.2.2 PESTICIDES

The large amounts of food being produced in the fields of farmers understandably attract the attention of many biological populations—including animals, insects, and fungi—collectively known in the industry as “pests.” Pest control, to prevent loss of yields due to infestation and consumption by other organisms, is a natural and perpetual challenge to farmers. While it can be achieved using a range of management options, most pest control strategies involve some use of chemical pesticides. Similar to fertilizers, the manufacture, distribution, and sale of pest control chemicals is a global industry and the products used in Colorado agriculture are sourced from all over the U.S. and the world.

Expenditures by Colorado farmers, paid primarily to agricultural supply cooperatives and independent distributors, for pest control chemicals have increased steadily over the decade, more than doubling from \$83 million in 2005 to a peak of \$180 million in 2014. Expenditures for pesticides were down slightly, to \$169 million, in 2016.

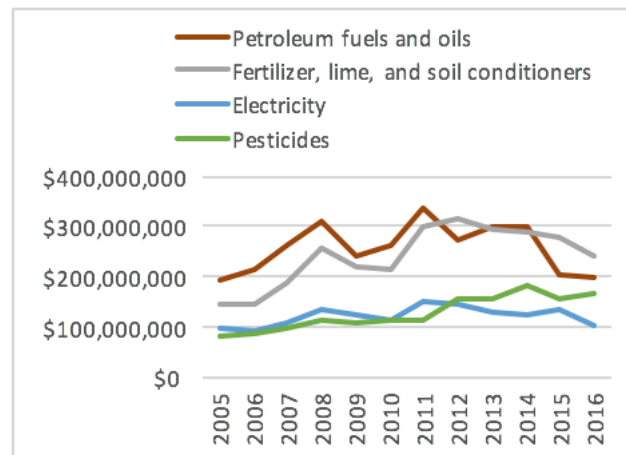
3.2.2.3 FUEL

Energy is essential to both crop and livestock production as well as other revenue generating activities. Gasoline, diesel, and other petroleum products are of primary importance for operation of machinery used in production as well as transport of supplies, equipment, and products. Ag co-ops, regional energy companies, and retail franchises of oil companies all sell to farm and ranch operations. Oil prices have seen enormous swings over the decade. Expenditures on fuel by Colorado farms and ranches started the decade at about \$200 million and peaked twice, at \$308 million in 2008 and at \$338 million in 2011. Given that net returns to the sector average \$800 to \$900 million, swings in costs on the order of \$100 million or so, can significantly affect the bottom line.

A LINK IN THE VALUE CHAIN:

In 2016, Colorado farmers paid \$241 million for fertilizers, lime, and soil conditioners.

Figure 3.13 Farm and ranch expenditures on chemical and energy inputs



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:

In 2016, Colorado farmers purchased \$169 million of pest control products.

3.2.2.4 ELECTRICITY

Farm buildings, offices, and many kinds of power equipment, pumps, etc., requires electricity. Rural electrification efforts a century ago assured a reliable connection of even the most remote locations to the grid. Today, Colorado is served by a combination of investor owned utilities (Xcel Energy and Black Hills Energy), 29 municipal utilities, and 26 Rural Electrical Associations. These retailers of electrical power both generate electricity themselves and purchase electricity from wholesale power providers, including the Platte River Power Authority, the Arkansas River Power Authority, Tri-State Generation and Transmission, and the Western Area Power Administration.

Electrification of rural America a century ago gave rise to the network of Rural Electrical Associations (REAs). The REAs are customer-owned not-for-profit cooperatives. Given their rural client base, the REAs are the electricity retailers for most Colorado farms and ranches. Even though they service only 19 percent of the state's total customer base and make only 22 percent of the total electricity sales in the state, they cover 70 percent of the land mass of the state.

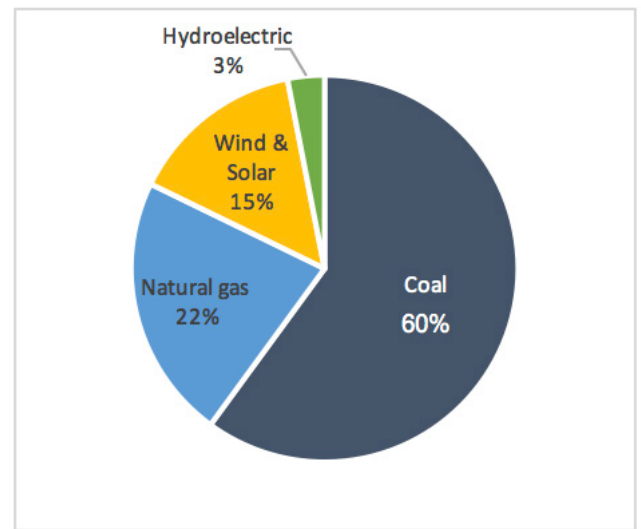
The sources of power generation for the state's electrical industry have been evolving. In 2000, coal accounted for 80 percent of power generation, natural gas accounted for 16 percent, and hydroelectric accounted for 3 percent. These shares have shifted significantly as relative costs of different power sources have changed. In particular, the cost of natural gas as a source of electrical power generation has dropped significantly as a result of fracking technology in the U.S. petroleum industry. Also, technology for alternative power generation, including both wind farms and solar farms, has developed dramatically.

In 2016 coal accounted for 60 percent, natural gas for 22 percent, and hydro was still 3 percent. The main difference was the addition of wind and solar, which accounted for 15 percent of the megawatt hours generated in 2015.

Colorado farms and ranches make up about 2 percent of total electricity usage in Colorado, commensurate with the percentage of population engaged in agriculture. In 2007, total receipts for electrical power distribution in Colorado were \$4.7 billion according to the U.S. Census, Survey of Business Owners. That same year, farms and ranches in Colorado paid \$111 million for electricity, or 2.3 percent of the total Colorado billings. In 2016, farms and ranches in Colorado paid a comparable amount of \$105 million.

A LINK IN THE VALUE CHAIN:
In 2016, Colorado farm and ranch expenditures on fuel and oil products was \$198 million.

Table 3.7 Shares of electric power industry generation in Colorado by primary energy source for 2015



A LINK IN THE VALUE CHAIN:
In 2016, Colorado farms and ranches paid \$105 million for electricity, largely to Colorado's Rural Electric Association (REA) co-operatives.

3.2.3 SERVICES PROVIDED AS INPUTS TO AGRICULTURAL PRODUCTION

In addition to consumable, physical inputs like feed, seeds, chemicals, and energy, farms and ranches also depend upon a number of services that are more economical to procure from others than to provide on the operation. These services may be provided by other agricultural operations. For example, one farmer with a specialized piece of equipment may use it for his own operation and also make it available for hire by neighboring farms. In such cases the accounting of value flows stay within the agricultural production sector, even though they would be counted towards the overall revenues of the sector. Alternatively, these services may be provided by specialized contractors or service providers, which may be considered as “upstream” of the farm and ranches in the value chain, in much the same way as fertilizer manufacturers. Finally, some services are provided by generalists, such as insurance or tax accounting, although even in these professions there are firms that specialize in providing these services specifically to farm and ranch operations.

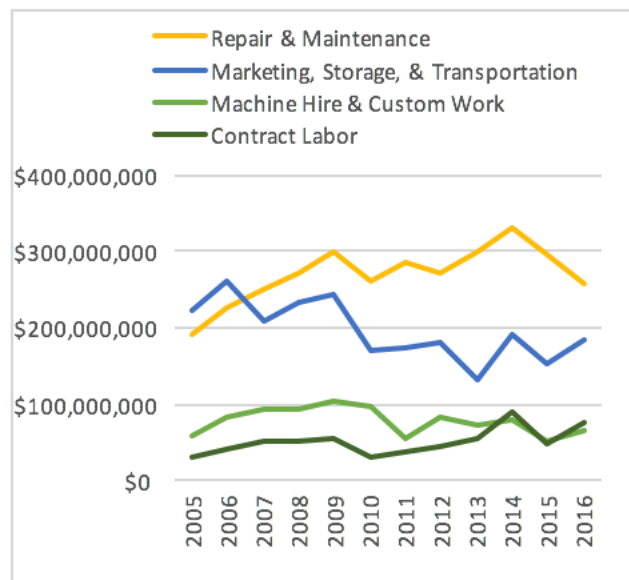
3.2.3.1 REPAIR AND MAINTENANCE

This category of expenses covers repair and maintenance of equipment and facilities. Such services are provided by local mechanics, as well as the repair and maintenance service departments of equipment manufacturers and vendors. The category also covers building contractors, HVAC service providers, electricians, plumbers, painters, and other such contractors and trade professionals that would be called upon to help repair and maintain physical facilities of the farm or ranch. Given that many such services are location specific, in that most of the time the service provider would need to visit the farm or ranch facility, it is reasonable to expect that much of the estimated \$256 million that Colorado farms and ranches spent on repair and maintenance in 2016 went to businesses and contractors within the state of Colorado.

3.2.3.2 MARKETING, STORAGE, AND TRANSPORTATION

After harvest, tons of product must be moved to market. In order to time the sale of that product to for advantageous price movements in the market, it may need to be stored for days, weeks, or months. In addition, inputs such as seed and chemicals need to be hauled onto the farm for planting and application. Thousands of head of cattle are moved from cow-calf operations to feed lots on a monthly basis. Machinery is moved from site to site and stored securely when not in use. While farms, dairies, and ranches maintain significant capacity to store and haul everything from grain, to milk, to live animals, additional services are needed for storage and transport.

Figure 3.14. Farm and ranch expenditures on services



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:
In 2016, Colorado farms and ranches paid \$256 million, largely to local businesses and contractors, for repair and maintenance services.

The infrastructure for such services are maintained and provided by local cooperatives, grain elevators, trucking companies, railroad companies, as well as some of the very large buyers of agricultural commodities. Again, because of the locational specificity of these services, the value of the expenditure by Colorado farms and ranches made on these services often goes to a hauler or a facility located in Colorado, or at least in a neighboring state, with a reasonable amount of reciprocity for such services back and forth across states lines.

3.2.3.3 MACHINE HIRE AND CUSTOM WORK

Farms and ranches have other options for obtaining machinery services, in lieu of purchasing the machinery and operating it themselves. These options can include the lease or rental of machinery, which may make better economic sense than purchasing machinery outright when it is a job that may be performed only occasionally. Another option is machine hire, paying someone who owns and operates the appropriate equipment. This may make economic sense as well, especially when the farm operation is short on skilled labor or when it is a job that requires uniquely specialized skills to operate the machinery. Rental or machine hire can be done for a range of tasks including among others: leveling and preparing fields, excavating for irrigation and drainage, cultivating, planting, spraying, harvesting, or hauling.

Equipment dealers, specialized equipment rental companies, and farm supply cooperatives provide equipment under lease and rental contracts. Custom hire is provided by specialized contractors or simply by neighboring farm operators that may have the needed equipment and are willing to hire out their services. Doing so can be a way for that operator to justify the capital expenditure on the equipment, if the asset's carrying cost exceeds the ability of their own operation to earn sufficient return on the capital investment.

Again, because of the localized and on-site nature of these services, a considerable share of the \$53 million that Colorado farms and ranches spent on machine hire and custom work in 2015 went to other businesses and contractors within the state. However, certain specialists, such as harvesting, do travel across multiple states following the harvest. Later, in 4.3.1, we consider the farm sector balance between purchase and supply of machine hire and custom work in Colorado (Figure 4.24), with the differences likely hinging on the question of what share of service providers are registered in other states or other sectors (construction, landscaping) within Colorado.

3.2.3.4 CONTRACT LABOR

In addition to full time or part time employees, farms and ranches occasionally require on-farm labor for particularly labor-intensive jobs, such as hand harvesting of fruits and vegetables. When this need arises, farms turn to companies that specialize in providing teams of laborers under contract. In such an arrangement, the contract labor services company is the employer of the workers, and thus is responsible for managing the hiring and compensation of all the individual laborers. The farm then has to manage just a single relationship with the contract labor company.

A LINK IN THE VALUE CHAIN

In 2016, Colorado farms and ranches paid \$183 million in transportation, storage, and marketing expenses to trucking companies and other such service providers.

A LINK IN THE VALUE CHAIN:

In 2016, Colorado farms and ranches paid \$67 million for machine hire and custom work, largely to other farms and ranches, or to specialized businesses and contractors.

Such arrangements are advantageous both for farms and for workers. The farms are able to obtain labor services when they are needed, without having to hire and then fire for exceptionally seasonal work. The workers are able to maintain more consistent employment by moving from farm to farm, and even from task to task, depending upon the season, all the while maintaining employment with a single employer, the contractor.

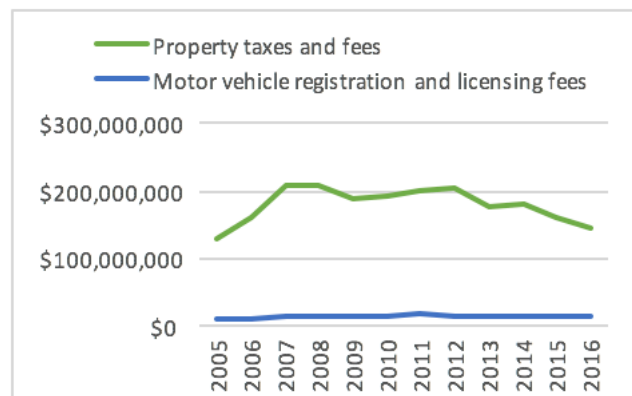
Contract labor is around 12 percent of the value of total compensation paid by farm and ranch operations to labor in in 2016 at \$75 million in 2016. It has not proven possible to find data that identifies the numbers of workers employed as contract laborers.

3.2.3.5 PUBLIC SERVICES (TAXES AND FEES)

County and the state governments provide a number of services, including country roads, bridges, public weed and pest control, and extension services. In order to support such state and local services, taxes are assessed, in particular, on those forms of productive capital—such as land and vehicles—that are associated with activities most likely to utilize and benefit from the public services provided.

A LINK IN THE VALUE CHAIN:
In 2016, Colorado farms and ranches paid \$75 million for contract labor.

Figure 3.15. Farm and ranch payments of state and local taxes and fees



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:
In 2016, Colorado farms and ranches paid \$146 million in property taxes and \$15 million in motor vehicle registration fees to Colorado county and state governments.

3.3 OTHER EXPENDITURES ON INPUTS SUPPORTING AGRICULTURAL PRODUCTION

Having considered the main categories of expenditure, we now turn to the remainder of the farm accounts. The USDA Farm Income and Wealth Statistics data series on “Value added to the U.S. economy by the agricultural sector” bundles all other farm and ranch expenses into a category called “miscellaneous” which includes a variety of things like non-capital tools and supplies, animal care expenses, business expenses, and insurance. However, only where additional sources give us expenditures information are we able to separate these expenses out from the \$709 million designated to “miscellaneous expenses” in 2016.

3.3.1 THE VARIETY OF OTHER INPUTS

Tools and Supplies: A share of expenses is allocated to the purchase of farm supplies, tools, and non-capital (non-durable) equipment. Most of this is spent at farm supply cooperatives, local retailers, hardware stores, and home centers. Yet, the manufactured goods are sourced from all over the world.

Livestock Related Expenses: Another set of expenses is allocated to animal health and breeding supplies, grazing fees, custom feeding fees, livestock rental fees, livestock contract production fees, and dairy assessment fees. Fees for grazing on public lands were considered in the earlier section on “Payments for Use of Capital that is Not Owned by Farm and Ranch Operations.”

Irrigation Water Fees: As noted earlier in the section on “Factor payments,” water irrigation fees, are included in miscellaneous expenses in the USDA accounts, and these may be interpreted to be water rental payments, which would be similar to land rental fees, thus a payment for access to a form of capital. Although, depending on the type of contract, purchase of water as an input to production may similarly be interpreted as a variable input to production, similar to chemicals or energy inputs. This amount was \$52 million in 2016.

Two other categories of miscellaneous expenses, both involving insurance, warrant more detailed consideration: crop insurance and health insurance.

Figure 3.16. Other expenses by Colorado farm and ranch operations, includes tools and supplies, insurance, and more



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

3.3.2 CROP INSURANCE

Also included in the “miscellaneous expenses” sum of \$709 million in 2016 were insurance premiums. Crop insurance and livestock price insurance are important risk management tools used by farmers. Insurance related expenses includes federal and private crop and livestock insurance premiums as well as casualty, hail, motor vehicle and all other insurance premiums. Federal insurance premiums are partly subsidized, and this represents an expense that is offset by federal insurance indemnities, discussed later in the section on “Revenues from Crop Insurance Payments”. In 2016, total insurance premiums were \$152 million, of which federal commodity insurance premiums were \$60 million.

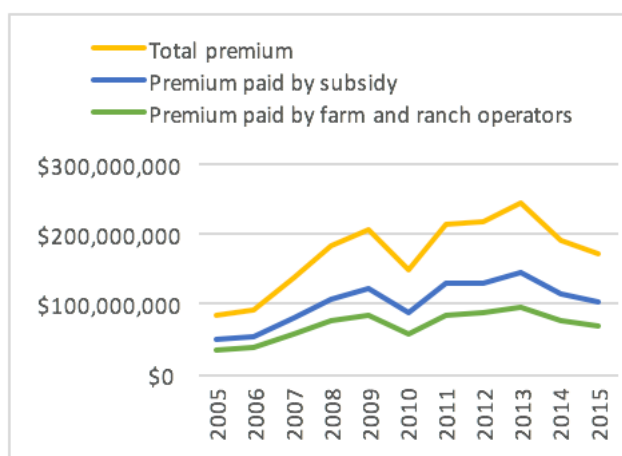
Farms and ranches employ a range of tools and strategies to manage the unique risks of agriculture as a business. Some of these are structural, such as diversifying sources of revenue and maintaining off-farm employment. Some risk-management assistance programs, such as commodity subsidies and disaster payments, are provided by the federal government as part of U.S. public policy for maintaining a robust agricultural sector and national food security. Other risk management tools are essentially business strategies, such as using futures and option contracts for locking in prices of sales and purchases, storing harvests for sale at a later date, or transporting product to a buyer that provides a more advantageous price. Finally, there are financial risk management tools, including asset and debt management strategies and various types of insurance. Crop and livestock insurance policies can be taken out by farmers with one of 15 private insurance companies in the U.S. that are backed (reinsured or supplemented) through more than a half dozen different insurance product programs, managed by the Federal Crop Insurance Corporation (FCIC), which is overseen by the Risk Management Agency (RMA) of the USDA. More than a half dozen different insurance program products are available. None of the major agricultural insurance companies are headquartered in Colorado (see Table 3.8). To analyze insurance costs in more detail, we use data from the Risk Management Agency (RMA) of the

Table 3.8 Crop and livestock insurance providers for Colorado farms and ranches in 2017

	Ag Insurance Provider	Parent company	Headquarters
1	American Farm Bureau Insurance Services (AFBIS)		Schaumburg, IL
2	AmTrust Agriculture Insurance		Leawood, KS
3	ARMtech Insurance Services		Lubbock, TX
4	Crop Pro Insurance		Des Moines, IA
5	Crop Risk Services	(formerly ASI AgriServe)	Decatur, IL
6	Diversified Crop Insurance Services	CGB Diversified Services	Jacksonville, IL
7	Farmers Mutual Hail Insurance Company of Iowa		West Des Moines, IA
8	GlobalAg	Global Ag Insurance Services	Fresno, CA
9	Great American Insurance	Great American Insurance Group	Cincinnati, OH
10	Hudson Crop	Hudson Insurance Group / Odyssey RE / Fairfax Financial	Overland Park, KS
11	ProAg	Tokio Marine HCC	Amarillo, TX
12	NAU Country Insurance Company	QBE Insurance	Ramsey, MN
13	Rain and Hail	Chubb	Johnston, IA
14	Rural Community Insurance Services (RCIS)	Rural Community Insurance Company	Anoka, MN

Source: National Crop Insurance Services

Figure 3.17. Crop and livestock insurance premium payments for Colorado farms and ranches

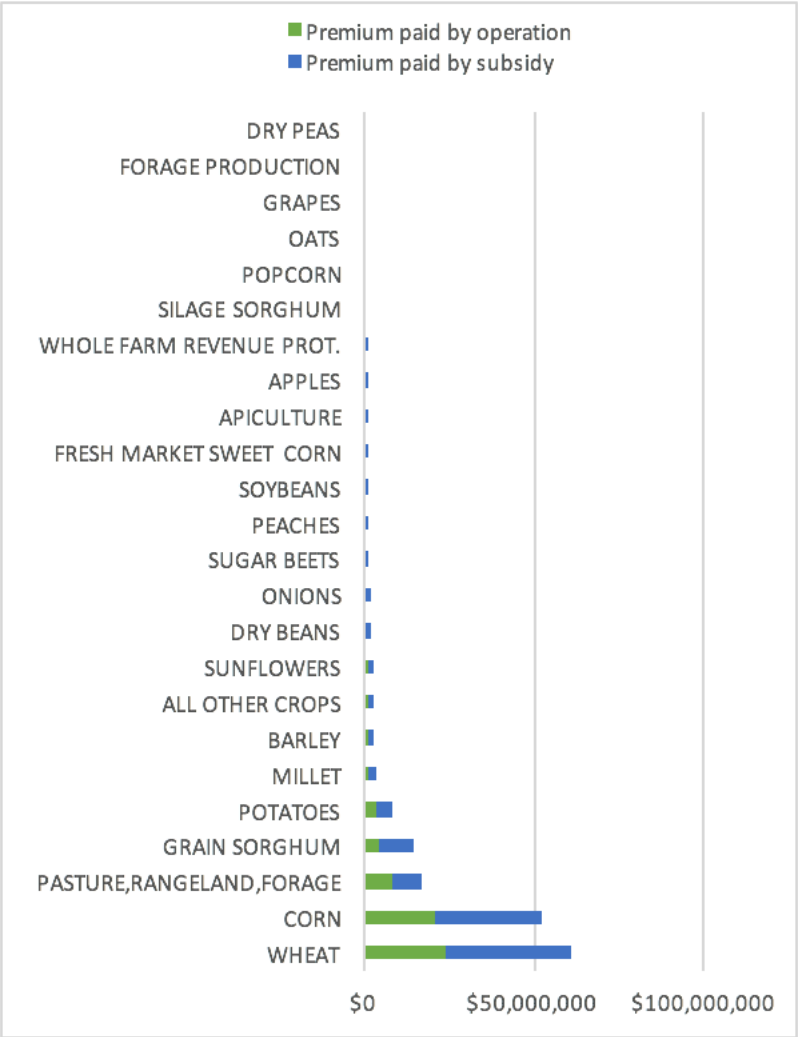


Data source: USDA Risk Management Agency, Business Reports and Data

USDA. The RMA estimates total expenditure on premiums for Colorado agriculture in 2015 was \$173 million, of which \$69 million (40 percent of the total) was paid by farm and ranch operators directly and \$104 million (60 percent) was covered by federal crop insurance subsidies under RMA (Figure 3.17). Thirty five percent of premiums was for wheat at \$61 million. Corn was 30 percent at \$52 million. Other crops covered by insurance in 2015 included hay, sorghum, potatoes, millet, barley, and some specialty crops (Figure 3.18).

A LINK IN THE VALUE CHAIN: In 2015, total premium payments for crop and livestock insurance made by Colorado farm and ranch operations was \$69 million.

Figure 3.18. Annual premiums paid in Colorado for crop and livestock insurance by commodity, 2015



Data source: USDA Risk Management Agency, Summary of Business Reports and Data

3.3.3 HEALTH INSURANCE

Health insurance is one expense that may be borne either by an employer or an employee. For farm and ranch enterprises that are corporations and that employ professional managers or laborers, health insurance may be one of the benefits provided by the farm or ranching business to its employees as part of their compensation package (accounted for in the previous sections on employee expenditures). However, for those farms and ranches in Colorado that are family-run businesses, health insurance for the primary operator is an important aspect of risk management for both the business and for the household.

According to national averages from the USDA Agricultural Resource Management Survey administered in 2015, U.S. farm operator households spent an average of \$3,066 on health insurance premiums and \$1,953 for out of pocket expenses. According to that analysis, 17 percent of the members of U.S. farm households purchased health insurance directly. 57 percent of farm operator household members were covered under employer-sponsored health insurance, presumably through off-farm employment of either the primary operator or the operator's spouse. Twenty six percent of farm household members were covered under public insurance,

A LINK IN THE VALUE CHAIN: In recent years, Colorado farm and ranch operator households have spent between \$110 to \$178 million on health insurance premiums and between \$71 and \$114 million in out of pocket health care expenses.

such as Medicare or Medicaid. And, 9 percent went without health insurance altogether. Between 2011 and 2015 there was a slight shift toward employer-sponsored insurance, again, most of which is from off-farm employment.

Given these values, total farm and ranch operator household spending on health insurance premiums in Colorado is estimated to have been between \$110 and \$178 million. Out of pocket health care expenses are estimated to have been between \$71 and \$114 million. It is not clear if these expenses show up in the insurance premiums under “miscellaneous expenses” tracked in the USDA Value Added farm accounts in Figure 3.16, as health insurance premiums paid for farm employees as part of an employment benefit package would likely have been recorded under labor costs.

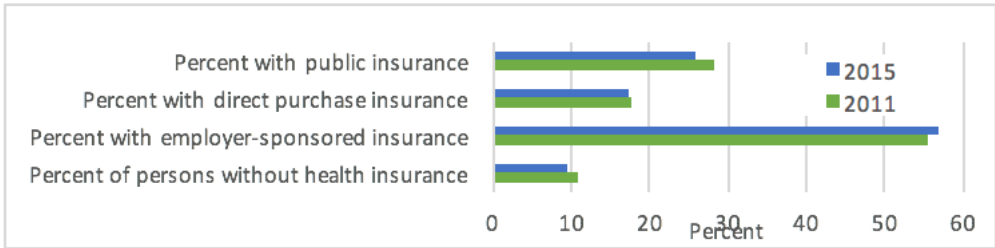
3.4 SUMMARY: COLORADO’S WORKFORCE IN THE AGRICULTURAL INPUTS INDUSTRIES

The workforce engaged in providing inputs to Colorado agriculture is diffused across multiple sectors. Here we analyze the workforce of about a dozen sectors that are largely focused on providing both products and services utilized in agricultural production. These include fertilizer mining and manufacturing, other agricultural chemical manufacturing, farm machinery manufacturing and wholesaling, and farm input supply dealers. A number of other sectors that serve agriculture also serve other sectors of the economy. Examples include fuel suppliers and veterinary services. As we have seen, fuel and oil products represent a major input expenditure for farm and ranch operations, yet the petroleum industry also sells fuel widely to industry, transport, and retail consumers. Veterinary services are a crucial input for animal agriculture. Yet, the large majority of veterinary services specialize in small animals and cater to household pets. In such sectors, it is not straightforward to segment the workforce data to the portion of the workforce that serves agriculture.

Table 3.9 List of industry sectors included in this workforce analysis of agricultural input industries

Code	Description
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
221310	Water Supply and Irrigation Systems
325311	Nitrogenous Fertilizer Manufacturing
325312	Phosphatic Fertilizer Manufacturing
325314	Fertilizer (Mixing Only) Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing
327410	Lime Manufacturing
333111	Farm Machinery and Equipment Manufacturing
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing
424910	Farm Supplies Merchant Wholesalers

Figure 3.19 Health insurance coverage of U.S. farm and ranch household members, comparing coverage in 2011 and in 2015



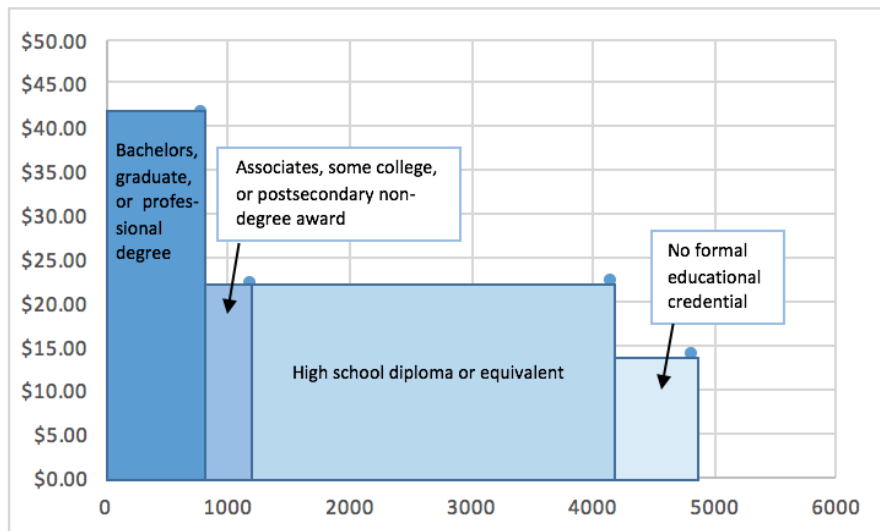
Data source: USDA Economic Research Service, Farm Household Income Characteristics, Health Insurance Coverage

Table 3.10 Staffing pattern overview for Colorado agricultural input industries

4,971		\$74,280		
Jobs (2017)		Avg. Earnings Per Job (2017)		
5% below National average		Nation: \$77,755		
Establishments (2017)		455		
Jobs Multiplier		4		
	2012 Jobs	2016 Jobs	Change	% Change
Colorado	3,988	4,847	859	21.5%
Nation	282,652	282,685	33	0.0%
Gender		Percent		
Male	69.5% <div></div>			
Female	30.5% <div></div>			
Age		Percent		
14-18	1.5% <div></div>			
19-24	6.8% <div></div>			
25-34	18.1% <div></div>			
35-44	20.9% <div></div>			
45-54	22.5% <div></div>			
55-64	21.6% <div></div>			
65+	8.7% <div></div>			
Race/Ethnicity		Percent		
White	85.0% <div></div>			
Hispanic or Latino	12.1% <div></div>			
Asian	0.9% <div></div>			
Black or African American	0.9% <div></div>			
Two or More Races	0.7% <div></div>			
American Indian	0.4% <div></div>			

Source: EMSI, 2018

Figure 3.20 Numbers employed and median hourly earnings, by typical entry-level educational requirements, in selected agricultural input industries in Colorado in 2016



Data source: EMSI, 2018

Table 3.11 Top 30 jobs in the agricultural input industry group in Colorado, by percent of total jobs in the industry group

SOC	Description	Employed (2012)	Employed (2016)	Change (2012 - 2016)	% Change (2012 - 2016)	% of Total Jobs (2017)	Median Hourly Earnings	Typical Entry Level Education
11-9199	Managers	10	61	51	510%	1.4%	\$30.64	Bachelor's degree
11-1021	General and Operations Managers	123	162	39	32%	3.4%	\$50.94	Bachelor's degree
13-1028	Buyers and Purchasing Agents	47	50	3	6%	1.0%	\$32.00	Bachelor's degree
13-1199	Business Operations Specialists	35	46	11	31%	1.0%	\$36.01	Bachelor's degree
13-2011	Accountants and Auditors	60	67	7	12%	1.4%	\$32.78	Bachelor's degree
41-1012	First-Line Supervisors of Non-Retail Sales Workers	41	99	58	141%	2.2%	\$28.72	High school diploma or equivalent
41-2011	Cashiers	43	44	1	2%	0.8%	\$10.65	No formal educational credential
41-2031	Retail Salespersons	34	42	8	24%	0.9%	\$11.64	No formal educational credential
41-4012	Sales Representatives	512	667	155	30%	13.3%	\$29.32	High school diploma or equivalent
43-1011	First-Line Supervisors of Office and Administrative Support Workers	46	56	10	22%	1.1%	\$27.76	High school diploma or equivalent
43-3031	Bookkeeping, Accounting, and Auditing Clerks	101	115	14	14%	2.2%	\$19.15	Some college, no degree
43-4051	Customer Service Representatives	113	135	22	19%	2.9%	\$16.57	High school diploma or equivalent
43-4151	Order Clerks	36	40	4	11%	0.8%	\$16.52	High school diploma or equivalent
43-5071	Shipping, Receiving, and Traffic Clerks	81	92	11	14%	1.7%	\$15.19	High school diploma or equivalent
43-5081	Stock Clerks and Order Fillers	117	135	18	15%	2.7%	\$12.92	High school diploma or equivalent
43-6014	Secretaries and Administrative Assistants	93	119	26	28%	2.3%	\$17.51	High school diploma or equivalent
43-9061	Office Clerks	108	133	25	23%	2.8%	\$17.45	High school diploma or equivalent
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	95	120	25	26%	2.8%	\$12.98	No formal educational credential
49-9071	Maintenance and Repair Workers	60	75	15	25%	1.5%	\$18.22	High school diploma or equivalent
51-1011	First-Line Supervisors of Production and Operating Workers	58	63	5	9%	1.4%	\$29.96	High school diploma or equivalent
51-2098	Assemblers and Fabricators, Including Team Assemblers	71	74	3	4%	1.4%	\$15.00	High school diploma or equivalent
51-4121	Welders, Cutters, Solderers, and Brazers	41	41	0	0%	0.8%	\$20.27	High school diploma or equivalent
51-8031	Water and Wastewater Treatment Plant and System Operators	179	205	26	15%	3.9%	\$25.13	High school diploma or equivalent
51-9011	Chemical Equipment Operators and Tenders	28	37	9	32%	0.9%	\$18.15	High school diploma or equivalent
53-1048	First-line Supervisors of Transportation and Material Moving Workers	32	44	12	38%	0.9%	\$27.73	High school diploma or equivalent
53-3031	Driver/Sales Workers	40	39	(1)	(3%)	0.7%	\$11.86	High school diploma or equivalent
53-3032	Heavy and Tractor-Trailer Truck Drivers	135	183	48	36%	3.7%	\$21.42	Postsecondary nondegree award
53-3033	Light Truck or Delivery Services Drivers	111	149	38	34%	3.2%	\$16.82	High school diploma or equivalent
53-7051	Industrial Truck and Tractor Operators	48	68	20	42%	1.4%	\$16.49	No formal educational credential
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	157	200	43	27%	4.2%	\$14.19	No formal educational credential

THE OUTPUTS FROM PRODUCTION AGRICULTURE

Colorado farms and ranches received more than \$7.2 billion in revenue in 2016. The sources of these revenues vary significantly, but each source of revenue received by farms and ranches represents an area where agriculture adds value to the economy. And each source of revenue creates a branch of the value chain, as the products or services arising from agriculture are taken up and used in additional economic activities that themselves generate value in Colorado.

As we reasoned before, when considering the inputs to agriculture, there is no reason to think that all of the revenue earned by Colorado farms and ranches occurs from sales made within the state. Indeed, we know that many Colorado-grown farm products are sold out of state and even exported each year. However, given the geographical nature of agricultural production, there is high likelihood that at least the initial link or two of the value chain downstream from Colorado farms and ranches involve businesses or individuals that also reside in Colorado.

The three main areas of revenue generation by the farm and ranch sector considered here are (1) crop production and sales, (2) livestock production and sales, and (3) other sources of revenue.

4.1 CROP OUTPUTS

4.1.1 FEED AND FORAGE CROPS: CORN, SORGHUM, MILLET, BARLEY, OATS, AND HAY

The largest volume and value of crop production in Colorado is devoted to crops intended primarily for consumption by livestock. This includes grains, such as corn, sorghum, millet, barley, oats and rye. It also includes silage, mostly from varieties of corn and sorghum. It also includes grass and alfalfa hay. The numbers reported in Figure 4.1 are estimated farm gate receipts for each crop in each year. To be clear, the values represented are a function of the acreage, the yields from those acres, and the price for the crop commodity in that year. When any one of those three factors goes up or down, the value of total receipts will go up or down.

The largest of the feed crops by total receipts is corn, and the value of corn to Colorado farmers exploded and then re-contracted over the course of the last decade, with the value of the crop tripling from roughly \$300 million a year as recently as 2006 to nearly \$1 billion in 2011 and 2012. This explosion was due largely to price increases for corn associated with a global surge in commodity prices during those years. Corn acreage and production had not greatly expanded. As prices turned lower, the value of the Colorado corn crop returned to levels of about \$500 million in 2015 and 2016.

The value of the hay crop (including alfalfa) has also grown significantly, more than doubling between 2005 and 2012. The value of Colorado hay sales in 2005 was \$194 million, and in 2012 was over \$440 million. Especially given the time and resource constraints, particularly irrigation water, on developing productive hay acreages, this rapid increase is almost entirely due to price effect. Since that peak, hay sales climbed back down to just under \$300 million by 2016.

Sorghum is grown for both silage and for feed grain. But, it makes up a much smaller production and sale value in Colorado, at \$63 million in 2016.

The production values of other grain crops (other than wheat, which is primarily used for human consumption) are similarly an order of magnitude smaller than that of corn or hay. Revenues from millet and barley were both \$35 million in 2011; and, for oats less than \$2 million was reported.

Corn production as well as sorghum and millet production are concentrated in the east and northeast regions, with some sorghum production extending into the southeast. Plantings of the other small grains, including barley, oats and rye, are more diffused, with the largest areas of concentration being the San Luis valley, in south central Colorado around Alamosa, and in the Front Range, between Denver and Fort Collins. Hay production is also widely geographically diffused, tending to locations in river valleys across the state.

The uses or—in the jargon of industry—the “disappearance” of feed crops follow varying patterns. A share of each year’s harvest never leaves the operation where it was grown. Some of it is sold directly to neighbors. And, some enters more formal marketing channels. Generally, given the excess demand in Colorado for livestock feed (see Figure 3.10 “Difference between value of feed purchased and value of feed produced in Colorado” in the section 3.2.1.2 on Purchased Feed) due to the large populations of fed beef cattle and dairy cattle on feed (see below, sections 4.2.1 Beef and 4.2.2 Dairy), it is necessary for such operations to purchase some feed from outside Colorado.

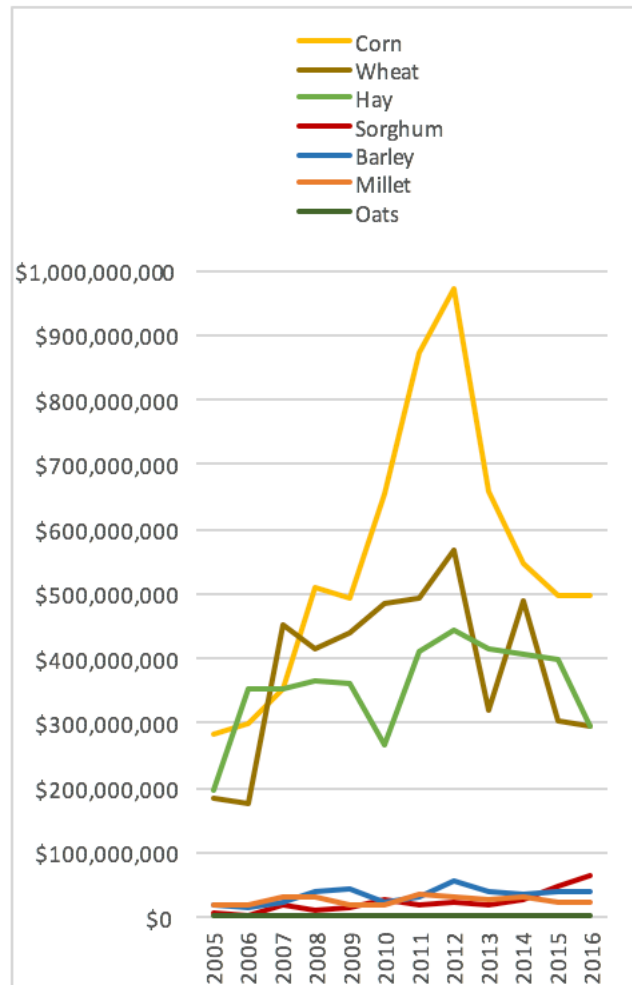
Most of the hay and alfalfa crop is either fed to animals on the operations that grew it or is sold to nearby livestock operations. A smaller share is taken to regional auction. Given the costs involved to transport heavy, bulky forage crops, they are typically not shipped long distances. Only under conditions that drive up prices in one region relative to others, such as the drought in 2011 and 2012, is it economical to haul hay across state lines.

The production and use of corn silage, produced from the entire plant, follows a similar pattern, again following transport cost considerations due to weight and volume. Silage is typically used on the operation where it was produced or is sold to neighbors and hauled only a short distance, ideally directly from the field where harvested to storage on location where it will be fed.

Grain is of course the most compact, storable, and transportable of the feed crop outputs, and it is the most versatile in its uses above and beyond just feeding animals so it is the product most commonly sold into marketing channels.

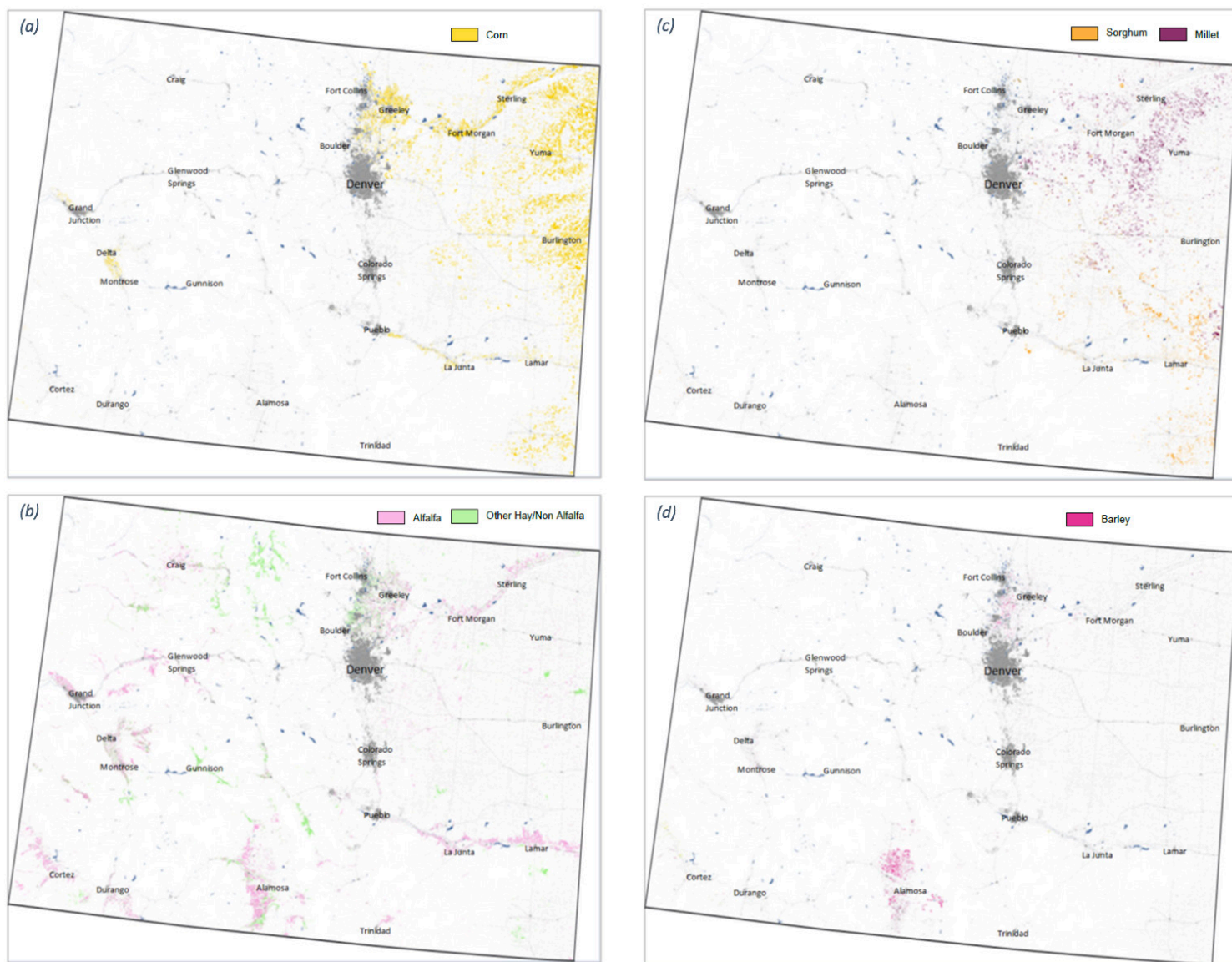
Nationally, the U.S. corn crop is put to agricultural, food, and fuel uses, as well as being shipped to export markets (Table 4.2). More than one third of the U.S. corn crop is ultimately channeled to feeding livestock,

Figure 4.1 Value of grain and forage crops grown in Colorado 2005-2016



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

Table 4.1 Maps of areas in Colorado planted to main feed and fodder crops: (a) corn, (b) alfalfa and hay, (c) sorghum and millet, and (d) barley. (Urban areas in grey.)



Source: USDA National Agricultural Statistical Service, CropScape

whether domestically or overseas. Another third is fermented into ethanol for use as fuel. Less than 10 percent of the corn crop is used for human food consumption, mostly in the form of processed food ingredients such as high-fructose corn syrup, glucose, and starch. Only about one percent of the corn crop is milled and consumed by humans in the form of breakfast cereal, corn chips, corn tortillas, and such.

The picture is decidedly different, however, for the Colorado corn crop. Given the size of the state’s livestock sector, an estimated 70 to 80 percent share of Colorado corn goes toward livestock feed uses. According to Colorado Corn, approximately 25 to 30 percent of the Colorado corn crop, based on NASS acreage estimates, gets fed on the farm where it was produced or is otherwise utilized without even entering formal market channels. Only 20 to 30 percent of the Colorado corn crop is left to go toward all other uses, most of which is for ethanol production (Colorado Corn, 2018).

Three large corn ethanol plants are located in northeastern Colorado, in the cities of Windsor, Sterling, and Yuma, respectively (see section 5.6, below, on “Bio-fuels”). Given the already existing regional imbalance between supply and demand, these plants were built with the understanding that they would need to ship in grain corn by rail from neighboring states. Each ethanol plant processes roughly 18 to 20 million bushels per year to perform at capacity for a rough total of about 55 million bushels of corn making a first stop at an ethanol plant. Each of the three plants, according to Colorado Corn, like to purchase as much local corn as feasible, although the feasible amount is not likely to be above 35 percent of their total needs in any given year.

Table 4.2 The many uses of the U.S. corn crop in 2016

Category of use	million bu	US percent	CO ^{/1} percent
Agricultural use		33.4%	
Animal Feed	5,114	33.2%	70-80%
Seed	31	0.2%	~0%
Food/beverage use		9.1%	~0%
High-fructose corn syrup (HFCS)	472	3.1%	
Glucose and dextrose	337	2.2%	
Starch	239	1.5%	
Cereals and other products	203	1.3%	
Alcohol for beverages	143	0.9%	
Fuel use		33.9%	
Alcohol for fuel	5,224	33.9%	10-20%
Other use		23.6%	
Exports	1,901	12.3%	2-5%
Ending stocks	1,737	11.3%	

Data source: USDA Economic Research Service, Feed Grains Yearbook, 2018

/1 general range for Colorado based on industry experience, from Colorado Corn (2018)

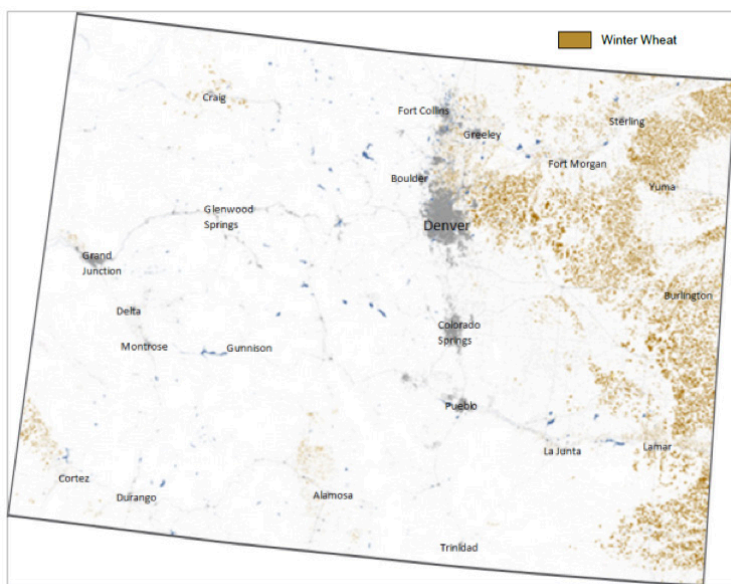
The main rationale for the location of these ethanol plants in Colorado, however, was their proximity to cattle feeding operations. This is because the equivalent of about one third of the grain volume used as an input to ethanol production is returned as a major byproduct in the form of “distiller’s grains.” Distiller’s grains are the mash of ground corn grains left over after the yeast has fermented most of the sugars into ethanol, and the ethanol has been distilled away. This grain residue is therefore relatively high in protein, low in carbohydrates, and makes a high-quality animal feed. The volume of distiller’s grains offsets a portion of the corn that would have been used for feed, plus it offsets some need for protein supplements, most commonly supplied as soy-bean meal. Indeed, for ethanol plants, much of the economics of ethanol production hinges on the revenues and costs of dealing with the byproducts, especially the distiller’s grains. Thus, close proximity to large cattle feeding operations that can utilize the distiller’s grains without high transportation costs can be essential.

Between demand for livestock feed and demand for ethanol production, an estimated 80 to 90 million bushels of grain corn is shipped into the state of Colorado each year (Colorado Corn, 2018). Similarly, barley and oats grown in Colorado are largely channeled toward livestock feed blends. These grains also have a number of food and beverage uses. For example, a sizable share of the barley grown in Colorado each year is for malting and brewing beer (see section, below, on “Beverage Manufacturing”).

A LINK IN THE VALUE CHAIN:

In 2016, Colorado farmers received \$920 million for feed crops. Half of that was for corn, at \$496 million, and a third was for hay, at \$296 million.

Figure 4.2 Map of areas in Colorado planted to wheat, in brown. (Urban areas in grey.)



Source: USDA National Agricultural Statistical Service, CropScape

4.1.2 FOOD GRAINS: WHEAT

Wheat is the primary food grain grown in Colorado. The other major food grain, rice, is virtually nonexistent in Colorado, given its climate. The quantities of wheat grown in Colorado made it the fifth largest state in winter wheat production in 2016. The location of wheat production corresponds closely to the location of corn, sorghum, and millet, on the plains in eastern and northeastern Colorado (compare map in Figure 4.2 to maps in Figure 4.1). Thus, production and marketing of wheat shares the grain handling infrastructure of these regions. The value of wheat production in Colorado tripled between 2006 and 2012, but then declined by half between 2012 and 2016. The value of the Colorado wheat harvest had averaged around \$175 million through 2006. In 2012, Colorado farms produced and sold \$567 million. By 2016, the cash receipts value of the Colorado wheat crop was down to \$294 million. (Figure 4.1).

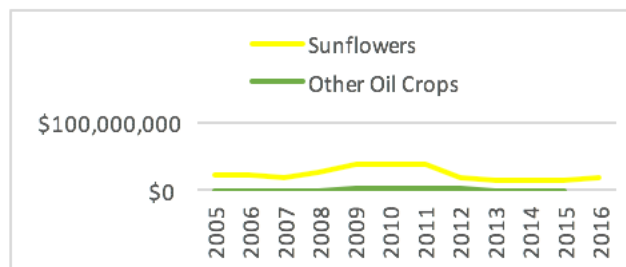
A LINK IN THE VALUE CHAIN:

In 2016, Colorado farmers received \$294 million for the sale of wheat.

4.1.3 OILSEED CROPS: SUNFLOWER

The primary oilseed crop grown in Colorado is sunflower, with only a small amount of other oilseeds. Geographically, oilseed production is fairly diffused across the plains of eastern Colorado, with a few pockets of relative concentration. The high point in the value of oilseed production was in 2011 at \$40 million, virtually all from sunflower. The value decreased by half since then to \$18 million in 2016.

Figure 4.3 Value of receipts for oilseed crops by Colorado farms

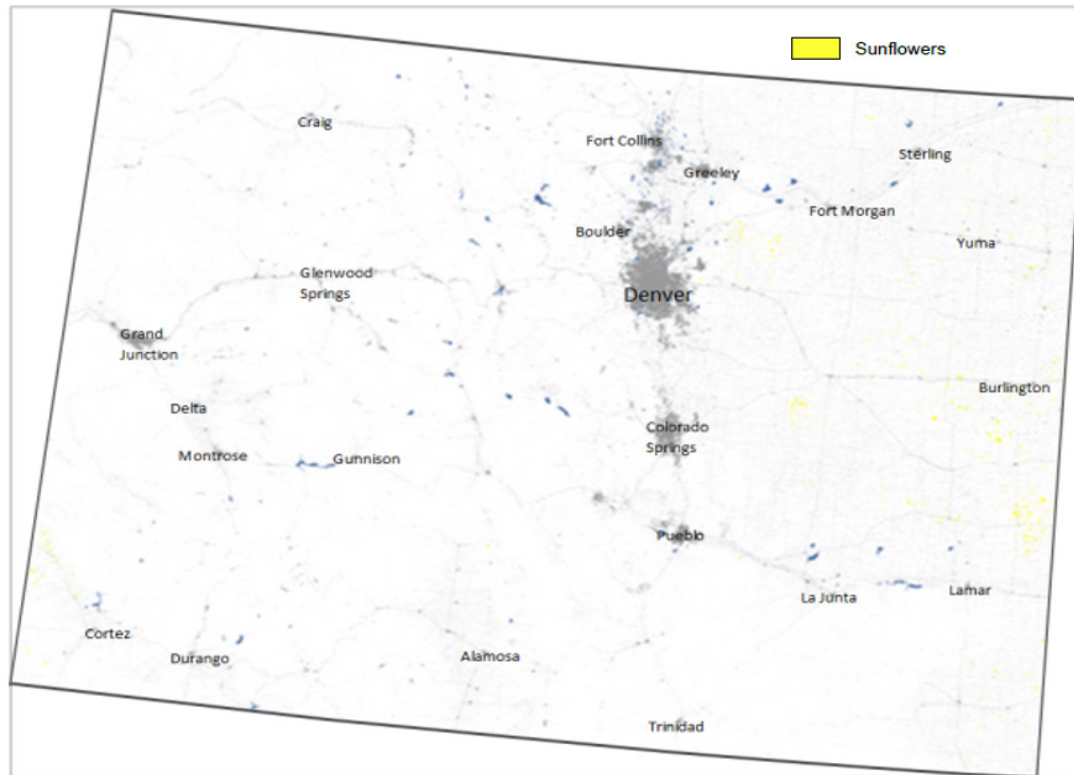


Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:

In 2016, Colorado farms received \$18 million for production of oilseed crops, primarily sunflower.

Figure 4.4 Map of areas in Colorado planted to sunflowers, in yellow. (Urban areas in grey.)



Source: USDA National Agricultural Statistical Service, [CropScape](#)

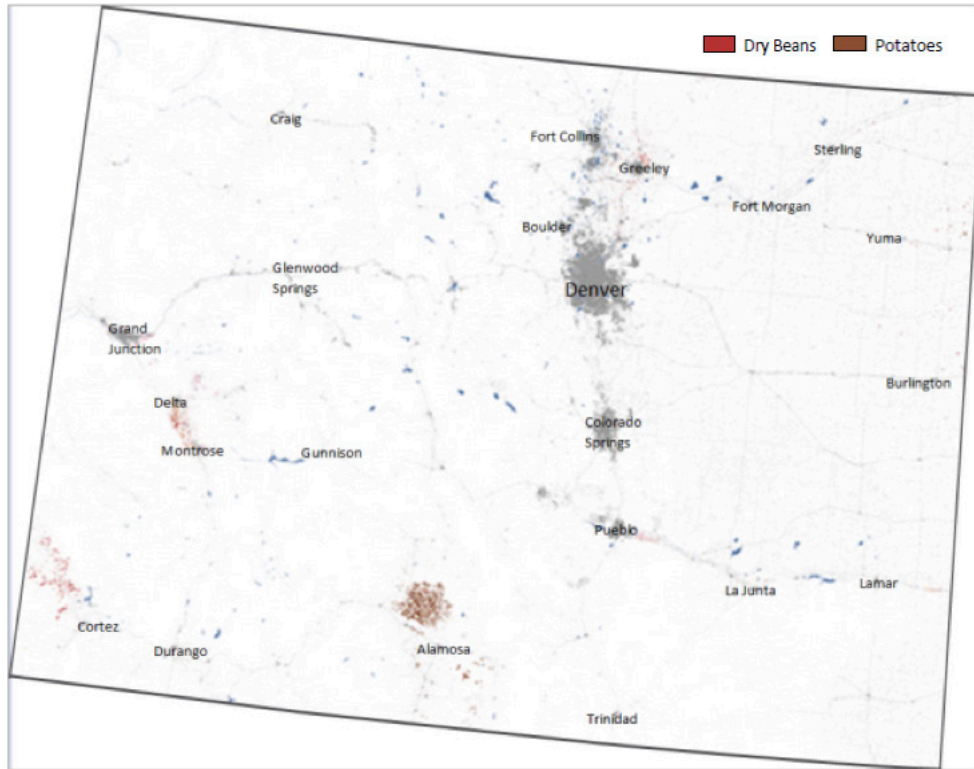
4.1.4 FRUITS AND VEGETABLES

Fruit and vegetable production in Colorado is limited by climate. However, there are particular regions of Colorado with the right conditions that have proven to be quite amenable to fruit and vegetable production. These include parts of the northern Front Range, the San Luis valley in south central Colorado (particularly for potatoes), the Grand Valley of the Colorado River near Grand Junction (particularly for peaches and wine grapes), the Gunnison and Uncompahgre River valleys near Delta (particularly for sweet corn), the north fork valley of the Gunnison River around Hotchkiss and Paonia (particularly for fruits and wine grapes), and the Dolores River valley near Cortez (particularly for dry beans).

Potato is the single largest fruit or vegetable crop grown by Colorado farmers, with cultivation concentrated primarily in the San Luis Valley. Over the last decade, Colorado potato farms produced and sold an average of \$180 million worth of potatoes each year. The rest of the vegetables grown in the state achieved a combined value comparable to that of potatoes up until 2007, but have declined by \$100 million over the last decade (Figure 4.6, panel (a)). These are primarily onions, dry bean, sweet corn, cabbage, and carrots (Figure 4.6, panel (b)). Fruits grown in Colorado make up a much smaller value category than vegetables, totaling only \$27 million in 2016. The main fruit crops are peaches, of which the value has almost tripled in the last decade, followed by apples and cantaloupes (Figure 4.6, panel c).

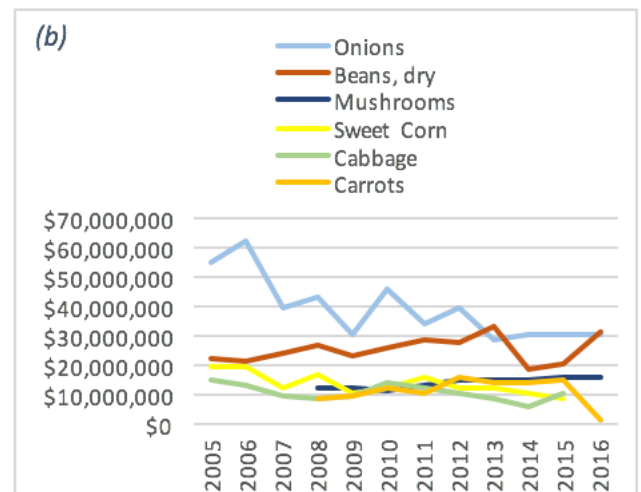
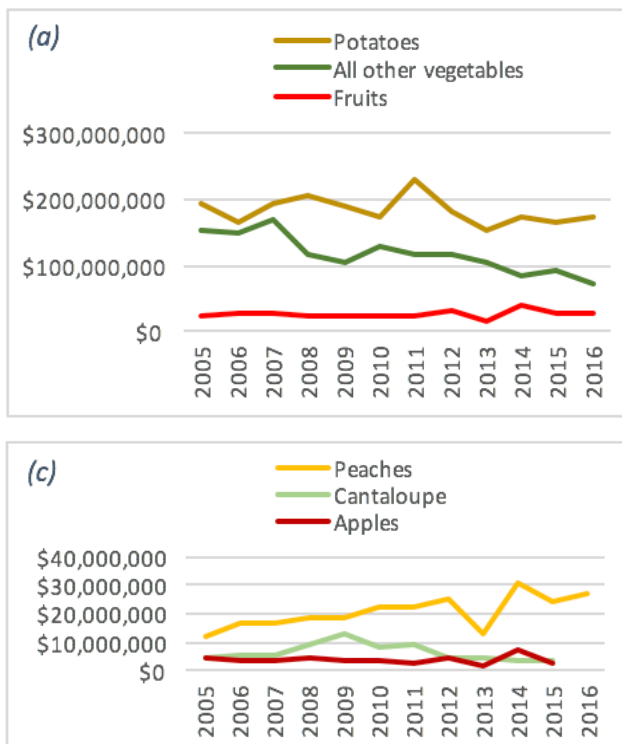
A LINK IN THE VALUE CHAIN: In 2016, Colorado farms received \$175 million for sales of potatoes, \$71 million for other vegetables and \$27 million for fruit: making a total of \$272 million for all fruits and vegetables combined.

Figure 4.5 Map of areas in Colorado planted to fruits, in orange, dry beans, in red, and potatoes, in brown. (Urban areas in grey.)



Source: USDA National Agricultural Statistical Service, CropScape

Figure 4.6 Value of cash receipts by Colorado farms for (a) all fruits and vegetables, including potatoes, (b) other vegetables separately, and (c) fruits separately (including field melons)



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

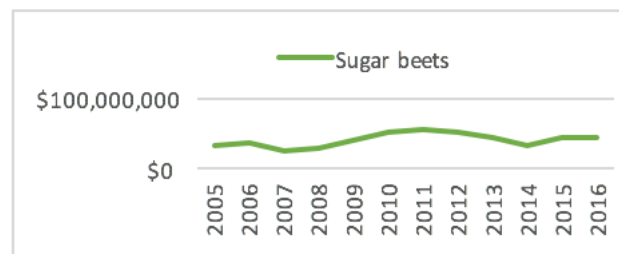
4.1.5 SUGAR BEETS

Historically, sugar beets and sugar processing have played prominent roles in the development of Colorado agriculture. While still present, sugar beets are something of a niche crop in Colorado today. They are typically grown under irrigation in rotation with other crops.

Sugar cultivation and production in the U.S. (USDA-ERS, Sugar and Sweeteners Background, 2012) is shared between sugar cane, which accounts for about 45 percent of U.S. sugar production, and sugar beet, which accounts for about 55 percent. Sugar cane cultivation is located in warm climates such as Florida, Louisiana, Texas, and Hawaii. Sugar beet cultivation is more dispersed across five more temperate regions. Cold winters facilitate the harvesting and storage of sugar beets, as their sucrose content tends to break down relatively quickly after harvest the warmer the weather. The northern and central Great Plains—including portions of North Dakota, Montana, Nebraska, Wyoming, and Colorado—accounts for 14 percent of U.S. sugar beet acres.

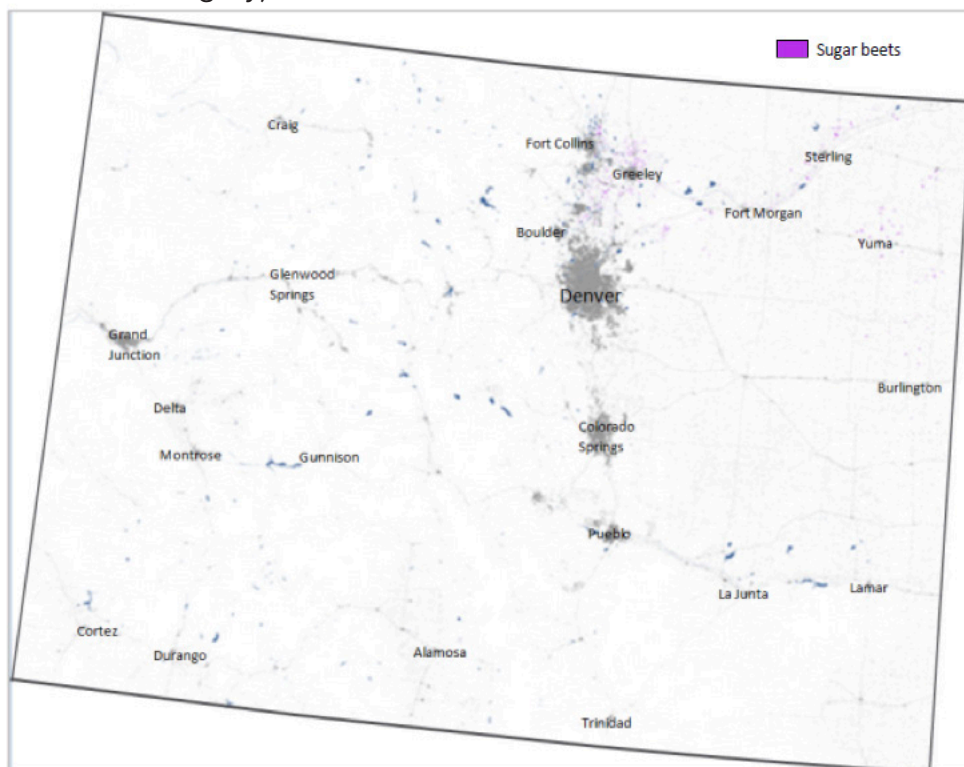
In Colorado, sugar beet cultivation is distributed throughout the eastern part of the state, with relative concentrations along the South Platte River valley and the northern Front Range (Figure 4.8). Over the last decade, the value of Colorado's sugar beet harvest has fluctuated around an average of about \$40 million a year. The lowest year was 2007, when it brought in just \$27 million. The peak year was 2011, at \$57 million. The value in 2016 was \$46 million.

Figure 4.7 Value of cash receipts for sugar beets produced in Colorado



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

Figure 4.8 Map of areas in Colorado planted to sugar beets, in purple. (Urban areas in grey).



Source: USDA-NASS, CropScape

A LINK IN THE VALUE CHAIN:
In 2016, Colorado growers received \$46 million for sugar beets.

4.1.6 GREENHOUSE AND NURSERY CROPS

A category of crops often overlooked when considering traditional agriculture are those grown on nurseries or in greenhouses. These are typically raised for residential, recreational, and commercial landscaping, for gardening, or for indoor ornamental use. Species include trees, shrubs, flowers, groundcover, and turf for landscaping, as well as potted plants, both indoor and outdoor, for gardening and ornamental uses.

Greenhouse and nursery crops are considered high value crops. As such, they do not typically require significant land, but they can be fairly intensive in their requirements of water, fertilizer, and pesticides. Also, they can require fairly intensive capital investments and energy expenditures for climate control.

Sometimes referred to as the “green industry” when considered in combination with those professionals who install and maintain cultivated landscapes, the demand for greenhouse and nursery crops is highly correlated with the dynamics of construction and real estate development. Growth in the urban corridor along the Front Range, as well as the development of a number of the smaller communities in the Mountains and on the Western Slope, has provided a traditional base of demand.

USDA accounts ceased tracking greenhouse and nursery revenues as a separate category for Colorado after 2012. It appears that after the 2012 Census of Agriculture, statistics on horticultural crops are only collected for 15 leading states. It may not be a coincidence that Colorado’s Amendment 64 which legalized marijuana, was passed by Colorado voters in a referendum in 2012. The vigorous expansion in Colorado of indoor growing facilities for cannabis following that decision would have presented a number of challenges to statistical tracking by the USDA.

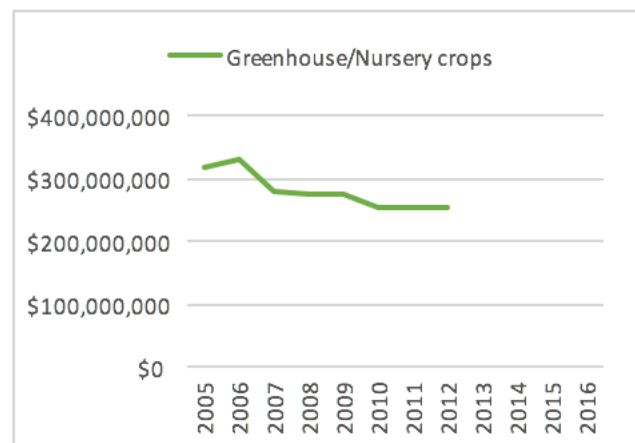
4.1.7 FOREST PRODUCTS

While Colorado has large expanses of forest lands, the state has made only a marginal contribution to U.S. timber production. In contrast, in some southern states, agroforestry-based timber production is an important agricultural activity. One factor affecting Colorado is that the majority of forest lands (over 70 percent) are publicly owned. Typical to western mountain states, many Colorado forest lands are located in difficult terrain, making them uneconomical to develop commercially. Many forest lands are also located in areas important to recreation and tourism, and are therefore not routinely logged.

A LINK IN THE VALUE CHAIN

Colorado greenhouses and nurseries received \$253 million in 2012—the last year for which USDA statistics are reported—for production and sale of a variety of horticultural landscaping and ornamental plants. With recovery of real estate and construction, sales likely rebounded above \$300 million by 2016.

Figure 4.9 Value of sales of greenhouse and nursery crops in Colorado

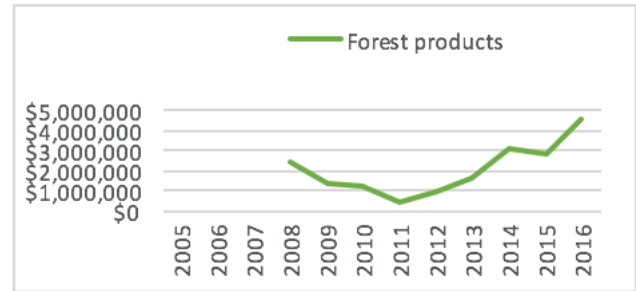


Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

Given these factors, with forest harvests historically below a critical threshold size, sawmills or other processing facilities are very scarce in the state of Colorado. As a result, trees that are harvested often must be trucked to neighboring states to be milled or processed.

However, after 2011, partly induced by the outbreak of Pine Beetles that infested and killed millions of acres of trees, Colorado farm and ranch operations began reporting increasing sales of forestry products. Some of those were being harvested in order to mitigate wildfire danger. In 2016, revenues from forest products were \$4.6 million.

Figure 4.10 Forest products are a small but growing source of revenue for Colorado farms and ranches



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:

Sales of forest products by Colorado farms and ranches were just \$4.6 million in 2016.

4.2 ANIMALS AND ANIMAL PRODUCT OUTPUTS

Extensive rangelands across the high plains and in the inter-mountain valleys of Colorado (see map in Figure 2.5) have historically made livestock a major economic activity. Since the first settlers arrived—and the era of cattle herding on the open range—ranching has been a way of life in the American west. The South Platte River valley developed over time into the western-most reach of highly productive irrigated corn cultivation. It was perhaps this geographical convergence of western rangelands with mid-western-levels of feed production capacity that made northeastern Colorado a center for livestock feeding and slaughter. The western climate and wide-open spaces also contributed to the concentration of livestock production, as dryer conditions made animal waste management easier and any air quality impacts were not as likely to bother residential neighbors. The growing Denver and Front Range urban populations provided a sizable regional consumer market for livestock products. But it was good access, via major transportation corridors, to other major markets in the U.S. and abroad that turned Colorado into a global hub of the livestock industry.

The livestock most commonly produced in Colorado are cattle, for both beef and dairy. Colorado is ranked as the fourteenth largest state in terms of beef cattle and the sixteenth in terms of milk cows (USDA-NASS, Colorado Cattle Facts, 2011). Colorado is one of the leading U.S. states in production of lamb, even though total numbers are much smaller. Colorado is also historically known for significant ownership of horses. Other livestock include goats, hogs, and some poultry. Cultivation of trout, famous in the mountain streams and lakes of Colorado, is a niche animal protein product, but one with significant growth potential.

4.2.1 BEEF

There are effectively two main phases of beef cattle production—roughly based on the beef cattle life cycle—that are today separated into two different types of livestock operation: cow-calf operations and cattle feeding operations. In addition, beef production is augmented by dairy cattle, including both male calves as well as dairy cows after their milk production has declined.

4.2.1.1 COW-CALF

The first type of operation is the traditional ranch, often called a cow-calf operation because they are primarily involved in the birth, rearing, and weaning of the young. This part of the cattle production life cycle does not exhibit much in the way of economies of scale. The primary function of these operations is the maintenance of reproduction herds—with a crop of calves each year—as well as achieving the initial weight gain of young steers and heifers in the herd, by feeding them on produced forage and range lands typically not productive enough to be dedicated to other higher value crops. As such, cow-calf operations can be geographically dispersed, large in acreage, and more remote from regions of major agricultural productivity.

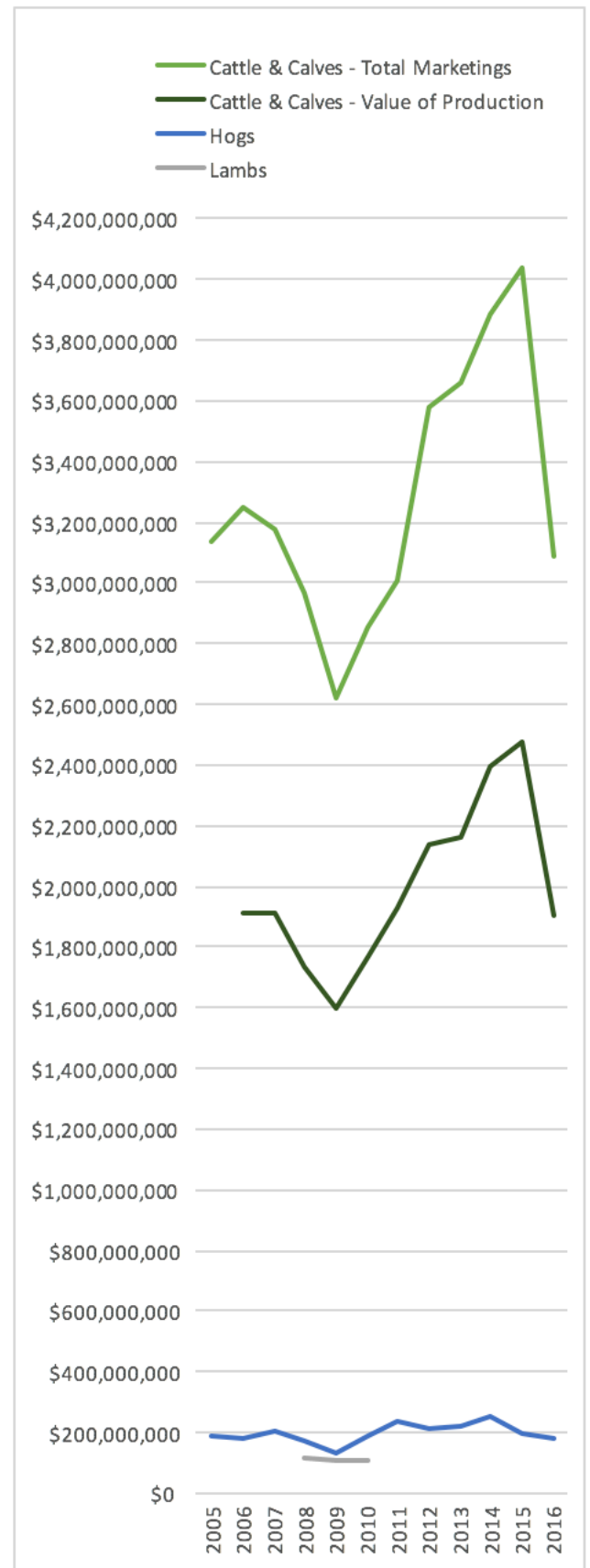
Cow-calf operations are numerous in Colorado. Given their size, they tend to be smaller in annual revenues per acre of land, when compared alongside other agricultural operations. In the mid-sized categories of Colorado farm and ranch operations we tend to see large overall land areas but modest overall revenues, as evidenced in Figure 2.3 and Figure 2.4. This is likely due to the high prevalence of family operated cow-calf operations. In addition, some cow-calf operations make use of additional acreage, such as public lands, for grazing (For details, see section 3.1.2.3 Grazing on Public Lands.)

About half of the cow-calf operations in Colorado are quite small, maintaining fewer than 100 head of beef cattle. Such small-scale operations are not capable of providing a primary income for a household. Most such cow-calf operations are instead providing supplemental income, along with enabling their operators to enjoy a ranching lifestyle and other associated recreational benefits (USDA-APHIS, Small-Scale U.S. Cow-Calf Operations, 2011).

Among cow-calf operations there is a smaller group of specialized seed stock operations which focus on cattle breeding and the genetic development of pure bred and blended genetic lines. These operations are tightly networked with breeders in other states and countries, trading in breeding cows, bulls, and semen, in efforts to maintain superior herd genetics.

As younger generations of beef cattle mature—after

Figure 4.11 Value of production and marketings of meat animals by Colorado ranchers and feeders



they are weaned and have reached an appropriate weight—the females (called heifers until they have calved for a second time) are selected either to stay on the cow-calf operation and be bred to produce calves (and are called “cows” after their second calf) or they are selected to be put on feed to gain weight for slaughter. In any given year, about 35 to 40 percent of heifers are retained for calving. Of the males, virtually all are castrated, and as steers are typically placed on feed to then gain weight for slaughter. Only a select few males with superior genetics are kept as bulls for the purpose of breeding.

The calf crop in Colorado in 2016 was approximately 830,000 head, contributing to a total inventory of about 1,642,000 cattle on cow-calf operations. This consisted of about 772,000 calves and heifers, about 810,000 steers, and 55,000 bulls. At an average value of \$1,490 per head, the total inventory value of the cattle on Colorado’s cow-calf operations was about \$2.45 billion in 2016

A LINK IN THE VALUE CHAIN:

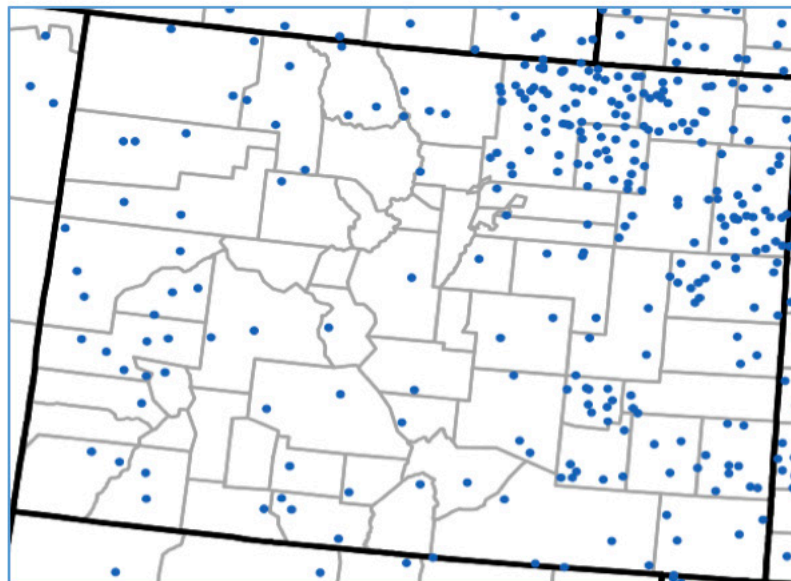
In 2016, marketings of live beef cattle among Colorado operations, primarily being placed on feed for market, was about 2,670,000 head, valued at \$3.1 billion.

4.2.1.2 FEEDING OPERATIONS

When selected to be placed on feed, cattle are typically moved from cow-calf operations to feeding operations, stockers or feedlots.

In general, there are several fundamental reasons for moving cattle to feeding operations. First, it is more efficient to transport animals when they weigh less. Not only does it save on need for trucks, fuel, and wear-and-tear on roads, but it is also easier on the animals. Second, optimal weight gain and meat quality is attained by reducing the movement of cattle and increasing their dietary intake. The economics of beef cattle feeding operations hinge largely on the logistical advantages of bringing cattle to the feed, rather than the feed to the cattle, for the final phase of intensive weight gain prior to slaughter. Depending upon weight at placement, a cow can be on feed for 90 days to almost a year.

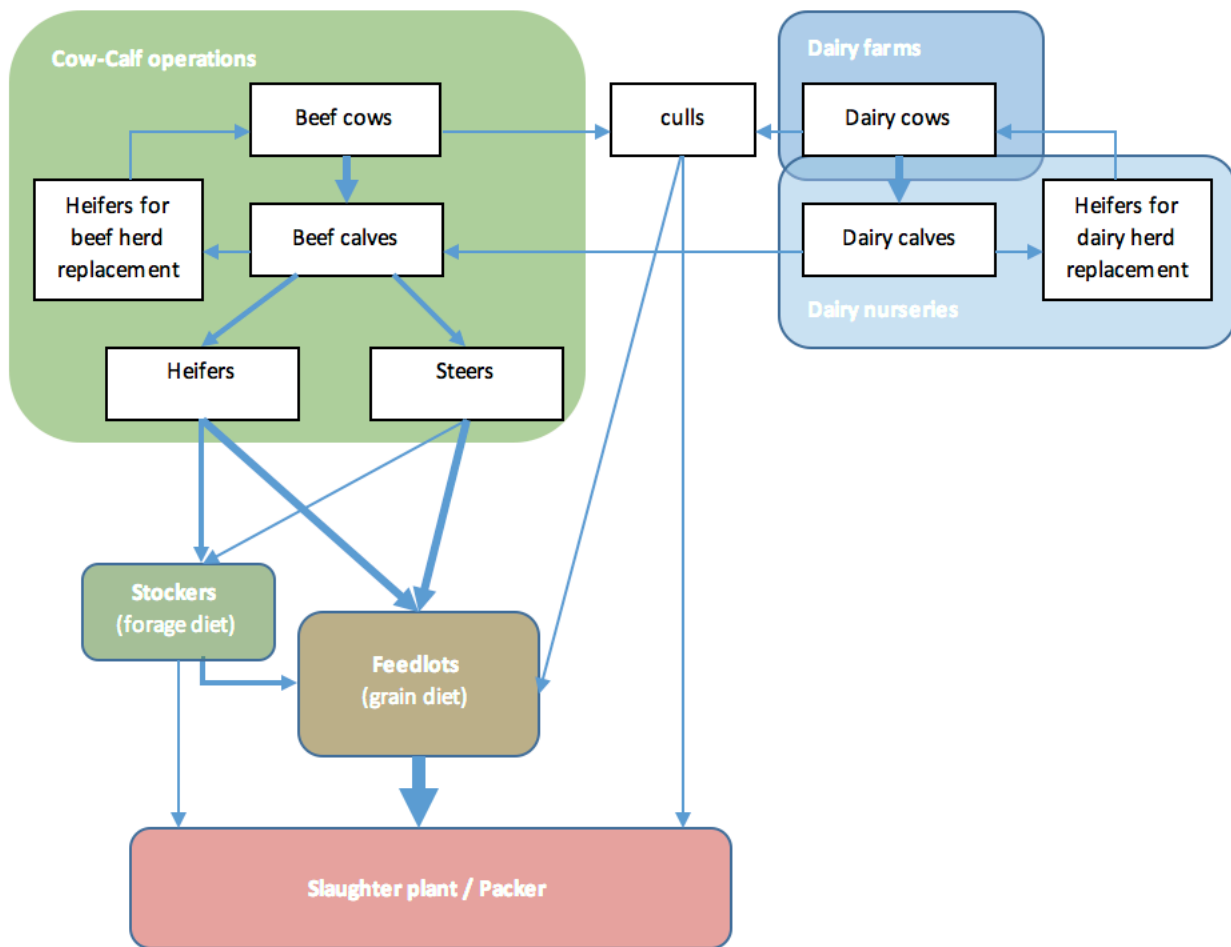
Figure 4.12 Map of population density of cattle and calves in Colorado



Source: USDA, 2012 Census of Ag Atlas Maps

1 dot = 10,000 cattle

Figure 4.13 Flow diagram of the beef and dairy system



Some cattle of lower weight may be purchased by stocker operations, with good forage but typically without a breeding herd or sufficient facilities to maintain a herd full time. The cattle are fed on the grass for a period of time, often from spring to fall, in order to increase their weight, and then sold on to feedlots.

On feedlots, cattle spend three to nine months being fed to gain weight for slaughter. Feedlots are larger and more concentrated than stocker operations. This is the point in the beef production value chain at which economies-of-scale really begin to take hold. Feedlots with capacities of greater than 1,000 head handle 80 to 90 percent of all fed cattle. On feedlots, cattle are kept in pens, are fed concentrated high-nutrient diets, and are carefully looked after for veterinary needs.

The feedlot capacity in Colorado is two to three times greater than the capacity of the state's cow-calf operations to supply it with animals. In 2016, 1,850,000 cattle were placed on feed in Colorado's cattle feeding operations. Yet, the calf crop on Colorado's cow-calf operations the previous year, in 2015, was only 800,000. The difference was made up by inshipments of 1,500,000 head of cattle to Colorado in 2016 for feeding. These beef cattle typically come from states to the northwest, such as Wyoming, Montana, and Idaho.

The preference of Colorado as a location for cattle feeding operations is due to several factors:

- Dry climate of the high plains eases animal health and manure management issues.
- Proximity to ample irrigated forage, grain, and silage production, such as in the South Platte River valley and Yuma County;
- Proximity to major slaughter facilities, such as those in Greeley and Fort Morgan;
- Access to major transportation corridors, both trucking (along interstates I-25, I-70, and I-80) and rail.

The inventories of cattle on feed are highly dynamic. In any month, the running inventory at Colorado feeding operations is around 1,000,000 head. Each month in 2016, an average of 180,000 head of cattle is placed on feed at Colorado feed operations, and each month a corresponding average of 175,000 head of cattle are marketed by feeding operations, primarily to nearby slaughter plants. The difference in these averages of 5,000 head a month includes death losses, movements of cattle from feedlots back to pasture, and shipments to other feedlots for further feeding. (USDA-NASS, Colorado Agricultural Statistics, 2017)

The pressures that most affect returns to beef cattle production include decreasing consumer demand, growing demand for exports, increased feed costs, economies of scale in meatpacking, and increasing vertical coordination through supply contracts. (For more detail see Koontz, Economic factors impacting the cattle industry, the size of the beef cattle herd, and profitability and sustainability of cow-calf producers, 2010).

A LINK IN THE VALUE CHAIN:
In 2016 Colorado beef operations produced 1,745,000 fed beef cattle, valued at \$1.9 billion.

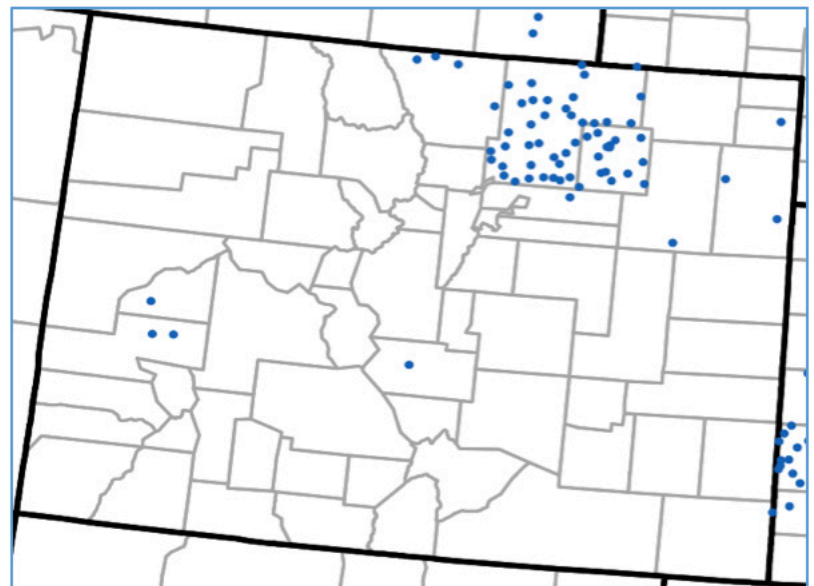
4.2.2 DAIRY

A dairy farm can be thought, in some respects, to be a specialized sort of cattle feeding operation. Indeed, many of the same factors that have made the Platte River Valley and northeastern Colorado a favorable location for cattle feeding operations have also made it favorable for dairy production. These factors include plentiful nearby supplies of feed and fodder, a favorable arid climate for maintaining animal health and environmental standards, and proximity to markets and market infrastructure. As such, dairy production has been increasingly concentrated in Colorado over the past decade, particularly in Weld, Morgan, and Larimer counties (Figure 4.14).

A dairy cow, however, is very different from a beef cow. Not only are breeds different, but so is the life cycle and the typical level of investment and revenue per cow. The life of a dairy cow begins in a nursery operation, usually associated with a working dairy, where a pregnant cow is relocated bear and rear her young. The value of a heifer calf is approximately three times that of a bull calf, as naturally heifers are the ones retained for future milk production. Bull calves are castrated and, once weaned, fed for beef production. The imbalance in value between sexes is the motivation behind the work on technologies for the sexing of bull semen, for sex selection when doing artificial insemination of dairy cows.

The primary revenue source of a dairy is the milk produced. A typical milk cow in the U.S. will today produce about 23,000 pounds of milk per year; the average Colorado milk cow in 2016 produced 25,980 pounds, one of the highest per cow rates in the country. With 148,000 milk cows in 2016, Colorado dairies produced 3.9 billion pounds of milk. At an average value of \$16.70 per hundredweight, Colorado dairies saw gross receipts of almost \$655 million in 2016.

Figure 4.14 Map of milk cows in Colorado



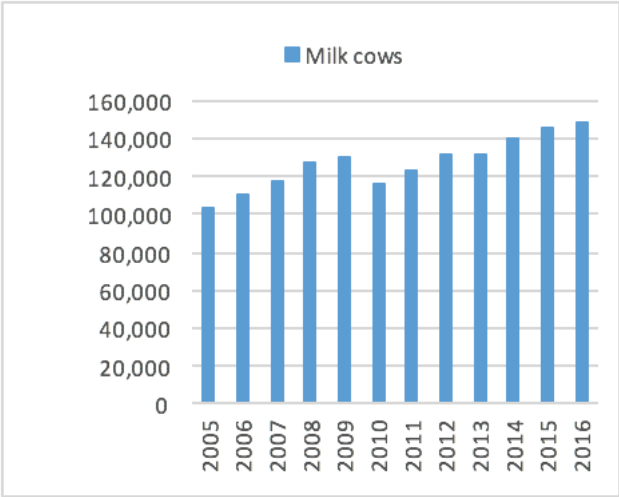
Source: USDA, 2012 Census of Ag Atlas Maps

1 dot = 2,000 milk cows

Once the productivity of a dairy cow declines, typically after three years, it will be culled from the dairy herd for slaughter. The use of culled dairy cattle in beef production rounds out the economic returns to a dairy operation if animal health is well attended. It can also complement certain aspects of beef production. Meat from dairy cattle is quite lean, since they tend to put so much of their metabolic energy and fat into milk production. The lean meat from culled dairy cattle is, for example, useful for producing lean blends of ground beef. The dairy sector has been one of the fastest growing in Colorado over the last decade, with receipts growing from around \$200 million in the early 2000s to close to \$900 million in 2014. Lower prices brought the value of dairy production down to \$655 million in 2016, even though production volume continued to increase.

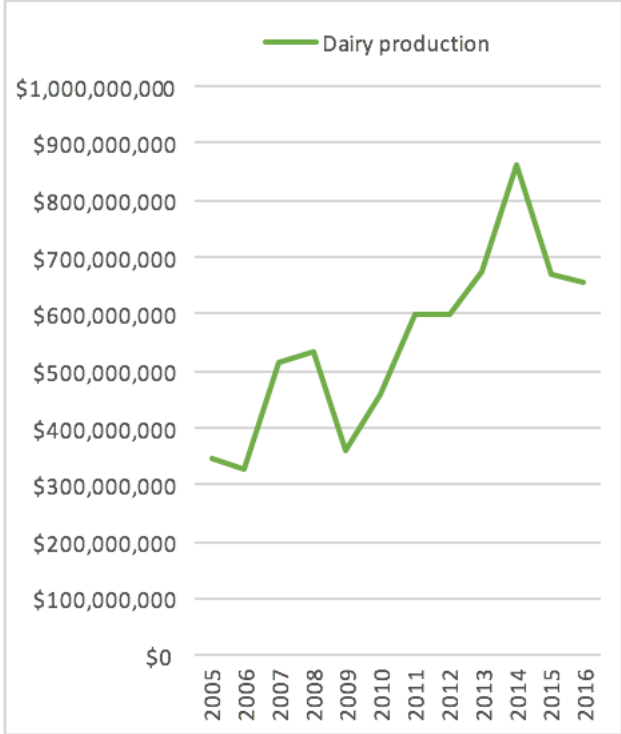
A LINK IN THE VALUE CHAIN:
In 2016, Colorado dairy farms received \$655 million for dairy production.

Figure 4.15 Population of milk cows on Colorado dairy farms



Source: USDA NASS: Colorado Agricultural Statistics 2017

Figure 4.16 Value of production of milk and milkfat by Colorado dairy farms



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

4.2.3 HOGS AND PIGS

While overshadowed by the numbers and the value of beef and dairy cattle, significant numbers of small livestock are also grown in Colorado. Colorado raises a significant population of hogs and pigs. According to conventional usage, the term “pig” refers to a younger animal, less than 120 pounds, while a “hog” is a mature animal, more than 120 pounds, and thus approaching weight for market.

Hog production is largely on the eastern plains, in areas such as Yuma County co-located in areas of large production of feed grains (Figure 4.17). In 2016, Colorado had an inventory of 670,000 hogs, of which 150,000

were breeding sows. At an average of 10.1 baby pigs per litter in 2016, a crop of 3,063,000 pigs was produced, and altogether 3,128,000 head of hogs was marketed. Receipts for these were \$182 million in 2016 (Figure 4.11). However, as explained later, in the section on “Animal Slaughter, Processing, and Meat Packing,” just 20,300 hogs were slaughtered in Colorado in 2016, meaning that virtually all hogs marketed for slaughter are shipped out of state.

4.2.4 SHEEP, LAMBS AND GOATS

Colorado typically ranks among the leading states in the nation in production of sheep and lambs. In 2016, Colorado ranked third in sheep and lamb production and fourth in wool production.

Sheep and lamb production follows a similar lifecycle pattern to that of beef production, with two types of operations: stock-sheep operations graze sheep and lambs on the range, especially during warm months, and lamb-feeding operations feed and finish lambs for market. One difference is, of course, the value of wool production from sheep and lambs.

In Colorado in 2016, the sheep inventory was 435,000, of which 191,000 were breeding stock, producing a lamb crop of 180,000 (USDA-NASS Colorado Agricultural Statistics, 2017). Animals are found on range throughout the state, but they are particularly prevalent on the Western Slope and the Southwest. The high populations in Weld County are also due to the presence of several large lamb feeding operations (Figure 4.18).

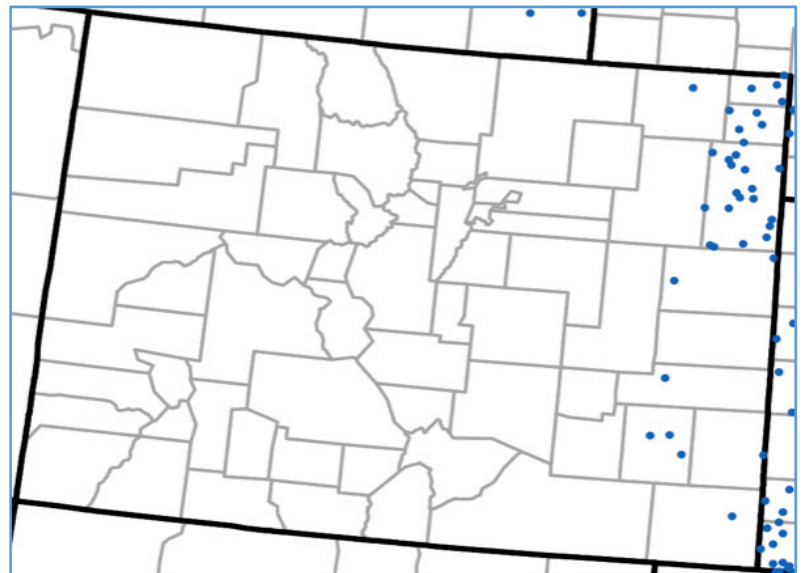
Similar to the situation in cattle, however, Colorado lamb feeding operations and slaughter plants have considerably greater capacity than do Colorado stock-sheep operations. Sheep and lamb inshipments were on the order of half a million head in 2016, coming largely from other mountain states.

In 2016, 829,600 lambs and sheep were slaughtered in Colorado; however, prices and cash receipts for sheep and lambs are not reported by the USDA. In the last year estimates

LINK IN THE VALUE CHAIN

In 2016 Colorado hog operations received \$182 million for marketing of hogs.

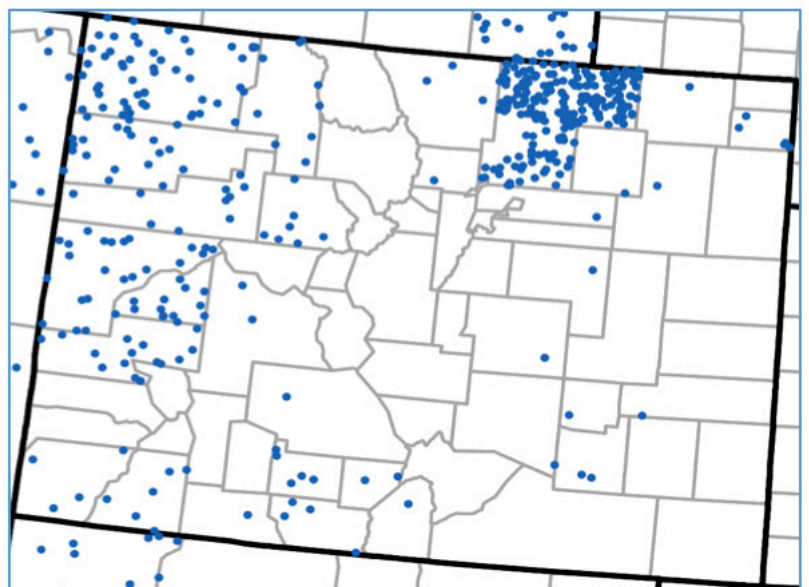
Figure 4.17 Map of hogs and pigs in Colorado



Source: USDA, 2012 Census of Ag Atlas Maps

1 dot = 20,000 hogs & pigs

Figure 4.18 Map of sheep and lambs in Colorado^A



Source: USDA, 2012 Census of Ag Atlas Maps

1 dot = 1,000 sheep & lambs

were made, 2010, Colorado sheep and lamb operations received \$111 million for sheep and lamb marketings. In 2010 inventories were 370,000 compared to 2016 inventories of 435,000.

Wool is also a source of revenue, albeit much smaller, for sheep and lamb producers, and paradoxically prices and revenues for wool are reported by USDA. In 2016, 295,000 sheep were shorn to produce 2.2 million pounds of wool. At \$1.70 per pound, the value of wool production was \$3.7 million in 2016 (USDA-NASS, Colorado Agricultural Statistics, 2017).

Colorado is a niche producer of goats, with a total estimated inventory of 35,000 goats in 2016. Of these, 24,000 were meat goat breeds, 10,000 were dairy goats, and approximately 1,000 were Angora goats. Separate revenue figures for goats are not available. (USDA-NASS, Colorado Agricultural Statistics, 2017).

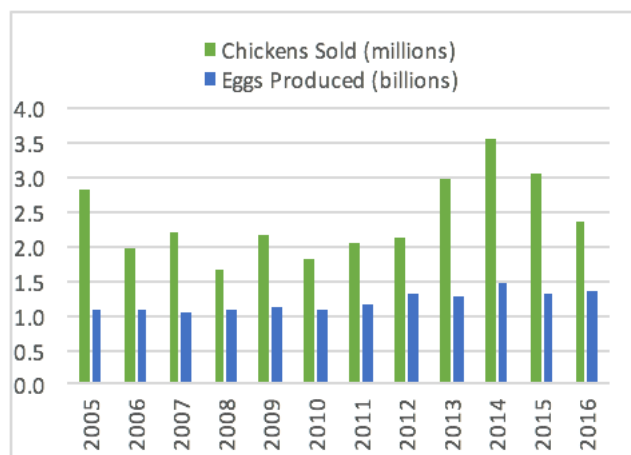
4.2.5 POULTRY AND EGGS

Compared to other states, Colorado has a moderate level of poultry and egg production. The largest producing states are located throughout the South and Southeast. Over recent years the number of chickens sold in Colorado has ranged between 1.7 million a year to 3.5 million a year. In 2016, 2.4 million chickens were sold for slaughter, for a value of sales of \$730,000. By contrast, in 2016, more turkeys than chickens were produced and sold for slaughter in Colorado, resulting in cash receipts of \$32 million. Egg production in Colorado has increased in recent years, with an average layer inventory of 4,606,000 million hens in 2016 producing 1.3 billion eggs. The value of egg production in 2016 was \$68 million.

A LINK IN THE VALUE CHAIN:

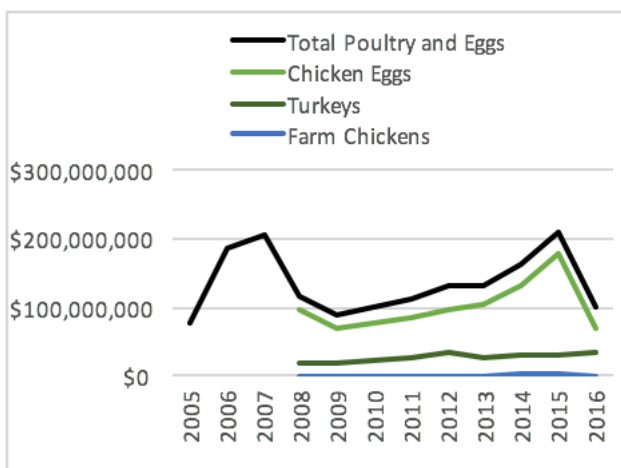
In 2016, USDA reports \$128 million for “All other animals and products”, a category mostly consisting of sheep and lambs as well as goats. In 2016 sheep and lamb producers received \$3.7 million for wool.

Figure 4.19 Chickens and eggs produced in Colorado 2005-2016



Data source: USDA-NASS, Colorado Agricultural Statistics, 2017

Figure 4.20 Value of sales of poultry and egg products



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN: Colorado poultry operations received \$101 million for sale of eggs, chickens, and turkeys in 2016.

4.2.6 HORSES

Historically, horses have played several very important roles in farming and ranching. Today those roles are met by tractors, combines, pickups, 4-wheelers, and other power equipment. About a century ago the internal combustion engine began replacing animal power in agriculture. Subsequently, horse populations in America have decreased significantly. Yet, still today, horses have a presence in the agriculture of the American West.

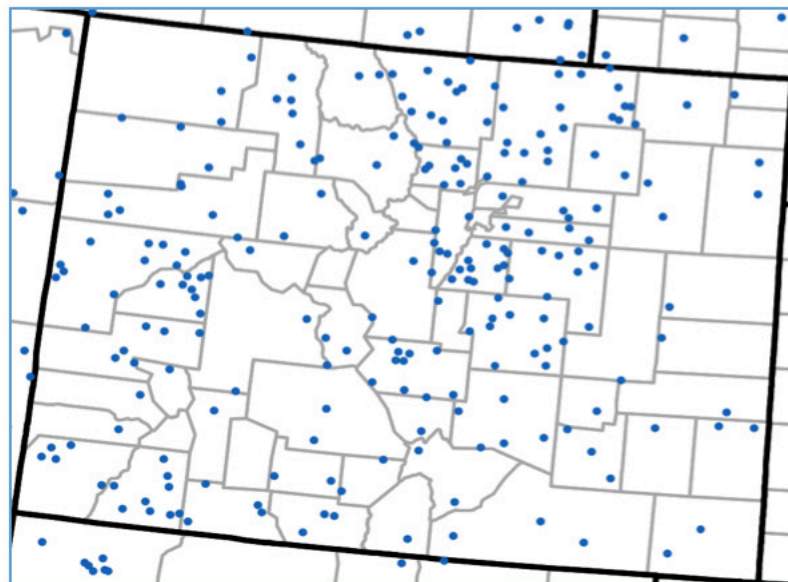
Horses are primarily bred and raised for recreational uses, such as racing, rodeo, backcountry packing, showing, jumping, and pleasure riding. However, on some cow-calf operations and cattle feeding operations, horses remain the preferred vehicle for certain jobs.

According to recent survey (EQUINE 2015, USDA, 2016), 40 percent of horses in the U.S. are on farm and ranch operations, 39 percent are on personal residences for recreational use, another 12 percent are kept at equine boarding facilities and riding stables, again for recreational use, and 7.6 percent are on equine breeding farms. Although controversial, there is a small export market for horse meat—primarily to Belgium, France, and Japan. While horse herds are not kept intentionally for meat production, culled horses are regularly shipped for slaughter in Canada and Mexico, and the packed meat is then shipped on to these export markets.

A LINK IN THE VALUE CHAIN:
When most recently reported, from the 2012 Census of Agriculture, Colorado farms and ranches received \$32 million for sales of horses, ponies, mules, burros, and donkeys.

Geographically, horses are kept all over Colorado. The most discernible pattern is that the horse population roughly follows the human population density (Figure 52). The direct income from raising horses is due to sales of animals (reported here). Other income for an equestrian business, however, can also be considerable, including expenditures on boarding, upkeep, and training for recreational uses.

Figure 4.21 Map of population density of horses in Colorado



Source: USDA, 2012 Census of Ag Atlas Maps

1 dot = 500 horses & ponies

4.2.7 TROUT AND OTHER AQUACULTURE

The term “aquaculture” refers to the cultivation of aquatic species or, more simply, “fish farming.” The practice is rapidly growing around the world as a way of providing protein for human consumption, in addition to rearing livestock. In Colorado, as a landlocked state, aquaculture is not as large an agricultural activity as it is in coastal areas. But, a few types of fish do thrive, and can be cultivated, in Colorado’s freshwater environments, in particular trout.

Trout and other freshwater fish are cultivated on a significant scale. Most of the fish caught by anglers in Colorado’s rivers, streams, lakes, and reservoirs were stocked there, having begun their lives in the hatcheries of the Colorado Parks and Wildlife or the U.S. Fish and Wildlife Service (USFWS), located around the state (Figure 4.22).

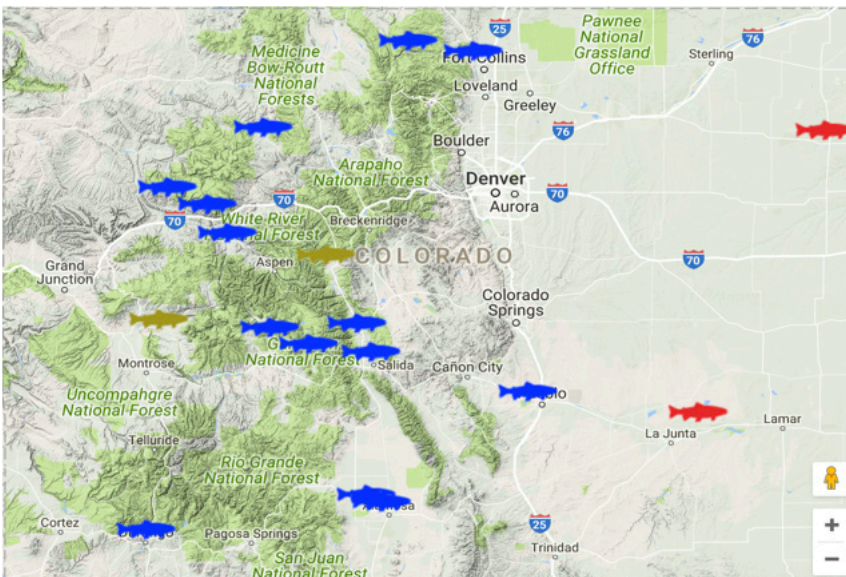
There are also several commercial operations around the state that cultivate trout and other species for sale. Many of these business operations are focused on stocking fish in privately owned waters for recreational purposes, thus complementing the efforts of the publicly run hatcheries. Some of the private operations also provide farmed trout directly to food markets.

A list of Colorado fish farms and other aquaculture companies can be found on the website of the Colorado Aquaculture Association (www.colaqua.org).

A recent analysis by Colorado State University of private stocking of fish for recreational use estimates that over \$36 million is spent annually at privately stocked properties (Diesenroth, Bond, and Geleta, Who Is Stocking Privately Produced Fish? A Look at the Customers of the Private, Recreation-Based Aquaculture Industry in Colorado, 2012).

The value of commercial trout aquaculture in Colorado has ranged between \$1 and \$2 million over the last decade. In 2016 it was \$2.2 million.

Figure 4.22 Map of government run fish hatcheries in Colorado



Source: Colorado Parks and Wildlife, Fish Hatcheries, <http://cpw.state.co.us/learn/Pages/Hatcheries.aspx>

**A LINK IN THE
VALUE CHAIN:**
Commercial trout
aquaculture in the
state of Colorado
sold \$2.2 million in
2016.

4.2.8 HONEYBEES

Few people think “insects” when they think of farm animals, but in fact the cultivation of honeybees is an integral part of today’s agriculture. Not only do bees produce honey, which is an important food, but more importantly bees provide an essential service to other sectors of agriculture: pollination. Fruit crops in particular, such as Colorado’s peach and apple trees, depend upon honeybees annually to transfer pollen from flower to flower and thus initiate the production of that year’s fruit crop. Lack of pollination means crop failure.

While some honeybee hives are kept on orchards permanently, it is increasingly common to hire specialized honeybee farmers to bring in additional hives for pollination services during the crucial several weeks a crop is in flower. The honeybees are moved around the state, and the country, from one flowering crop, when it is in season, to the next. This also keeps the honey production of the hives at a higher pace, as they are able to collect nectar from more willing sources than if they stayed at a single location where food supplies eventually languished.

Several honeybee operations based in Colorado have maintained operations around \$2 to \$3 million annually (Figure 4.23). They produced honey valued at \$2.8 million in 2016.

4.3 SERVICES PROVIDED BY FARM AND RANCH OPERATIONS

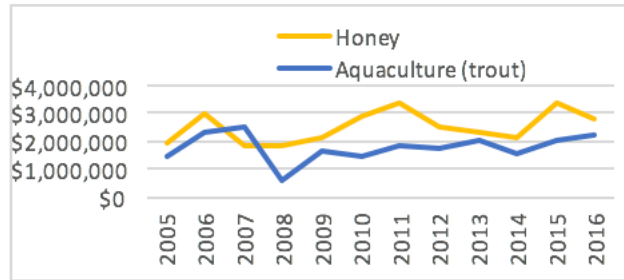
In addition to receiving revenue directly for the commodities produced, Colorado farms and ranches have several additional sources of revenue that represent additional flows of value from their operations.

4.3.1 MACHINE HIRE AND CUSTOM WORK

In addition to the on-farm sales and use of physical commodities including purchased feed, purchased seed, and purchased animals there is a category of on-farm services, which represents value of work done by farms and ranches for other farms and ranches. This is the category of “Machine hire or custom work,” described previously as an expense category; but here we consider the revenues from providing these services to neighbors.

Generally, we expect to see farms and ranches expend more on machine hire and custom work than they earn from providing it, such that this category would be a net expense for the farm and ranch sector. Off-farm equipment vendors or specialized custom work contractors make up the difference by

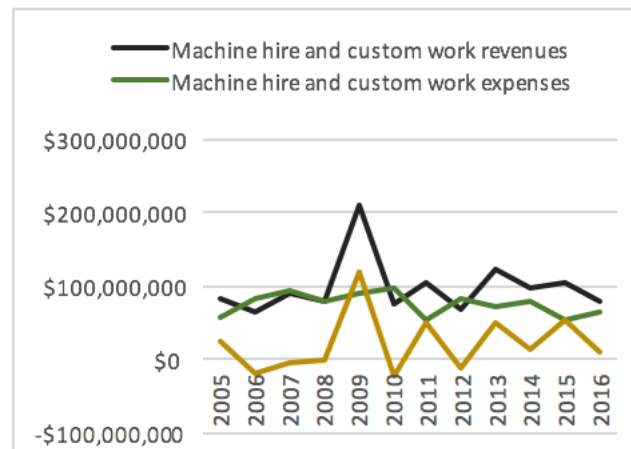
Figure 4.23 Value of sales of other livestock products, including trout and honey



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:
Colorado honeybees produced \$2.8 million of honey in 2016.

Figure 4.24 Machine hire and custom work revenues vs expenses for Colorado farms and ranches



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

providing services to farm operations. However, we observe that over the last decade, Colorado farms and ranches more often report earning more from providing machine hire and custom work than they spend on it. These may be services to non-operator household neighbors, such as mowing or earthwork. 2016 was an example of such a year, with Colorado farms and ranches receiving \$78 million for machine hire and custom work compared to paying expenses of \$67 million for machine hire and custom work, resulting in a net income to the sector of over \$11 million.

4.3.2 AGRITOURISM AND FARM-BASED RECREATION

Increased interest by farm and ranch enterprises in finding ways to diversify income sources, coupled with increased interests by the general public in outdoor recreation and support of local agriculture has made farm-based recreation an emergent industry in Colorado. The main forms of farm-based recreation are the following:

- Outdoor Recreation – fishing, hunting, wildlife photography, and horseback riding
- Educational experiences – farm and cannery tours, cooking classes, wine tastings, trail riding, cattle drives, and farm life experiences
- Entertainment – harvest festivals and corn mazes
- On-farm direct sales – “u-pick” operations and road side stands
- Off-farm direct sales – farmers’ markets, county and state fairs, and other special events.

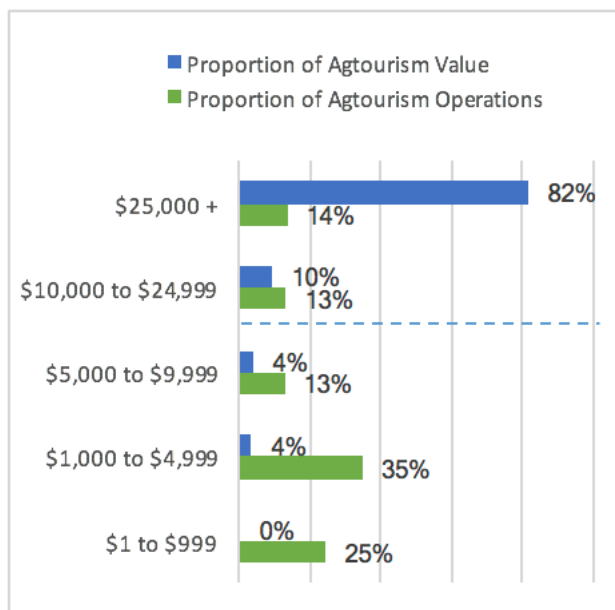
Agtourism or farm based recreation revenues are not reported as a separate category in the annual estimations of receipts and expenditures by USDA. But, they are routinely surveyed every five years in the USDA Census of Agriculture. According to the 2012 Census of Agriculture, 864 farms in Colorado reported total receipts of \$28 million from agtourism and farm-based recreation activities. The number of farms participating in farm-based recreation was up from 679 farms in the 2007 Census of Agriculture, but revenues were down from \$33 million in 2007. In 2012, agtourism and recreation represents 6% of the overall revenues for those 864 farms that reported receiving at least some revenue from this source.

Figure 4.25 illustrates that 73 percent of the operations in Colorado that reported farm-based recreation revenues in 2012 had total sales of less than \$10,000; however, they accounted for only 8 percent of the revenue. Twenty seven percent of the operations in Colorado that reported farm-based recreation received \$10,000 or more, and accounted for 92 percent of the income generated from farm-based recreation in Colorado.

A LINK IN THE VALUE CHAIN:

In 2016 Colorado farms and ranches received \$78 million for machine hire and custom work.

Figure 4.25 Distribution of farm-based recreation/agtourism revenues across farm and ranch operations of different income classes in Colorado

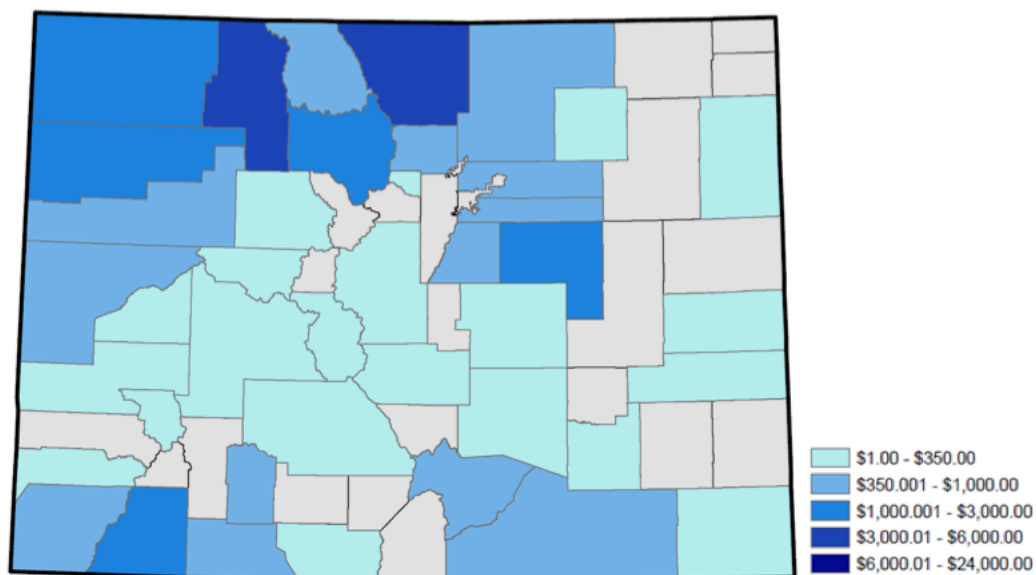


Data source: USDA NASS, 2012 Census of Agriculture, Income from Farm-Related Sources, Colorado

Regional differences in numbers of operations and incomes from farm-based recreation are illustrated in the map in Figure 4.26. The Northwest region of the state leads in income from farm-based recreation as well as number of operations, particularly from hunting and fishing opportunities. Eastern Colorado is the smallest in both income and prevalence of operations with agritourism activities.

While it is a small source of revenue for the sector overall, agritourism and farm-based recreation can offer unique income diversification opportunities to agricultural producers in Colorado, while providing Colorado residents an exposure to agriculture. The number of operations providing farm-based recreation increased from 2007 to 2012, and, with current trends toward locally produced foods, farm and ranch based recreation is should continue to be an integral part of Colorado agriculture.

Figure 4.26 Map of the value of agtourism and farm-based recreation by county in Colorado, 2012



Source: Anders Van Sandt, dissertation, Department of Agricultural and Resource Economics, Colorado State University, 2018

A LINK IN THE VALUE CHAIN: In 2012—the latest year for which data are available—Colorado farms and ranches received \$28 million from agtourism and recreational services.

4.4 REVENUES TO FARM AND RANCH OPERATIONS FROM RISK MANAGEMENT STRATEGIES

Farm and ranch operations must employ a range of tools and strategies to manage the unique risks of agriculture as a business. Some of these are essentially business strategies, such as future contracts and options for managing prices of sales and purchases, storing harvests for sale at a later date once prices go up, or transporting product to a buyer that provides a more advantageous price. Some of these tools and strategies are structural, such as diversifying sources of revenue and maintaining off-farm employment.

However, some risk management options are provided by the federal government as part of U.S. public policy for maintaining a robust agricultural sector and national food security. These include programs such as commodity subsidies, conservation payments, and disaster payments, as well as premium subsidies to help encourage farm and ranch operators to purchase an optimal level of crop and livestock insurance coverage.

The economic rationale for government intervention is to smooth out the rough edges of the financial risks and to spread out the costs of domestic U.S. agricultural production. These subsidies can be thought of, in some sense, as a “down payment” made by Americans on their annual grocery bill—a down payment that helps to assure that the monthly payments at the grocery store are lower and to help assure that all American

households are able to regularly afford an adequate diet. These government programs can also be thought of as a way of keeping agricultural lands open and undeveloped—whether in active agricultural production or set aside for conservation measures—rather than being sold off, parceled, and developed as residential and commercial real estate. Finally, these subsidies can be partly thought of as payments that help keep food production located domestically here in the U.S., without which more farms and ranches would become insolvent, leaving U.S. consumers more dependent on imports from foreign food producers.

These subsidies are criticized, however. Some argue that they represent wasteful government spending, feeling that they are not effective in achieving the stated economic and strategic goals. Some argue that they distort agricultural production towards those crops for which subsidies are offered and away from those for which they are not offered. America's trade partners, particularly in developing countries, argue that these subsidies create an unfair trade imbalance, hurting the agricultural sectors of their economies on which they are reliant for economic growth and reducing poverty and hunger.

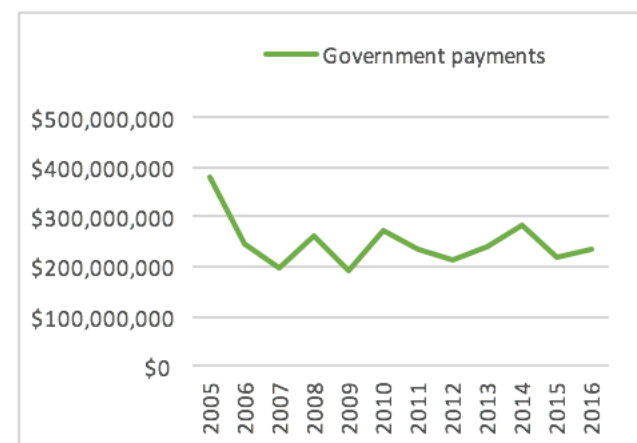
4.4.1 REVENUES FROM GOVERNMENT PAYMENTS

Since the economic devastation wrought on U.S. agriculture by the Great Depression and the Dust Bowl in the 1920s and 1930s, Congress has every five years considered a package of legislation called the “Farm Bill” that provides for a range of risk-mitigating financial programs administered by the USDA for the support of U.S. farms and ranches.

Today, three basic types of programs provide payments to agricultural producers. First are production subsidy programs, which typically provide payments to support the production of specific commodities. The two main crops grown in Colorado that account for most of this type of commodity payments are corn and wheat, with combined payments of about \$150 million per year to Colorado farmers. Other crops, such as barley, sorghum, and sunflower, receive smaller amounts, collectively about \$15 million a year. Livestock and dairy subsidies are more variable, but bring in an average of \$20 million a year to Colorado. Altogether, production subsidy programs account for about \$180 million a year in government payments.

Second are programs that compensate farmers and ranchers to keep registered lands out of agricultural production and maintain them for conservation purposes or the provision of ecosystem services. These programs typically target environmentally sensitive lands such as riparian habitat or wetlands. The main program of this type is the Conservation Reserve Program (CRP). Colo-

Figure 4.27 Government payments of farm subsidies, conservation incentives, and federal disaster relief to Colorado farms and ranches



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN

Colorado farms and ranches received \$234 million in government payments in 2016, primarily from USDA commodity and conservation programs.

rado farms and ranches receive about \$80 million a year in payments under the CRP and related environmental programs.

Third are programs that help farms and ranches in the event of emergencies brought on by natural disasters, such as droughts, floods, or blizzards. Disaster payments made under such programs are much more variable and over the last decade have ranged from \$6 to \$130 million depending on the year.

Altogether, Colorado farms and ranches have received an average of about \$250 million per year in federal payments over the last decade. In 2016, the amount was \$234 million. Thus, federal farm payments to Colorado farm and ranch operations average out to \$42 dollars per Colorado citizen.

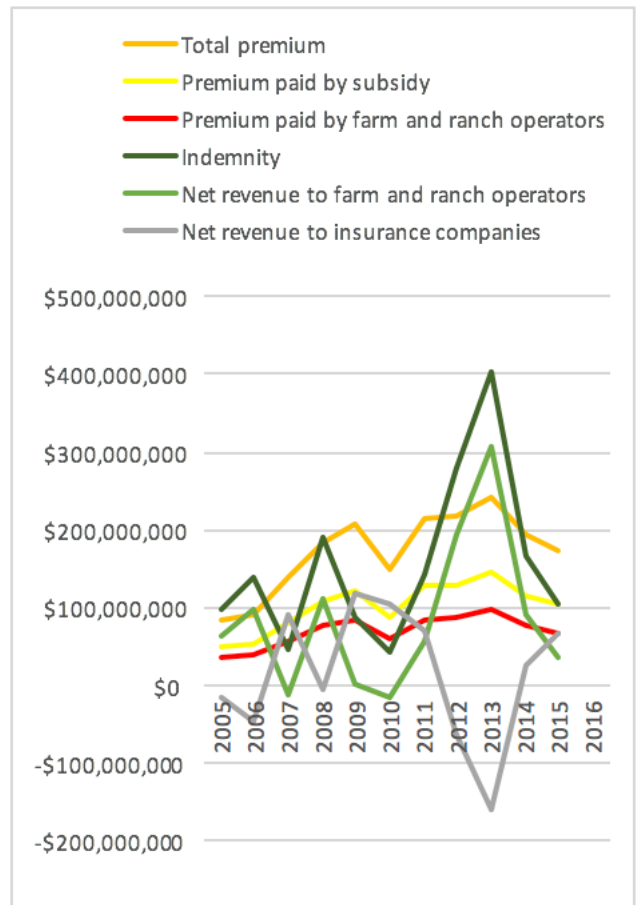
4.4.2 NET REVENUES FROM CROP INSURANCE

Crop insurance is an additional tool designed to manage financial risks for agricultural producers. As explained in the previous section of this report on “Farm and ranch expenses for crop insurance and livestock price insurance,” Colorado farms and ranches pay only part of the premium for crop and livestock insurance, with the federal government, through the Federal Crop Insurance Corporation, paying the rest of those insurance premium payments. However, when farmers realize crop losses, they receive the full amount of indemnity payouts from their crop insurance policies.

For example, in 2015 (the latest year for which data were available), total premium payments to insurance companies was \$173 million. The premium paid by subsidy from the federal government was \$104 million while Colorado farms and ranches paid the other \$69 million, or 40 percent of the total. Over the past decade, government subsidies consistently covered about 60 percent of the crop insurance premium for Colorado producers (Figure 4.28).

Annual premium payments have grown steadily over the last decade. Due to subsidized premium payments, the average annual aggregate premium payments paid by Colorado farm and ranch operators was \$71 million,

Figure 4.28 Crop insurance indemnities paid to Colorado farm and ranch operations, relative to premium payments made by subsidy and by Colorado farm and ranch operators



Data source: USDA Risk Management Agency, Business Reports and Data

A LINK IN THE VALUE CHAIN: Crop and livestock insurance policies held by Colorado farms and ranches paid indemnities of \$106 million and resulted in a net revenue of \$37 million in 2015, due to the fact that 60 percent of the cost of the policy premiums was subsidized by the federal government. (Average net revenue over the last decade was \$85 million per year.)

measured over the decade from 2005 to 2015. Interestingly, however, Colorado farms and ranches appear to have actually purchased less insurance subsequent to the very large indemnity payout years of 2012 and 2013. They (and the federal subsidy) paid smaller amounts in 2014 and 2015.

Losses by Colorado farmers have been sporadic, but have resulted in indemnities paid on claims averaging \$155 million per year over the decade from 2005 to 2015. Thus, the net revenues to Colorado farms and ranches from crop and livestock insurance (indemnity minus premium paid by operators) averaged \$85 million per year over the decade from 2005 to 2015. On occasional years, the insurance companies underwriting crop insurance policies for Colorado farm and ranch operations took considerable losses, such as -\$62 million in 2012 and -\$160 million in 2013. However, the net revenues to insurance companies averaged \$17 million per year over the full decade from 2005 to 2015. And, finally, the net cost to the government (and thereby to U.S. taxpayers) equaled the amount of premium paid by the subsidy, which averaged \$102 million per year over the decade from 2005 to 2015.

4.5 OFF-FARM EMPLOYMENT

Nationally, in 2016, the households of farm or ranch operators in the U.S. had, in total, an average income of \$117,918. By comparison, the average U.S. household income was \$83,143. In other words, farm operator households have 42 percent higher income than average U.S. households. In 2011, this gap was 25 percent, so it has grown significantly in the last five years. For U.S. farm households, 2016 income from the farm operation was estimated to be \$24,731, while income from off-farm sources was \$93,187 (Figure 4.29(a)). Thus, off-farm income provides 79 percent of total household income across U.S. farm households.

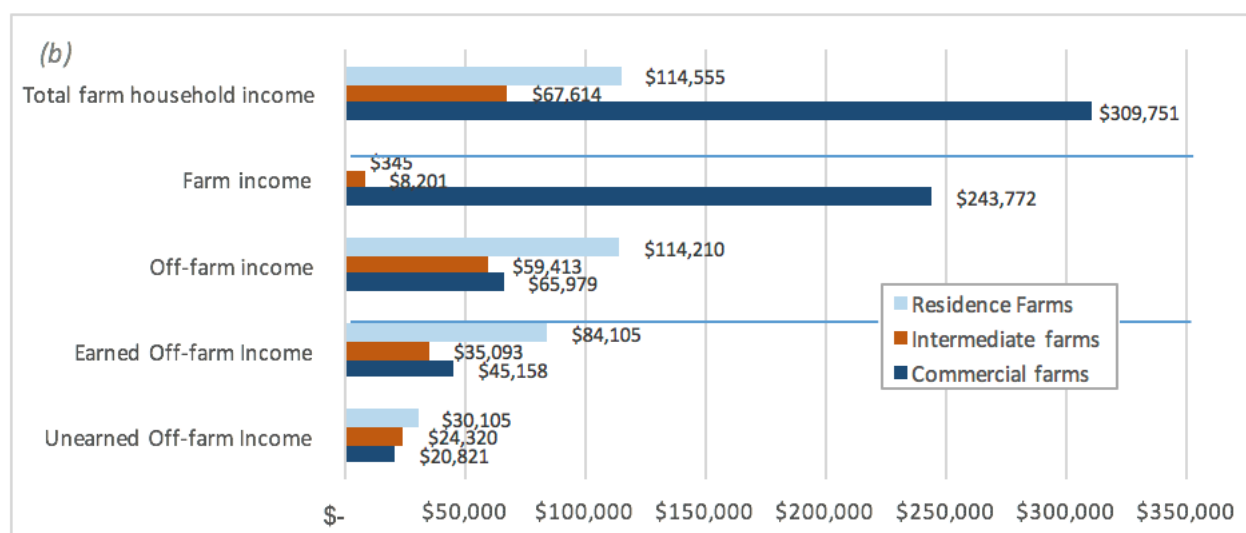
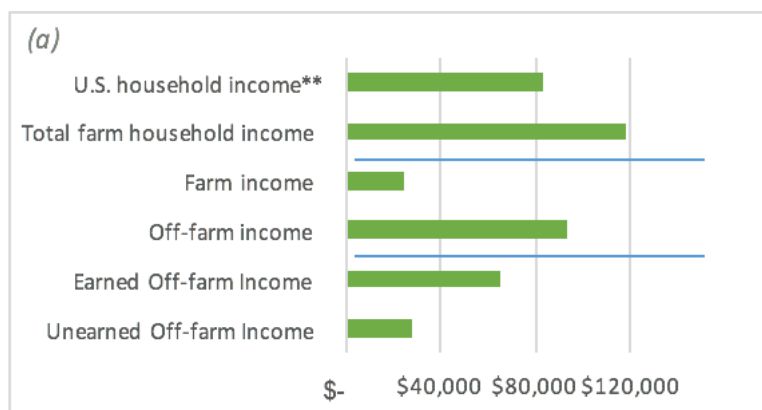
However, averages can sometimes be misleading. Dividing farm operator households into three broad categories, we see that commercial farm operator households have, simultaneously, a much higher average income overall, at \$309,751, and a lower average off-farm income, at just \$65,979, or just 22 percent of total farm household income. At the other end of the spectrum households of operators on residential farms have a higher average income overall, at \$114,555, and an average farm income of just \$345. Clearly these households are not relying upon the farm income. Many are, in fact, taking a loss in the farm operation, bringing the average farm income close to zero. Tellingly, these households have the highest average from unearned income sources, such as investments. The greatest discrepancy are the intermediate farms, with total family income of \$67,615, actually 20 percent below average U.S. household income. These lower-income farm-operator households are more dependent on off-farm income.

Even so, off farm income offers a number of advantages. To the extent that it is unrelated to farming activities, can provide some income source diversification and thus some income stabilization for households engaged in farming and ranching. Off-farm income may also provide other important income smoothing or diversification benefits, such as health or retirement savings plans.

State-specific data on off-farm income is not available. However, assuming that the households of Colorado farm and ranch operators fit U.S. averages, a first approximation is that in 2016 the households of Colorado farm and ranch operators received roughly \$3.4 billion in off-farm income, up from \$2.3 billion a decade earlier (Figure 4.30), thus cushioning these households against the vagaries of farm incomes. This must be interpreted with caution, because the large majority of these households are associated with residence farms who already enjoy a higher household income, and may have, for this very reason, purchased a rural property and engage in minor recreational or household-scale agricultural production activities on the side.

A LINK IN THE VALUE CHAIN:
Households of Colorado farm and ranch operators had an estimated off-farm income of \$3.4 billion in 2016.

Figure 4.29 Average income, by source, for principal farm operator households in the U.S., 2016. (a) averages for all farms and (b) averages for residence farms, intermediate farms, and commercial farms separately.



Data source: USDA Economic Research Service, Farm Household Income and Characteristics

Definitions: Residence farms (retirement and residential/lifestyle farms), Intermediate farms (low- and medium-sales farms), and Commercial farms (large, very large, and nonfamily farms), see USDA Economic Research Service, Updating the ERS Farm Typology, EIB-110, 2013.

4.6 VALUE OF OTHER BENEFITS OF FARMING AND RANCHING TO OPERATOR HOUSEHOLDS

In terms of the value chain, some other benefits are generated that are realized by those engaged in agricultural production, but for which they do not receive actual payment. These can be thought of as “in kind” or intangible benefits of being associated with the farm or ranch.

4.6.1 VALUE OF HOME CONSUMPTION

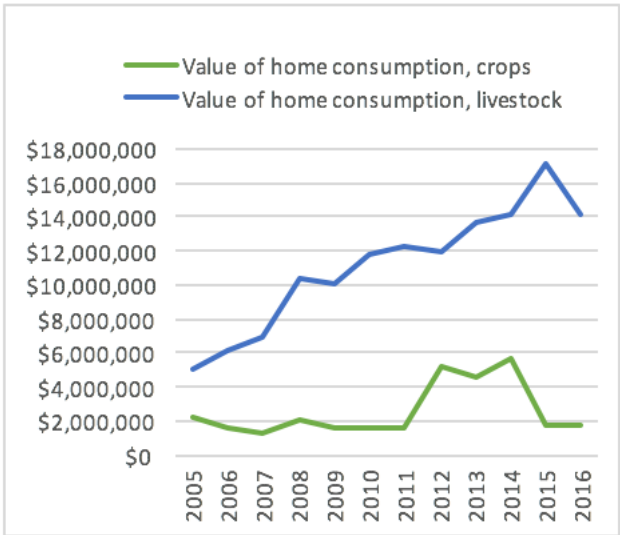
Over the long sweep of human history, a farmer’s first concern was to feed his or her family. Once household consumption needs were met, they would then sell surplus product in the marketplace. In today’s economy of specialized production, most farmers are focused on marketing their harvests as commodities, expecting that their farm income will contribute to taking care of the needs of their families. However, there are still opportunities for farm households to enjoy the fruits of their agricultural labors, quite literally.

The value of home consumption of crops and livestock products has trended upward over the last decade. The value used to be split more closely between crops and livestock products. Since 2005, the value of home-consumed livestock products has increased, to about \$14 million in 2016, while the value of home consumed crops has remained more modest, at about \$2 million in 2016.

4.6.2 VALUE OF OPERATOR DWELLINGS

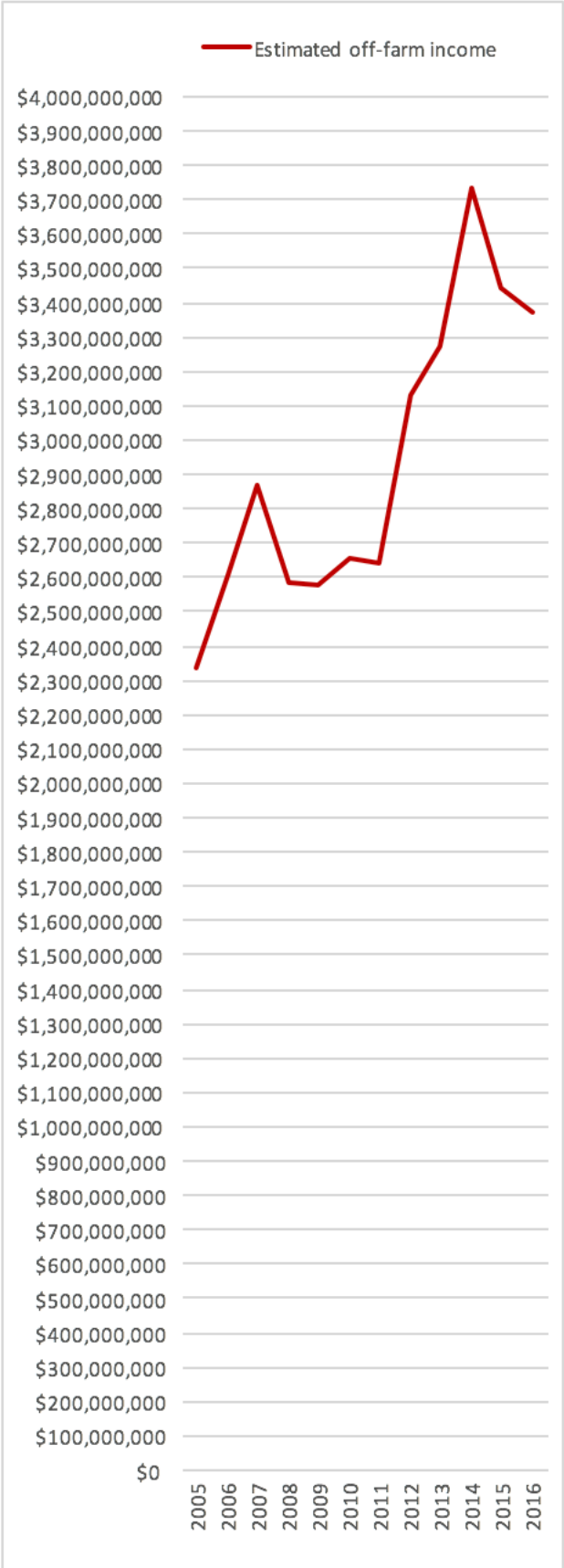
Farm and ranch operations often include some sort of residential real estate, a farmhouse or a ranch house. While accounting for the value of such dwellings can vary, based on a variety of factors, it can be another benefit to the farm or ranch owner and/or operator, either providing them with a residence (and thus offsetting their household’s cost of renting or purchasing a home separately), providing hired managers or workers with a residence (and thus offsetting some of the cost of employing them). Regardless of the use,

Figure 4.31 The value of home consumption of crops and livestock products by Colorado farm and ranch households



A LINK IN THE VALUE CHAIN: Households of Colorado farm and ranch operators consumed about \$16 million worth of crop and livestock products in 2016.

Figure 4.30 Estimated off-farm income for households of principal farm and ranch operators in Colorado



the value of such dwellings can be expressed in terms of their opportunity costs as rental properties. The value of the farm or ranch dwelling is essentially tied up in the capital value of the land. It does not always, however, directly contribute to the agricultural productivity of the farm or ranch operation and thus should be accounted for separately. And, as we can see in Figure 4.32, that value is not insignificant.

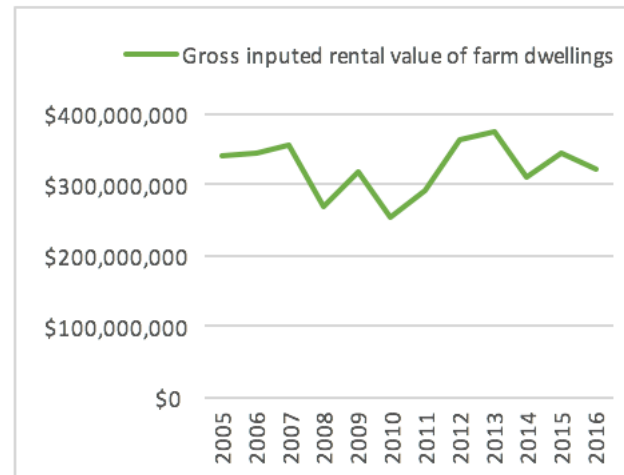
4.6.3 VALUE OF THE AGRARIAN LIFESTYLE

Finally, we must note that for those who live and work in agriculture there is a less tangible value of the agrarian lifestyle that comes with operating a farm or ranch. True, that value is not for everyone, at least not to the same extent. It is also true that the intangible value is intrinsically wrapped up in the operational decisions and capital gains considerations of farmers as business investors and owners of capital (Blank, 2005).

But, career and lifestyle preferences are real and can be revealed in a variety of ways, such as by direct survey methods or by revealed preferences of farm and ranch operators. In particular, the large population of residential farms, with high off-farm incomes, reveals preferences for a lifestyle more closely connected to the land and to rural amenities. Such preferences for the agrarian lifestyle can also be seen in the willingness of equine enthusiasts and agritourism consumers when they pay for the recreational experiences of on-farm activities. The magnitude of this value, however, is a question for further investigation.

A LINK IN THE VALUE CHAIN:
Colorado farms and ranches realized an imputed value of \$321 million from on-farm residential dwellings in 2016.

Figure 4.32 Gross imputed value of farm dwellings



Data Source: USDA Economic Research Service, Farm Income and Wealth Statistics, Value added to the U.S. economy by the agricultural sector, Colorado

A LINK IN THE VALUE CHAIN:
Many place a high value on the opportunity to live the agrarian lifestyle on a farm or ranch in Colorado.

4.7 VALUE OF AGRICULTURAL PRODUCTION AND AGRICULTURAL LANDS TO THE PUBLIC

It is clear that consumers value the commercial products of agriculture. This is evidenced by the power of consumer demand driving the commercial value chain from its retail base. Yet, consumers also value some of the less tangible aspects of agriculture as well: things that cannot be simply bought and sold. These include such provisions that come from agriculture as open space, wildlife habitat, water quality, recreational opportunities, and the lifestyle and qualities of rural communities. To be accurate and complete, a value chain analysis must consider these sources of value to society as well.

There are two general ways that residents and visitors to Colorado benefit from Colorado farms and ranches beyond their direct purchase and consumption of the commercial commodities and services they provide (Seidl, 2006).

First, there is the value of “ecosystem services.” These arise when individuals, businesses, and communities directly derive value from the environmental qualities or services provided by agriculture or the agricultural use of neighboring lands. Such benefit, for example, can include improved water quality from wells fed by a watershed that has been preserved by an operating ranch as grazing pastures and woodlands. Or, simply being in vicinity of a farm that has preserved open space, good views, and wildlife habitat can be of real value, compared to being surrounded by urban congestion, traffic, and sprawl.

Second, people also derive real value from knowing that the characteristics of agricultural lands remain intact even if they do not come into direct contact with them. This is called “existence” value. Just knowing that there is pristine open space “out there” provides comfort and assurance to many, a sense that the world is “right” and that our connection with America’s past is still intact can be a source of pride and comfort.

As an extension of “existence” value, many people also feel better about the world because they know that those desirable features of the countryside will be preserved and passed on to future generations for them to experience if they so desire. This is called an “option” value. It can be described as the value of setting aside natural habitat and agricultural lands as a sort of savings or bequest, keeping those resources available to be utilized in the future if and as they are needed at that time.

We must be clear that some of these intangible values may be highly location-specific. They follow the old real estate adage that the three most important factors in a property’s value are “location, location, and location.” For example, the last remaining open space within an already crowded urban corridor may elicit a much more vigorous response from the community to be preserved in its traditional state than would a lonely strip of grazing land forty miles away from the nearest paved highway. Still, there is a tremendous and often unappreciated value imparted by agricultural operations and agricultural lands to the larger population. Fortunately, there are several ways to get a glimpse at this value.

4.7.1 VALUE OF OPEN SPACES AND ECOSYSTEM SERVICES

There are several ways that people can be observed making economic decisions that show how much they enjoy or want to preserve the ecosystem services, the existence value, or the option value of agriculture and agricultural lands. As a result, there are several ways to measure, often with surprising accuracy, the value that people place on the less tangible benefits that agriculture provides.

One lens through which we can see the value of agricultural areas is the expense borne by tourists to visit areas that benefit from nearby agricultural use, such as hunting on public lands surrounded by ranches that provide game habitat. If there is a value to a certain region, people will want to visit. The more they want to visit, the more they are likely to pay to make their visit happen. Surveying travel costs incurred by visitors can indirectly measure how much the intangible qualities that are due to agricultural lands matter to them. A second lens through which the value of agricultural lands can be seen is in real estate prices of non-agricultural properties located nearby farm and ranch lands. This becomes clear, for example, by comparing the value of two houses that are equivalent in terms of square footage, number of baths, quality of kitchen, and all the other characteristics that real estate agents—or Zillow.com—are sure to consider. The only difference is that one house abuts the picturesque land of a working ranch while the second house is boxed in, deep in a suburban neighborhood. We would expect the house with access to open space and a ranch view will sell for more than the house that is boxed in by its neighbors. The difference in the real estate value between these two houses is an indirect measure of the value that those bidding in the real estate market place on the benefits they derive from being close to the ranch lands. Again, these benefits can occur even if the homeowners are not granted access to go onto the ranch property. Those benefits may be merely the expectation that the land behind them is not likely to be dug up and developed changing their view into one of roofs and backyards.

A third lens that reveals the value of agricultural open space is payment made to preserve agricultural lands. Both public and private entities may purchase farm and ranch lands outright or may purchase “development” or “conservation” easements on farm and ranch properties, in order to preserve them as working agricultural lands, as open space, or as natural habitat. The purchase of farm and ranch lands occurs typically in prime locations, whether from a planning perspective by public authorities or from a wildlife or environmental quality point of view by private organizations such as The Nature Conservancy.

In the purchase of a development easement or the “development rights” on an agricultural property, the farmer or ranch owner is paid an agreed amount and an easement is then created that restricts the use of that property as agreed. This strategy addresses the fact that those who purchase land for real estate development are often willing and able to pay a higher price for farm land to develop it for residential or commercial use. The easement mechanism is intended to assure that the land owner still is able to receive the fair market value “as if” they were to sell the property for real estate development. While there are investment and tax incentives that can complicate the pricing of these easements, they do, however, derive their basic value from the willingness of the public or of private organizations to collect the necessary funds and make the purchase.

Lands that have been sold outright or that have sold off development easements often continue to be operated as agricultural lands by their owners. In other cases they may be turned into public parks or into private preserves. Limited agricultural uses, such as seasonal grazing may continue to be allowed. How they are operated is not exactly the point for this discussion, however. It is rather the mere fact that the preservation of such lands can elicit an economic transaction to keep them in agriculture, or as open space reveals, the very real value of the daily, monthly, or annual stream of ongoing benefits for society that come from those lands.

It is also possible to observe the value that people derive from agriculture simply by asking them about it. Methods have been devised to elicit values and attitudes from survey respondents, asking them various questions about how much they would be willing to pay to preserve a resource or how they feel about agriculture.

A survey, conducted by Colorado State University, sought to assess the “contingent valuation” that residents of Chaffee County, Colorado, place on ranchland open space and on water quality associated with those open space lands (Cline and Seidl, 2008). In that survey half of the county residents who responded thought that all working landscapes should be preserved in their current condition. In response to questions about how much it was worth to them, the average value per person was about \$153 per year to preserve the county’s working landscapes and \$114 a year to provide additional funding for water quality. These translate into close to \$3 million a year of value for the residents of the county from these characteristics of the county’s ranchlands.

4.7.2 VALUE OF COLORADO AGRICULTURE TO RESIDENTS OF COLORADO

As part of this overall project, a survey was conducted on Public Attitudes about Agriculture and Food by our team at Colorado State University for the Colorado Department of Agriculture (Christenson et al, Colorado Department of Agriculture, 2017). It looks at how Colorado residents feel about aspects of agriculture that may not be as easily described in dollars and cents.

This survey of Colorado residents found that agriculture is viewed as the second most important industry in Colorado, after tourism, but before hi-tech, education, and mining. Eighty six percent of respondents indicated that the presence of farms, ranches, and agriculture was important to Colorado. Over 95 percent felt that it is important to maintain agricultural land and water in agriculture. The motivations for this were, according to 70 percent, to maintain food production, according to 63 percent to maintain open space and wildlife habitat, according to 61 percent to provide agricultural jobs and businesses in the state. Just 34 percent said that it is important to maintain Colorado’s western heritage. The survey also found that more than 90 percent of Coloradans would buy more Colorado products if they were labeled as such or were more available.

4.8 SUMMARY: COLORADO'S WORKFORCE IN PRODUCTION AGRICULTURE

The structure of the workforce engaged in production agriculture is complex. Not only are owner-operators of farms deeply involved, there are also hired employees and contractors. All three of these categories can include a combination of managers, skilled tradespeople, and laborers:

- Owner-operators:
- Primary operators
 - Part time operators
- Employees:
- Primary operators
 - Part time operators
 - Laborers
- Contract workers:
- Skilled trades workers
 - Laborers

According to the 2012 Census of Agriculture, on Colorado's 37,054 farms and ranches, there were 59,479 primary operators. Of these, 23,705 describe farming as their primary occupation, while the remaining 35,774 have another primary occupation or are retired and work on the farm or ranch as part time operators. However, not all of these operators identified in the Census of Agriculture are owners. Some are employees hired as full time or part time operators. Additional employees are hired as full time or part time laborers. According to the Census of Agriculture, 7,393 of the 37,054 farms and ranches in Colorado hired at least one employee, including 15,454 as full time and 23,429 as part time employees. These numbers do not differentiate between employees with management responsibilities and those with labor jobs. Finally, figures are available that show farm expenditures on contract services and contract labor, but they do not indicate the numbers of workers employed by the firms providing the contracted services or labor.
















Across a set of production agriculture subsectors (Table 4.3), EMSI reports about 28,000 employed in the crop and livestock production sector in Colorado (Table 4.4). Employment in farming and ranching is in relative decline, with a less than 1 percent job growth rate between 2012 and 2016, falling short of the rate of growth in the state's workforce. The demographic structure of the industry is relatively old, with the largest age group between 55 and 64, and there is a large gender gap, with 72 percent male and 28 percent female. Farming and ranching jobs are less prevalent in Colorado than in the nation as a whole (at 21 percent below the national average). Average earnings in Colorado agriculture are on par with agriculture nationwide, at just over \$36,000 per job per year. The 30 most common jobs in the sector and recent growth trends by job category are shown in Table 4.5.

Table 4.3 The list of industry sectors included in this workforce analysis of production agriculture

Code	Description
111000	Crop Production
112000	Animal Production
113110	Timber Tract Operations
113210	Forest Nurseries and Gathering of Forest Products
113310	Logging
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
114210	Hunting and Trapping
115111	Cotton Ginning
115112	Soil Preparation, Planting, and Cultivating
115113	Crop Harvesting, Primarily by Machine
115114	Postharvest Crop Activities (except Cotton Ginning)
115115	Farm Labor Contractors and Crew Leaders
115116	Farm Management Services
115210	Support Activities for Animal Production
115310	Support Activities for Forestry

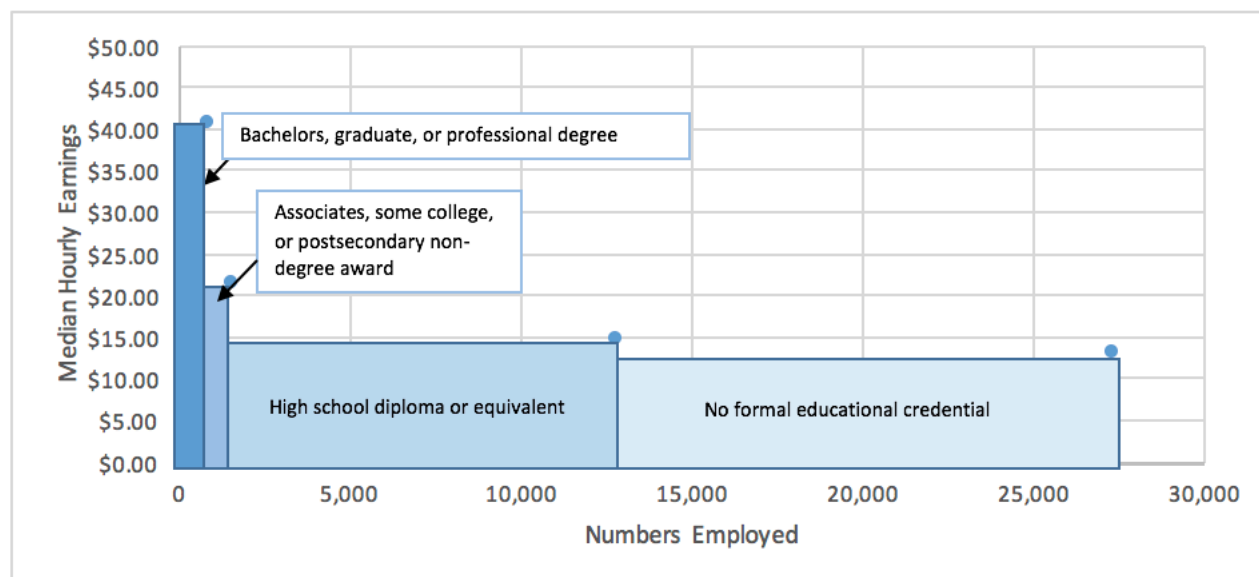
A LINK IN THE VALUE CHAIN: A variety of indirect lifestyle and environmental benefits are generated by agriculture. Over 95 percent of respondents in a recent survey report that it is important to them to maintain agricultural land and water in agriculture.

Table 4.4 Staffing pattern overview for Colorado's production agriculture

28,028		\$36,375	
Jobs (2017)		Avg. Earnings Per Job (2017)	
21% below National average		Nation: \$36,429	
Establishments (2017)		1,677	
Jobs Multiplier		2	
2012 Jobs	2016 Jobs	Change	% Change
27,200	27,286	86	0.3%
Gender		Percent	
Male		71.5%	
Female		28.5%	
Age		Percent	
14-18		1.7%	
19-24		8.2%	
25-34		20.0%	
35-44		19.8%	
45-54		17.7%	
55-64		20.4%	
65+		12.1%	
Race/Ethnicity		Percent	
White		65.3%	
Hispanic or Latino		27.9%	
Black or African American		2.4%	
Asian		2.0%	
Two or More Races		1.7%	
American Indian		0.5%	

Source: EMSI, 2018

Figure 4.33 Numbers employed and median hourly earnings in production agriculture in Colorado, by typical entry-level education requirements



Data source: EMSI, 2018

Table 4.5 Top 30 jobs in the production agriculture industry group in Colorado, by percent of total jobs in the industry group

SOC	Description	Employed (2012)	Employed (2016)	Change (2012 - 2016)	% Change (2012 - 2016)	% of Total Jobs in Industry	Median Hourly Earnings	Typical Entry Level Education
11-9013	Farmers, Ranchers, and Other Agricultural Managers	9,266	7,338	(1,928)	(21%)	24.8%	\$12.37	High school diploma or equivalent
11-9199	Managers, All Other	113	100	(13)	(12%)	0.4%	\$30.64	Bachelor's degree
11-1021	General and Operations Managers	111	124	13	12%	0.5%	\$50.94	Bachelor's degree
13-2011	Accountants and Auditors	95	98	3	3%	0.4%	\$32.78	Bachelor's degree
37-2011	Janitors and Cleaners	111	123	12	11%	0.5%	\$12.35	No formal educational credential
37-3011	Landscaping and Groundskeeping Workers	166	186	20	12%	0.7%	\$13.80	No formal educational credential
39-2011	Animal Trainers	313	293	(20)	(6%)	1.0%	\$12.24	High school diploma or equivalent
39-2021	Nonfarm Animal Caretakers	359	331	(28)	(8%)	1.2%	\$11.53	High school diploma or equivalent
41-4012	Sales Representatives, Wholesale and Manufacturing	91	87	(4)	(4%)	0.3%	\$29.32	High school diploma or equivalent
43-3031	Bookkeeping, Accounting, and Auditing Clerks	209	201	(8)	(4%)	0.7%	\$19.15	Some college, no degree
43-5071	Shipping, Receiving, and Traffic Clerks	68	64	(4)	(6%)	0.3%	\$15.19	High school diploma or equivalent
43-6014	Secretaries and Administrative Assistants	146	158	12	8%	0.6%	\$17.51	High school diploma or equivalent
43-9061	Office Clerks, General	146	139	(7)	(5%)	0.5%	\$17.45	High school diploma or equivalent
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	559	591	32	6%	2.3%	\$24.27	High school diploma or equivalent
45-2041	Graders and Sorters, Agricultural Products	638	600	(38)	(6%)	2.3%	\$9.48	No formal educational credential
45-2091	Agricultural Equipment Operators	722	981	259	36%	3.6%	\$15.29	No formal educational credential
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	8,604	10,100	1,496	17%	38.2%	\$12.98	No formal educational credential
45-2093	Farmworkers, Farm, Ranch, and Aquacultural Animals	890	1,203	313	35%	4.4%	\$13.48	No formal educational credential
45-2099	Agricultural Workers, All Other	134	125	(9)	(7%)	0.5%	\$14.90	No formal educational credential
45-3011	Fishers and Related Fishing Workers	151	67	(84)	(56%)	0.2%	\$12.58	No formal educational credential
45-4022	Logging Equipment Operators	97	78	(19)	(20%)	0.3%	\$19.07	High school diploma or equivalent
49-9071	Maintenance and Repair Workers, General	130	169	39	30%	0.6%	\$18.22	High school diploma or equivalent
51-9111	Packaging and Filling Machine Operators and Tenders	111	146	35	32%	0.5%	\$14.88	High school diploma or equivalent
51-9199	Production Workers, All Other	60	78	18	30%	0.3%	\$16.08	High school diploma or equivalent
53-3031	Driver/Sales Workers	56	67	11	20%	0.2%	\$11.86	High school diploma or equivalent
53-3032	Heavy and Tractor-Trailer Truck Drivers	322	360	38	12%	1.4%	\$21.42	Postsecondary nondegree award
53-3033	Light Truck or Delivery Services Drivers	125	147	22	18%	0.5%	\$16.82	High school diploma or equivalent
53-7051	Industrial Truck and Tractor Operators	159	190	31	19%	0.7%	\$16.49	No formal educational credential
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	207	184	(23)	(11%)	0.7%	\$14.19	No formal educational credential
53-7064	Packers and Packagers, Hand	363	321	(42)	(12%)	1.2%	\$11.24	No formal educational credential

Source: EMSI, 2018

COMMODITY MARKETING, PROCESSING, AND FOOD AND BEVERAGE MANUFACTURING

Once agricultural products are harvested—and assuming they are not used on farm—they are sold to those who value those products. The vast majority of agricultural products are sold to intermediaries in the value chain who are able to create some value added with those products. Sometimes that value is created simply by transporting the product and marketing it, making sure that it arrives in the hands of those who need it for their own business purposes, when and where they need it. Value can also be created by processing agricultural products, changing their form or extracting valuable constituent parts, such as by milling or slaughtering or simply washing and freezing. And value is added by manufacturing products that use the agricultural commodity as an input or ingredient. These processing and manufacturing industries include trades, such as milling, baking, or brewing, that are as old as civilization itself.

Marketing, processing, and manufacturing enterprises develop according to a different logic than agricultural production. Their location and specialization is less dependent upon the available land and water resources or the microclimate of the given region. Some businesses are more economically viable if located near the source of a particular agricultural input, such as animal slaughter plants near large feedlot operations or cheese making near dairy farms. Others are less tied to the source of inputs, such as confectionary manufacturers, who may even import chocolate and other ingredients from outside the U.S. Instead, such businesses may be located where they are because of local expertise, a large nearby consumer base, other marketing advantages, or simply because of history and good fortune.

From this stage, the value chain of Colorado agriculture becomes much more integrated with the national and global economies. While some of Colorado's food or beverage manufacturing businesses may focus on local or regional markets, many sell to buyers much further afield. Out of a total of \$16.9 billion in sales in 2016 by Colorado agricultural commodity marketing and food and beverage manufacturing, an estimated \$7.1 billion (42 percent) were sold in Colorado and an estimated \$9.8 billion (58 percent) were sold out of state; of those an estimated \$1.6 billion (10 percent of the total) were exports from the U.S.

As we leave the farm gate, we leave behind one of our richest sources of data on Colorado agriculture. The statistics that have been highlighted in the first three parts of this report from the USDA do not extend down the value chain to its middle segments of marketing, processing, and manufacturing. We turn instead to statistics compiled by the services of Economic Modeling Specialists Incorporated (EMSI) which include sector-specific estimates on industry inputs and outputs and industry workforce that draw from a wide range of government sources, including the Bureau of Economic Analysis, U.S. Census Bureau, the Bureau of Labor Statistics, and others.

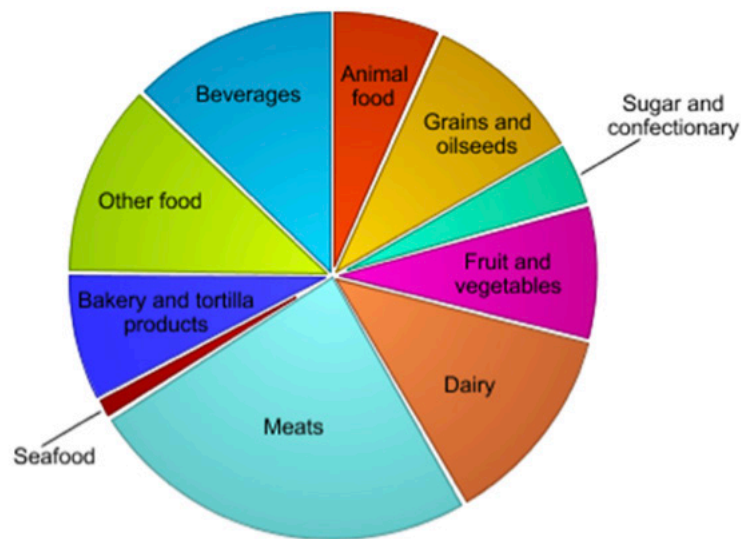
5.1 Overview of Agribusinesses and Food and Beverage Manufacturing in Colorado

Food and beverage manufacturing enterprises transform raw agricultural materials into products for intermediate or final consumption by applying labor, machinery, energy, and scientific knowledge. Some products may serve as inputs for further processing (such as syrup for manufacturing soda). According to a recent USDA Economic Research Service report, in 2015, these plants accounted for 16 percent of the value of shipments from all U.S. manufacturing plants, with meat, beverage and dairy manufacturing representing the largest sectors (Figure XX). These plants employed more than 1.5 million workers in 2015 (about 14 percent of all U.S. manufacturing employment and just over 1 percent of all U.S. nonfarm employment). The meat process-

ing industry employed the largest percentage of food and beverage manufacturing workers in 2015 (31 percent), followed by bakeries (16 percent), and fruits and vegetables (11 percent).

The presence of food and beverage manufacturing throughout the US is illustrated in Figure 5.2. Colorado is a relatively active state for the mountain west region. In this section, we will explore the state’s manufacturing establishment and employment dynamics in more detail.

Figure 5.1 Components of food and beverage manufacturing value, for the entire United States, 2015

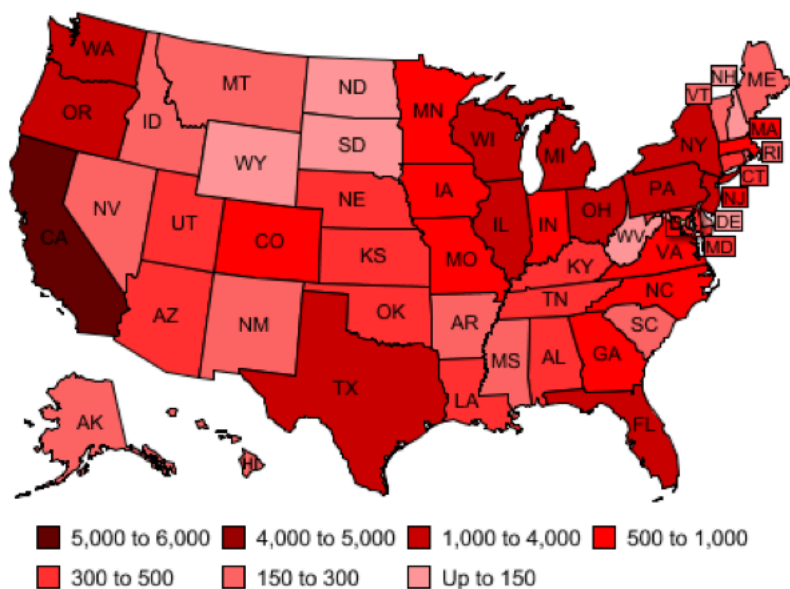


Source: USDA Economic Research Service, using data from U.S. Census Bureau, County Business Patterns, <https://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/manufacturing.aspx>, accessed November 2017

There is no complete listing of all agricultural and food businesses in Colorado, but there are some websites and directories that offer information to understand the breadth of the sectors.

The Rocky Mountain Agribusiness Association is one trade group that provides Advocacy, Education, and Networking for the broader industry, with over 150 companies and 400 individual industry professionals as members (<https://rmagbiz.site-ym.com/>). Their online directory is available to its members. For businesses that are distributing, processing or serving food between the farm gate and consumers, Colorado MarketMaker is a joint initiative of the Colorado Department of Agriculture and Colorado State University

Figure 5.2 Total food and beverage manufacturing establishments in 2015



Source: USDA Economic Research Service, using data from U.S. Census Bureau, County Business Patterns

that integrates business-developed profiles created when they join the state’s Colorado Proud program with purchased business data to make a more complete picture of the industry, including all registered food sector firms. The Colorado Market Maker system provides an online directory and mapping system for all of profiles (<https://co.foodmarketmaker.com/catalog/business>). Figure 5.3 shows an example map for one sector and county of Colorado, and Figure Table 5.1 provides a list of sub-sectors, along with the total number of business establishments in each in 2013, total employment, and shows how the smallest, mean/median, and largest employers vary by size. This

gives a sense of the industry's structure. For 2013, there were 15,598 business in the 21 sectors listed. Together they employed a total of 250,915 employees in 2013.

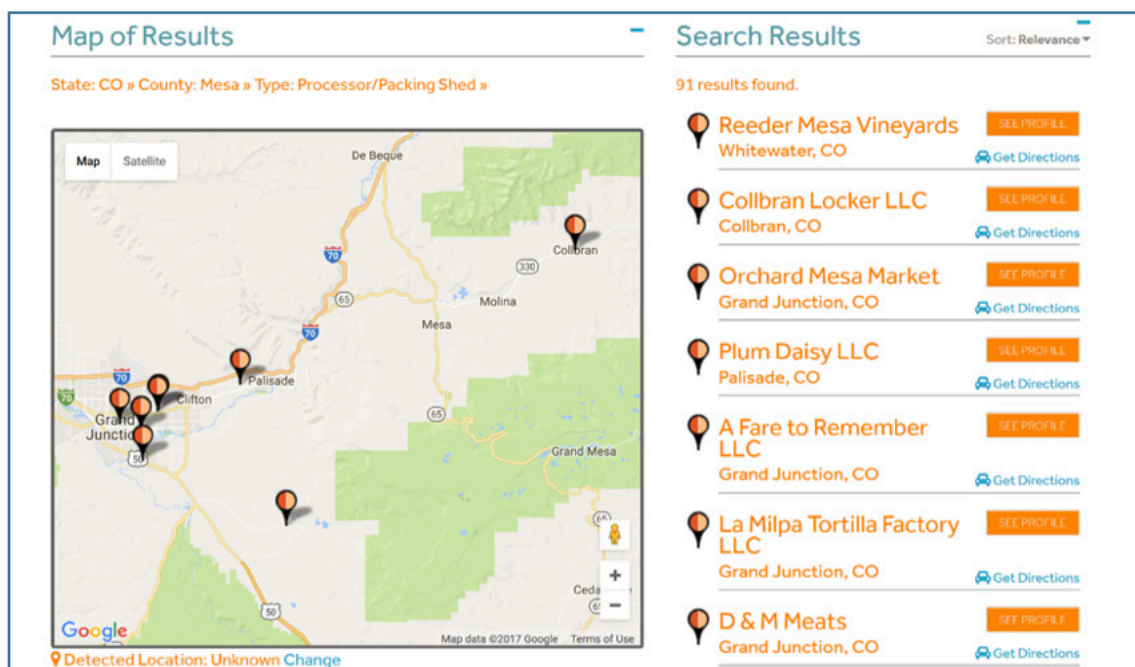
Beyond these aggregate numbers, it is interesting to note how the size of employers vary across sectors and metro/non-metro establishments. For example, the difference between an average and largest employer in flour milling is relatively small (33 vs. 77 for metro millers) when compared to bakeries (12 vs. 506 in metro areas). The structure of the industry may be important if it is a signal of entrepreneurship (more small firms may be start-up businesses) or market access for Colorado producers (smaller firms may provide sales opportunities to producers looking to sell to processors who can use their primary products). In general, metro establishments employ more workers than non-metro businesses, but these numbers are more even in the retail and food service sectors.

In addition to these 2013 data, we can explore the longer-term trends for this industry using data available through a cooperative agreement with the USDA Economic Research Service. First, we will consider the number of firms in each sector over time as a signal of sector dynamics. Figure X groups three food manufacturing sectors that appear to be mature and stable, as indicated by a small and stable number of establishments across the past couple of decades. Two of these are staple ingredient products, and both relate to commodities grown in the state (flour, small grains, sugar beets). Employment numbers have remained stable (flour milling and frozen food) or declined (sugar) over this same period.

5.2 AGRICULTURAL COMMODITY MERCHANDISING

Merchant wholesalers of agricultural commodities are in the business of buying from producers and then aggregating, storing, transporting, and selling the commodity to intermediate or final users. As “market mediators”, they will typically be attentive to price changes and use a number of financial or contractual mechanisms, such as futures contracts or options, to make money by following the classic adage “buy low, sell high.” However, the value they add to the value chain is very real and comes essentially from smoothing out differences in supply and demand along the value chain, making sure that products get to users when and where, and in the quantities, they are needed.

Figure 5.3 Example of Colorado MarketMaker map for one sector of food and beverage manufacturing establishments in a region of western Colorado



Source: Colorado Market Maker, <https://co.foodmarketmaker.com/catalog/business>, accessed November 2017

Table 5.1 Overview of businesses in Colorado's agricultural and food value chain after the farm gate: Metro vs Non-Metro numbers of establishments and structure of employment, 2013

Supply Chain Sector	Location	Smallest Employer	Median Employer	Mean Employer	Maximum Employer	Total Employment	Number of Establishments
Food and Beverage Manufacturers							
Flour Milling	Non-Metro	2	4	6	15	24	4
Flour Milling	Metro	3	20	33	77	196	6
Sugar	Non-Metro	2	29	43	102	124	3
Sugar	Metro	3	14	23	62	138	6
Frozen Food	Non-Metro	1	4	4	6	7	2
Frozen Food	Metro	2	9	46	275	409	9
Dairy Products	Non-Metro	1	17	49	200	327	7
Dairy Products	Metro	1	8	42	317	1255	32
Animal Slaughter	Non-Metro	1	4	50	1439	2088	42
Animal Slaughter	Metro	1	7	98	1855	7835	81
Seafood	Non-Metro	3	3	3	4	5	2
Seafood	Metro	2	4	6	14	27	4
Bread/Bakery	Non-Metro	1	3	6	73	533	86
Bread/Bakery	Metro	1	4	12	506	4212	386
Snack Food	Non-Metro	2	17	17	33	33	1
Snack Food	Metro	2	11	31	197	442	14
Soft Drink and Bottled Water	Non-Metro	1	6	9	37	187	21
Soft Drink and Bottled Water	Metro	1	10	57	583	2312	42
Breweries	Non-Metro	2	6	16	49	137	9
Breweries	Metro	1	12	416	3863	8313	34
Wineries	Non-Metro	2	2	3	8	33	10
Wineries	Metro	1	3	7	67	179	28
Distilleries	Non-Metro	1	2	2	3	4	2
Distilleries	Metro	2	3	4	7	11	2
Distributors/Merchant Wholesalers							
Grocery and Retail MW	Non-Metro	1	3	8	127	1336	171
Grocery and Retail MW	Metro	1	3	14	736	11921	871
Beer-Wine-Liquor MW	Non-Metro	2	9	12	37	279	28
Beer-Wine-Liquor MW	Metro	1	5	24	606	2815	147
Food and Beverage Retailers							
Grocery Stores	Non-Metro	1	6	14	194	7426	523
Grocery Stores	Metro	1	4	23	641	34726	1609
Specialty Food Retailers	Non-Metro	1	2	5	261	777	150
Specialty Food Retailers	Metro	1	3	6	477	3821	732
Beer-Wine-Liquor Stores	Non-Metro	1	3	3	29	1029	319
Beer-Wine-Liquor Stores	Metro	1	3	4	131	4153	1041
Food and Beverage Service							
Full-Service Restaurants	Non-Metro	1	9	15	1275	17851	1189
Full-Service Restaurants	Metro	1	10	20	2389	85020	4276
Limited-Service Restaurants	Non-Metro	1	7	13	199	4657	357
Limited-Service Restaurants	Metro	1	10	18	1771	31818	1793
Special Food Services	Non-Metro	1	2	6	50	460	72
Special Food Services	Metro	1	4	13	406	3764	288
Drinking Places (Alcoholic Beverages)	Non-Metro	1	3	7	140	1852	272
Drinking Places (Alcoholic Beverages)	Metro	1	5	9	219	8379	927

Source: 2013 NETS data

In Colorado, the bulk of merchandizing business involves grains and oilseeds. According to Colorado Corn, there are roughly 125 grain buying entities across Colorado—elevators, cooperatives, brokers, etc.—with some of the more visible and larger operations being Cenex Harvest States (CHS), Cargill, Temple Grain, and Roggen Elevator. Most operate in the Northeast, East Central, and Southeast regions of Colorado (Colorado Corn, 2018), within the major grain and oilseed-producing regions illustrated on the map in Figure 2.5 Map of Colorado land cover and crops). Given the very nature of the business, such facilities and operations are geographically widespread.

According to EMSI annual estimates, the 130 or so farm commodity merchant wholesalers operating in Colorado realized about \$216 million in sales in 2016. Sales have grown 35 percent over the last five years. They employ 1,300 workers, with total earnings of about \$188 million in 2016.

Employment in these sectors has remained relatively stable over the last decade, with a slight shift out of grains and into other farm products. Earnings grew with commodity prices from 2006 until 2012, but have stagnated since. Other agricultural products—like pork, milk, or some fresh produce—are not handled by such market mediators. The delivery of the output may be internal to the same business entity that does the production, or the product may already be contracted by users before it is physically produced. In such vertical coordination strategies (see MacDonald et al, 2004), the costs of transportation and storage may be internal to the sector. (For more on these, see the earlier section on farm expenses for “Marketing, Storage, and Transportation”.)

A LINK IN THE VALUE CHAIN

Agricultural commodity merchants made an estimated \$216 million in sales in Colorado in 2016.

5.3 AGRICULTURAL COMMODITY EXPORTS

One possible destination for a range of commodities produced by Colorado farms and ranches is export from the United States to foreign markets around the world. In 2016, about \$1.6 billion worth of agricultural exports from the U.S. are estimated by the USDA to have originated from Colorado.

Table 5.2 Agricultural commodity merchant wholesalers: number of establishments, estimated sales, sales growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
424510	Grain and Field Bean Merchant Wholesalers	63	\$106,593,672	\$132,312,568	24%
424520	Livestock Merchant Wholesalers	24	\$22,789,800	\$35,438,742	56%
424590	Other Farm Product Raw Material Merchant Wholesalers	29	\$8,358,604	\$31,418,655	276%
493130	Farm Product Warehousing and Storage	16	\$22,297,382	\$17,172,460	-23%
TOTAL		132	\$160,039,458	\$216,342,425	35%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
424510	Grain and Field Bean Merchant Wholesalers	0.72	641	\$49,142,808
424520	Livestock Merchant Wholesalers	1.12	372	\$13,158,254
424590	Other Farm Product Raw Material Merchant Wholesalers	0.96	142	\$11,639,055
493130	Farm Product Warehousing and Storage	0.86	173	\$9,354,935
TOTAL			1,329	\$83,295,052

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector’s share of employment in Colorado is the same as the sector’s share of employment nationally. A value of 1.10 indicates that the sector’s share of employment in Colorado is 10% higher than the sector’s share of employment nationally.

/2 Total Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers’ compensation.

It must be noted that no one comprehensively tracks exact transactions of agricultural commodities as they leave the state and then the country. In fact shipments of commodities are combined and commingled from many sources before they arrive at major ports for export. State export numbers are based upon calculations from records of total U.S. exports, records of state level production, and relative state level prices, to arrive at an estimate of what share of total U.S. exports have been fulfilled by the products grown in Colorado.

According to estimates by the USDA's Economic Research service, the largest Colorado contribution, by value, to U.S. agricultural exports in 2016 was beef, at \$307 million (USDA-ERS, State Export Data, 2018). This represents about 16 percent of the value of Colorado beef production in 2016.

Wheat, at \$181 million was the second largest Colorado contribution to agricultural exports. While 40 percent of the total U.S. wheat crop was exported, about 62 percent of the Colorado wheat crop is estimated to have been exported in 2016, based on comparing farm receipts with USDA export estimates.

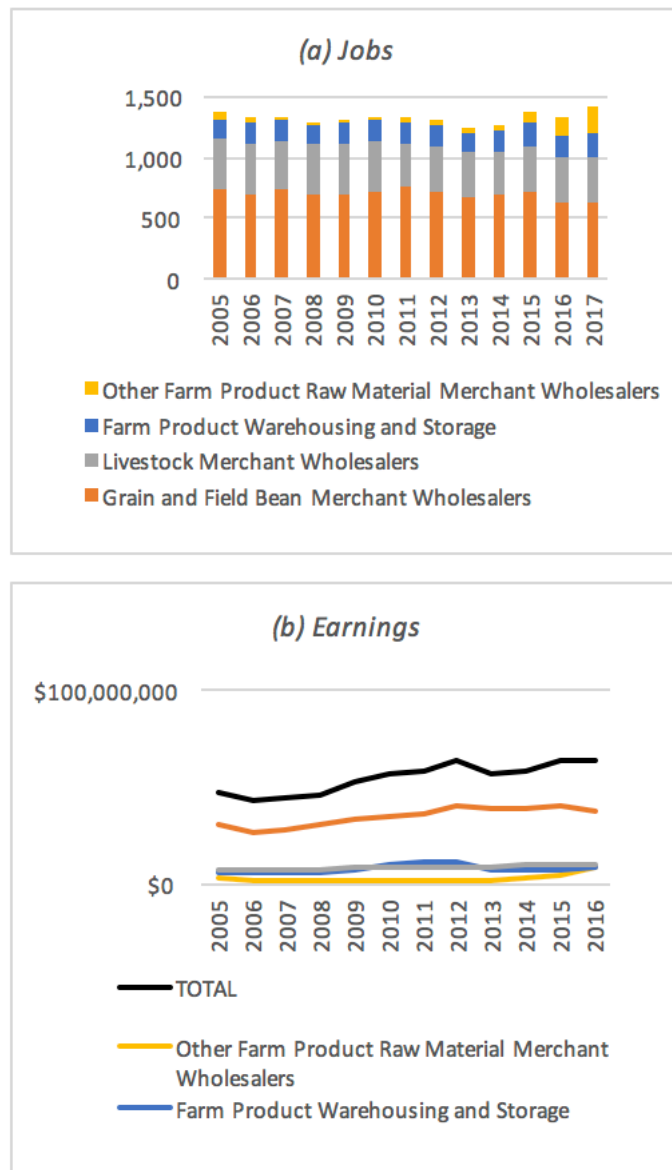
Much of these grain exports are handled by the commodity merchant wholesalers reviewed in the previous section. Thus, their contribution to the value chain of Colorado agriculture is greater than just in-state sales. Major export terminals are located in the U.S. northwest and the Gulf coast. Thus, a majority of the Colorado grain crop in a given year is transported to one of those locations.

Over \$1 billion worth of other agricultural exports are estimated to have come from Colorado in 2016, including a wide range of raw products, food ingredients, and manufactured products such as beer and wine. Given the size of craft brewing in Colorado, beer is likely to contribute significantly to Colorado's export values in the "other products" category.

5.4 GRAIN MILLING AND OILSEED PROCESSING

Recall from Part 3 that Colorado farms produced and sold \$496 million worth of corn, \$295 million worth of wheat, and \$18 million worth of oilseeds in 2016. Grain and oilseed milling is a value adding process that involves the grinding and separating of the constituent parts of the grain or oilseed. Wheat grain is milled into flour. Corn can be milled into solid and oil components, and each of these can be further separated or processed into ingredients like corn starch or

Figure 5.4 Agricultural commodity marketing jobs and payroll in Colorado, 2005-2016



Data source: EMSI, 2018

A LINK IN THE VALUE CHAIN: Agricultural commodity exports from the U.S. that originated from the state of Colorado were estimated to be worth \$1.6 billion in 2016.

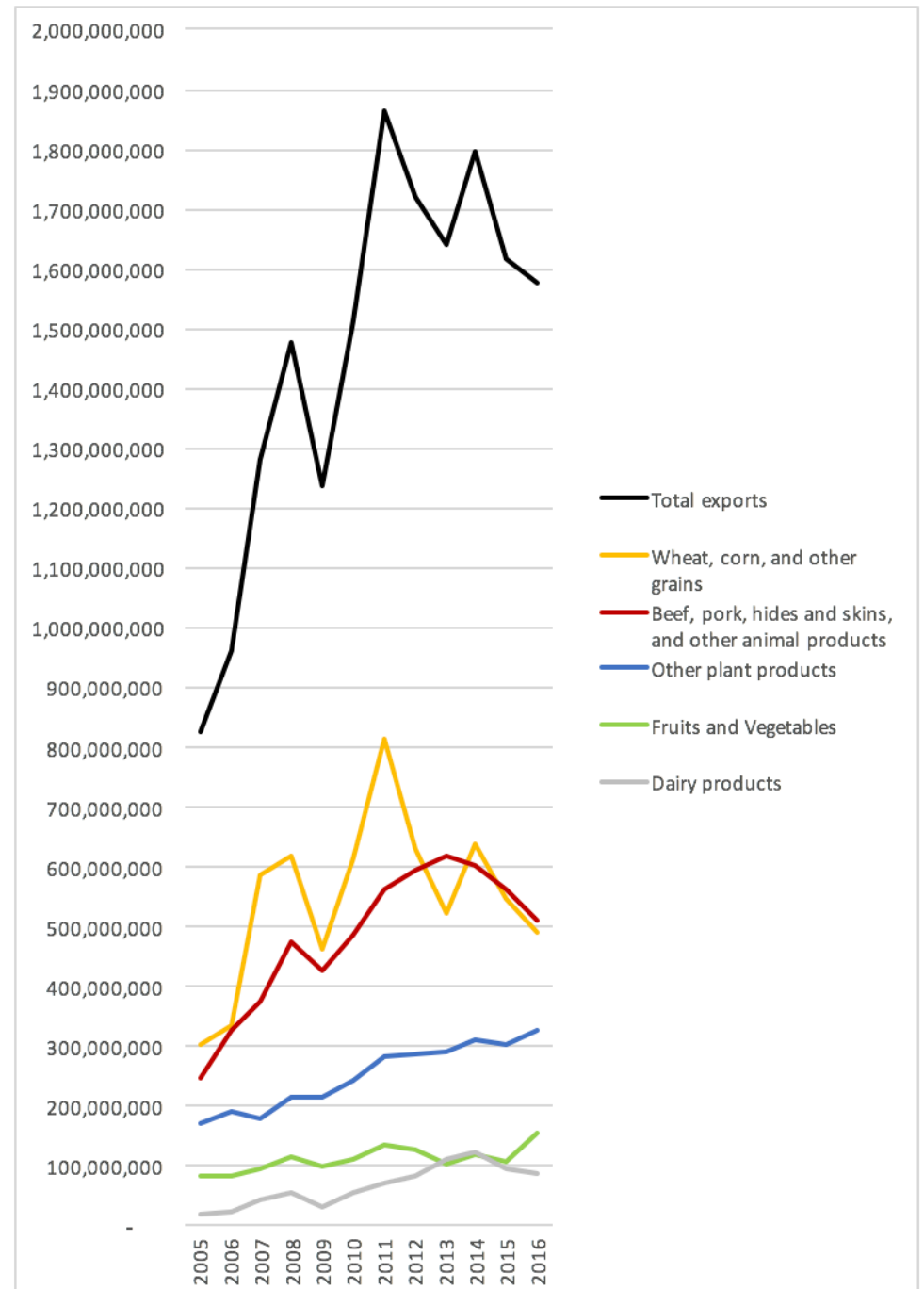
high fructose corn syrup (HFCS). Some of this processing of grains may be useful for animal feed, which will be considered further in the following section on “Animal Feed and Animal Food Manufacturing.”

In the U.S., wheat milling capacity has long been mostly located along the Mississippi River and Great Lakes. Thus, much of the Colorado wheat crop that is not exported and is instead processed domestically is transported to these major milling facilities. Large purchasers of Colorado wheat, both directly and indirectly via local and regional grain merchandisers, include Cargill, ConAgra, and others. The largest wheat milling capacity in Colorado is the Ardent Mills facility in Commerce City. It can handle about 15 percent of the Colorado crop and is part of an innovative segment of identity-preserved production for premium whole wheat products (Haley, 2012).

In 2016, according to EMSI estimates, there were five flour mills, four malting operations, and two other grain and oilseed processing facilities in the state. Flour milling accounted for an estimated \$239 million in sales, up 77 percent from five years earlier. Processing of other grains and oilseeds, largely corn and sunflower, accounted for an additional \$105 million. Niche malt manufacturing has emerged in the state, with four new establishments in the last five years with combined sales in 2016 of about \$8 million.

This segment of the value chain is estimated to employ about 250 Coloradans and pay about \$22 million in total earnings, including wages, salaries, and benefits.

Figure 5.5 Colorado’s agricultural exports, as estimated by USDA



Data source: USDA Economic Research Service, State Export Data, U.S. Agricultural Exports, State detail by commodity

A LINK IN THE VALUE CHAIN:

Grain millers and oilseeds processors sold \$344 million in 2016.

5.5 ANIMAL FEED AND ANIMAL FOOD MANUFACTURING

Recall from Part 3 that Colorado farms sold \$920 million of feed crops in 2016. Half of that was corn, at \$496 million, and a third was for hay, at \$296. In fact, animal feed plays a pivotal role in the value chain of Colorado agriculture, a complex linking of crop production, livestock production, and processing/manufacturing.

Given the large livestock populations in Colorado, there is naturally a large demand for animal feed (an estimated \$1.16 billion in 2016, as described in the section on “Purchased Feed” in Part). Additionally, given the large animal slaughter and meat processing industry described in the previous section, there is a large supply of slaughter by-products that can be used in the manufacture of both animal feeds for livestock and pet foods.

Table 5.3 Grain and oilseed processing firms: number of establishments, estimated sales, sales growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311211	Flour Milling	5	\$ 134,948,888	\$ 238,596,705	77%
311213	Malt Manufacturing	4	-	\$ 8,377,299	-
311221	Wet Corn Milling	0	\$ 2,937,693	\$ 313,708	-89%
311225	Fats and Oils Refining and Blending	2	\$ 7,517,411	\$ 96,386,320	1182%
TOTAL		11	\$ 145,403,992	\$ 343,674,033	136%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
311211	Flour Milling	0.79	198	18,842,130
311213	Malt Manufacturing	0.66	16	645,800
311221	Wet Corn Milling	0.00		20,548
311225	Fats and Oils Refining and Blending	0.36	42	2,416,820
TOTAL			255	21,925,298

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

/2 Total Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

The products of the animal feed and animal food manufacturing businesses include bulk grain-based and fodder-based products, as well as protein supplements and other dietary supplements, primarily sold to feedlots. Products also include bagged feeds sold to smaller livestock operations and to consumers via animal feed stores and farm and ranch supply retail outlets. Other products include bagged and canned dog and cat foods manufactured using a range of grain, vegetable, meats, and other animal byproducts in their formulations.

Thirty-four firms located in Colorado manufactured an estimated \$592 million worth of livestock feeds in 2016. These products utilized some of the \$920 billion of feed crops as well as some of the byproducts, such as bone meal, from the animal slaughter in Colorado. Colorado's feed crop production, imports of corn grain, and

food manufacturing together supplied the \$1.16 billion of feed purchased by Colorado farms and ranches in 2016. Colorado also accounted for an estimated \$143 million worth of animal feeds exported from the U.S. in 2016 (USDA-ERS State Export Data, 2018).

In addition, 17 dog food and cat food manufacturers in Colorado produced and sold \$569 million worth of pet food products largely destined for retail markets. Together, businesses manufacturing feeds and foods for animals accounted for \$1.2 billion in sales of product, over 1,000 jobs, and about a \$97 million in payroll in Colorado in 2016.

A LINK IN THE VALUE CHAIN:

Manufacturers of animal foods and feeds sold a total of \$1.2 billion in 2016. Of this, manufactured livestock feeds were \$592 million, and were accounted for in feed purchases by farm and ranch operations. Dog and cat food manufacturing accounted for \$568 million in 2016.



5.6 BIOFUELS MANUFACTURING

After animal feeding, one of the largest uses of the Colorado corn crop is fermentation and distillation to produce ethanol, a “biofuel” that can be used in combination with gasoline. In the U.S., by law, gasoline must be sold as a blend with 10 percent content of an oxygenator to enable complete combustion in an automobile’s engine to improve air quality. Ethanol is the preferred oxygenator in the market today, resulting in a blend known as “E10”. A high ethanol blend, E85, is also widely available in the U.S. In Colorado there are four ethanol plants, three of which utilize corn grain as primary feedstock. The fourth is a smaller specialty plant designed to utilize waste from the brewery industry.

The biorefinery in Golden, associated with the Coors brewery, is primarily a pilot facility. The combined capacity of the three main plants is 150 million gallons of ethanol per year. At full production these plants can utilize close to 50 million bushels of corn. Thus, the capacity of these three plants is sufficient to utilize more than a third of the 135 million bushels of corn grain produced in Colorado in 2016. This is high enough capacity needs that additional corn grain is brought into the state to meet the combined demand for livestock feeding and ethanol fermentation.

About one third of the grain mass used in ethanol production—thus about 15 to 18 million bushels a year in Colorado—is returned as distillers’ grains. So, in addition to the sale of ethanol for use in gasoline blends, distillers’ grains are sold for animal feed.

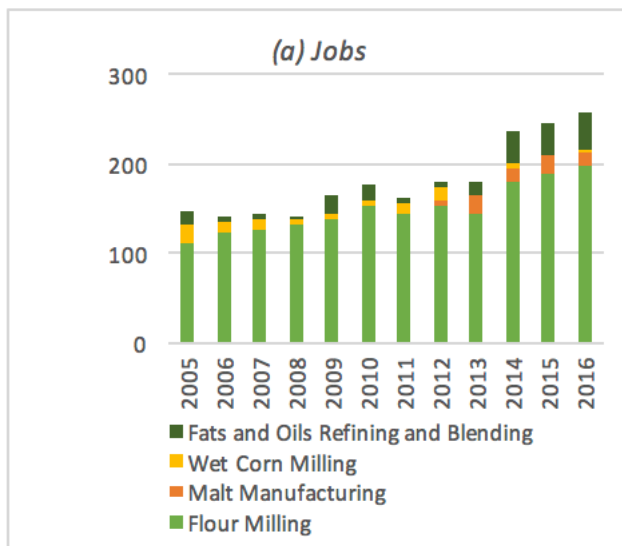
Table 5.4 Animal food and feed manufacturing firms: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311111	Dog and Cat Food Manufacturing	17	\$332,768,373	\$568,887,192	71%
311119	Other Animal Food Manufacturing	34	\$381,179,993	\$592,088,457	55%
TOTAL		51	\$ 713,948,366	\$1,160,975,649	63%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
311111	Dog and Cat Food Manufacturing	1.44	659	\$53,472,794
311119	Other Animal Food Manufacturing	0.84	522	\$43,872,266
TOTAL			1181	\$97,345,060

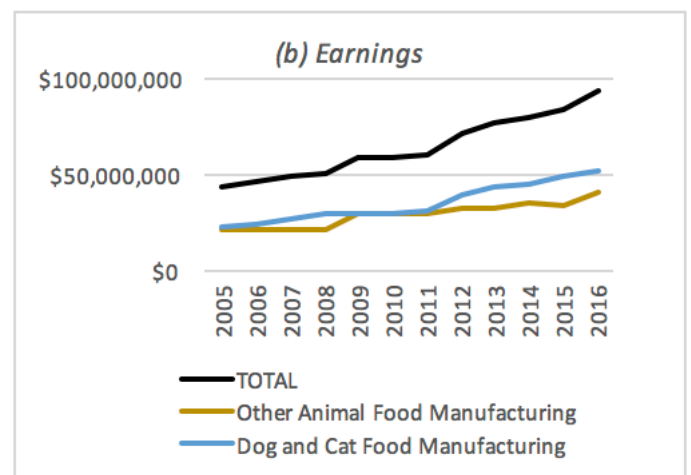
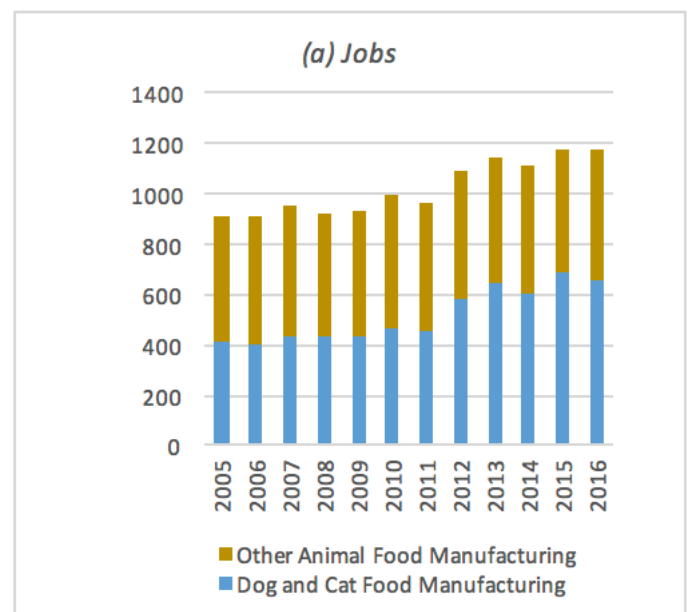
Data source: EMSI, 2018

Figure 5.6 Grain milling and oilseed processing: jobs and earnings 2005-2016



Data source: EMSI, 2018

Figure 5.7 Animal food and feed manufacturing: jobs and earnings 2005-2016



Data source: EMSI, 2018

Another important co-product from fermentation is carbon dioxide. Ethanol plants are equipped to capture CO2 as it is produced and bottled. This can then be sold to a number of customers, including manufacturers of carbonated beverages.

According to EMSI estimates, Colorado’s ethanol plants sold about \$120 million, while employing about 100 workers and paying about \$15 million in payroll.

An additional nascent bioenergy sector in Colorado is biomass co-generation in electric power. Likely this is utilizing forestry byproduct, such as sawmill scrap, sawdust, or pellets. But, worldwide the use of biomass for electricity generation is greater than the use of grain or sugar crops for biofuel manufacture.

A LINK IN THE VALUE CHAIN:
Colorado ethanol plants sold an estimated \$141 million in 2016.

Table 5.5 Ethanol biofuel plants in Colorado

Refinery name	Location	Nameplate capacity
Front Range Energy	Windsor, CO	48 million gallons/year
Merrick & Co. (MillerCoors Ethanol)	Golden, CO	3 million gallons/year
Sterling Ethanol	Sterling, CO	52 million gallons/year
Yuma Ethanol	Yuma, CO	50 million gallons/year
Total		153 million gallons/year

Source: Ethanol Producers Magazine, Fuel Ethanol Plants Map

Table 5.6 Bioenergy producers: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
221117	Biomass Electric Power Generation	1	-	\$ 168,668	-
325193	Ethyl Alcohol Manufacturing	3	118,381,404	\$ 141,145,959	19%
TOTAL				\$ 141,314,627	

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
221117	Biomass Electric Power Generation	0.02	1	-
325193	Ethyl Alcohol Manufacturing	0.48	98	\$ 7,589,165
TOTAL			99	\$ 7,589,165

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector’s share of employment in Colorado is the same as the sector’s share of employment nationally. A value of 1.10 indicates that the sector’s share of employment in Colorado is 10% higher than the sector’s share of employment nationally.

/2 Total Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers’ compensation.

5.7 SUGAR REFINING

Sugar beets must be processed relatively quickly following harvest, as the sucrose contained in the beet begins to break down quickly. The processing needs be completed during the harvest season. That fact, combined with high transport costs (given that sugar beets are primarily water), makes regional processing centers a necessity. The products from sugar beet refining include granulated and powdered sugar, molasses products, and beet pulp. The sugar is sold both in retail and industrial quantities. The molasses products and beet pulp can be used as animal feed.

Western Sugar Cooperative, in Fort Morgan, a location central to the Colorado beet growing region, is the primary sugar refiner in Colorado.

Table 5.7 Sugar refiners: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311313	Beet Sugar Manufacturing	4	\$ 61,701,134	\$ 81,174,817	32%

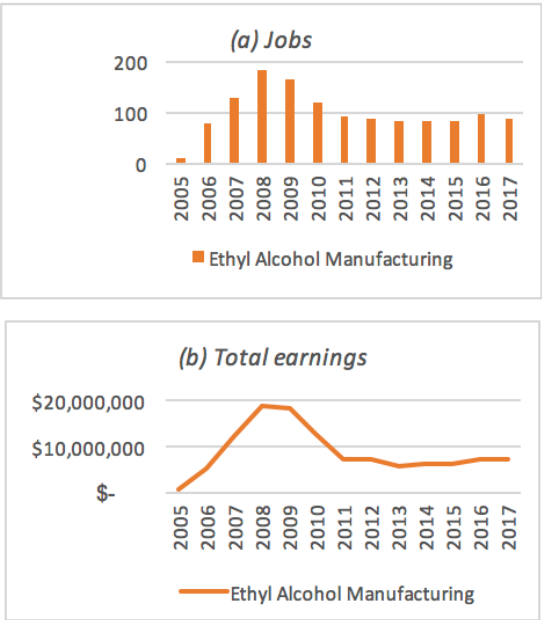
NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
311313	Beet Sugar Manufacturing	1.99	243	\$ 11,484,574

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

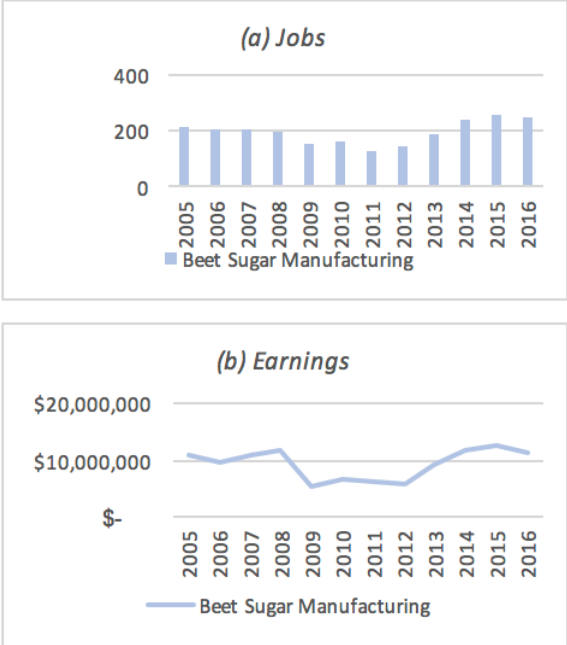
/2 Total earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 5.8 Biofuels manufacturing: jobs and earnings in Colorado, 2005-2016



Data source: EMSI, 2018

Figure 5.8 Sugar refiners: (a) jobs and (b) earnings in Colorado, 2005-2016



Data source: EMSI, 2018

5.8 WOOD AND PAPER PRODUCT MANUFACTURING

With close to 25 million acres of forest land in Colorado, it has a surprisingly small forest products industry. In section 3 above, we saw that the USDA estimates that only \$5 million of forest products were harvested in Colorado in 2016. The EMSI input-output models agree, reporting timber tract operations (NAICS code 113110) to have produced \$4.2 million and forest nurseries (NAICS code 113210) to have produced \$2.4 million, so together contributing \$6.6 million to revenues. These industry categories align with what we could consider agricultural forestry. But, whether the total is \$5 million or \$6.6 million, these are small numbers and do not suggest enough harvest to support much of a wood or pulp-and-paper products industry in Colorado. However, according to EMSI, logging (NAICS code 113310) in Colorado harvested \$36 million in 2016, above and beyond the agroforestry categories of production and harvest.

Altogether these harvests support 33 small sawmills in Colorado with total employment of 292 and single paper mill in Denver that employs about 30, with total 2016 earnings of \$15 million. The location quotient for sawmills is just 0.19, meaning that Colorado has only one fifth the national average of employment in sawmills. Still, employment and earnings may have ticked up slightly due to the Pine Beetle crisis during 2007-2012 (Figure 5.10).

Table 5.9 Sawmills and paper mills: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
321113	Sawmills	33	\$90,550,857	\$79,681,182	-12%
322110	Pulp Mills	0	-	-	
322121	Paper (except Newsprint) Mills	1	\$9,649,739	\$8,569,608	-11%
322122	Newsprint Mills	0	-	-	
322130	Paperboard Mills	0	\$4,648,770	\$330,128	-93%
	TOTAL	\$34	\$104,849,366	\$88,580,918	

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
321113	Sawmills	0.19	292	\$13,784,510
322110	Pulp Mills	0.00	0	\$-
322121	Paper (except Newsprint) Mills	0.03	27	\$1,203,772
322122	Newsprint Mills	0.00	0	\$-
322130	Paperboard Mills	0.00	10	\$34,350
	TOTAL		\$329	\$15,022,633

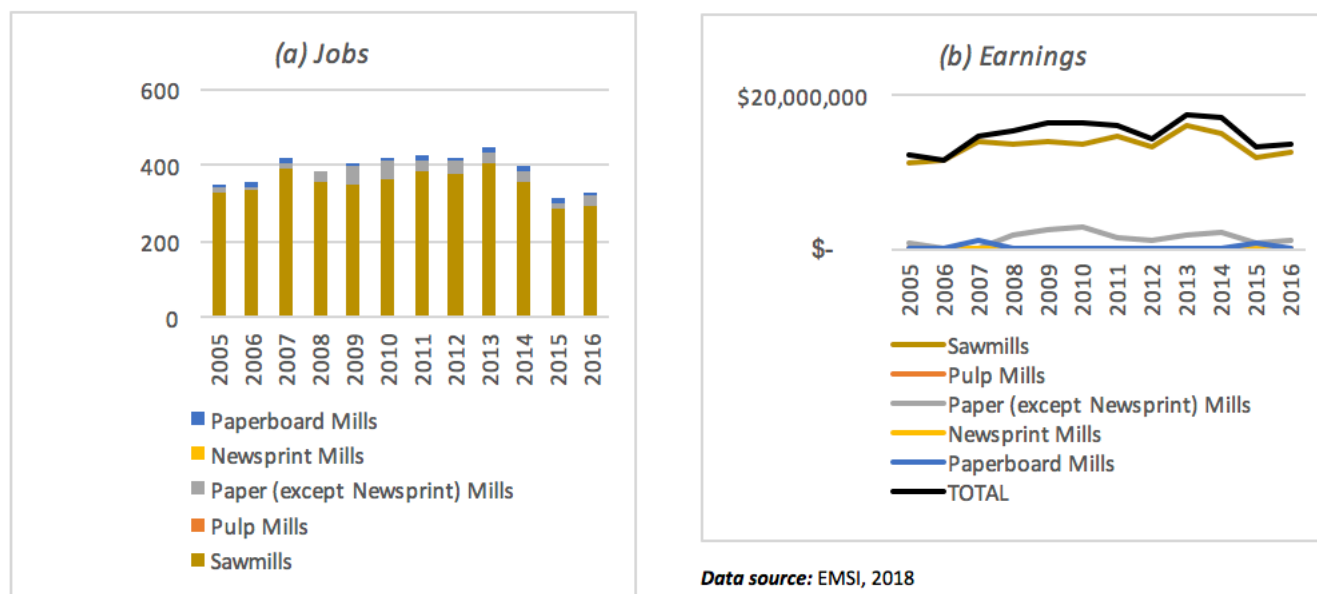
Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

A LINK IN THE VALUE CHAIN

Colorado sugar beet processors sold \$81 million of sugar and co-products in 2016.

Figure 5.9 Sawmills and paper mills: (a) Jobs and (b) Earnings in Colorado, 2005-2016



5.9 ANIMAL SLAUGHTER, PROCESSING, AND MEAT PACKING

Cattle represent the largest volume passing through Colorado slaughter plants. In 2016, 2,457,300 head of cattle were slaughtered in Colorado. Total live weight of the cattle slaughtered was 3,437,263,000 pounds, with an average live weight per animal in 2011 of 1,400 pounds.

Sheep and lambs are the second largest volume. In 2016, 829,600 sheep and lambs were slaughtered in Colorado, making Colorado sheep production the largest among U.S. states. Live weight of the sheep and lambs slaughtered was 133,906,000 pounds, with an average live weight per animal in 2016 of 162 pounds. Virtually all hogs grown in Colorado (99.7 percent) were shipped out of state for slaughter, packing, and processing. While 3,128,000 hogs were marketed by Colorado livestock producers, just 20,300 hogs were slaughtered in Colorado in 2016. Live weight of those hogs slaughtered was 2,481,000 pounds, meaning average live weight per hog in 2011 was 252 pounds. In addition, 2,369,000 chickens and an unspecified count of turkeys were slaughtered and processed in Colorado in 2016. (USDA-NASS, Colorado Agricultural Statistics, 2016)

The products of the meatpacking industry include fresh meat, frozen boxed meat, tallow, hides, and other byproducts, such as organ meats, bone meal, and blood products. Fresh meat is the most valuable. Frozen boxed meat is sold at a discount relative to fresh. Most fresh meat is sold quickly via grocery and specialty retail outlets as well as foodservice outlets. Fresh and frozen meat is sold to food manufacturers to use as an ingredient in manufactured products.

According to USDA State Export Data (2018), an estimated \$307 million worth of the beef and veal and \$58 million of the pork exported from the U.S. in 2016 originated in Colorado. Many of the hides produced in Colorado, at \$76 million, are also exported. According to EMSI (2012), animal slaughter and meat processing accounted for \$2.96 billion in sales in Colorado in 2011. It employed over 8,270 workers and had an estimated \$316 million annual payroll.

There are 32 USDA registered livestock slaughter plants in Colorado (Meat, Poultry and Egg Product Inspection Directory, USDA). Of these, two stand out as being industrial scale operations.

JBS, with its North America headquarters located in Greeley, Colorado, is the largest animal protein producer and the largest protein producer in the world. Its beef plant in Greeley, with reported capacity of 5,500 head per day, makes the JBS Greeley Beef plant the largest slaughter and meatpacking operation in Colorado.

Cargill Meat Solutions, located in Fort Morgan Colorado, is the other major beef slaughter plant in the state, with reported capacity of 5,000 head or 4 million pounds per day.

The combined capacity of just these two plants exceeds 3 million head per year. Since the total reported slaughter for the state of Colorado for 2016 was 2,457,300 head (USDA-NASS, Colorado Agricultural Statistics, 2016), this implies that these plants do not operate at full capacity.

A LINK IN THE VALUE CHAIN:
Colorado slaughter houses produced \$3.4 billion of animal products in 2016.

Table 5.10 Animal slaughter and meat processing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311611	Animal (except Poultry) Slaughtering	38	\$2,103,397,192	\$2,646,563,455	26%
311612	Meat Processed from Carcasses	31	\$672,737,586	\$674,378,179	0%
311613	Rendering and Meat Byproduct Processing	1	\$40,551,179	\$9,017,907	-78%
311615	Poultry Processing	3	\$120,532,181	\$30,189,913	-75%
311710	Seafood Product Preparation and Packaging	1	\$20,672,723	\$12,337,021	-40%
TOTAL		74	\$2,957,890,861	\$3,372,486,475	14%

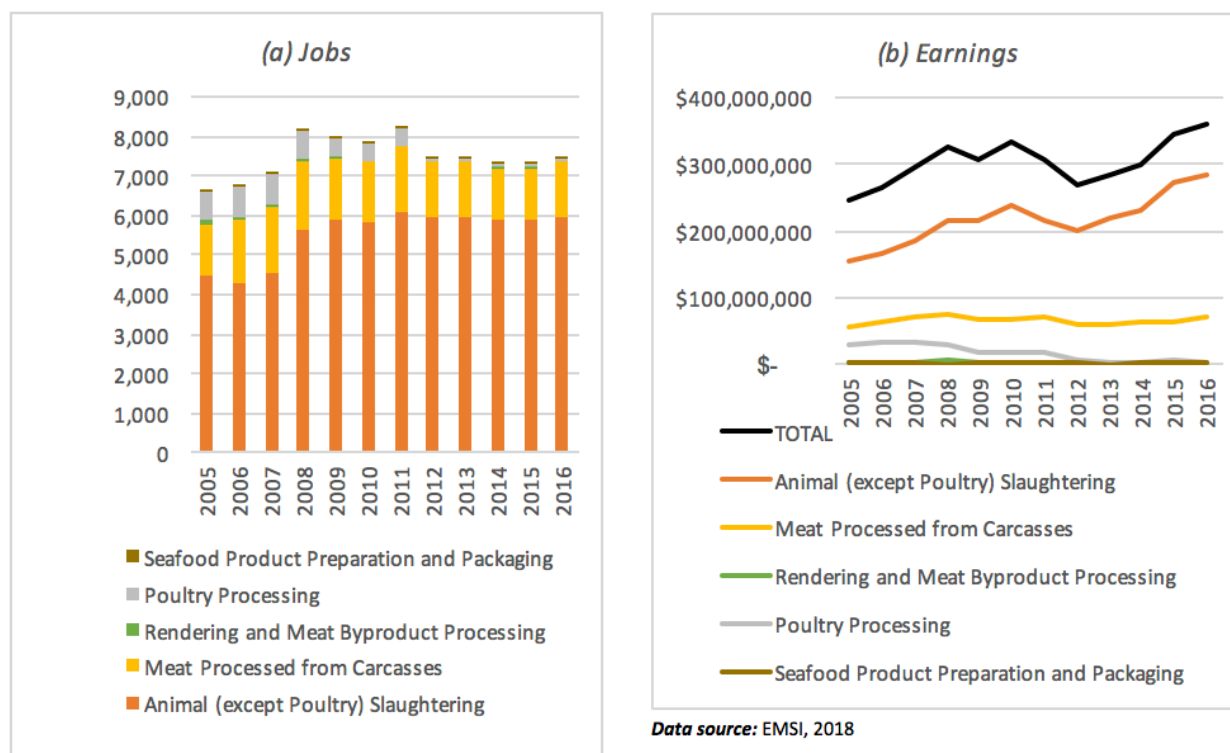
NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
311611	Animal (except Poultry) Slaughtering	2.40	5,971	\$285,966,878
311612	Meat Processed from Carcasses	0.61	1,361	\$71,297,907
311613	Rendering and Meat Byproduct Processing	0.06	10	\$940,655
311615	Poultry Processing	0.02	105	\$4,531,751
TOTAL			27	\$2,208,424

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

/2 Total earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 5.10 Animal slaughter and meat processing: (a) jobs and (b) earnings in Colorado, 2001-2016



5.10 HIDE TANNING AND LEATHERWORKING

One additional manufacturing business that utilizes a product of the animal slaughter and meatpacking sector is hide tanning and leather manufacturing. The roughly 2.5 million cattle and 1 million sheep slaughtered in Colorado each year produce a lot of leather and sheepskins. A large proportion of these hides and skins are exported for tanning and manufacturing, mostly to Mexico and Korea.

Table 5.11 Leather and hide tanning and leatherworking: number of firms, sales, growth, location quotient, jobs, earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
316110	Leather and Hide Tanning and Finishing	6	\$2,230,160	\$13,292,345	496%
316210	Footwear Manufacturing	4	\$1,869,596	\$6,893,942	269%
316992	Women's Handbag and Purse Manufacturing	2	\$1,685,330	\$10,068,336	497%
TOTAL		12	\$5,785,086	\$30,254,624	423%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Total Earnings /2
316110	Leather and Hide Tanning and Finishing	0.49	42	\$2,219,192
316210	Footwear Manufacturing	0.07	17	\$1,147,252
316992	Women's Handbag and Purse Manufacturing	0.60	16	\$1,677,776
TOTAL			75	\$5,044,218

Data source: EMSI, 2018

5.11 DAIRY PROCESSING AND PRODUCT MANUFACTURING

We saw that Colorado dairy farms sold \$655 million of milk in 2016. Almost 100 percent of this milk met “Grade A” fluid milk standards. However, given natural variations in dairy supply due to weather and normal seasonal fluctuations in milk cow productivity, as well as the short shelf life of fresh milk, an excess production capacity has long been maintained in the dairy sector in order that fluid milk demand can still be met during those dips in supply. On average, only one-third of U.S. milk production is bottled and sold as fluid milk, while half of U.S. milk production is used to manufacture cheese. The remaining sixth is used to make all other dairy products, such as butter, ice cream, sour cream, yogurt, and so on. This pattern is followed reasonably closely in Colorado, with more routed toward cheese manufacturing (70 percent by value) and less toward other dairy products (4 percent by value). None goes to butter manufacturing or to dry or condensed milk products in Colorado as of 2016.

In Colorado, there are 10 dairy businesses that process, bottle, and sell fluid milk. In 2016, according to EMSI estimates, they sold \$691 million.

There are several distinctions among these firms. First there are “mainstream” large volume bottlers that sell through major retail grocery stores. There has been considerable consolidation in this sector over the last couple decades. Colorado is also home to a couple of the major players in the U.S. organic dairy sector, as fresh dairy is one of the strongest sectors of organic sales.

Meadow Gold Dairies was founded in Nebraska in the 1890s and was for almost a century owned by the Beatrice Group, which grew it into a multi-state brand. Today, Meadow Gold Dairies is owned by Dean Foods and operates in several western states. Colorado plants are located in Englewood, Greeley, and Delta. Meadow Gold branded dairy products are sold at major retailers such as Walmart.

Horizon Organic is now a subsidiary of DanoneWave, and specializes in certified organic milk and dairy products. Horizon sells both organic milk and manufactured dairy products under its “Horizon” brand through major retailers such as Albertsons, Kroger, Safeway, and Walmart.

Aurora Organic Dairy, based in Boulder, Colorado, operates dairy farms in Colorado and Texas. Aurora’s main processing plant is in Platteville, Colorado, north of Denver. In contrast to Horizon’s business strategy, Aurora supplies major retailers with organic milk that the retailer labels and sells under their private brand.

A LINK IN THE VALUE CHAIN:
Dairy product manufacturing firms in Colorado accounted for \$2.3 billion in sales in 2016. Of this, cheese manufacturing accounted for \$1.9 billion.

In Colorado there are just a handful of cheese manufacturers, but the sector produced and sold an estimated \$1.9 billion of cheese in 2016. This segment is dominated by Leprino Foods. While Leprino originated as a small Italian grocery and cheese market in Denver in the 1950s, today it is the world’s largest producer of mozzarella cheese, supplying the pizza topping to food manufacturers and retailers in 40 countries.

The 27 dairy product manufacturing firms in Colorado together accounted for \$2.3 billion in sales in 2016 of which an estimated \$89 million was exported (USDA-ERS, State Exports Data, 2018). They employed over 2,300 workers, supported an annual payroll of over \$200 million, and saw a 19 percent increase in their workforce over the decade between 2005 and 2016.

Table 5.12 Dairy product manufacturing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311511	Fluid Milk Manufacturing	10	\$589,904,359	\$690,741,259	17%
311512	Creamery Butter Manufacturing	0	-	-	
311513	Cheese Manufacturing	8	\$1,199,806,806	\$1,922,924,699	60%
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing	0	\$61,025,302	\$78,635	-100%
311520	Ice Cream and Frozen Dessert Manufacturing	9	\$67,717,405	\$109,506,667	62%
TOTAL		27	\$1,918,453,872	\$2,723,251,259	42%

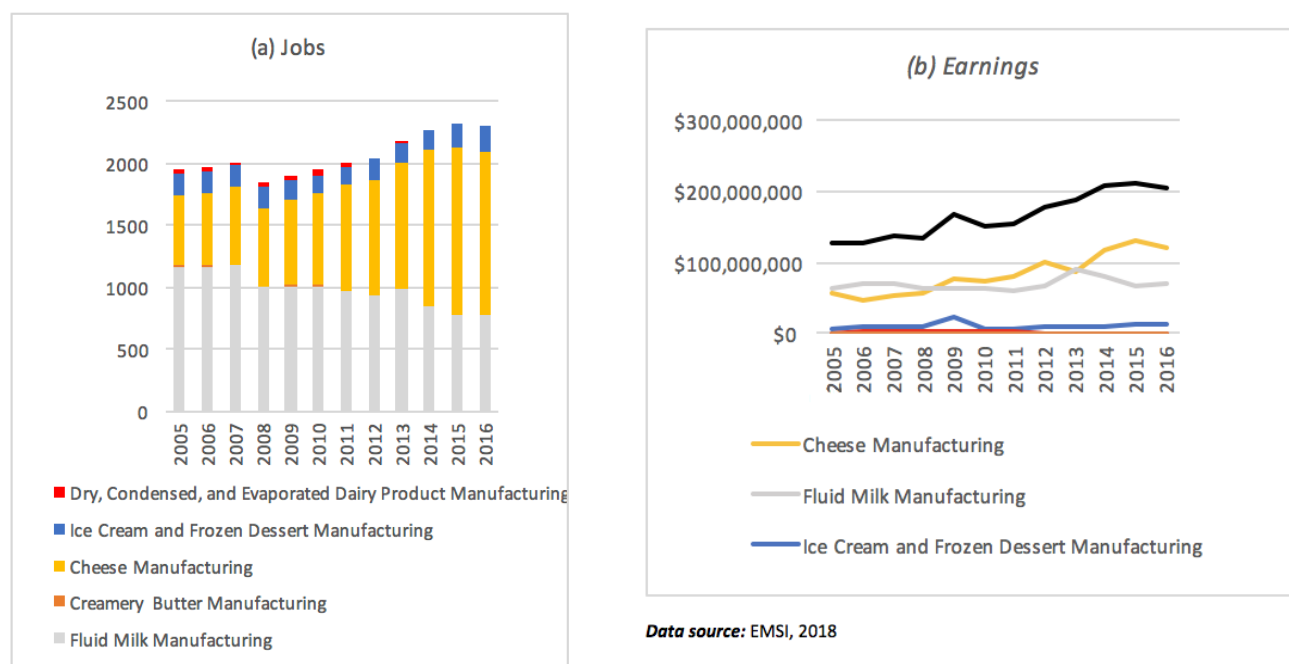
NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
311511	Fluid Milk Manufacturing	0.78	777	\$72,009,272
311512	Creamery Butter Manufacturing	0.00	0	-
311513	Cheese Manufacturing	1.57	1,322	\$120,094,122
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing	0.00	0	\$6,073
311520	Ice Cream and Frozen Dessert Manufacturing	0.55	208	\$14,199,087
TOTAL			2,307	\$206,308,553

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 5.11 Dairy product manufacturers: (a) Jobs and (b) Earnings in Colorado, 2005-2016



5.12 FRUIT AND VEGETABLE MARKETING AND PROCESSING

As noted in Part 3, Colorado farms grew \$272 million worth of fruits and vegetables. This broke out into \$176 million from potatoes, \$71 million from other vegetables, and \$27 million from fruits. In commodity marketing and food processing, the characteristics of the value chain for fruits and vegetables are, in some ways, similar to dairy. The value chain divides into a “fresh” branch and a “processing” branch. In general, returns for fresh produce are higher, but logistical and marketing challenges are intense, to say the least, as making a final sale of the product is a race against time. Processing of fruits and vegetables, whether simply fresh-frozen, canned, pickled, or used in a manufactured food such as a salsa, a pastry, or an ice cream, typically results in lower but more reliable returns. In both branches of the value chain, however, scale and seasonality of production provide distinct challenges to developing a more extensive and robust value chain within Colorado.

There are 10 firms in Colorado engaged in frozen specialty food manufacturing, a subsector of fruit and vegetable manufacturing. These food manufacturing firms accounted for \$190 million in sales in 2016, which has grown more than 50% over the last decade, as well as 575 jobs and \$29 million in payroll. An additional 25 firms were engaged in other methods of fruit and vegetable manufacturing, including canning and dehydrating. These firms had combined sales of \$125 million and accounted for 270 jobs and a payroll of \$17 million in 2016. Overall, fruit and vegetable processing grew almost 60 percent as a sector between 2005 and 2016.

Of Colorado-grown produce, it is estimated that, in 2016, \$50 million of fresh vegetables and \$6 million of fresh fruits grown in Colorado were exported from the U.S. Likewise, \$96 million worth of processed vegetables and \$6 million of processed fruits were exported from the U.S. in 2016, for a total of \$157 million in fruit and vegetable exports (USDA-ERS, State Export Data, 2018).

Table 5.13 Fruit and vegetable processing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311411	Frozen Fruit, Juice, and Vegetable Manufacturing	0	-	-	-
311412	Frozen Specialty Food Manufacturing	10	\$125,083,942	\$189,911,568	52%
311421	Fruit and Vegetable Canning	20	\$39,698,754	\$74,034,302	86%
311422	Specialty Canning	0	\$2,526,318	\$9,450,248	274%
311423	Dried and Dehydrated Food Manufacturing	5	\$30,803,221	\$42,083,351	37%
TOTAL		35	\$198,112,235	\$315,479,468	59%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
311411	Frozen Fruit, Juice, and Vegetable Manufacturing	0.00	0	-
311412	Frozen Specialty Food Manufacturing	0.55	575	\$29,035,761
311421	Fruit and Vegetable Canning	0.12	131	\$10,141,550
311422	Specialty Canning	0.00	10	\$1,294,933
311423	Dried and Dehydrated Food Manufacturing	0.63	130	\$5,836,071
TOTAL			846	\$46,308,315

Data source: EMSI, 2018

A LINK IN THE VALUE CHAIN: Fruit and vegetable processors in Colorado made sales of \$315 million in 2016.

5.13 BAKED GOODS AND CONFECTIONERY MANUFACTURING

Baked goods and confections utilize significant quantities of wheat, sugar, milk, eggs, and other manufactured food ingredients considered in the previous sections of this part of the value chain. There has been significant growth in the number of bread/bakery and snack food establishments over the past couple of decades, and this mimics what is seen in national trends (Thilmany et al, 2017). Over this same period, bakery employment almost doubled and snack food processing employment more than tripled (signaling they are labor intensive businesses). These growth sectors may align with several notable market trends including health-related labeling (gluten free, whole grains), ethnic foods (tortillas, hummus) and natural foods (organic breads, veggie-based chips). Close to 300 firms in Colorado manufacture baked goods and confections, selling \$1.64 billion, employing over 7,000 people, and making over \$320 million in payroll in 2016.

Table 5.14 Baked goods and confectionery manufacturing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311230	Breakfast Cereal Manufacturing	4	\$24,273,285	\$90,131,415	271%
311340	Nonchocolate Confectionery Manufacturing	21	\$49,853,775	\$88,089,576	77%
311351	Chocolate and Confectionery Manufacturing from Cacao Beans	4	\$-	\$11,473,462	
311352	Confectionery Manufacturing from Purchased Chocolate	38	\$203,061,485	\$325,417,375	60%
311811	Retail Bakeries	117	\$114,048,065	\$174,292,712	53%
311812	Commercial Bakeries	64	\$414,596,692	\$489,107,626	18%
311813	Frozen Cakes, Pies, and Other Pastries Manufacturing	3	\$21,993,455	\$87,583,527	298%
311821	Cookie and Cracker Manufacturing	12	\$19,020,482	\$7,150,819	-62%
311824	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	8	\$163,818,221	\$199,716,350	22%
311830	Tortilla Manufacturing	25	\$87,129,006	\$167,314,181	92%
TOTAL		296	\$1,097,794,466	\$1,640,277,042	49%

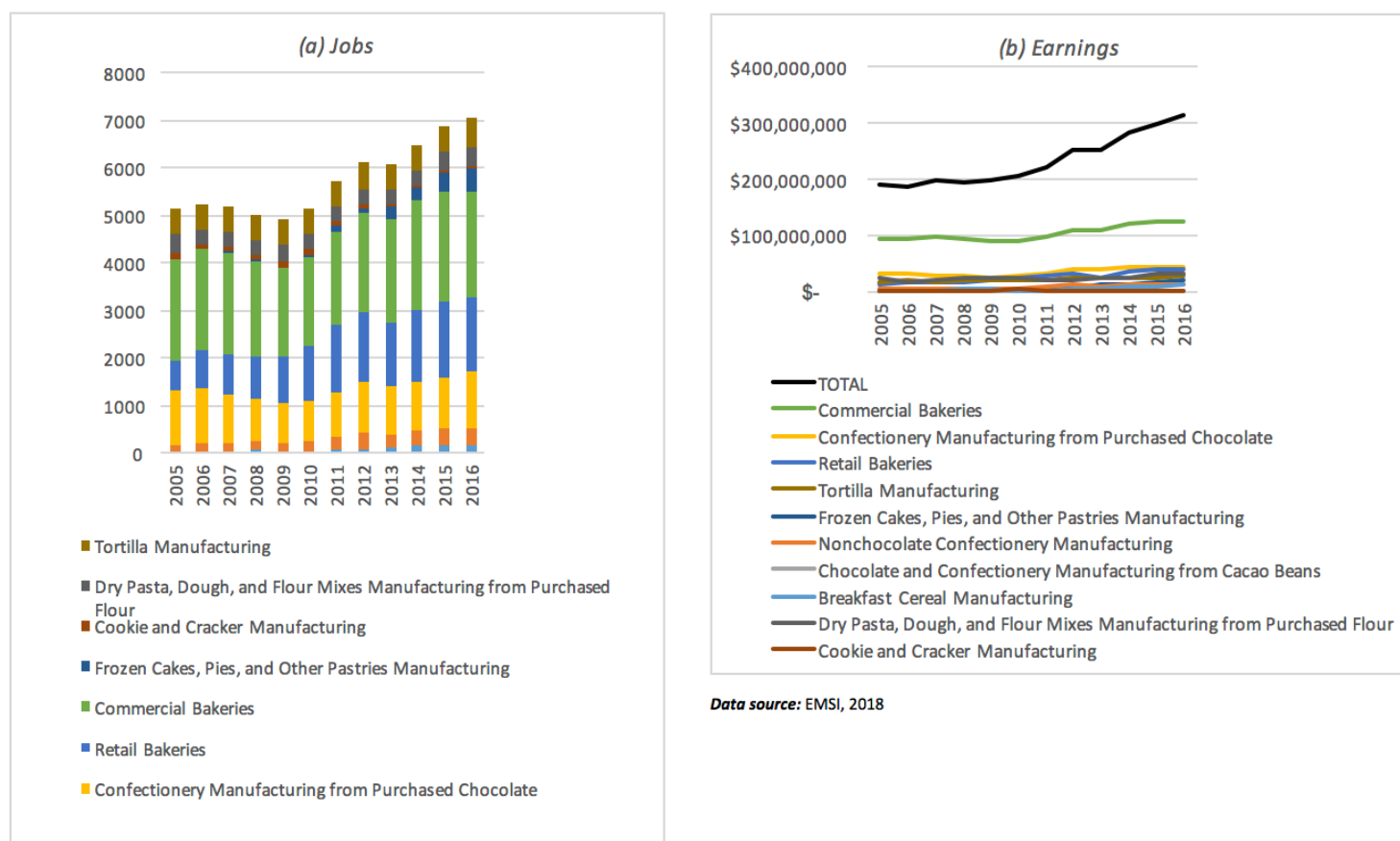
NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
311230	Breakfast Cereal Manufacturing	0.78	180	\$11,378,618
311340	Nonchocolate Confectionery Manufacturing	0.91	345	\$12,567,704
311351	Chocolate and Confectionery Manufacturing from Cacao Beans	0.09	33	\$1,624,654
311352	Confectionery Manufacturing from Purchased Chocolate	2.05	1,219	\$46,361,036
311811	Retail Bakeries	0.92	1,573	\$45,133,197
311812	Commercial Bakeries	0.89	2,217	\$125,608,166
311813	Frozen Cakes, Pies, and Other Pastries Manufacturing	2.13	501	\$22,509,273
311821	Cookie and Cracker Manufacturing	0.08	53	\$1,113,051
311824	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	0.96	402	\$30,888,969
311830	Tortilla Manufacturing	1.73	616	\$26,597,626
TOTAL			7,139	\$323,782,294

Data source: EMSI, 2018

^{/1} Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1.00 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

^{/2} Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 5.12 Baked goods and confectionery manufacturing:
(a) Jobs and (b) Earnings in Colorado, 2005-2016



Data source: EMSI, 2018

5.14 OTHER FOOD MANUFACTURING

Colorado firms manufacture a range of other foods—including snack foods, seasonings and dressings, and perishable prepared foods—as well as other categories outside of those already considered. Over 100 firms lie in these “other” categories, representing a diversity of offerings, including snacks, nut butters, dressings, condiments, spices, and more. Their combined sales were not insignificant, totaling \$1.24 billion in 2016. They had about 2,600 employees and a payroll of \$169 million in 2016. Like other sectors of food manufacturing, growth in sales was over 50 percent between 2005 and 2016.

A LINK IN THE VALUE CHAIN:
Colorado food manufacturers of baked goods and confections sold \$1.6 billion in 2016.

A LINK IN THE VALUE CHAIN:
Colorado food manufactures across the range of other product categories not already considered sold \$1.2 billion in 2016.

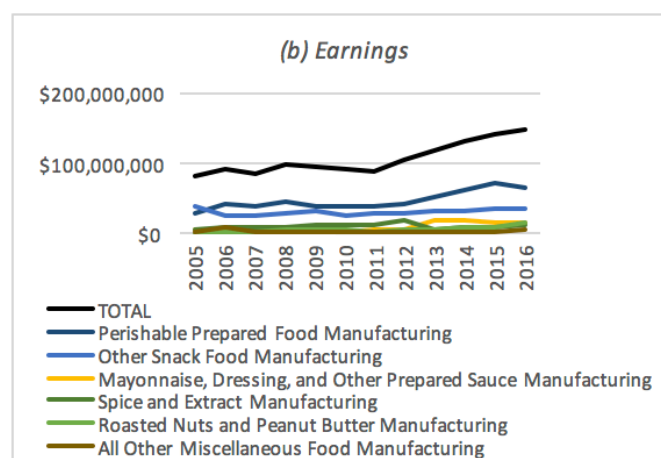
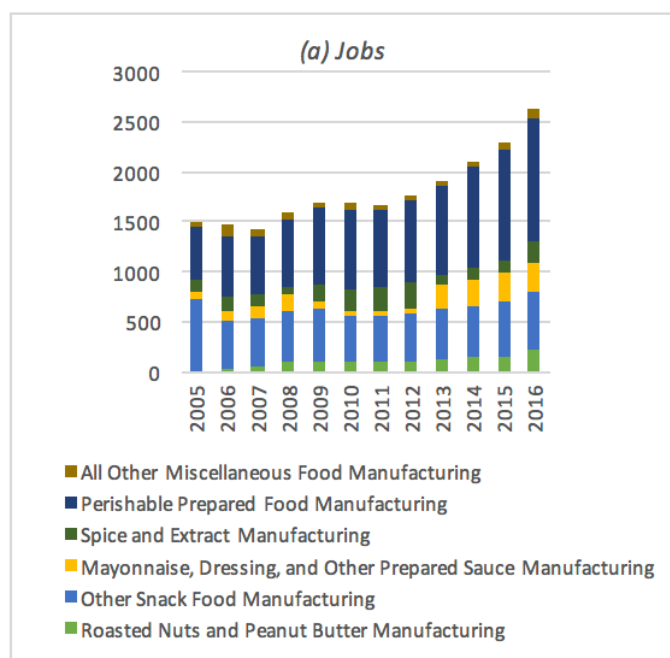
Table 5.15 Other food manufacturing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
311911	Roasted Nuts and Peanut Butter Manufacturing	14	\$39,812,930	\$154,446,553	288%
311919	Other Snack Food Manufacturing	11	\$271,998,190	\$371,498,185	37%
311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	9	\$39,937,784	\$112,184,780	181%
311942	Spice and Extract Manufacturing	10	\$116,697,316	\$84,631,534	-27%
311991	Perishable Prepared Food Manufacturing	62	\$284,050,088	\$456,930,373	61%
311999	All Other Miscellaneous Food Manufacturing	13	\$33,225,795	\$60,046,481	81%
TOTAL		119	\$785,722,103	\$1,239,737,906	58%

NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
311911	Roasted Nuts and Peanut Butter Manufacturing	0.78	220	\$15,827,282
311919	Other Snack Food Manufacturing	0.77	575	\$37,729,896
311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	1.04	303	\$18,279,421
311942	Spice and Extract Manufacturing	0.51	217	\$13,617,024
311991	Perishable Prepared Food Manufacturing	1.34	1,213	\$74,165,411
311999	All Other Miscellaneous Food Manufacturing	0.19	111	\$9,718,957
TOTAL			2,639	\$169,337,992

Data source: EMSI, 2018

Figure 5.13 Other food manufacturing: (a) Jobs and (b) Earnings in Colorado, 2005-2016



Data source: EMSI, 2018

5.15 BEVERAGE MANUFACTURING

The most fundamental input to beverage manufacturing is water, and given the quality and reliability of fresh Rocky Mountain water, Colorado has long been a favored location for some sectors of beverage manufacturing, particularly beer brewing. As a result, beverage manufacturing is a major sector of the agricultural and food value chain in Colorado.

One product already discussed is consumed as a beverage, and that is fresh milk. However, since milk is also widely used as an ingredient in baking or other food manufacturing it must be considered more broadly with dairy products. Nonetheless, some portion of the \$590 million of fluid milk sold by Colorado dairy manufacturers could be attributed as a beverage.

Soft drinks manufacturing involves bottling plants for the major soft drink brands, including Coke and Pepsi-Co products, generic manufacturers, as well as a handful of small specialty manufacturers. The main inputs, besides water, are sugar, high fructose corn syrup, or artificial sweeteners and flavorings. Colorado soft drink manufacturers made sales of \$724 million in 2016 and employed over 1,400 with a payroll of \$101 million, all of which are down about 10 percent from the levels reported five years earlier.

Bottled water and ice manufacturing likewise draw upon local water sources. It is somewhat surprising that this sector is not larger, given the quality of the Rocky Mountain water resources that are available. However, shipping costs are significant, and thus the limited demand from the smaller populations in the state may account for why it is not as large a sector as it might be. Twenty-six firms made combined sales of about \$200 million of bottled water and ice in 2016, employing 450 and reporting \$28 million in payroll.

Since the Colorado climate does not allow for growing coffee bushes or tea plants, coffee and tea manufacturing is almost entirely reliant upon bulk import of raw materials from more tropical climates. Typically, value-added manufacturing in this category involves coffee roasting and tea blending, as well as packaging for commercial food service and retail sales. Herbal teas are a specialty of Celestial Seasonings, founded in Boulder, Colorado, in 1969, but today part of the Hain Celestial Group based in New York. Tea and coffee manufacturing accounted for \$334 million in sales in 2016, employing about 600 on a payroll of \$40 million.

Breweries are the single largest sector of beverage manufacturing in Colorado. With a national location quotient of almost 5.00 (meaning that prevalence of employment in breweries in Colorado is five times greater than in the U.S. on average), it is clearly a sector in which Colorado has specialized. Two large industrial breweries, the Coors Brewery in Golden, Colorado, owned by MillerCoors, and the Budweiser Brewery in Fort Collins, Colorado, owned by Anheuser-Busch InBev, contribute significantly to this sector. Both of these breweries derive advantage from their Rocky Mountain water supply. In addition, Colorado has become a leading state in the trend toward craft brewing and microbreweries, with New Belgium Brewery, in Fort Collins identified as the third largest craft brewery in the U.S. yet just one among many across Colorado. According to the Beer Institute, there were 364 active brewery licenses in Colorado in 2016, making it the 3th state in terms of craft brewers and craft beer production, but the 1st state in terms of economic impact per capita (Brewers Association, 2018). Colorado breweries are estimated to have sold \$3.87 billion worth of beer in 2016 and to employ over 5,100, with an annual payroll of \$420 million. Brewing is one of the largest food and beverage sectors in the state.

Wineries have grown significantly in Colorado in the last two decades. Colorado Wine, the association for winemakers in Colorado, lists 140 vineyard, wineries, cellars, cideries, and meaderies (<http://www.coloradowine.com>). The U.S. Census Bureau's County Business Patterns data counted 38 winery establishments in Colorado in 2010. EMSI counted 49 operations in 2011. Differences arise from the fact that many are boutique operations, are non-employers that are not reported in some data sources, and some enterprises designated as wineries are essentially retail tasting rooms. Some wineries in the state, however, are achieving significant

quantity and quality of production. Most of the grape cultivation in Colorado is concentrated in the western valleys of the Colorado River and the Gunnison River. Production wineries are also common in the Front Range, catering to the larger populations in that region, but rely on imported grapes from western Colorado or California. The sector had estimated sales of \$75 million in 2016, employed about 330, and had an annual payroll of \$15 million.

Distilleries have also been growing significantly in recent years, due to increased interest in craft spirits. The Colorado Distillers’ Guild lists 20 members (<http://www.coloradodistillersguild.com/members>), while the U.S. Census Bureau’s County Business Patterns counted just 7 distillery establishments in Colorado in 2010, while EMSI counted 10 operations in 2011. Similar to wineries, the discrepancies in such numbers is due to the fact that some are quite small, cottage industry operations. Still, the sector had estimated sales of \$48 million in 2011, employed over 80, and had an annual payroll of \$10 million. Growth is evident from the 30 percent growth in distillery jobs between 2011 and 2012. Altogether, beverage manufacturing accounted for some \$5.3 billion in sales, over 6,000 jobs, and \$530 million in payroll in Colorado in 2011.

A LINK IN THE VALUE CHAIN:
Colorado beverage manufacturers sold \$5.4 billion in 2016. Of that, beer, at \$3.7 billion, was the largest beverage manufacturing sector.

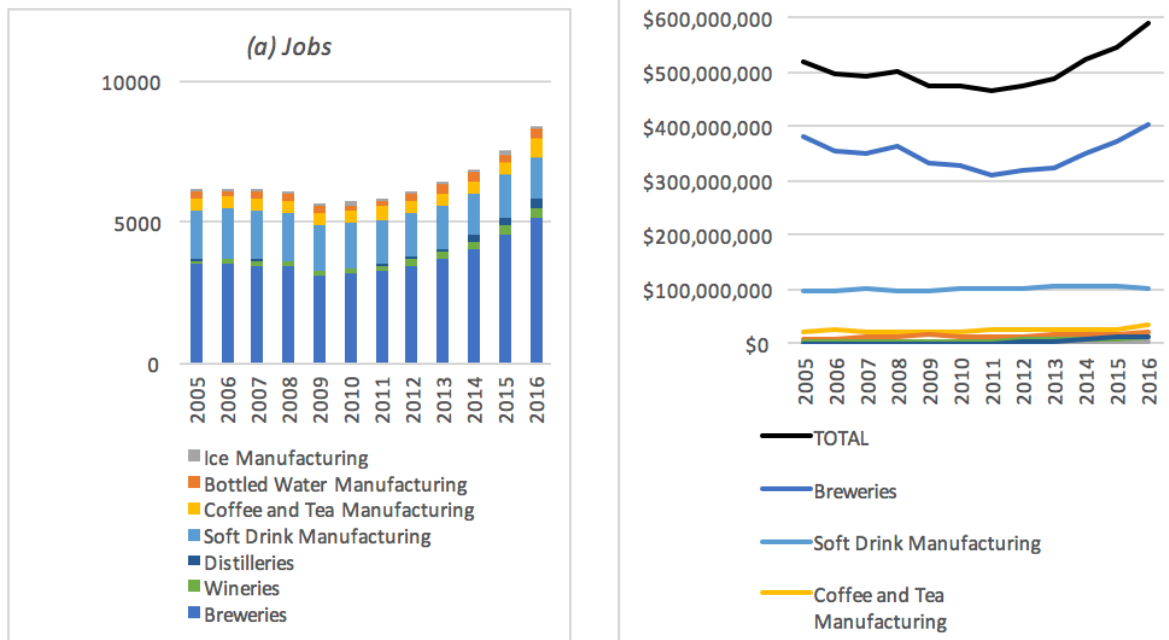
Table 5.16 Beverage manufacturing: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
312111	Soft Drink Manufacturing	17	\$806,299,713	\$724,481,015	-10%
312112	Bottled Water Manufacturing	16	\$104,509,861	\$155,513,400	49%
312113	Ice Manufacturing	10	\$44,243,913	\$45,593,113	3%
311920	Coffee and Tea Manufacturing	32	\$287,617,541	\$334,428,035	16%
312120	Breweries	206	\$3,927,934,764	\$3,874,270,659	-1%
312130	Wineries	49	\$81,099,204	\$75,194,430	-7%
312140	Distilleries	44	\$47,873,048	\$235,041,320	391%
TOTAL		374	\$5,299,578,044	\$5,444,521,972	3%

NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
312111	Soft Drink Manufacturing	1.00	1,467	\$101,810,503
312112	Bottled Water Manufacturing	1.20	334	\$21,674,606
312113	Ice Manufacturing	0.84	117	\$6,377,233
311920	Coffee and Tea Manufacturing	1.56	610	\$40,373,740
312120	Breweries	4.78	5,179	\$419,646,971
312130	Wineries	0.29	331	\$14,479,151
312140	Distilleries	1.51	345	\$16,852,583
TOTAL			8,383	\$621,214,788

Data source: EMSI, 2018

Figure 5.14 Beverage manufacturing: (a) Jobs and (b) Earnings in Colorado, 2005-2016



Data source: EMSI, 2018

5.16 SUMMARY: COLORADO'S WORKFORCE IN COMMODITY MARKETING, PROCESSING, AND FOOD AND BEVERAGE MANUFACTURING

Over 34,000 are employed in the agricultural commodity merchandising, ingredient processing, and food and beverage manufacturing sectors (listed in Table 5.17) in Colorado. Food and beverage manufacturing jobs are somewhat less prevalent in Colorado than in the nation as a whole. Average earnings in the sector in Colorado are higher than in the sector nationwide, at nearly \$60,000 per job per year. Employment is robust, with job growth of 17 percent between 2012 and 2016, twice the national rate of job growth of 8 percent in these sectors. The demographic structure is relatively young, with the largest age group between 25 and 34, but there is a gender disparity, with 64 percent male and 36 percent female. The structure of the most common jobs in the sector and recent trends are shown in Table 5.19.

Figure 5.15 Numbers employed and median hourly earnings in commodity marketing, processing, and food and beverage manufacturing industries in Colorado, by typical entry-level education requirements

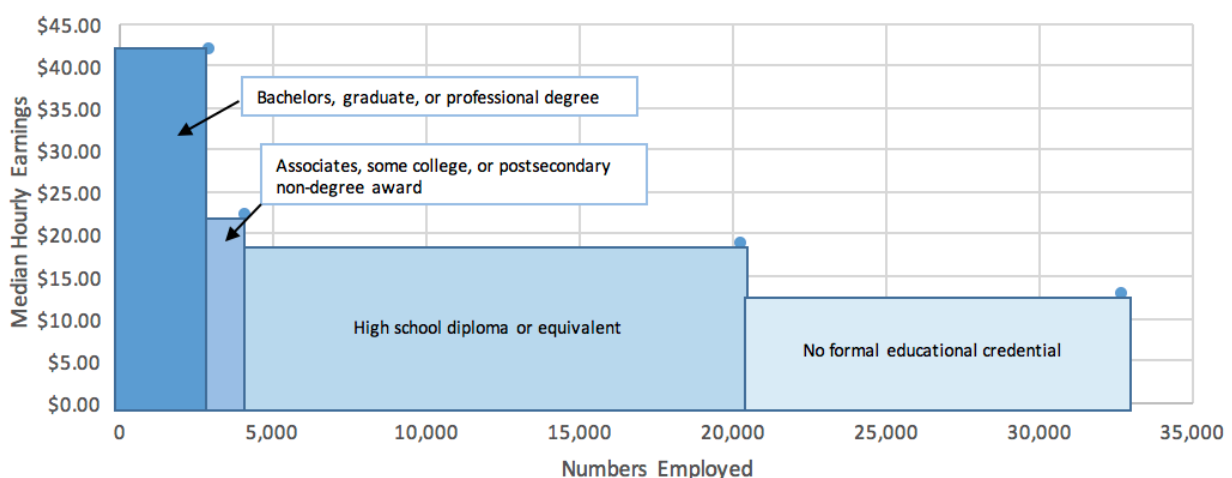


Table 5.17 The list of industry sectors included in this analysis of the workforce in commodity marketing, processing, and food and beverage manufacturing

Code	Description		
311111	Dog and Cat Food Manufacturing	311710	Seafood Product Preparation and Packaging
311119	Other Animal Food Manufacturing	311811	Retail Bakeries
311211	Flour Milling	311812	Commercial Bakeries
311212	Rice Milling	311813	Frozen Cakes, Pies, and Other Pastries Manufacturing
311213	Malt Manufacturing	311821	Cookie and Cracker Manufacturing
311221	Wet Corn Milling	311824	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour
311224	Soybean and <u>Other</u> Oilseed Processing	311830	Tortilla Manufacturing
311225	Fats and Oils Refining and Blending	311911	Roasted Nuts and Peanut Butter Manufacturing
311230	Breakfast Cereal Manufacturing	311919	Other Snack Food Manufacturing
311313	Beet Sugar Manufacturing	311920	Coffee and Tea Manufacturing
311314	Cane Sugar Manufacturing	311930	Flavoring Syrup and Concentrate Manufacturing
311340	Nonchocolate Confectionery Manufacturing	311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing
311351	Chocolate and Confectionery Manufacturing from Cacao Beans	311942	Spice and Extract Manufacturing
311352	Confectionery Manufacturing from Purchased Chocolate	311991	Perishable Prepared Food Manufacturing
311411	Frozen Fruit, Juice, and Vegetable Manufacturing	311999	All Other Miscellaneous Food Manufacturing
311412	Frozen Specialty Food Manufacturing	312111	Soft Drink Manufacturing
311421	Fruit and Vegetable Canning	312112	Bottled Water Manufacturing
311422	Specialty Canning	312113	Ice Manufacturing
311423	Dried and Dehydrated Food Manufacturing	312120	Breweries
311511	Fluid Milk Manufacturing	312130	Wineries
311512	Creamery Butter Manufacturing	312140	Distilleries
311513	Cheese Manufacturing	316110	Leather and Hide Tanning and Finishing
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing	321113	Sawmills
311520	Ice Cream and Frozen Dessert Manufacturing	325193	Ethyl Alcohol Manufacturing
311611	Animal (except Poultry) Slaughtering	327213	Glass Container Manufacturing
311612	Meat Processed from Carcasses	424520	Livestock Merchant Wholesalers
311613	Rendering and Meat Byproduct Processing	424590	Other Farm Product Raw Material Merchant Wholesalers
311615	Poultry Processing		

Table 5.18 Staffing pattern overview for the agricultural commodity marketing, processing, and food and beverage manufacturing industries in Colorado

34,787 Jobs (2017) 11% below National average		\$59,404 Avg. Earnings Per Job (2017) Nation: \$59,854		
Establishments (2017)		1,249		
Jobs Multiplier		6		
	2012 Jobs	2016 Jobs	Change	% Change
Region	28,512	33,448	4,936	17.3%
Nation	1,912,704	2,069,020	156,316	8.2%
Gender		Percent		
Male	63.7%		<div></div>	
Female	36.3%		<div></div>	
Age		Percent		
14-18	1.2%		<div></div>	
19-24	9.6%		<div></div>	
25-34	27.4%		<div></div>	
35-44	22.5%		<div></div>	
45-54	21.1%		<div></div>	
55-64	14.3%		<div></div>	
65+	3.9%		<div></div>	
Race/Ethnicity		Percent		
White	56.7%		<div></div>	
Hispanic or Latino	31.1%		<div></div>	
Black or African American	5.6%		<div></div>	
Asian	4.9%		<div></div>	
Two or More Races	1.0%		<div></div>	
American Indian	0.5%		<div></div>	

Source: EMSI, 2018

Table 5.19 Top 30 jobs in commodity processing and food and beverage manufacturing in Colorado, by percent of total jobs in the industry group

SOC	Description	Employed (2012)	Employed (2016)	Change (2012 - 2016)	% Change (2012 - 2016)	% of Total Jobs in Industry (2017)	Median Hourly Earnings	Typical Entry Level Education
11-1021	General and Operations Managers	409	535	126	31%	1.6%	\$50.94	Bachelor's degree
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	289	308	19	7%	0.9%	\$12.35	No formal educational credential
41-2011	Cashiers	373	401	28	8%	1.2%	\$10.65	No formal educational credential
41-2031	Retail Salespersons	552	845	293	53%	2.6%	\$11.64	No formal educational credential
41-4012	Sales Representatives, Wholesale and Manufacturing	823	959	136	17%	3.1%	\$29.32	High school diploma or equivalent
43-5071	Shipping, Receiving, and Traffic Clerks	312	382	70	22%	1.2%	\$15.19	High school diploma or equivalent
43-5081	Stock Clerks and Order Fillers	308	387	79	26%	1.1%	\$12.92	High school diploma or equivalent
43-9061	Office Clerks, General	282	346	64	23%	1.0%	\$17.45	High school diploma or equivalent
45-2041	Graders and Sorters, Agricultural Products	216	348	132	61%	1.1%	\$9.48	No formal educational credential
45-2093	Farmworkers, Farm, Ranch, and Aquacultural Animals	242	284	42	17%	0.9%	\$13.48	No formal educational credential
49-9041	Industrial Machinery Mechanics	572	742	170	30%	2.2%	\$27.45	High school diploma or equivalent
49-9071	Maintenance and Repair Workers, General	566	564	(2)	(0%)	1.7%	\$18.22	High school diploma or equivalent
51-1011	First-Line Supervisors of Production and Operating Workers	751	909	158	21%	2.7%	\$29.96	High school diploma or equivalent
51-3011	Bakers	1,010	1,227	217	21%	3.8%	\$12.58	No formal educational credential
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	1,983	1,964	(19)	(1%)	5.9%	\$12.74	No formal educational credential
51-3023	Slaughterers and Meat Packers	1,184	1,128	(56)	(5%)	3.1%	\$13.22	No formal educational credential
51-3091	Food and Tobacco Roasting, Baking, and Drying Machine Operators	337	327	(10)	(3%)	1.0%	\$14.01	No formal educational credential
51-3092	Food Batchmakers	1,074	1,586	512	48%	4.7%	\$12.59	High school diploma or equivalent
51-3099	Food Processing Workers, All Other	529	588	59	11%	1.7%	\$12.49	No formal educational credential
51-9012	Separating, Filtering, Clarifying, Precipitating, Machine Operators	772	1,254	482	62%	4.2%	\$18.52	High school diploma or equivalent
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	399	494	95	24%	1.6%	\$20.53	High school diploma or equivalent
51-9111	Packaging and Filling Machine Operators and Tenders	1,942	2,421	479	25%	7.6%	\$14.88	High school diploma or equivalent
51-9198	Helpers--Production Workers	750	806	56	7%	2.2%	\$13.75	High school diploma or equivalent
53-3031	Driver/Sales Workers	475	402	(73)	(15%)	1.3%	\$11.86	High school diploma or equivalent
53-3032	Heavy and Tractor-Trailer Truck Drivers	530	527	(3)	(1%)	1.5%	\$21.42	Postsecondary nondegree award
53-3033	Light Truck or Delivery Services Drivers	366	412	46	13%	1.2%	\$16.82	High school diploma or equivalent
53-7051	Industrial Truck and Tractor Operators	902	1,053	151	17%	3.2%	\$16.49	No formal educational credential
53-7061	Cleaners of Vehicles and Equipment	285	284	(1)	(0%)	0.9%	\$11.43	No formal educational credential
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1,059	1,034	(25)	(2%)	3.2%	\$14.19	No formal educational credential
53-7064	Packers and Packagers, Hand	867	833	(34)	(4%)	2.5%	\$11.24	No formal educational credential

Source: EMSI, 2018

WHOLESALE

Wholesaling may be considered the “quiet” segment in the value chain. Wholesaling involves both the marketing arrangements as well as the storage, transportation, and distribution of agricultural and manufactured food products from suppliers or manufacturers to the retail outlets where they are offered for final retail sale, or where they will undergo final steps of preparation on site for retail sale (as is the case in much of the food service sector). As such, wholesalers are integral to the marketing and logistical functions of the value chain.

We have already considered the agricultural commodity marketing merchant wholesalers, those enterprises further up the value chain that move raw commodities and livestock between farms or from the farm or feedlot to the processor. Given the complex flow of materials and products within the agricultural value chain, the roles of these various market intermediaries are occasionally overlapping within different verticals of the value chain.

For example, fresh fruit and vegetable wholesalers may take produce all the way from the farm to the retailer. In the food grains, however, the grain merchants buying and transporting raw grain and the grocery wholesalers shipping boxed breakfast cereals may be very different.

A LINK IN THE VALUE CHAIN:
Food and beverage merchant wholesalers had estimated sales of \$3.7 billion in 2016.

From the point of view of the public, wholesale trade operates largely behind the scenes, and thus does not garner the same visibility as manufacturing (at least when it results in branded product lines) and the retail sector. Still, food, beverage, and nursery wholesale operations in Colorado had estimated sales of over \$3.6 billion in 2016, with close to 20,000 well-paying jobs, generating payroll of \$1.4 billion. Yet, these numbers do not tell the whole story. Some wholesale functions important to supplying the retail outlets in Colorado are managed within the vertically integrated structures of large retail chains. Additional complicating factor comes from the fact that Denver tends to serve as a regional distribution hub for multiple states in the western U.S., and thus some additional wholesale, storage, and transport activity may not show up in the state-specific estimates. In other words, the \$2.5 billion is probably an underestimate of the total economic activity in this segment of the value chain in Colorado.

Volume, speed, and efficiency determine the economics of wholesaling. Because of variation in these factors across different product categories, as well as differing geographic logistical and handling needs, there is a certain degree of specialization. The two largest categories are “general line grocery wholesalers” and “other grocery and related product wholesalers.” These consist of 520 firms supplying the bulk of grocery products. But, they also overlap significantly with other categories. Together, these two main categories were estimated to have handled over \$1.6 billion in sales and to have employed over 9,000 in 2016. Specialized food wholesale sectors include dairy, poultry, confectionary, fish, meat, fruit and vegetable. The beverage wholesalers are divided into two separate categories. The 64 beer wholesalers operating in Colorado are estimated to have sold \$293 million and to have supported over 1,500 jobs in 2016. The 150 wine and liquor wholesalers are estimated to have sold almost \$540 million and to have supported over 2,300 jobs.

The wholesale sector overall, had growth in sales of 37% in the five years from 2011 to 2016. It also supported the highest average earnings of all of the major sectors in the value chain, at almost \$66,000 per job.

Table 6.1 Wholesale: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
424410	General Line Grocery Merchant Wholesalers	116	\$647,164,561	\$876,874,630	35%
424420	Packaged Frozen Food Merchant Wholesalers	47	\$110,388,715	\$154,719,974	40%
424430	Dairy Product (except Dried or Canned) Merchant Wholesalers	47	\$60,586,863	\$72,271,169	19%
424440	Poultry and Poultry Product Merchant Wholesalers	8	\$19,841,935	\$47,997,186	142%
424450	Confectionery Merchant Wholesalers	97	\$177,068,981	\$243,582,739	38%
424460	Fish and Seafood Merchant Wholesalers	13	\$15,348,982	\$33,272,755	117%
424470	Meat and Meat Product Merchant Wholesalers	81	\$102,909,135	\$159,576,606	55%
424480	Fresh Fruit and Vegetable Merchant Wholesalers	57	\$148,279,629	\$215,230,038	45%
424490	Other Grocery and Related Products Merchant Wholesalers	405	\$558,553,121	\$749,128,572	34%
424810	Beer and Ale Merchant Wholesalers	64	\$224,539,361	\$292,901,854	30%
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers	150	\$404,729,154	\$539,825,310	33%
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers	47	\$87,342,662	\$98,569,510	13%
424940	Tobacco and Tobacco Product Merchant Wholesalers	30	\$74,092,314	\$93,471,605	26%
493120	Refrigerated Warehousing and Storage	12	\$39,718,751	\$76,175,470	92%
TOTAL		1,174	\$2,670,564,164	\$3,653,597,418	37%

(Table 6.1 continued)

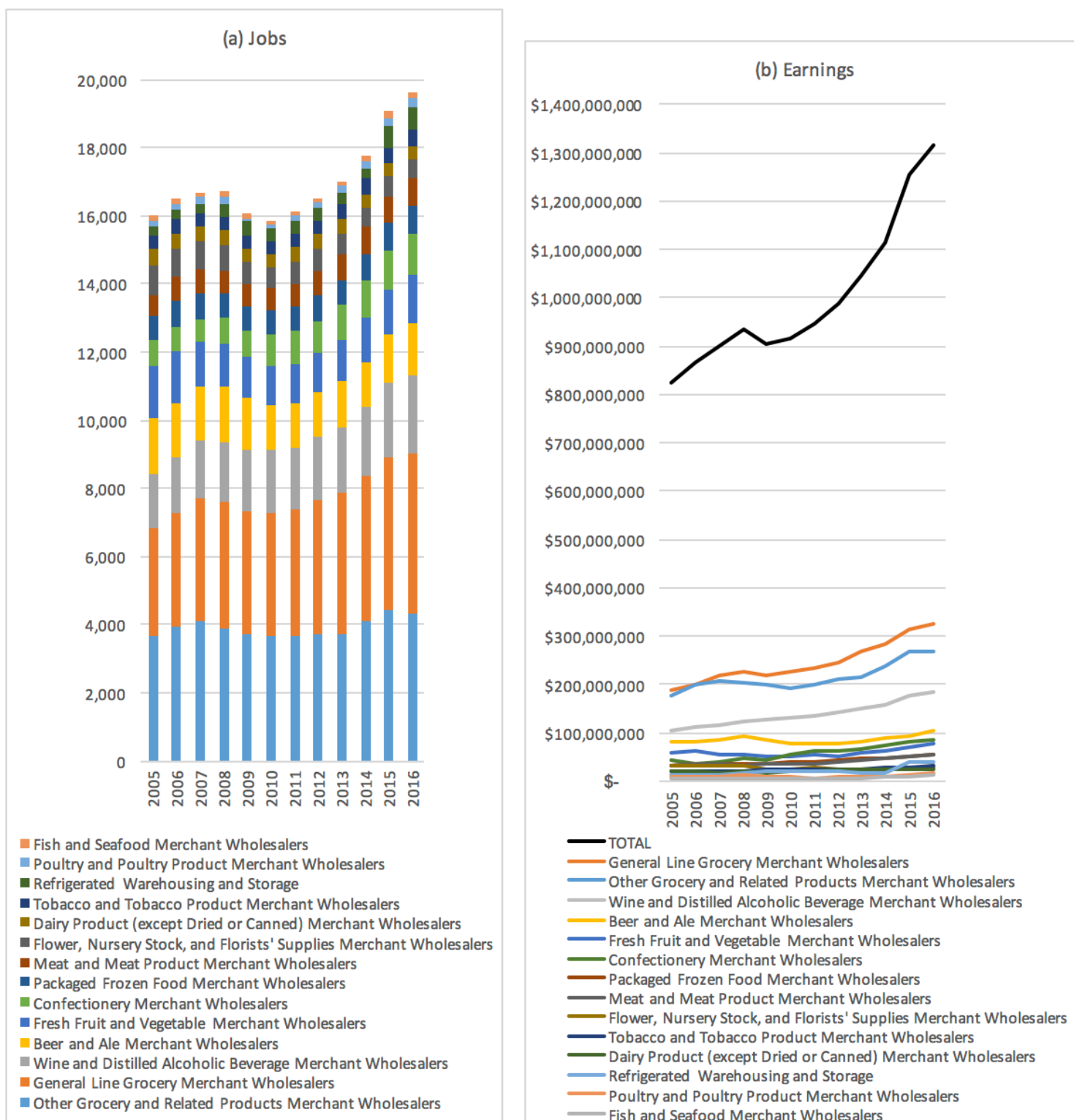
NAICS	Industry Sector Description	2016 Location Quotient /1	2016 Jobs	2016 Earnings /2
424410	General Line Grocery Merchant Wholesalers	1.09	4,670	\$326,771,714
424420	Packaged Frozen Food Merchant Wholesalers	1.53	858	\$57,620,748
424430	Dairy Product (except Dried or Canned) Merchant Wholesalers	0.51	379	\$26,893,969
424440	Poultry and Poultry Product Merchant Wholesalers	1.22	238	\$17,932,514
424450	Confectionery Merchant Wholesalers	1.13	1,189	\$90,758,925
424460	Fish and Seafood Merchant Wholesalers	0.39	201	\$12,445,156
424470	Meat and Meat Product Merchant Wholesalers	0.99	797	\$59,532,413
424480	Fresh Fruit and Vegetable Merchant Wholesalers	0.78	1,412	\$80,450,872
424490	Other Grocery and Related Products Merchant Wholesalers	1.05	4,352	\$279,391,646
424810	Beer and Ale Merchant Wholesalers	0.75	1,514	\$109,340,137
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers	1.50	2,315	\$202,320,556
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers	0.68	561	\$36,686,512
424940	Tobacco and Tobacco Product Merchant Wholesalers	1.09	487	\$34,559,813
493120	Refrigerated Warehousing and Storage	0.63	665	\$41,471,385
TOTAL			19,638	\$1,376,176,360

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average. A value of 1 indicated that the sector's share of employment in Colorado is the same as the sector's share of employment nationally. A value of 1.10 indicates that the sector's share of employment in Colorado is 10% higher than the sector's share of employment nationally.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 6.1 Food and Beverage and Related Wholesale: (a) Jobs and (b) Earnings in Colorado, 2005-2016



6.1 SUMMARY: COLORADO’S WORKFORCE IN WHOLESALING

For this summary we consider the workforce in the food and beverage wholesale sectors, listed in Table 6.1, in Colorado. Over 20,000 were employed in the wholesale sectors in Colorado in 2017 (Table 6.2).

Employment in these wholesale sectors is very robust, with job growth of 19 percent between 2012 and 2016, significantly outpacing a job growth of 6 percent nationally in the same sectors. The demographic structure of employment is relatively young, with the largest age group being between 25 and 34, but there is a significant gender imbalance, with 71 percent male and 29 percent female. The prevalence of food and beverage whole-sale jobs in Colorado is on parity, with about 98 percent of the level seen across the nation as a whole. Average annual earnings in these sectors in Colorado, at \$70,041, are slightly higher than average annual earnings in these sectors nationwide, and they are the highest seen in any of the major segments of the value chain of agriculture and food in the state of Colorado (Table 6.2). The structure of the most common jobs in the commodity marketing and wholesale sectors and recent trends are shown in Table 6.3.

Table 6.1 The list of industry sectors by NAICS code included in this analysis of the workforce in food and beverage wholesale

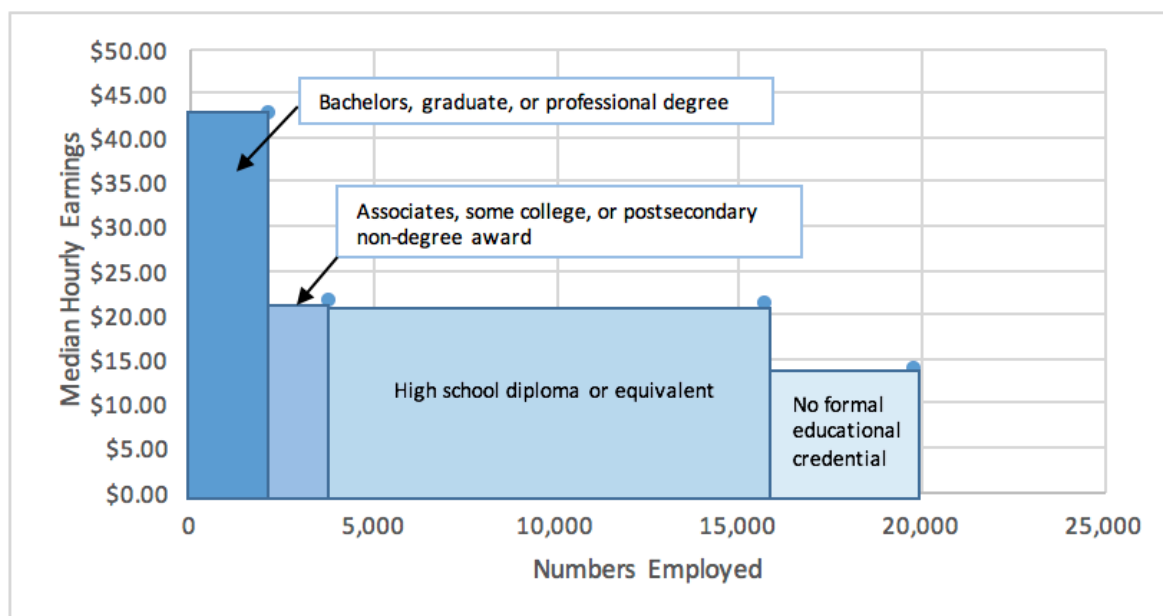
Code	Description
424410	General Line Grocery Merchant Wholesalers
424420	Packaged Frozen Food Merchant Wholesalers
424430	Dairy Product (except Dried or Canned) Merchant Wholesalers
424440	Poultry and Poultry Product Merchant Wholesalers
424450	Confectionery Merchant Wholesalers
424460	Fish and Seafood Merchant Wholesalers
424470	Meat and Meat Product Merchant Wholesalers
424480	Fresh Fruit and Vegetable Merchant Wholesalers
424490	Other Grocery and Related Products Merchant Wholesalers
424810	Beer and Ale Merchant Wholesalers
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers
424940	Tobacco and Tobacco Product Merchant Wholesalers
493120	Refrigerated Warehousing and Storage
493130	Farm Product Warehousing and Storage

Table 6.2 Staffing pattern overview for the food and beverage wholesale industries in Colorado

20,286		\$70,041		
Jobs (2017)		Avg. Earnings Per Job (2017)		
2% below National average		Nation: \$66,750		
Establishments (2017)		1,284		
Jobs Multiplier		3		
	2012 Jobs	2016 Jobs	Change	% Change
Colorado	16,676	19,813	3,137	18.8%
Nation	1,044,204	1,104,305	60,101	5.8%
Gender		Percent		
Males	70.7%		<div></div>	
Female	29.3%		<div></div>	
Age		Percent		
14-18	0.5%		<div></div>	
19-24	6.5%		<div></div>	
25-34	24.0%		<div></div>	
35-44	24.5%		<div></div>	
45-54	24.0%		<div></div>	
55-64	16.5%		<div></div>	
65+	4.0%		<div></div>	
Race/Ethnicity		Percent		
White	66.4%		<div></div>	
Hispanic or Latino	23.6%		<div></div>	
Black or African American	5.3%		<div></div>	
Asian	2.8%		<div></div>	
Two or More Races	1.3%		<div></div>	
American Indian	0.4%		<div></div>	

Source: EMSI, 2018

Figure 6.3 Numbers employed and median hourly earnings in the food and beverage wholesale industries in Colorado, by typical entry-level education requirements



Data source: EMSI, 2018

Table 6.3 Top 30 jobs in the food and beverage wholesale industries in Colorado, by percent of total jobs in the industry group

SOC	Description	Employed (2012)	Employed (2016)	Change (2012 - 2016)	% Change (2012 - 2016)	% of Jobs in Industry (2017)	Median Hourly Earnings	Typical Entry Level Education
11-2022	Sales Managers	157	195	38	24%	1.0%	\$66.30	Bachelor's degree
11-1021	General and Operations Managers	328	430	102	31%	2.2%	\$50.94	Bachelor's degree
13-1028	Buyers and Purchasing Agents	213	284	71	33%	1.5%	\$32.00	Bachelor's degree
13-1161	Market Research Analysts and Marketing Specialists	128	223	95	74%	1.1%	\$31.14	Bachelor's degree
13-1199	Business Operations Specialists, All Other	114	138	24	21%	0.7%	\$36.01	Bachelor's degree
13-2011	Accountants and Auditors	167	189	22	13%	1.0%	\$32.78	Bachelor's degree
27-1026	Merchandise Displayers and Window Trimmers	186	276	90	48%	1.6%	\$12.80	High school diploma or equivalent
41-1012	First-Line Supervisors of Non-Retail Sales Workers	452	473	21	5%	2.3%	\$28.72	High school diploma or equivalent
41-2011	Cashiers	124	131	7	6%	0.7%	\$10.65	No formal educational credential
41-2031	Retail Salespersons	132	131	(1)	(1%)	0.7%	\$11.64	No formal educational credential
41-4012	Sales Representatives, Wholesale and Manufacturing	3,219	3,594	375	12%	17.7%	\$29.32	High school diploma or equivalent
43-1011	First-Line Supervisors of Office and Admin Support Workers	133	188	55	41%	0.9%	\$27.76	High school diploma or equivalent
43-3031	Bookkeeping, Accounting, and Auditing Clerks	261	306	45	17%	1.6%	\$19.15	Some college, no degree
43-4051	Customer Service Representatives	281	333	52	19%	1.6%	\$16.57	High school diploma or equivalent
43-4151	Order Clerks	165	207	42	25%	1.1%	\$16.52	High school diploma or equivalent
43-5071	Shipping, Receiving, and Traffic Clerks	336	442	106	32%	2.2%	\$15.19	High school diploma or equivalent
43-5081	Stock Clerks and Order Fillers	778	1,173	395	51%	6.3%	\$12.92	High school diploma or equivalent
43-6014	Secretaries and Administrative Assistants	214	266	52	24%	1.3%	\$17.51	High school diploma or equivalent
43-9061	Office Clerks, General	301	367	66	22%	1.7%	\$17.45	High school diploma or equivalent
49-9071	Maintenance and Repair Workers, General	116	161	45	39%	0.8%	\$18.22	High school diploma or equivalent
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	122	159	37	30%	0.6%	\$12.74	No formal educational credential
51-3099	Food Processing Workers, All Other	48	119	71	148%	0.7%	\$12.49	No formal educational credential
51-9111	Packaging and Filling Machine Operators and Tenders	141	222	81	57%	1.2%	\$14.88	High school diploma or equivalent
53-1048	First-line Supervisors of Transportation and Material Moving Workers	303	335	32	11%	1.8%	\$27.73	High school diploma or equivalent
53-3031	Driver/Sales Workers	1,543	1,542	(1)	(0%)	7.6%	\$11.86	High school diploma or equivalent
53-3032	Heavy and Tractor-Trailer Truck Drivers	1,056	1,193	137	13%	5.9%	\$21.42	Postsecondary nondegree award
53-3033	Light Truck or Delivery Services Drivers	671	973	302	45%	4.8%	\$16.82	High school diploma or equivalent
53-7051	Industrial Truck and Tractor Operators	728	858	130	18%	4.5%	\$16.49	No formal educational credential
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	1,194	1,371	177	15%	6.8%	\$14.19	No formal educational credential
53-7064	Packers and Packagers, Hand	392	447	55	14%	2.1%	\$11.24	No formal educational credential

Source: EMSI, 2018

CONSUMERS AND THE RETAIL END OF THE VALUE CHAIN

Ultimately, the value chain derives its value from the population of final consumers that it serves. Consumers are the ones who place value upon the array of products offered by the value chain. Each consumer is willing to pay a certain amount for a given final product. And, it is the extent to which the value chain can deliver that product at a cost that does not exceed what consumers are willing to pay that determines the volume of products purchased. This is, of course, nothing more than the simple economics of demand and supply.

Identifying the retail value of goods and services from the agricultural value chain faces a number of challenges. This is mostly due to the blended nature of most retail: not all of the value of the products or services being sold in most venues derives from agriculture. For example, grocery stores—let alone supercenters and club stores—sell far more than those food, beverage, pet food, and nursery or floral products that can be directly attributed to the agricultural value chain. Most grocery chains include some toiletries, and perhaps a pharmacy, a photo center, greeting cards, kitchen and household items, cleaning supplies, and seasonal goods. Larger grocery stores may even include limited sections of clothing, bed and bath linens, home décor, books and entertainment, office supplies, toys, and even furniture. Supercenters and club stores include full departments for most of these non-food items, plus electronics and computers, automotive and hardware, sporting goods and jewelry. Similarly, in restaurants and food service, the share of the restaurant-goer's check that covers the value of the food consumed is often less than a third. Instead, the bulk of the value that the consumer is paying for is the location, and certainly the service of everyone from the chef, to the server, to the bus boy and dishwasher. Disentangling the value of agricultural and food products and services at retail will require us to consider several different angles, and to do so drawing from several different sources of data.

Publicly available data to measure retail sales is scarce. Difficulty arises from the fact that the numbers reported for the food retail sector inevitably include the full gamut of products sold at grocery and club stores—reaching well beyond just the food and beverage products or the nursery and garden center sales. This is true of the input-output model data (EMSI, 2018) from which most of the detailed estimates for retail segment of the value chain are primarily drawn. Thus, retail sector sales numbers generally overestimate the amount of retail based directly on the agriculture value chain.

To illustrate, Table 7.1 shows a blend of secondary data and information from the five largest food retailers in the U.S., all of which have significant presence in the Colorado market. Together the five largest food retailers in the U.S. accounted for an estimated \$320 billion in food sales. Yet, total sales reported by these six companies were \$561 billion. Thus, food makes up an estimated 57 percent of total sales of the five largest food retail companies in the United States. Food sales as a share of total sales range from a high of 100 percent at WholeFoods (which is obviously still an overestimate) to a low of just 21 percent at Target stores.

Another essential feature of the value chain that must be recognized at this point is that, in most product categories, the vast majority of goods being retailed in Colorado originate outside of Colorado. Most fundamentally that is because Colorado consumers demand the full set of product choices that anyone anywhere in America would demand. Retailers and wholesalers procure their full range of inventories from wherever it is most economically advantageous to do so. Of course, in some product categories, such as fresh dairy or fresh produce, there are advantages, due to transport and shelf-life factors, to procuring product regionally, closer to the retail outlet. However, in many product categories, especially those dominated by national brands or manufactured packaged foods and beverages, product is transported in from wherever the processing or

manufacturing happens to be located. There are a number of product categories in which there is simply no manufacturer or supplier located in Colorado.

There are other reasons for procuring product from out of state. The large retailers all have well-honed global supply chains. The decision of what products are made available by a retailer within the Colorado market may be dictated their larger national supply chain management strategies. In such strategic plans, state boundaries may be largely invisible. Decisions are much more likely to be influenced by the terms of contracts with major suppliers located around the world.

In some regards, this integration of the retail end of the state's value chain with the global economy mirrors that seen further up the value chain with agricultural commodity marketing and wholesale sales of the products of many food manufacturers. Those establishments seek to sell Colorado-grown or manufactured products to the highest bidders or to enter into the most advantageous terms of a longstanding supplier contract possible, anywhere in the world. Thus, between the manufacturing and the retail segments of the value chain there are a large amount of product leaving the state and, reciprocally, a large amount of product entering the state. It is not clear from the available data what share of the value of food and agricultural products sold at retail within Colorado actually came from Colorado agriculture. This is partly due to the lack of data, and partly due to intrinsic measurement challenges given the vertical complexity of the value chain.

Table 7.1 Reported major food retailer revenues from total sales and estimated food sales for the entire U.S. market, 2016

Company	U.S. total sales (2016)	U.S. food sales (2016)	Food as % of total
Walmart	\$346,069,000,000	\$190,337,950,000 ¹	55%
Kroger (King Sooper, City Market)	\$108,465,000,000	\$81,891,075,000 ²	76%
SuperValu (Safeway, Albertsons)	\$17,820,000,000	\$16,902,000,000 ³	95%
Target	\$73,785,000,000	\$15,494,850,000 ⁴	21%
Whole Foods	\$15,389,000,000	\$15,389,000,000 ⁵	100%
Big 5 subtotal	\$561,528,000,000	\$320,014,875,000	57%

¹ Assumes food still accounts for 55% of WalMart's U.S. division sales (http://www.retailleader.com/top-story-industry_news-walmart_s_grocery_segment_accounts_for_55_of_u.s._sales-663.html) and annual report (http://s2.q4cdn.com/056532643/files/doc_financials/2015/annual/2015-annual-report.pdf)

² Based on sales attributed to non-perishable and perishable categories in annual report (<http://ir.kroger.com/Cache/1500085468.PDF?O=PDF&T=&Y=&D=&FID=1500085468&iid=4004136>)

³ Non-perishable and perishable grocery product categories (<http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9NTgzODU4fENoaWxkSUQ9MjkkMDE2fFR5cGU9MQ==&t=1>)

⁴ Food and pet supplies accounts for 21% of total sales (https://corporate.target.com/_media/TargetCorp/annualreports/2015/pdfs/Target-2015-Annual-Report.pdf)

⁵ Assumes negligible non-food sales (http://s21.q4cdn.com/118642233/files/doc_financials/2015/Annual/2015-WFM-10K.pdf)

7.1 ESTIMATING COLORADO CONSUMER EXPENDITURES ON FOOD AND ALCOHOLIC BEVERAGES

One way to get a better sense of how much Colorado consumers actually spend on food and beverage products is to extrapolate U.S. Bureau of Labor Statistics' Consumer Expenditure (CE) survey estimates to the Colorado population. This approach enables us to "ground truth" estimates presented for the main segments of the retail market that follow.

The 2010 U.S. Census counted 5,029,196 Coloradans, and the Census Bureau estimates that by July 2016 the population of Colorado was 5,540,545 (U.S. Census Bureau, 2018). USDA estimates of U.S. per capita food expenditures are only current through 2014. We extrapolated the long-term trend in those USDA series to project per capita food expenditures to 2016. For 2016, total per capita expenditures for food was \$4,875. This subdivides into at-home food consumption of \$2,400 and away-from-home food consumption of \$2,475. The USDA also reports expenditures on alcoholic beverages. Following similar methods, we estimated that in 2016 per capita expenditure on alcoholic beverages was \$568, which subdivides into \$299 for packaged alcoholic beverages for at home consumption and \$270 for drinks consumed away from home. (See Table 7.2.)

When we multiply these U.S. national averages by the Colorado population we obtain estimates for total expenditures by Colorado population on food and alcoholic beverages.

Total estimated at-home food expenditures by Coloradans was \$13.3 billion and total estimated packaged alcoholic beverage expenditures for at home consumption was about \$1.6 billion. “At-home” food expenditures refer to grocery purchases as well as direct-from-farm purchases at retail prices. At-home alcoholic beverage purchases include packaged beer, wine, and distilled spirits.

Estimated expenditures on alcoholic beverages consumed at-home in 2016 was \$1.6 billion. Estimated expenditures on drinks away from home was \$1.5 billion. Thus, using these USDA expenditures data total spending by Colorado consumers on food and alcoholic beverages in 2016 was about \$30.1 billion. “Away-from-home” expenditures include restaurant and other food service purchases, as well food services at workplaces, schools, and other institutions. Away-from-home alcoholic beverage purchases include beer, wine, and distilled spirits purchased and consumed at restaurants, bars, breweries, and vendors at events and venues.

7.2 FOOD RETAIL, FOR AT-HOME CONSUMPTION

We turn now to other data (EMSI, 2018) to get an estimate of retail sales in Colorado, as well as the numbers of retail establishments, jobs, and earnings. There are over 3,000 retail food stores around Colorado. These include 656 supermarkets and grocery stores, 134 warehouse or club stores, 410 specialty food stores, 220 health food and supplements stores, and over 1,600 convenience stores, including those at gas stations.

Table 7.2 Estimating expenditures by Colorado consumers on food and alcoholic beverages, at home and away from home, in 2016

Colorado Population (U.S. Census Bureau)			
2010	5,029,196		
2016	5,456,574		

U.S. per capita food expenditures (USDA ERS) ¹			
	At home	Away from home	Total
2016	\$2,400	\$2,475	\$4,875

Colorado total estimated food expenditures			
	At home	Away from home	Total
2016	\$13,297,308,000	\$13,712,848,875	\$27,010,156,875

U.S. per capita alcoholic beverage expenditures (USDA ERS)			
	Packaged beverages, at home	Away from home	Total
2016	\$299	\$270	\$568

Colorado total estimated alcoholic beverage expenditures			
	Packaged beverages, at home	Drinks, away from home	Total
2016	\$1,632,649,292	\$1,471,128,973	\$3,103,778,266

Data sources: U.S. Census Bureau Quick Facts and USDA Economic Research Service, Food Expenditures, <https://www.ers.usda.gov/data-products/food-expenditures.aspx>

1/ USDA food and alcoholic beverages expenditure data was only available through 2014. Our 2016 estimates are forward projections based upon the long-term trends of the USDA per capita expenditures series, fitted to a polynomial trend line.

These establishments are estimated to have made \$7.2 billion in sales in 2016 (Table 7.3). (Notably, this number is low compared to estimates in the previous section based on USDA per capita expenditures.) About half of these sales, over \$3 billion, were made by supermarkets and grocery stores. The warehouse and club stores account for another \$2 billion. Of the remainder, just over \$700 million in sales were by convenience stores and about \$370 million were by specialty food stores and health food stores. It is estimated that there are almost 92,000 jobs in food retail stores in Colorado, generating just over \$3 billion in earnings.

A small portion of at-home food consumption comes from direct sales from farm to consumer, as well as at home consumption by farm operator households. This type of retail, with some of the unique aspects it poses for value chain, will be discussed in more detail in a later section of this report.

A LINK IN THE VALUE CHAIN:
 Supermarkets and other types of food retail stores sold an estimated \$7.2 billion in 2016.

7.2.1 RETAIL SALES OF PET FOOD

The USDA calculations of food expenditures intentionally exclude pet food. However, pet food is clearly a product of agriculture, containing both animal and plant ingredients. While a substantial share of sales occur at grocery stores, supercenters, or club stores, we cannot directly observe that amount. We do observe, however \$230 million in sales by specialized pet food stores that employed 2,800 workers.

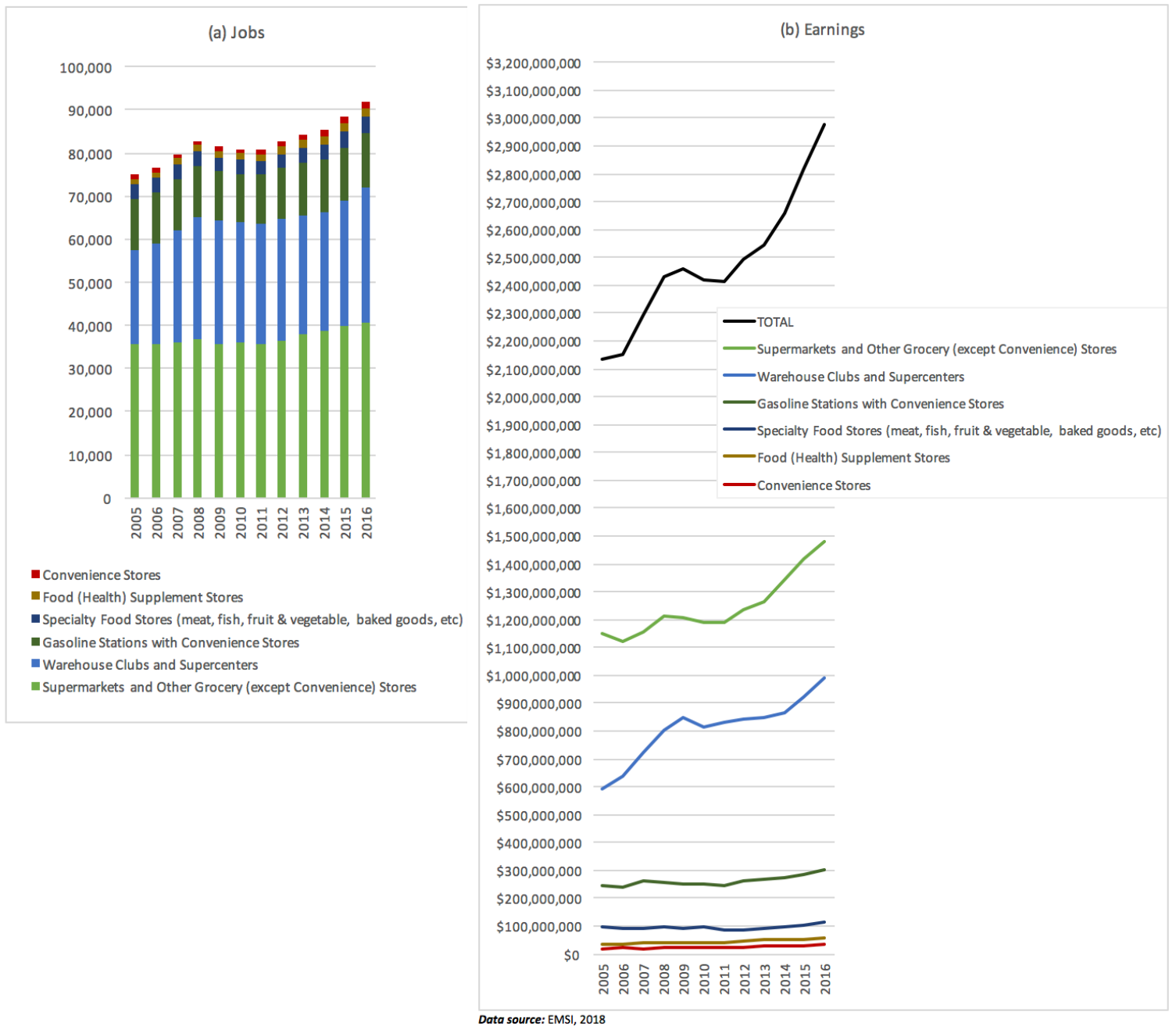
Table 7.3 Food retail stores (for at-home consumption): number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
445110	Supermarkets and Other Grocery (except Convenience) Stores	656	\$3,055,243,774	\$3,470,030,477	14%
452311	Warehouse Clubs and Supercenters	134	\$2,115,927,411	\$2,345,147,648	11%
445120	Convenience Stores	192	\$63,983,316	\$84,902,865	33%
447110	Gasoline Stations with Convenience Stores	1,472	\$645,631,371	\$851,053,017	32%
445200	Specialty Food Stores	410	\$245,062,099	\$265,326,902	8%
446191	Food (Health) Supplement Stores	221	\$122,988,006	\$210,230,960	71%
453910	Pet and Pet Supplies Stores	231	\$179,181,356	\$228,713,678	28%
TOTAL		3,316	\$6,428,017,333	\$7,455,405,546	16%

NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
445110	Supermarkets and Other Grocery (except Convenience) Stores	0.87	40,710	\$1,484,618,996
452311	Warehouse Clubs and Supercenters	1.08	31,148	\$993,269,526
445120	Convenience Stores	0.51	1,665	\$36,402,941
447110	Gasoline Stations with Convenience Stores	0.84	12,596	\$313,172,544
445200	Specialty Food Stores	0.70	3,900	\$113,845,928
446191	Food (Health) Supplement Stores	1.87	1,902	\$77,857,865
453910	Pet and Pet Supplies Stores	1.28	2,771	\$84,571,190
TOTAL			94,692	3,103,738,990

Data source: EMSI, 2018

Figure 7.1 Food retail stores: (a) Jobs and (b) Earnings in Colorado in 2016



A LINK IN THE VALUE CHAIN:

In 2016, Colorado consumers paid an estimated \$527 million for ethanol as part of the typical gasoline purchased.

7.2.2 ETHANOL BLENDED IN GASOLINE

One additional consideration for retail sales of products that derive from the agricultural value chain is the retail value of ethanol sold at the fuel pump. The lion's share of biofuel retail sales occur as a portion of conventional gasoline sold at the pump. Under clean air requirements, gasoline blends must include an "oxygenator" which in Colorado, as in most states in the U.S. today, is attained by adding 10 percent ethanol, which is often referred to as an "E10" gasoline. While there is also "E85" as well as biodiesel, based on vegetable oils, sold at some fuel stations, the amount is very small relative to the amount of ethanol used in conventional E10.

The retail value of the ethanol can be estimated, fairly reasonably, as 10 percent of the retail value of all gasoline sold in Colorado. According to energy consumption estimates from the U.S. Energy Information Agency (EIA), Colorado motorists consumed 258.5 trillion BTUs worth of motor gasoline, excluding ethanol (<https://www.eia.gov/state/?sid=CO>). This converts to 2.15 billion gallons of gasoline. As a first approximation, if we figure that makes up roughly 90 percent of sales at the pump, an additional 238 million gallons of ethanol was sold as the other 10 percent in the conventional E10 blend. The EIA also reports that the average price per gallon for gasoline sold in the Rocky Mountain region was \$2.21. This would put the retail sales of gasoline in Colorado at \$5.27 billion, with the value of the 10 percent ethanol portion at \$527 million in 2016.

7.3 RESTAURANTS AND FOOD SERVICE

In 2016, there were close to 11,000 food service establishments operating in Colorado, including 4,685 full-service and 4,188 limited-service restaurants, 1,134 snack bars, 228 caterers, 153 food trucks. In addition to these, there were 324 food service contractors, serving an array of clients, including institutional food service cafeterias such as hospitals, etc. and 37 community food service establishments providing meals. All together, these outlets sold an estimated \$14 billion in 2016, a total which has grown rapidly over the last five years, increasing 38 percent over five years since 2011 (Table 7.3). This number is also in close agreement with our previous projection of \$13.7 billion based on USDA per capita expenditures data (Table 7.1). These food service establishments had 223,000 employees and a payroll of \$5.1 billion in 2016.

These various food services are the largest segment of the value chain in terms of absolute size of workforce. It is also a labor-intensive sector, with wages accounting for a high share of sales (at 40 percent) relative to most other segments of the agriculture and food value chain.

A LINK IN THE VALUE CHAIN:
Food service establishments made \$14.0 billion in sales in 2016. Full service restaurants accounted for just over half of this, at \$7.2 billion.

7.4 ALCOHOLIC BEVERAGE RETAIL STORES AND DRINKING PLACES

Estimates of alcoholic beverage expenditures in Colorado derived from the USDA expenditures data are \$1.6 billion for at-home packaged beverages and \$1.5 billion for drinks away from home (Table 7.2). However, our estimates from EMSI of alcoholic beverage sales, for both at home and away from home, are much more conservative. According to these, sales of alcoholic beverage were less than a third of the level that the USDA expenditure levels would suggest. A significant share of alcoholic beverage sales are in sectors, such as full service restaurants or directly from breweries, that are not included in this tally of sectors from the EMSI data.

In 2016, there were almost 1,272 beer, wine, and liquor stores. Store sales for at home consumption are estimated to have been \$500 million. They employed over 7,100 workers supporting a payroll of almost \$215 million. Adding to these, there were also 778 drinking establishments, such as bars and brewpubs, operating in Colorado in 2016, which had \$328 million in sales, employment of 8,900, and a payroll of \$208 million. A major question about the integrity of these data comes from the fact that they reflect a 26 percent decrease in sales of alcohol at bars and restaurants; which does not seem likely.

Table 7.4 Restaurants and food service: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
722511	Full-Service Restaurants	4,685	\$5,831,116,826	\$7,201,781,101	24%
722513	Limited-Service Restaurants	4,188	\$2,879,216,498	\$5,604,396,616	95%
722514	Cafeterias, Grill Buffets, and Buffets	68	\$110,797,635	\$55,230,424	-50%
722515	Snack and Nonalcoholic Beverage Bars	1,134	\$484,678,072	\$404,751,264	-16%
722310	Food Service Contractors	324	\$594,304,491	\$341,918,599	-42%
722320	Caterers	228	\$196,957,120	\$250,863,793	27%
722330	Mobile Food Services	153	\$31,532,743	\$84,371,072	168%
454210	Vending Machine Operators	55	\$46,780,366	\$57,577,590	23%
624210	Community Food Services	49	\$29,336,222	\$38,985,259	33%
TOTAL		10,884	\$10,204,719,973	\$14,039,875,718	38%

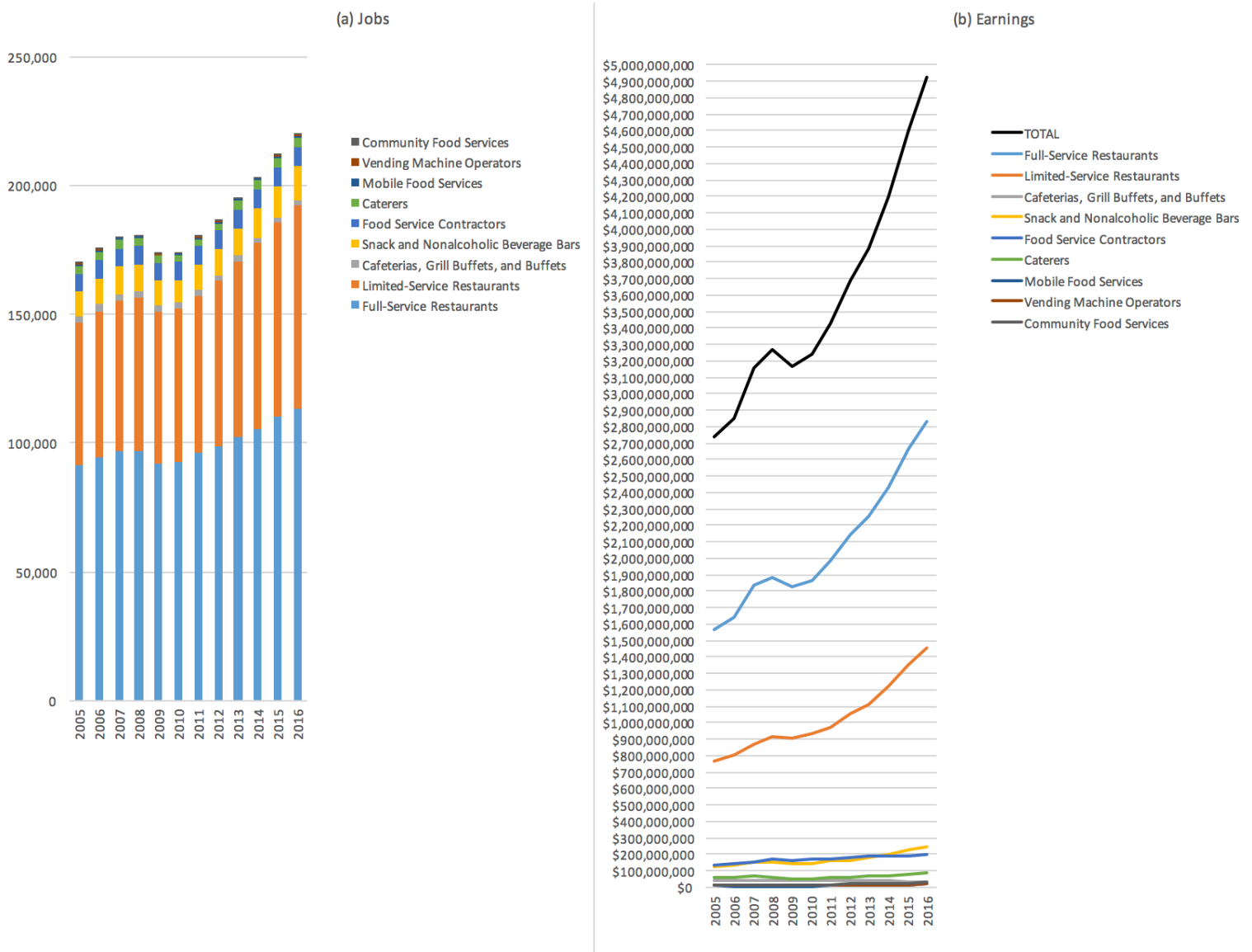
NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
722511	Full-Service Restaurants	1.16	114,500	\$2,868,020,896
722513	Limited-Service Restaurants	1.02	80,299	\$1,486,756,139
722514	Cafeterias, Grill Buffets, and Buffets	0.72	1,735	\$34,927,164
722515	Snack and Nonalcoholic Beverage Bars	1.13	13,709	\$256,335,904
722310	Food Service Contractors	0.76	7,290	\$216,378,462
722320	Caterers	0.89	3,536	\$158,824,483
722330	Mobile Food Services	1.07	845	\$53,409,520
454210	Vending Machine Operators	0.69	573	\$21,330,278
624210	Community Food Services	0.98	654	\$29,553,878
TOTAL			223,141	\$5,125,536,723

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

Figure 7.2 Restaurants and food service: (a) Jobs and (b) Earnings in Colorado 2005-2016



Data source: EMSI, 2018

A LINK IN THE VALUE CHAIN:

Retail sales of beer, wine, and liquor stores and the revenues of drinking places combined were \$829 million in 2016.

Table 7.5 Alcoholic beverage retail sales: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
445310	Beer, Wine, and Liquor Stores	1,272	\$384,713,929	\$500,082,094	30%
722410	Drinking Places (Alcoholic Beverages)	778	\$441,014,526	\$328,495,113	-26%
TOTAL		2,050	\$825,728,455	\$828,577,207	0%

NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
445310	Beer, Wine, and Liquor Stores	2.38	7,126	\$214,010,632
722410	Drinking Places (Alcoholic Beverages)	1.23	8,865	\$207,860,178
TOTAL			15,991	\$421,870,810

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers' compensation.

7.5 NURSERY AND GREENHOUSE RETAILERS AND LANDSCAPING SERVICES

A number of rather different retail venues drive the value chain for nursery and greenhouse crop production. Some are found in food retail stores, such as flower sales in grocery stores and seasonal garden centers at supercenters. Nevertheless, the main retail outlets are nurseries, garden centers, farm supply stores, and florist shops, as well as landscaping services. There are also important relationships between these retail sectors and production agriculture, in addition to the basic supplier-retailer relationship with nursery and greenhouse crop production.

Nurseries sell ornamental and food producing horticultural plants they have produced themselves as well as plants that they obtain from nursery wholesalers. The plant materials sold by garden centers and farm supply stores are mostly obtained wholesale from production nurseries, both inside and outside of Colorado. These stores also sell related products, such as soil amendments, fertilizers, pesticides, tools and equipment. Nursery, garden center, and farm supply stores together made an estimated \$228 million in sales in 2016, employed over 2,500 workers, and paid over \$84 million in payroll. Just under 200 florist shops around Colorado, supplied by a system of over 50 floral wholesalers, buy flowers from around the world, and retailed them to Colorado consumers for an estimated \$126 million in 2016. Florists employed 1,200 workers and provided some \$47 million in earnings. Landscaping services largely represent a form of retail service direct to Color-

do households. Yet, the sector could, interestingly, be listed as a form of production agriculture service (akin to Machine Hire and Custom Work) insofar as it represents the “farming of the urban landscape”, and involves a similar profile of operator management, labor, machinery, fertilizer, irrigation, and such. It is a large sector, with over 2,000 operations making service sales of over \$1.7 billion in 2016. It is very labor intensive, employing 22,000 workers, and making \$823 million in payroll. Wages represents 48 percent of sales.

Table 7.6 Nursery, greenhouse, garden center, and landscaping service retail sales: number of establishments, estimated sales, growth, location quotient, jobs, and total earnings in Colorado in 2016

NAICS	Industry Sector Description	2016 firms	2011 Estimated Sales	2016 Estimated Sales	% change in sales 2011-2016
444220	Nursery, Garden Center, and Farm Supply Stores	262	\$151,431,902	\$228,422,117	51%
453110	Florists	189	\$99,746,157	\$126,450,092	27%
561730	Landscaping Services	2,058	\$1,036,429,774	\$1,724,821,146	66%
TOTAL		2,509	\$1,287,607,833	\$2,079,693,355	62%

NAICS	Industry Sector Description	2016 Location Quotient ^{/1}	2016 Jobs	2016 Earnings ^{/2}
444220	Nursery, Garden Center, and Farm Supply Stores	1.06	2,523	\$84,183,878
453110	Florists	0.82	1,154	\$46,810,224
561730	Landscaping Services	1.04	22,080	\$822,559,750
TOTAL			25,757	\$953,553,852

Data source: EMSI, 2018

/1 Location Quotient quantifies how concentrated the industry is in Colorado compared to the U.S. average.

/2 Earnings includes wages and salaries as well as supplements, such as employer contributions to pensions, insurance, and workers’ compensation.

A LINK IN THE VALUE CHAIN:

Retail sales of nursery and greenhouse products and the revenues of landscaping services combined were \$2.1 billion in 2016.

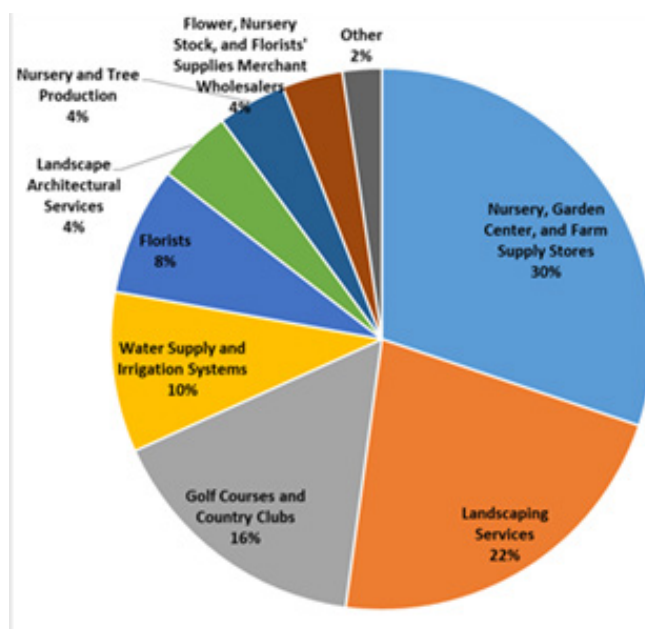
7.6 “LOCAL FOODS” DIRECT-TO-CONSUMER AND INTERMEDIATED SALES OF COLORADO GROWN AGRICULTURAL PRODUCTS

Interest in local foods has grown substantially in recent years, driven by a number of factors and perceived benefits from both producers’ and the consumers’ points of view. Local and state policymakers have also developed expectations that the expansion of local food marketing channels can help contribute to the growth of—or at least the diversification of—their regional economies. (See Thilmany, Bond, and Bond, 2007; Bauman, Thilmany and Jablonski, 2018)

COLORADO'S GREEN INDUSTRY: AGRICULTURE'S CONTRIBUTIONS TO HOUSEHOLD AND URBAN ENVIRONMENTS

The environmental horticulture industry, or green industry, is comprised of a diverse supply chain of enterprises ranging from those producing plant materials (and their input providers) to those in direct interaction with the consumers, households and businesses seeking plants and landscapes, including producers, wholesalers, retailers and service activities in environmental and landscape plants. The industry recently commissioned a study of their total economic contribution of Colorado's green industry in 2015 so it is integrated into the Blueprint to showcase this important sector.

Figure 7.3 Share of 2015 revenue by industry for all Colorado green industry sectors



The economic contribution was estimated to be \$2.8 billion in 2015, with the shares in various sectors presented in Figure 7.3. From 1999 to 2015, Colorado's green industry grew by 90% from \$900 million in sales to \$1.7 billion, outpacing the economic growth of the state by 8%. As of 2015, Colorado's green industry had recovered to pre-recession sales levels, despite a notable dip for several years following 2008.

Nursery, garden center, and farm supply stores have the largest contribution, of \$980 million, followed by landscaping services at \$716 million, and golf courses and country clubs at \$525 million (Figure 7.3). Nursery, garden center, and farm supply stores and landscaping services comprise over half of all green industry sales, representing 30% and 22% of total sales, respectively.

Green industry employment in Colorado grew by 23%, from 35,000 to 43,000, outpacing employment growth across the state by 4%. Unlike revenue, employment has not yet recovered, remaining 1% below 2007 levels. Landscaping services provide the largest share of green industry jobs with 21,000 jobs annually, accounting for 48% of green industry employment. From 1999-2015 green industry wages increased by 87% from \$636 million to \$1.5 billion. Pre-recession wages peaked in 2007 at \$1.3 million and since that time have increased 14 percent to \$1.5 million.

Mirroring overall consumer trends, about half of expenditures on local foods are for at-home consumption and half are for away-from-home consumption. Thus, the marketing of locally produced foods is both to consumers and to restaurants and other food services establishments. A significant share of the sales of locally produced foods for at-home consumption are intermediated, with the producer selling to a retail outlet who then markets the food on to consumers as “locally produced.”

According to a recent analysis by the USDA (Low et al, 2015) \$6.1 billion of food sales in the U.S. in 2012 were considered “local.” Of this, it is estimated that another \$1.2 billion in sales (25 percent of the total) was marketed by producers through both direct-to-consumer and intermediated marketing channels. But, \$2.7 billion (56 percent of the total) was marketed exclusively through intermediated marketing channels. Thus, a simple rule of thumb is that about 3 times the amount of food sold locally thorough direct-to-consumer channels is being sold through intermediated channels.

Direct-to-consumer marketing channels for farms and ranches include farmers markets, direct roadside sales, and community supported agriculture (CSA) channels, in addition to other sales associated with agtourism or farm based recreation. Nationally, direct-to-consumer marketing by agricultural producers has been growing very rapidly over the last decade, albeit from a very small initial base.

In 2011 the total number of farmers markets in the nation had reached 7,175, according to USDA estimates. Today, there are 8,687 farmers markets listed in the USDA’s National Farmers Market Directory. The Colorado MarketMaker database lists 183 farmers markets in Colorado (www.comarketmaker.com/).

Direct marketing via roadside stands and community supported agriculture (CSA) is also on the rise. A 2006 count reported 1,080 CSA farms in the U.S., of which 27 were in Colorado (Adams, 2006). A national database maintained by the website, Local Harvest (www.localharvest.org/search.jsp) currently reports 7,095 CSA’s in the U.S., with 172 in Colorado.

Colorado has seen a significant increase in farms that marketing directly to consumers. In 2002 there were 2,343 Colorado farms and ranches engaged in direct marketing. By the 2007 Census of Agriculture the number had increased by 434 farms (19 percent) to 2,777 farms and ranches. At that point 7.5% of all Colorado farms and ranches were doing some direct marketing compared to 6.2% for the U.S. as a whole.

According to the 2012 Census of Agriculture, 2,896 farms and ranches (8 percent of all farm and ranch operations) in Colorado sold \$19.2 million in agricultural products directly to consumers. The importance of direct markets for small farms (under \$75,000 of annual sales) appears to be significant; farms with gross cash farm income below \$75,000 accounted for 85 percent of local food in 2012. Yet, these farms are estimated to account for only 13 percent of local food sales. Those with gross cash income above \$350,000 accounted for just 5 percent of farms but 67 percent of sales (Low et al, 2015).

Others producers are adding value or creating a greater profit margin for their farms and ranches through direct sales locally and regionally to food cooperatives, specialty food retailers, restaurants, and institutions. Not surprisingly, supermarkets remain the dominant channel for food shopping according to consumer preferences, so the integration of more local foods into larger store formats is likely to continue as a trend. Intermediated direct sales through food service establishments are important because, as discussed above, the majority of food dollars spent by Colorado consumers are on away-from-home consumption.

The potential for direct sales to local food service establishments is quite high. Food service establishments, and the chefs who help make buying decisions for them, likely spend 35 to 40 percent of their retail revenues on food inputs. It has become common for restaurants to promote occasional or seasonal menu items featuring locally grown products. However, securing reliable sales contracts between Colorado growers and the independent or Colorado-based franchise establishments that are most promising has proven to be a chal-

lenge. There are a few examples of successful long-term arrangements in locally raised beef (Meyer Natural Beef in Good Times), but there is no success story to date in contracting the supply of fresh produce by a major restaurant enterprise in Colorado.

One set of institutional buyers that are actively coming on line in procuring locally grown food products are school districts. The Senate’s recent passage of the Healthy, Hunger-Free Kids Act of 2010—with stated objectives to reduce childhood hunger, promote health through improved nutritional quality, reduce childhood obesity and improve program efficiency—may be an important policy development. The Act is intended to expand afterschool meals for at-risk children and help schools improve the nutritional quality of school meals. Many believe that local sourcing, networking between producers and school lunch program staff, and integration of collaborative producer marketing and distribution efforts will help to achieve this. However, looking at actual marketing activity, current purchases are well below estimated potential. One of the major constraints is the capacity for districts to handle raw, unprocessed fruits and vegetables; another is the fact that production seasons in Colorado do not align well with school sessions. Another potential institutional buying group consists of hospitals. U.S. hospitals spend some \$12 billion a year on meal service, but there has been little research done in Colorado.

7.7 THE FOUNDATIONS OF THE VALUE CHAIN: COLORADO CONSUMERS

Consumers, who make up the foundation of the value chain, can be counted as individuals, but often for consumption decisions it is more meaningful to count consumer households. The United States Census Bureau estimates that the population of Colorado was 5,540,545 on July 1, 2016, an increase of 10.17% since the 2010 United States Census. In 2010, the average household size was 2.49 people (down slightly from 2000) and in Colorado there were 1,972,868 households, up significantly from 2000.

Our 2016 estimates of Colorado retail food and beverage expenditures, from section 7.1 and Table 7.2, were \$27 billion in 2016, and of those expenditures, they were split among three broad categories: \$13.3 billion on food consumed at home, \$13.7 billion on food eaten away from home and \$3.1 billion on alcoholic beverages.

To explore these numbers in a little more detail, at the household level, we can consider the most recent data available on average food expenditures per household in Colorado (Table 7.7). The table shows that food expenditures, both at home and away from home, went down between 2000 and 2010, but it is important to realize that, since the average household size in Colorado is going down over time, that may explain the small decline in expenditures for most categories. Perhaps it is more important to note that the expenditures on food eaten at home is declining faster than food consumed away from home, indicating that the restaurant and food service sector is increasing in relative importance.

Table 7.7 Annual average household food expenditures (nominal \$)

	2000	2010
Food Expenditures	8,471	8,071
Food at Home Expenditures	4,940	4,656
<i>Bakery & Cereal</i>	<i>680</i>	<i>618</i>
Flour	9	7
Rice	26	23
Pasta/Cornmeal/Other Cereal Grains	37	34
Bread	129	119
<i>Meat at Home</i>	<i>1,230</i>	<i>1,075</i>
Beef	368	309
Pork	247	206
Poultry	218	194
Seafood	184	170
Eggs	55	54
<i>Dairy Products</i>	<i>563</i>	<i>516</i>
<i>Fruits & Vegetables</i>	<i>841</i>	<i>820</i>
Food away from Home Expenditures	3,531	3,415
Lunch	1,134	1,063
Dinner	1,419	1,419
Breakfast	315	307
Alcoholic Beverages	619	613

Source: Colorado MarketMaker compilation of US Census data

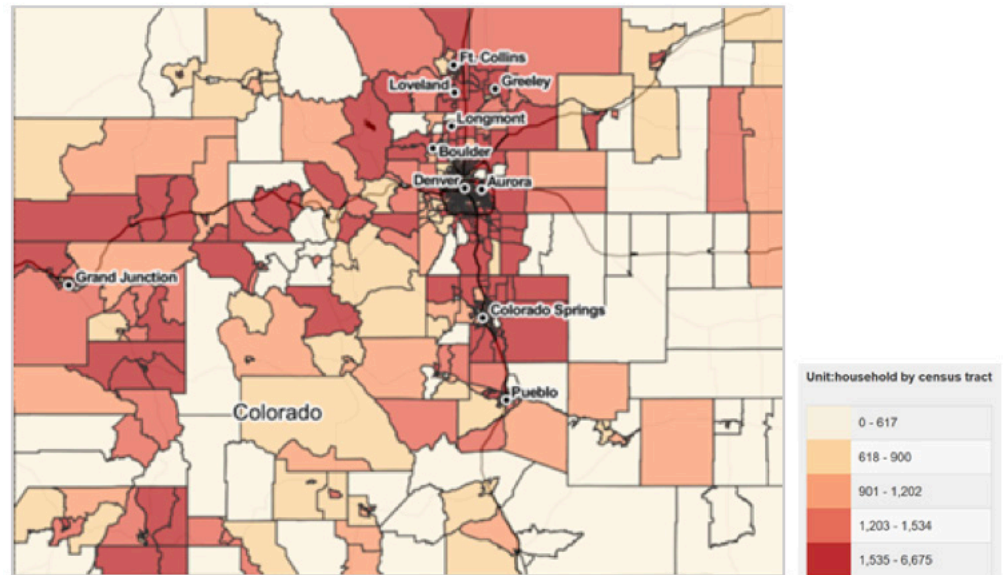
7.7.1 DOES WHERE THEY LIVE AFFECT HOW COLORADANS EAT?

Beyond the population in the state, another important factor that may drive how consumers interact with agriculture and food is their spatial relationship to the state's large metro areas, or in contrast, households more directly connected to the agricultural and rural areas of the state. Figures 7.4 and 7.5 illustrate how diverse households are in terms of their food expenditures for food consumed at home and away from home.

It should be noted that those households at the high end of this continuum stretch far beyond the average expenditures by households (up to \$6,675 for food at home and \$24,590 for food eaten away from home). More pertinent to this discussion are the patterns one might notice between rural and urban Colorado, with higher expenditures in the Front Range corridor, particularly for food eaten away from home. Similar patterns exist in some areas along interstate corridors where tourism may play a role in providing more food choices.

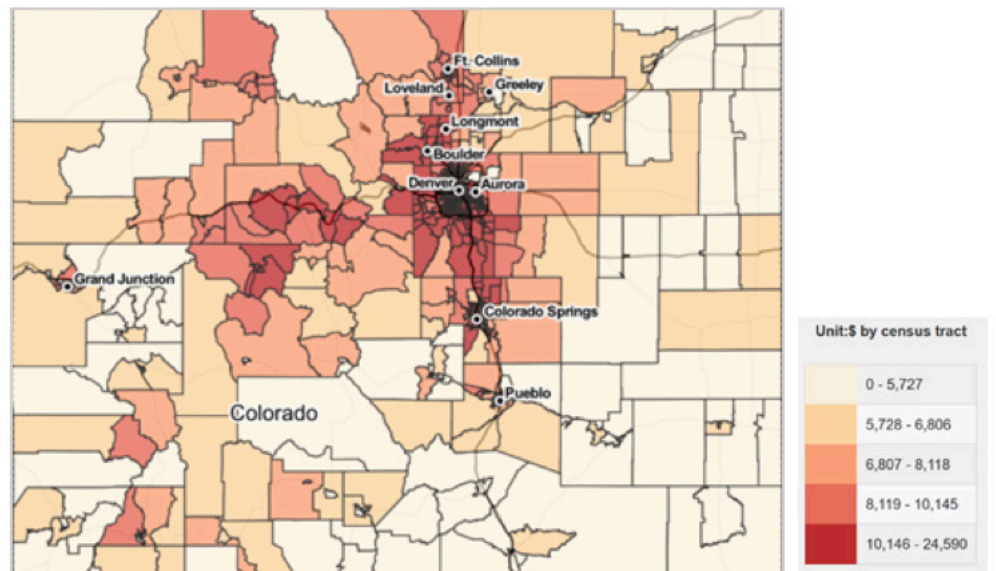
To compare how food expenditures are influenced by household locations, Figure 7.6 illustrates the Rural-Urban Continuum for Colorado, a metric developed by the United States Department of Agriculture to delineate the relative influence of metro versus rural areas on households, communities and markets. There are relatively notable patterns that emerge across these maps, and particularly since the food expenditure maps control for population (expenditures are per household), it is safe to conclude that metro area households are spending relatively more on their food purchases, and this difference is only more acute when you consider food eaten away from home.

Figure 7.4 Average food expenditures for food eaten at home per household by census tract



Source: Colorado MarketMaker, https://co.foodmarketmaker.com/main/market_research

Figure 7.5 Average food expenditures for food eaten away from home, per household by census tract



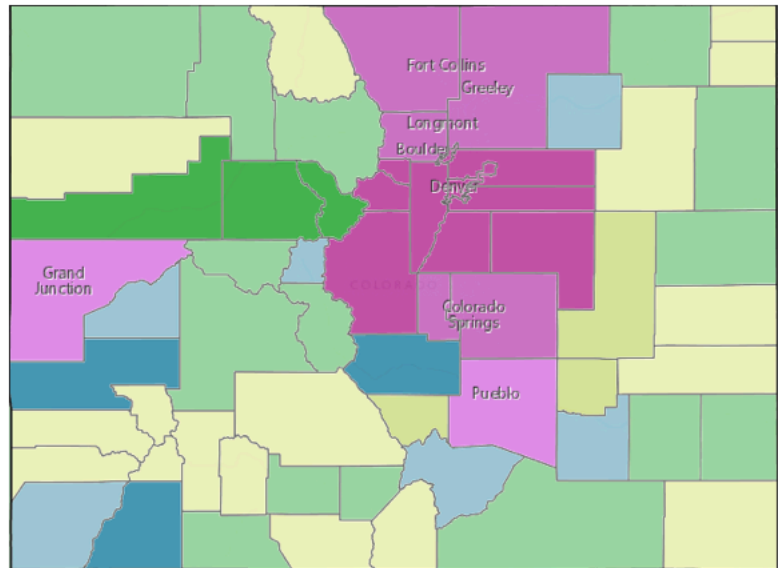
Source: Colorado MarketMaker, https://co.foodmarketmaker.com/main/market_research

To add a bit more context to the discussion of location, we can consider potential influences on demand. Richard Florida began defining a creative class with a focus on workers in occupations specializing in creative tasks who also demonstrate strong preferences for various amenities (Florida, 2002, 2005). Colorado appears as both a popular location and high growth area for the creative class (Figure 7.7), so understanding the influence of Coloradans whose creative nature may influence their business start-up (suppliers) and food purchasing (demand) behavior is relevant to this discussion. The overview of growth sectors (nationally and in Colorado) may signal that beverage, bakery, snack and dairy products may see renewed interest from entrepreneurs (on the supply side seeking new opportunities) and customers seeking new market offerings.

7.7.2 GINI COEFFICIENT AND IN-COME DISTRIBUTION

Just as creative class in-migration may be a great economic opportunity for the state's food sector, there are still concerns about making sure all Coloradans have access to healthful foods. So, another difference that may influence how location affects food purchases is income levels and inequality across populations. In economics, the Gini coefficient (sometimes expressed as a Gini ratio or a normalized Gini index) is a measure of statistical dispersion intended to represent the income or wealth distribution of an area's residents, and is the most commonly used measure of inequality. Figure 7.8 shows the most recent estimates of the Gini coefficient for Colorado counties. In this case, the differences between metro and non-metro are not as distinct, as there are areas of income inequality throughout the state, however, the drivers behind such inequality may be different across regions.

Figure 7.6 Rural-Urban continuum for Colorado

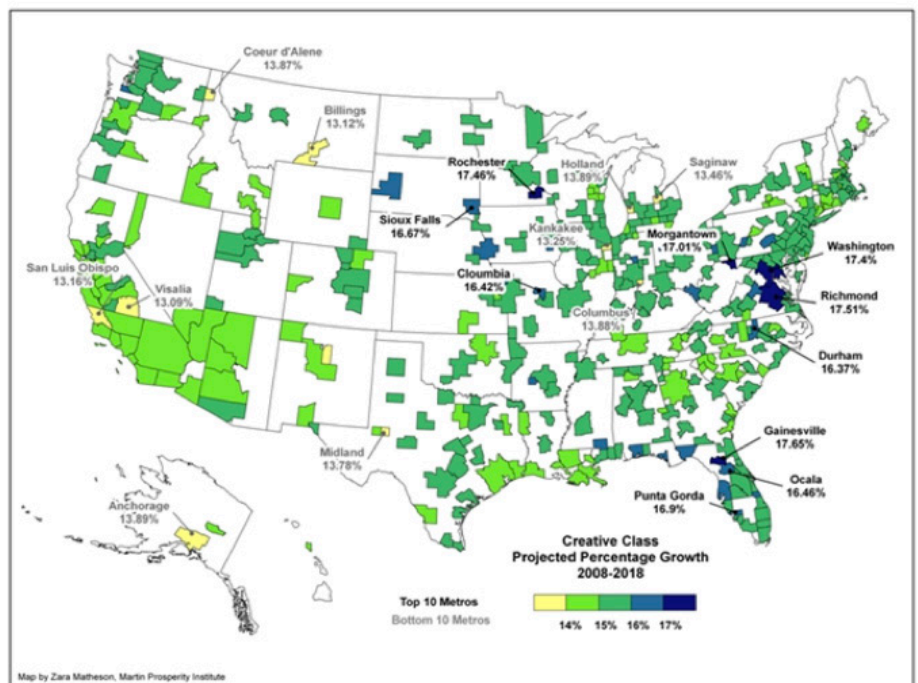


Rural-Urban Continuum Code (RUCC) by County, USDA 2013

- 1 - Metro - Counties in metro areas of 1 million population or more
- 2 - Metro - Counties in metro areas of 250,000 to 1 million population
- 3 - Metro - Counties in metro areas of fewer than 250,000 population
- 4 - Nonmetro - Urban population of 20,000 or more, adjacent to a metro area
- 5 - Nonmetro - Urban population of 20,000 or more, not adjacent to a metro area
- 6 - Nonmetro - Urban population of 2,500 to 19,999, adjacent to a metro area
- 7 - Nonmetro - Urban population of 2,500 to 19,999, not adjacent to a metro area
- 8 - Nonmetro - Completely rural or less than 2,500 urban population, adjacent to a metro area
- 9 - Nonmetro - Completely rural or less than 2,500 urban population, not adjacent to a metro area

Source: Community Commons, 2017

Figure 7.7 Creative class, projected percentage of growth, United States, 2008-2018



Source: Zara Matheson, Martin Prosperity Institute

Figure 7.8 Colorado income inequality (GINI coefficient) by county, 2011

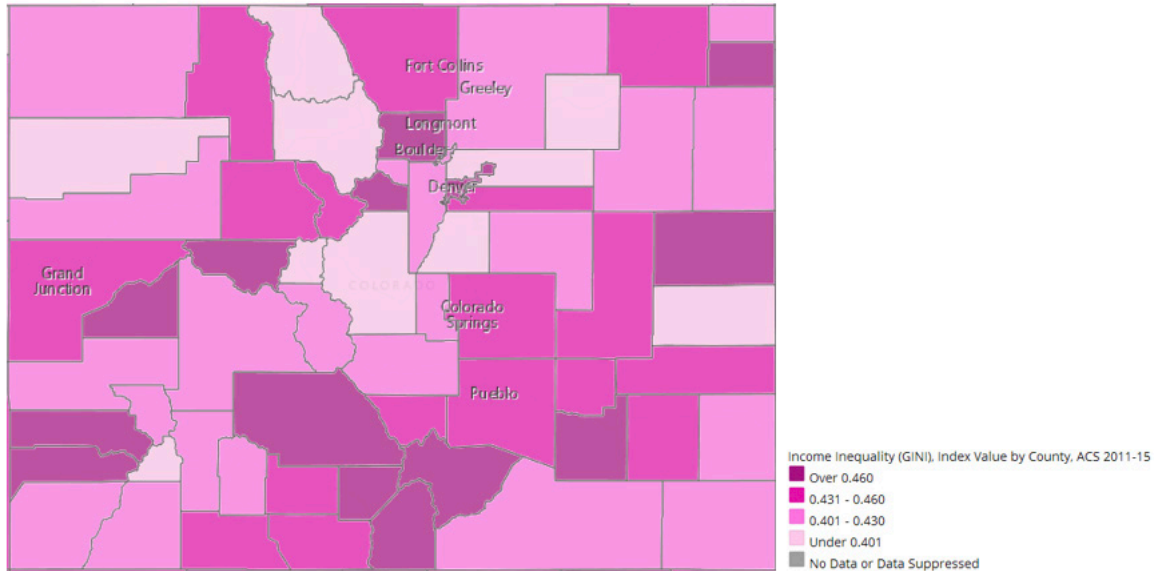
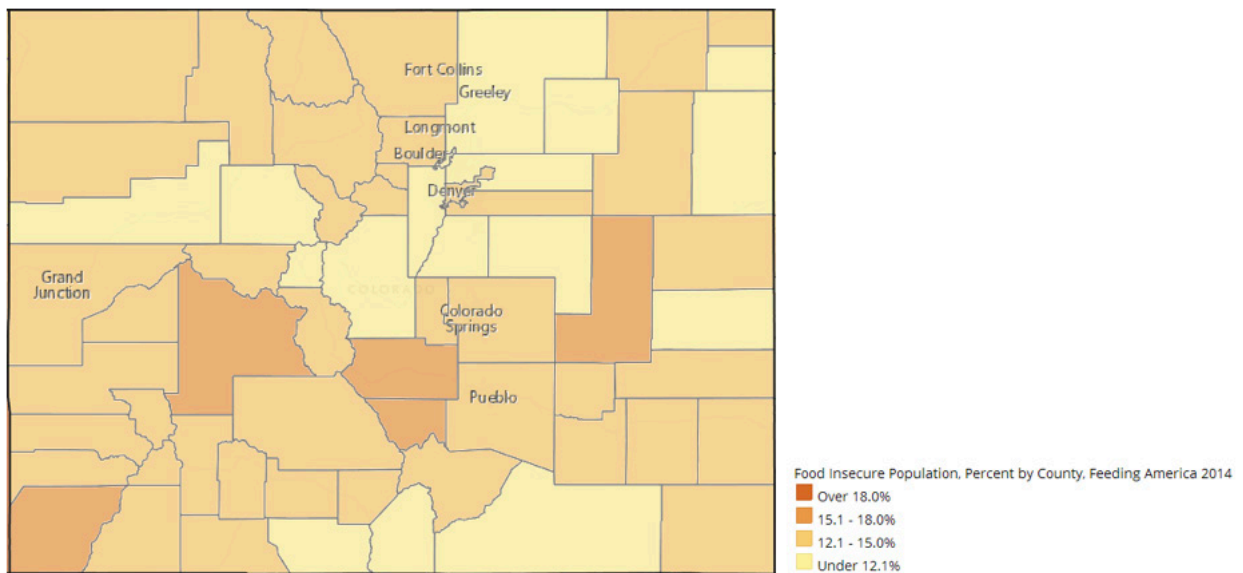


Figure 7.9 Colorado food insecurity estimates, by county, 2014

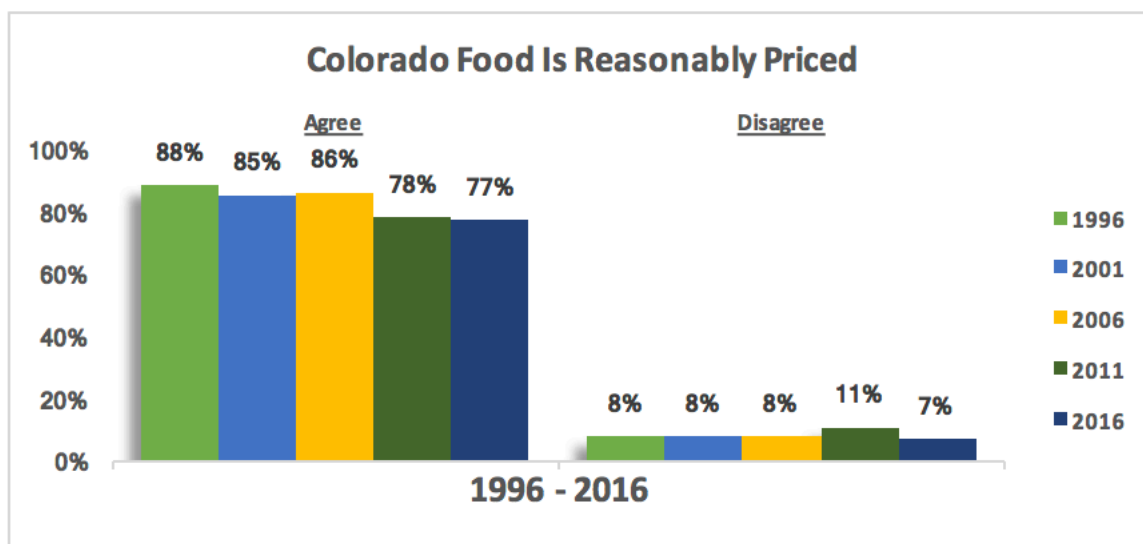


Source: Community Commons

7.7.3 FOOD INSECURITY AMONG COLORADO HOUSEHOLDS

One reason to include a discussion of income inequality in this study is because we might expect inequality to align with patterns of food insecurity throughout Colorado, as shown in Figure 7.9. Although there are food insecure households throughout the state, it seems income inequality may be a driver for food insecurity. This is an issue that will be explored in more detail in the summaries of community townhalls later in the report.

Figure 7.10 Do you agree or disagree that food is available at a reasonable price in Colorado?



Source: 2016 Public Attitudes about Agriculture in Colorado

7.7.4 THE IMPORTANCE OF AGRICULTURE TO COLORADANS

Beyond food expenditures, there are a few reasons to believe locations may influence a household's perceptions about agriculture and how they purchase food. For example, they may have a more direct connection with agriculture and food production. For more insights, we can turn to the 2016 survey on the Public Attitudes of Coloradans. When asked, most respondents agreed (77%) that agriculture provides food at a reasonable price in Colorado. Less than 1 in 10 (7%) did not agree with this statement. These proportions were similar to the 1996, 2001 and 2006 responses (Figure 7.10).

The role of agriculture in Colorado's quality of life is another dimension that has been asked throughout the years and it appears that agriculture remains a key element of the quality of life respondents experience in Colorado. Although there have been some minor shifts over the last three survey periods, it is notable that there are consistently 85-90% of Coloradans who feel agriculture is either Very or Moderately important to their quality of life. This does represent a slight decrease from previous years, particularly the share rating it as Very important, but given the high share of in-migration and numerous respondents with a short history in the state, the persistent perception of agriculture benefitting quality of life is encouraging.

In order to get a sense of the context each respondent had about agriculture, the first question on the survey consisted of three parts: (a) Do you currently live or work on a farm or ranch? (b) Have you ever lived or worked on a farm or ranch? (c) Does your household raise any of its own food products? Figure 7.13 shows the frequency of responses across the years.

Only about one fifth of all respondents (20.5%) reported having lived or worked on a farm at some point in their lives, a number that is significantly lower than 1996 (38.5%), 2001 (39.2%) and 2006 (37.3%) and more reflective of 2011 (23%). Less than 5% currently live or work on a farm or ranch, down substantially from early surveys, but up slightly from 2011 (3.6%). It should be noted that no criteria were given to respondents as to what constituted living or working on a farm or ranch so changes in results should be interpreted carefully. These responses were used to explore patterns throughout other parts of that survey as well. Table 7.8 shows that those who ever lived on a farm or who do so now were more prevalent among those who felt agriculture was important to Colorado's future.

Figure 7.11 How important is the presence of ranches, farms and agriculture to the quality of life in Colorado?

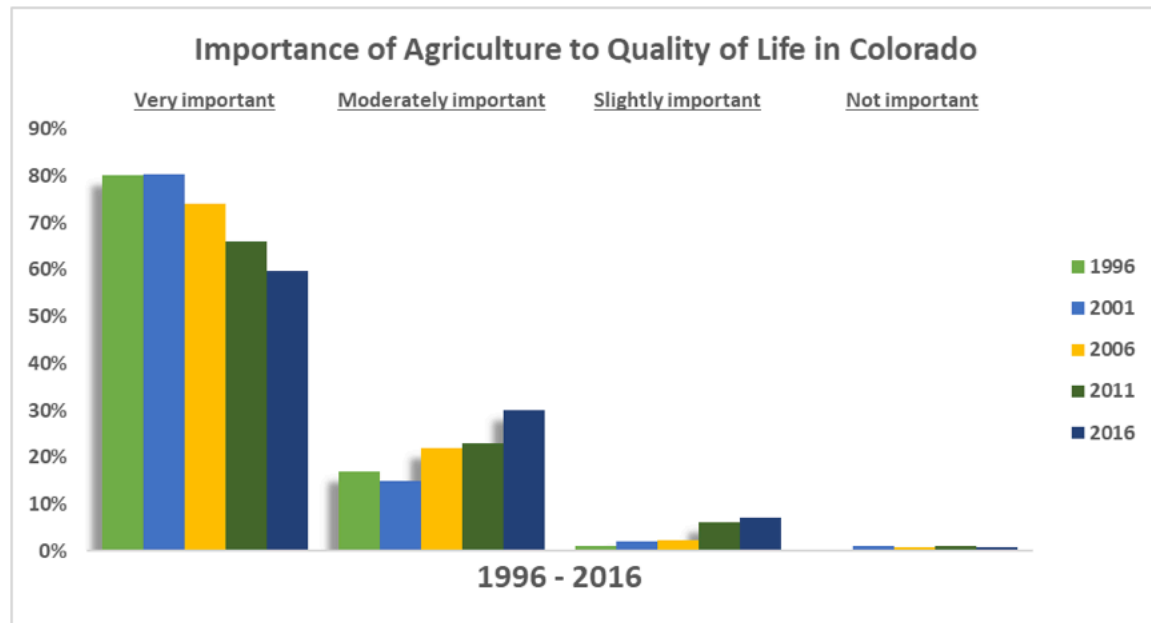
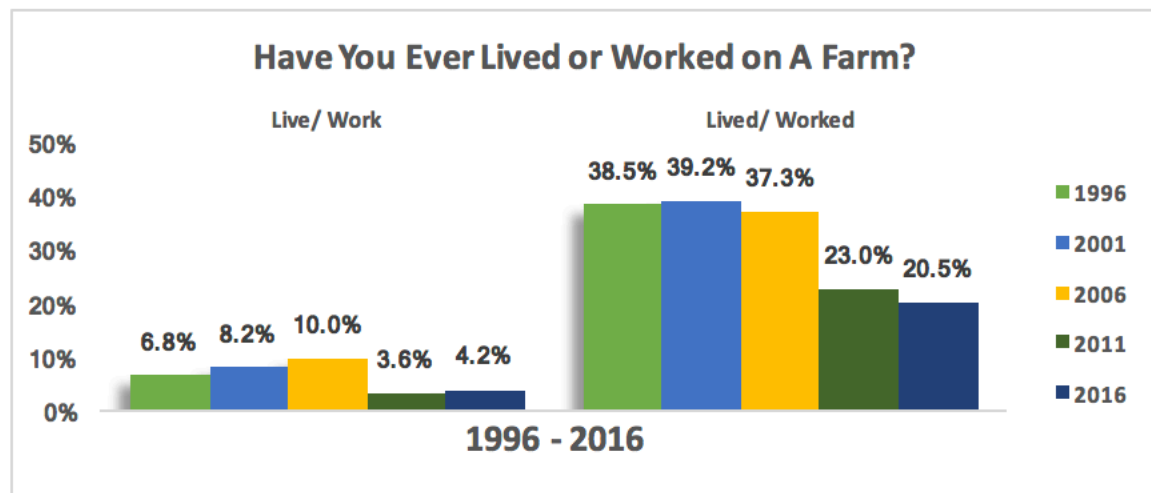


Figure 7.12 Have you ever lived or worked on a farm?



Source: 2016 Public Attitudes about Agriculture in Colorado

Table 7.8 Comparison of characteristics among those who think agriculture is important for Colorado's future

	All Coloradans	Those who think ag is important for Colorado's future
Live on a farm or ranch now	4.2%	6.8%
Ever lived on a farm	20.5%	26.1%
Lived in CO 20 years or more	57.1%	65.5%
Raise own food products (any)	31.8%	37.6%

Source: 2016 Public Attitudes about Agriculture in Colorado

7.8 SUMMARY: COLORADO'S WORKFORCE AT THE RETAIL END OF THE VALUE CHAIN

Over 342,000 are employed in the food and beverage retail, green industry retail, and food service sectors in Colorado. Employment is robust with growth of 15 percent between 2012 and 2016. The rate of job growth in Colorado was somewhat higher than nationally in these sectors. The demographic structure is quite young, with a significant share of the workforce between 19 and 24 years and the largest age group between 25 and 34 years. Given the size of this group, it is demographically much more representative of the population as a whole. There is almost perfect gender balance, with 49 percent male and 51 percent female. Retail jobs are just slightly more prevalent in Colorado than in the nation as a whole. Average earnings in the sector in Colorado are higher than in the sector nationwide, but are still less than \$27,000 per year. The structure and recent trends of the 30 most common occupations in the sector are shown in Table 7.11.

Table 7.9 The list of industry sectors included in this analysis of the retail and service sector workforce

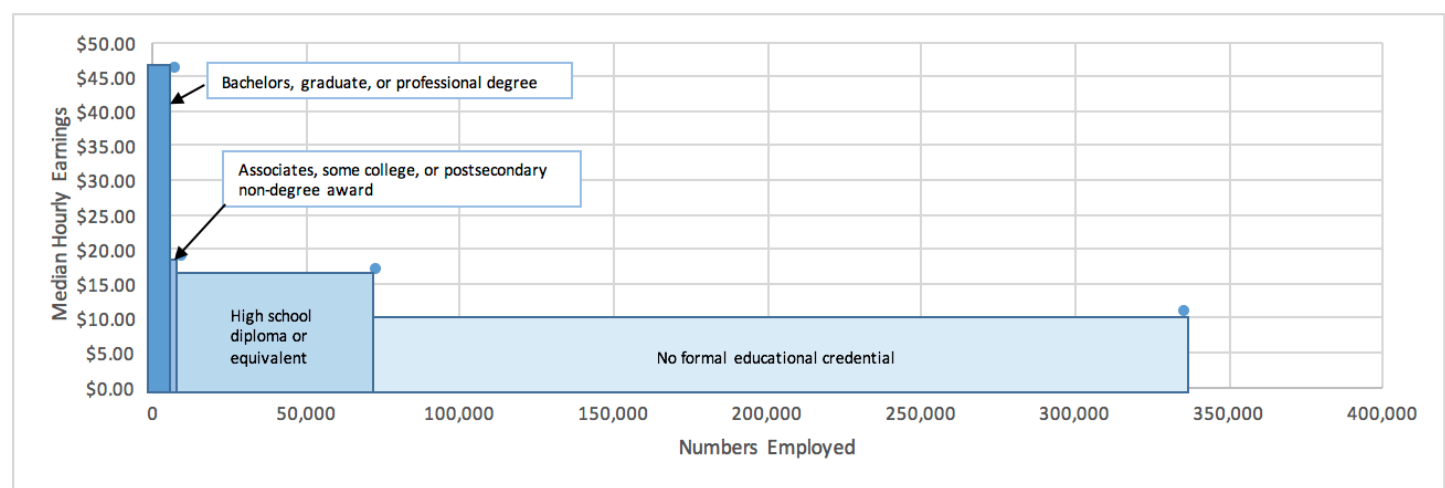
Code	Description
444220	Nursery, Garden Center, and Farm Supply Stores
445110	Supermarkets and Other Grocery (except Convenience) Stores
445120	Convenience Stores
445210	Meat Markets
445220	Fish and Seafood Markets
445230	Fruit and Vegetable Markets
445291	Baked Goods Stores
445292	Confectionery and Nut Stores
445299	All Other Specialty Food Stores
445310	Beer, Wine, and Liquor Stores
446191	Food (Health) Supplement Stores
446199	All Other Health and Personal Care Stores
447110	Gasoline Stations with Convenience Stores
452311	Warehouse Clubs and Supercenters
453110	Florists
453910	Pet and Pet Supplies Stores
453991	Tobacco Stores
624210	Community Food Services
722310	Food Service Contractors
722320	Caterers
722330	Mobile Food Services
722410	Drinking Places (Alcoholic Beverages)
722511	Full-Service Restaurants
722513	Limited-Service Restaurants
722514	Cafeterias, Grill Buffets, and Buffets
722515	Snack and Nonalcoholic Beverage Bars

Table 7.10 Staffing pattern overview for food and beverage and green industry retail and service sectors in Colorado

342,539		\$26,486		
Jobs (2017)		Avg. Earnings Per Job (2017)		
4% above National average		Nation: \$24,844		
Establishments (2017)		17,283		
Jobs Multiplier		2		
Region	2012 Jobs	2016 Jobs	Change	% Change
Region	291,143	335,780	44,637	15.3%
Nation	15,654,358	17,652,168	1,997,810	12.8%
Gender		Percent		
Male		49.7%	<div></div>	
Female		50.3%	<div></div>	
Age		Percent		
14-18		9.3%	<div></div>	
19-24		21.0%	<div></div>	
25-34		25.9%	<div></div>	
35-44		16.3%	<div></div>	
45-54		13.1%	<div></div>	
55-64		9.7%	<div></div>	
65+		4.7%	<div></div>	
Race/Ethnicity		Percent		
White		65.3%	<div></div>	
Hispanic or Latino		22.3%	<div></div>	
Asian		4.8%	<div></div>	
Black or African American		4.6%	<div></div>	
Two or More Races		2.1%	<div></div>	
American Indian		0.7%	<div></div>	

Source: EMSI, 2018

Figure 7.13 Numbers employed and median hourly earnings in the retail sectors in Colorado, by typical entry-level education requirements



Data source: EMSI, 2018

Table 7.11 Top 30 jobs in the food and beverage and green industry retail and service sectors in Colorado, by share of total jobs in the sector

SOC	Description	Employed (2012)	Employed (2016)	Change (2012 - 2016)	% Change (2012 - 2016)	% of Jobs in Industry (2017)	Median Hourly Earnings	Typical Entry Level Education
11-9051	Food Service Managers	2,733	2,620	(113)	(4%)	0.8%	\$19.75	High school diploma or equivalent
11-1021	General and Operations Managers	2,751	3,812	1,061	39%	1.1%	\$50.94	Bachelor's degree
35-1011	Chefs and Head Cooks	1,598	2,302	704	44%	0.7%	\$22.90	High school diploma or equivalent
35-1012	First-Line Supervisors of Food Preparation and Serving Workers	12,178	13,964	1,786	15%	4.2%	\$17.92	High school diploma or equivalent
35-2011	Cooks, Fast Food	7,950	8,317	367	5%	2.4%	\$10.30	No formal educational credential
35-2012	Cooks, Institution and Cafeteria	1,428	1,565	137	10%	0.5%	\$12.96	No formal educational credential
35-2014	Cooks, Restaurant	22,593	28,110	5,517	24%	8.5%	\$12.57	No formal educational credential
35-2015	Cooks, Short Order	1,837	2,053	216	12%	0.6%	\$11.23	No formal educational credential
35-2021	Food Preparation Workers	8,588	9,894	1,306	15%	2.9%	\$11.32	No formal educational credential
35-3011	Bartenders	8,866	9,751	885	10%	2.9%	\$9.63	No formal educational credential
35-3021	Combined Food Preparation and Serving Workers	47,439	56,925	9,486	20%	17.5%	\$10.23	No formal educational credential
35-3022	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	3,648	4,272	624	17%	1.2%	\$10.55	No formal educational credential
35-3031	Waiters and Waitresses	40,886	45,168	4,282	10%	13.2%	\$9.50	No formal educational credential
35-3041	Food Servers, Nonrestaurant	1,284	1,843	559	44%	0.5%	\$10.96	No formal educational credential
35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers	5,698	6,167	469	8%	1.9%	\$9.57	No formal educational credential
35-9021	Dishwashers	6,911	6,948	37	1%	2.0%	\$10.49	No formal educational credential
35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	7,491	9,160	1,669	22%	2.7%	\$10.02	No formal educational credential
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	1,622	1,729	107	7%	0.5%	\$12.35	No formal educational credential
41-1011	First-Line Supervisors of Retail Sales Workers	7,780	8,074	294	4%	2.4%	\$18.50	High school diploma or equivalent
41-2011	Cashiers	35,660	40,573	4,913	14%	12.1%	\$10.65	No formal educational credential
41-2031	Retail Salespersons	15,168	17,765	2,597	17%	5.2%	\$11.64	No formal educational credential
43-1011	First-Line Supervisors of Office and Admin Support Workers	1,113	1,355	242	22%	0.4%	\$27.76	High school diploma or equivalent
43-3031	Bookkeeping, Accounting, and Auditing Clerks	1,444	1,533	89	6%	0.4%	\$19.15	Some college, no degree
43-4051	Customer Service Representatives	1,936	2,433	497	26%	0.8%	\$16.57	High school diploma or equivalent
43-5081	Stock Clerks and Order Fillers	11,694	13,950	2,256	19%	4.2%	\$12.92	High school diploma or equivalent
51-3011	Bakers	1,760	2,239	479	27%	0.7%	\$12.58	No formal educational credential
51-3021	Butchers and Meat Cutters	1,900	1,967	67	4%	0.6%	\$15.62	No formal educational credential
53-3031	Driver/Sales Workers	3,407	4,726	1,319	39%	1.5%	\$11.86	High school diploma or equivalent
53-3033	Light Truck or Delivery Services Drivers	971	1,473	502	52%	0.5%	\$16.82	High school diploma or equivalent
53-7064	Packers and Packagers, Hand	1,963	2,076	113	6%	0.6%	\$11.24	No formal educational credential

Source: EMSI, 2018

EXPLORING INDUSTRY STRUCTURE AND SCALE ALONG THE VALUE CHAIN

To understand better the structure of the segments of the value chain beyond the farm gate, we collaborated with the United States Department of Agriculture Economic Research Service (USDA-ERS) to access the National Establishment Time-Series (NETS) database. The NETS database provides an annual record for a large part of the U.S. economy of the “births” and “deaths” of establishments, which are commonly combined to measure “churn”, rough measure of business creation and destruction, as well as employment dynamics. To create the database, Walls & Associates converts Dun and Bradstreet’s establishment data into a time-series database of establishment information (NETS).

Table 8.1 Colorado’s food and beverage value chain establishment numbers and employment structure, metro and non-metro, 2013

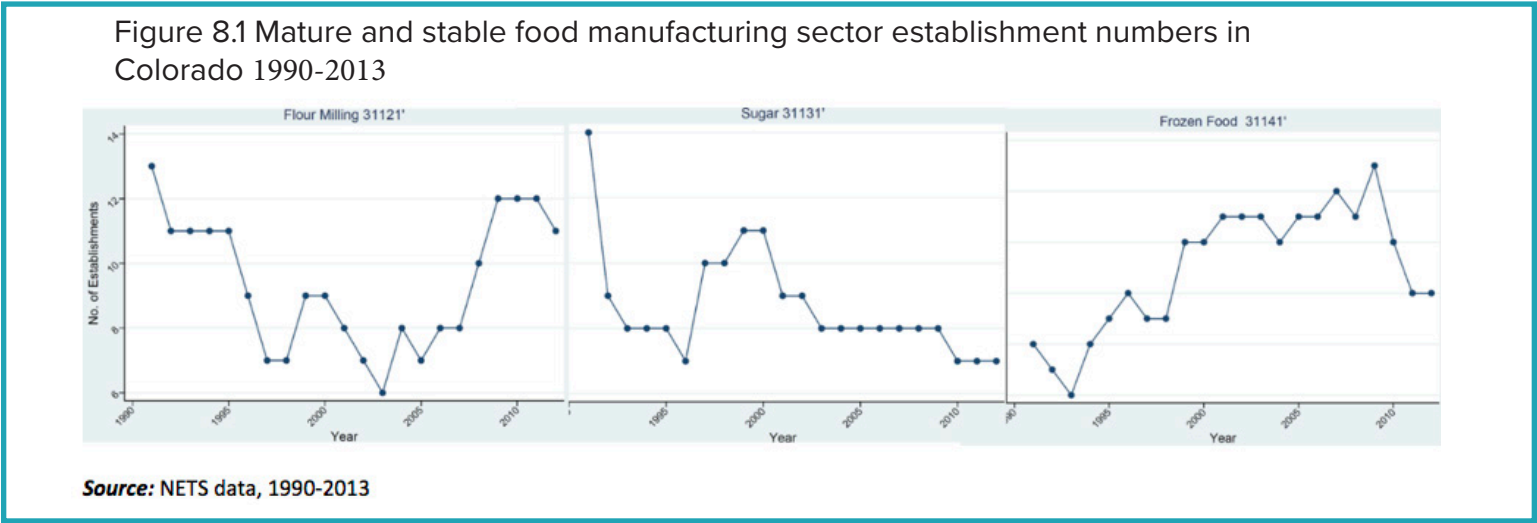
Supply Chain Sector	Location	Smallest Employer	Median Employer	Mean Employer	Maximum Employer	Total Employment	Number of Establishments
Food and Beverage Manufacturers							
Flour Milling	Non-Metro	2	4	6	15	24	4
Flour Milling	Metro	3	20	33	77	196	6
Sugar	Non-Metro	2	29	43	102	124	3
Sugar	Metro	3	14	23	62	138	6
Frozen Food	Non-Metro	1	4	4	6	7	2
Frozen Food	Metro	2	9	46	275	409	9
Dairy Products	Non-Metro	1	17	49	200	327	7
Dairy Products	Metro	1	8	42	317	1255	32
Animal Slaughter	Non-Metro	1	4	50	1439	2088	42
Animal Slaughter	Metro	1	7	98	1855	7835	81
Seafood	Non-Metro	3	3	3	4	5	2
Seafood	Metro	2	4	6	14	27	4
Bread/Bakery	Non-Metro	1	3	6	73	533	86
Bread/Bakery	Metro	1	4	12	506	4212	386
Snack Food	Non-Metro	2	17	17	33	33	1
Snack Food	Metro	2	11	31	197	442	14
Soft Drink and Bottled Water	Non-Metro	1	6	9	37	187	21
Soft Drink and Bottled Water	Metro	1	10	57	583	2312	42
Breweries	Non-Metro	2	6	16	49	137	9
Breweries	Metro	1	12	416	3863	8313	34
Wineries	Non-Metro	2	2	3	8	33	10
Wineries	Metro	1	3	7	67	179	28
Distilleries	Non-Metro	1	2	2	3	4	2
Distilleries	Metro	2	3	4	7	11	2
Distributors/Merchant Wholesalers							
Grocery and Retail MW	Non-Metro	1	3	8	127	1336	171
Grocery and Retail MW	Metro	1	3	14	736	11921	871
Beer-Wine-Liquor MW	Non-Metro	2	9	12	37	279	28
Beer-Wine-Liquor MW	Metro	1	5	24	606	2815	147
Food and Beverage Retailers							
Grocery Stores	Non-Metro	1	6	14	194	7426	523
Grocery Stores	Metro	1	4	23	641	34726	1609
Specialty Food Retailers	Non-Metro	1	2	5	261	777	150
Specialty Food Retailers	Metro	1	3	6	477	3821	732
Beer-Wine-Liquor Stores	Non-Metro	1	3	3	29	1029	319
Beer-Wine-Liquor Stores	Metro	1	3	4	131	4153	1041
Food and Beverage Service							
Full-Service Restaurants	Non-Metro	1	9	15	1275	17851	1189
Full-Service Restaurants	Metro	1	10	20	2389	85020	4276
Limited-Service Restaurants	Non-Metro	1	7	13	199	4657	357
Limited-Service Restaurants	Metro	1	10	18	1771	31818	1793
Special Food Services	Non-Metro	1	2	6	50	460	72
Special Food Services	Metro	1	4	13	406	3764	288
Drinking Places (Alcoholic Beverages)	Non-Metro	1	3	7	140	1852	272
Drinking Places (Alcoholic Beverages)	Metro	1	5	9	219	8379	927

Source: 2013 NETS data

These NETS data are of a different time period (years 1990-2013) than the EMSI data presented in the preceding sections (years 2005-2016). They also draw from different underlying sources and rely upon different techniques to fill in or estimate unobserved values in the data series. For this reason, while the NETS and EMSI data will reflect similar trends, they do not always match. In some cases, we have identified fairly major discrepancies between the two different data sources. Table 8.1 shares the listing of sectors provided, along with the total number of establishments in 2013, total employment, and how the smallest, mean/median and largest employers vary by size to give a sense of structure. For 2013, there were 15,598 firms, in 21 sectors, that employed a total of 250,915 employees.

Beyond these aggregate numbers, it is interesting to note how the size of employers vary across sectors and metro/non-metro establishments. For example, the difference between an average and largest employer in flour milling is relatively small (33 vs. 77 for metro millers) when compared to bakeries (12 vs. 506 in metro areas). The structure of the industry may be important if it is a signal of entrepreneurship (more small firms may be start-up businesses) or market access for Colorado producers (smaller firms may provide sales opportunities to producers looking to sell to processors who can use their primary products). In general, metro establishments employ more workers than non-metro businesses, but these numbers are more even in the retail and food service sectors.

In addition to these 2013 data, we can explore the longer-term trends for this industry using data available through a cooperative agreement with the USDA Economic Research Service. First, we will consider the number of firms in each sector over time as a signal of sector dynamics. Figure 8.1 groups three food-manufacturing sectors that appear to be mature and stable, as indicated by a small and stable number of establishments across the past couple of decades. Two of these are staple ingredient products, and both relate to commodities grown in the state (flour, small grains, and sugar beets). Employment numbers have remained stable (flour milling and frozen food) or declined (sugar) over this same period.

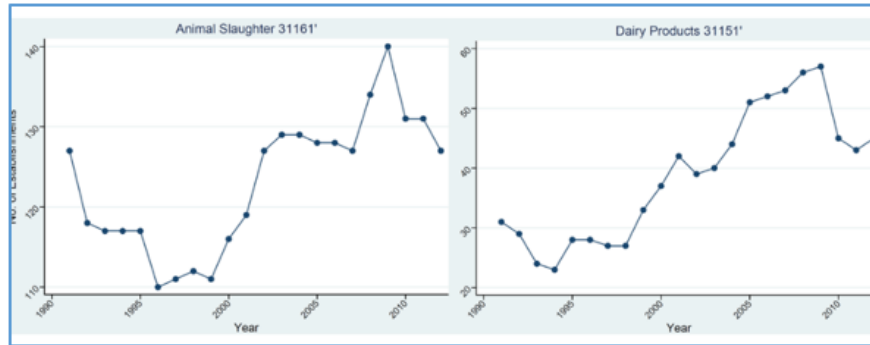


Colorado has a significant livestock presence, and this may be why there are large and growing numbers for processing in the animal product sector (Figure 8.2). The growth in number of processors could relate to both supply (more dairy, small livestock producers) and demand (differentiated products such as cheese, jerky, yogurt) factors. During this same period, employment for animal slaughter has dropped by half while dairy processing employment has more than doubled, so this may indicate a tradeoff between capital (mechanization in slaughter plants) and labor (skilled artisans for value-added dairy) within these sectors. The animal slaughter sector's dynamics are the focus of several community discussions summarized later in the report, as some in the livestock sector would like better access to supply chain partners such as these establishments.

Beyond animal product manufacturing, there has been a notable presence and growth in some other key food manufacturing sectors. Figure 8.3 shows there has been significant growth in the number of bread/bak-

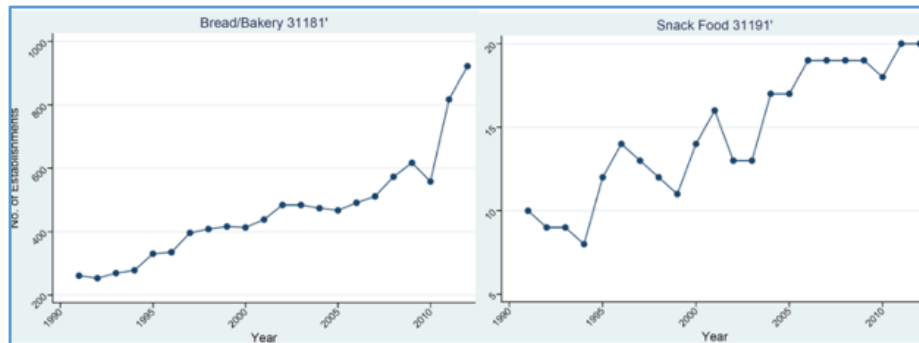
ery and snack food establishments over the past couple of decades, and this mimics what is seen in national trends (Thilmany et al, 2017). Over this same period, bakery employment almost doubled and snack food processing employment more than tripled (signaling they are labor intensive businesses). These growth sectors may align with several notable market trends including health-related labeling (gluten free, whole grains), ethnic foods (tortillas, hummus) and natural foods (organic breads, veggie-based chips).

Figure 8.2 Animal slaughter and product processing establishment numbers in Colorado 1990-2013



Source: NETS data, 1990-2013

Figure 8.3 Selected growth sectors in food processing, establishment numbers in Colorado 1990-2013



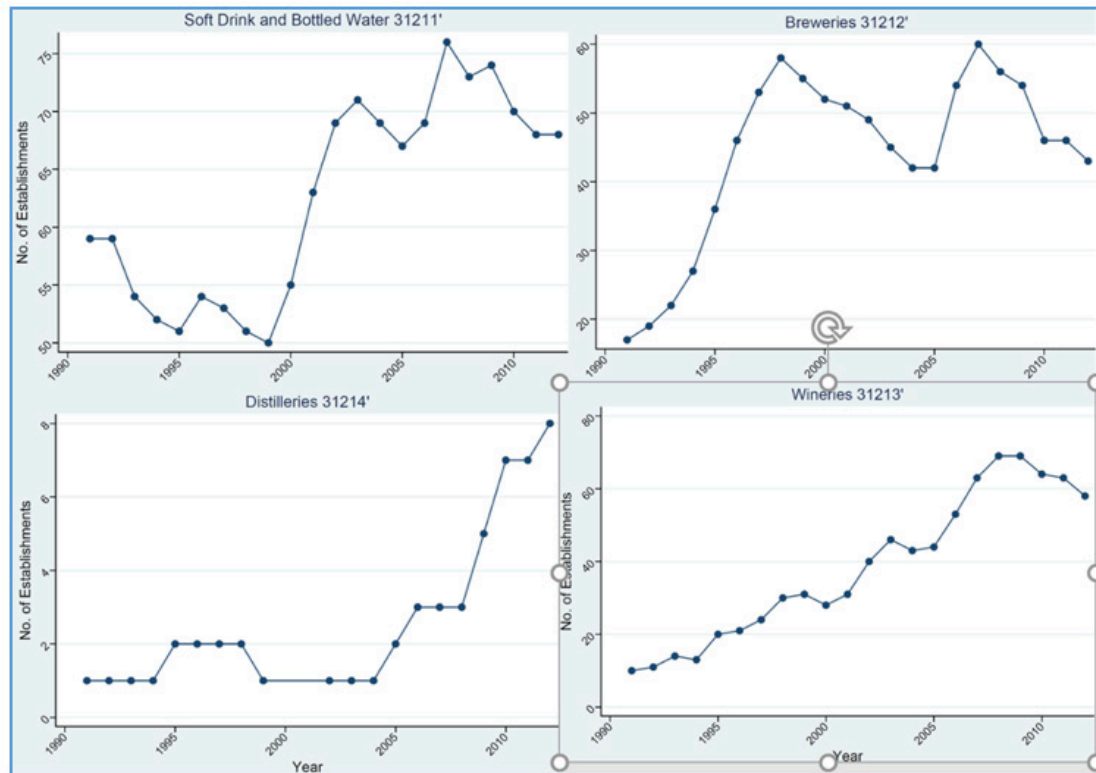
Source: NETS data, 1990-2013

Another sector that has attracted a great deal of interest is the beverage sector, and Figure 8.4 shows that there have been some notable dynamics in several beverage manufacturing sub-sectors. Although employment in these sectors is generally growing in light of the growth in firms (by three- and five-fold for wineries and distilleries, respectively), there is a more nuanced story for breweries. The brewing sector formerly dominated by large brewers (MillerCoors and Anheuser-Busch-InBev) actually employs less than half of the workers it did two decades ago, as those large brewers mechanize more operations, and craft brewers have not offset those job losses (20,000 down to about 8500 jobs in 2013).

For the wholesale sector, there has been notable growth in the number of firms, and although many entrants have been small, there has been a small increase in employment for groceries and almost doubling of employment in the beverage wholesaling sectors.

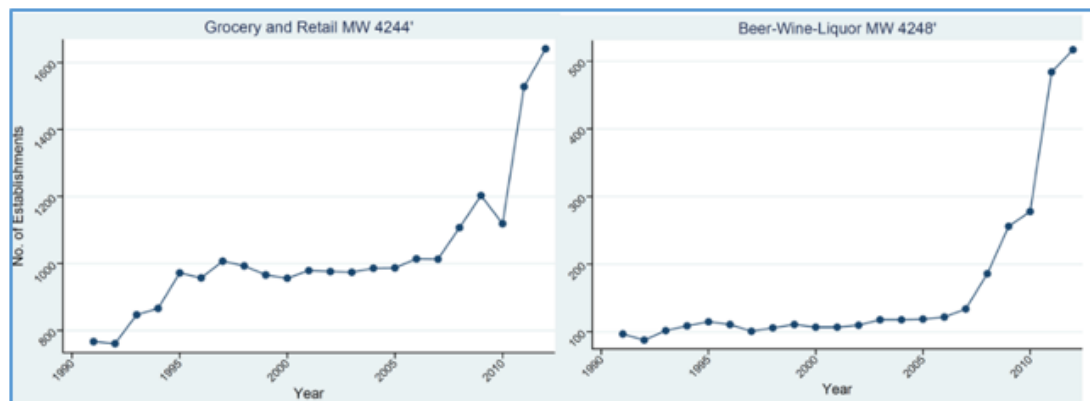
For the retail food sector, there has been notable growth in the number of establishments (Figure 8.6), and although in-migration to the state may suggest demand has been a key driver, these numbers outpace population growth for the state. Employment among general grocers is up less than 50%, but for Specialty Food Retailers (such as natural food stores or gourmet food shops) both establishment numbers and employment have almost tripled, suggesting a new type of food shopping may be emerging.

Figure 8.4 Beverage manufacturing establishment numbers in Colorado 1990-2013



Source: NETS data, 1990-2013

Figure 8.5 Merchant wholesaler (distributor/broker) establishment numbers in Colorado 1990-2013

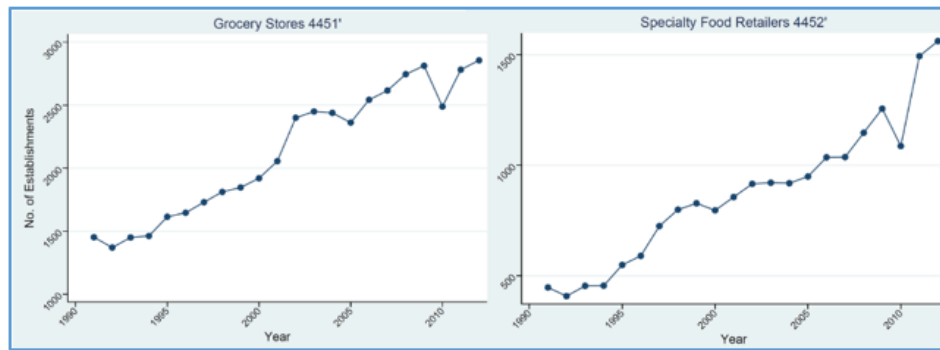


Source: NETS data, 1990-2013

Finally, as the consumer section details, a significant share of Colorado food dollars are now spent on food and beverages consumed away from home. Figure 8.6 shows that, while full-service restaurants grew and then disappeared after the 2008 recession, limited service restaurants (such as Mad Greens, Chipotle and Tokyo Joe's) grew and sustained their numbers over the past couple of decades.

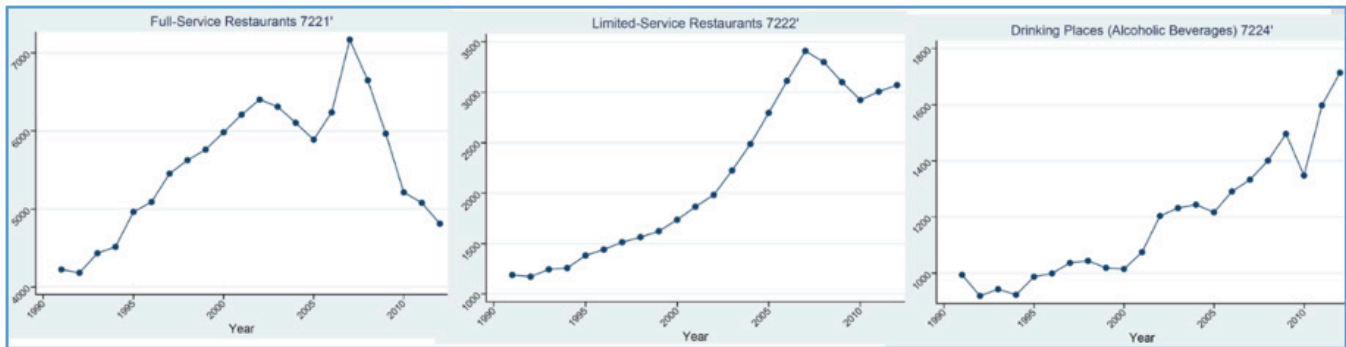
Employment numbers show very similar trends (with almost triple the employment for limited service restaurants in 2013 when compared to 1990). Given the growth in beverage manufacturing and wholesaling, it is not surprising to see a similar growth in the number and employment related to drinking places (which may also include brew pubs who designate themselves as such rather than as producers and distributors of beer).

Figure 8.6 Retail food sector establishment numbers in Colorado 1990-2013



Source: NETS data, 1990-2013

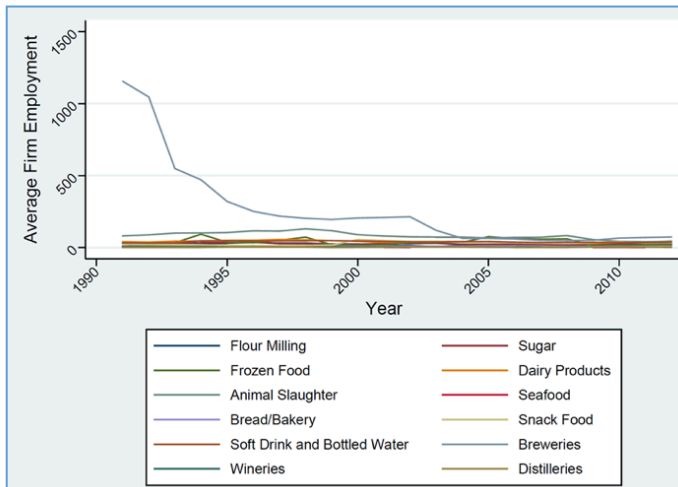
Figure 8.7 Food service establishment numbers in Colorado 1990-2013



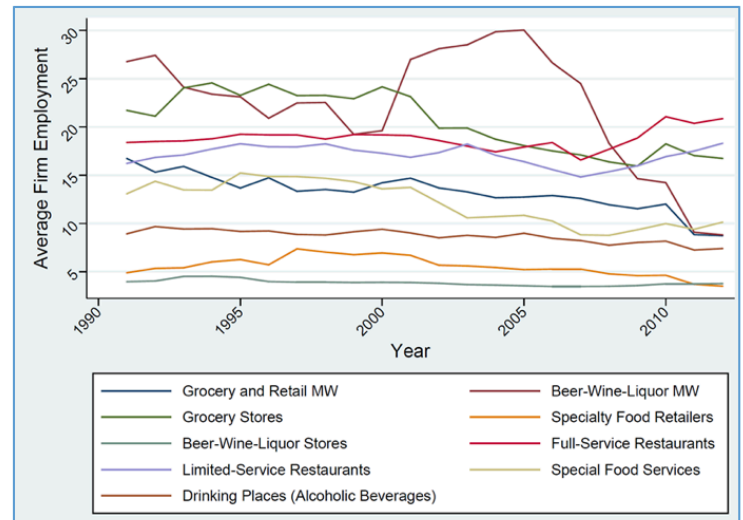
Source: NETS data, 1990-2013

Figure 8.8 Average firm employment by segment of the value chain, 1990-2013

(a) Processing and manufacturing



(b) Retail



Figures 8.8 (a) and (b) show how the average firm employment in each of these food system sectors has varied across the past couple of decades. The most striking change is the decline in average employment for breweries and animal slaughter, while other sectors remain relatively constant within the food and beverage manufacturing. This is not surprising given the emergence of the craft brewing industry, and also explains the large difference between the average and largest employer in that sector (Table 8.1). It is challenging to see more subtle differences because of this large range and change in the brewing sector. In contrast to the processing sectors, there has been more stable mean employment levels in wholesale, retail and food service sectors. The more gradual decline in average employment in the MW (distribution) sectors is expected given the growth in establishments in these sectors discussed earlier.

SUPPORTING AND SURROUNDING THE VALUE CHAIN: COLORADO COMMUNITIES

There are a variety of public sector, government, private, industry, non-profit, community, academic and research organizations that work in support of natural resource, agriculture, agribusiness and food issues in the state of Colorado, and many were partners on or participated in this project.

9.1 PRIVATE SECTOR ORGANIZATIONS

The Colorado Ag Council is perhaps the most visible and tightly knit organization of those organizations focused on agricultural issues (see Table 9.1). The Colorado Ag Council is a structured entity that pulls together statewide agriculture organizations that represent and serve Colorado agriculture producers. The Ag Council acts as a forum for discussion and review of issues important and currently being considered by its member organizations. The group meets regularly while the Colorado General Assembly is in session and may also meet for any other reason applicable to its formation and at the behest of its membership. (<https://www.coloradoagcouncil.net/>).

Table 9.1 Members of the Colorado Agricultural Council

Producer Organizations	Supporting Non-Voting Members
Colorado Aquaculture Association	Colorado Alliance of Mineral & Royalty Owners
Colorado Association of Conservation Districts	Catlin Augmentation Association
Colorado Association of Wheat Growers	Colorado Federation of Dog Clubs
Colorado Cattlemen's Association	Colorado Rural Electric Association
Colorado CattleWomen, Inc.	Colorado Veterinary Medical Association
Colorado Corn Administrative Committee	Colorado Weed Management Association
Colorado Corn Growers Association	Tri-State Generation & Transmission
Colorado Dairy Farmers PAT/PAC	
Colorado Egg Producers Association	
Colorado Farm Bureau	Non-Voting Ex-Officio Members
Colorado Fruit & Vegetable Growers Association	AFC Colorado Chefs Association
Colorado Horse Council	Advisor to the Governor on Water
Colorado Livestock Association	Colorado Agricultural Education/FFA
Colorado Onion Association	Colorado Ag Leadership Program
Colorado Pork Producers Council	Colorado Agriculture Water Alliance
Colorado Potato Administrative Committee Area II	Colorado Department of Agriculture
Colorado Potato Administrative Committee Area III	Colorado FFA Association
Colorado State Grange	Colorado FFA Foundation
Colorado Sugarbeet Growers	Colorado Foundation for Agriculture
Colorado Wool Growers Association	Colorado State University
GreenCO of Colorado	Rocky Mountain Food Industry Association
National Young Farmer's Coalition	Tomlinson & Associates
Rocky Ford Growers Association	USDA Farm Service Agency
Rocky Mountain Agribusiness Association	Western Dairy Association
Rocky Mountain Farmers Union	

9.2 PUBLIC SECTOR ORGANIZATIONS AND AGENCIES

The Colorado Food Systems Advisory Council was brought together with the charge to: advance recommendations that strengthen healthy food access for all Coloradans through Colorado agriculture and local food systems and economies. More specifically, the Colorado Food Systems Advisory Council (COFSAC), established through the LiveWell Colorado-initiated Senate Bill 10-106, is a legislatively-mandated, volunteer-based, 15-member body of state agencies and diverse food systems stakeholders. The COFSAC held its first meeting in January 2011 and more details on its work are available at: <http://www.cofoodsystmscouncil.org/>. Its membership includes a set of federal (rural and state government (Departments of Agriculture, Human Services, Public Health and Environment, and Education), industry (producer, small retailer and retail/distributor), non-profit (food security and nutrition/health), CSU Extension and academic seats.

Each member of COFSAC serves an important role on the task force, sharing their experiences and expertise in promoting, regulating, and developing vibrant, healthy, and safe agricultural and food economies. For example:

- The Colorado Department of Agriculture works to strengthen and advance Colorado agriculture; promote a safe and high-quality food supply; protect consumers; and foster responsible stewardship of the environment and natural resources. As one example, the Colorado Department of Agriculture administers the Colorado Proud program.
- The Colorado Department of Human Services works to design and deliver high-quality human and health services that improve the safety, independence, and well-being of the people of Colorado.

As one example, the Colorado Department of Human Services support food assistance programs, including the Supplemental Nutrition Assistance Program Education (SNAP-Ed) and Schools and Child Nutrition USDA Foods.

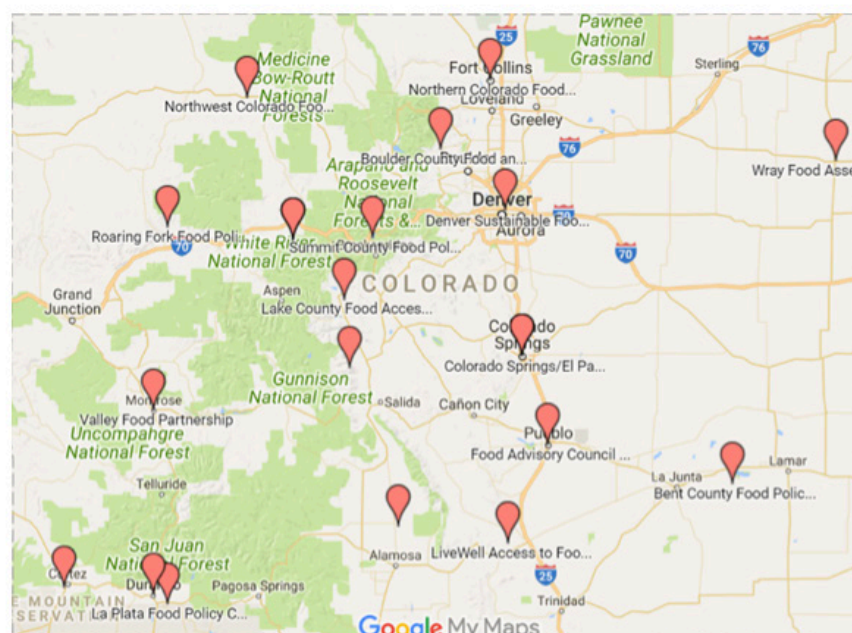
In 2010, the Colorado General Assembly also created the Colorado Farm to School Task Force to “Study, development, and recommend policies and methods to best implement a Farm to School Program.” In 2013, the Assembly reauthorized the Task Force to be continued indefinitely. The 15 appointed members and 15 ex-officials meet quarterly, and have crafted a road map of how to achieve “collaborative, sustainable implementation of farm to school statewide” and they are in the process of pursuing specific activities to support this vision.

The City and County of Denver also has a Sustainable Food Policy Council, with seats appointed by the Mayor and supported by Ex-Officio members (city staff who provide significant support to further the activities of the Council). The Council’s mission is to influence policy that fosters food security for all community members and promotes a healthy, equitable and sustainable local food system with consideration for economic vitality and environmental impact. The purpose of the council is to: 1) Promote and Oversee Progress on the Denver Food Vision and Action Plan; 2) Advise City on Food-Related Plans, Reports, and Programs; 3) Provide Recommendations to the City on Regulations and Policies; and 4) Build public and political will to support innovation and positive policy changes within the food system.

9.3 NON-PROFITS AND COMMUNITY ORGANIZATIONS

The state also includes many non-profit driven initiatives in the food system, which often support the public sector activities and initiatives. For example, there is a network of local food policy coalitions that meet under the umbrella of the Colorado Food Policy Network (COFPN). The Network was established in 2009 with the purpose “to advance healthy, community-based, economically viable food systems that ensure all Coloradans have access to affordable, nutritious food.” The COFPN works to achieve this through coordinating collective statewide action and building the capacity of local coalitions to effect change at the local level.

Figure 9.1 Members of the Colorado Food Policy Network (COFPN) Local Food Policy Councils

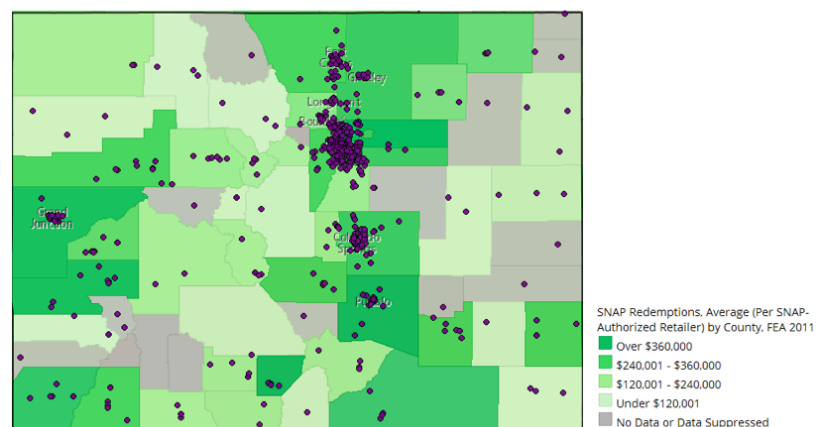


Source: [Google Maps](#)

Specifically, the COFPN works to implement peer mentoring, leadership development, and other technical assistance; host regional and statewide convenings; develop key metrics and a statewide food systems plan; create a state policy platform; and build a shared digital mapping and data system. A map of COFPN members is available in Figure 9.1.

Further, there is substantial activity, and increasing coordination, around statewide issues of food access and food security. As an example, in 2017 the CO Health Foundation supported the “Colorado Blueprint to End Hunger.” The effort brings together a steering committee of more than 30 organizations and individuals representing food banks, county governments, local, state and national hunger advocates, health care, state agencies and individuals experiencing hunger. The Blueprint will serve as a building plan for creating the policies, pipelines and partnerships needed to advance the good work already being done to combat hunger in Colorado. Part of what this coalition hopes to do is to leverage State and Federal dollars available through SNAP and WIC to mitigate hunger (see, for example, Figure 9.2 which shows the landscape of SNAP and WIC benefits by location).

Figure 9.2 Landscape of SNAP and WIC Benefits in Colorado



Colorado is also supported by a vibrant philanthropic community, many of which support issues related to food and agriculture. According to the Colorado Association of Funders (the statewide network of private foundation, community foundations, family foundations, corporate funders, federated funds, workplace giving programs, government agencies, etc.), one in twelve Coloradoans work in the nonprofit sector, which is supported by Colorado foundations. Table 9.2 shows the top giving foundations in the state of Colorado.

Table 9.2 Charitable foundations ranked by total annual giving in the state of Colorado

FOUNDATION NAME	TOTAL ANNUAL GIVING
The Colorado Health Foundation	\$84,689,039
The Daniels Fund	\$53,581,243
The Anschutz Foundation	\$50,341,039
El Pomar Foundation	\$19,864,939
Gates Family Foundation	\$16,969,887
Boettcher Foundation	\$10,082,376
Temple Hoyne Buell Foundation	\$9,281,665
The Denver Foundation	\$8,794,979
The Aspen Community Foundation	\$8,248,728
The Piton Foundation	\$7,722,803
Adolph Coors Foundation	\$7,400,903
The Colorado Trust	\$7,354,397
Rose Community Foundation	\$7,054,258
Bohemian Foundation	\$7,042,904
Global Greengrants Fund	\$6,928,104
Western Union Foundation	\$6,871,013
Helen K. and Arthur E. Johnson Foundation	\$6,039,047
Pikes Peak Community Foundation	\$5,968,639
Community Foundation of Northern Colorado	\$5,480,726
Henry P. Crowell and Susan C. Crowell Trust	\$4,225,000
Qwest Foundation	\$3,882,512
The Community Foundation Serving Boulder County	\$3,868,039
Bonfils-Stanton Foundation	\$3,328,560
The Louis and Harold Price Foundation, Inc.	\$3,250,884
Bikes Belong Foundation	\$3,228,417
Aspen Valley Medical Foundation	\$3,086,784
A.V. Hunter Trust, Inc.	\$2,484,440
The JFM Foundation	\$2,451,847
Monfort Family Foundation	\$2,276,178
The Anschutz Family Foundation	\$2,173,882
The Garth Brooks Teammates for Kids Foundation	\$2,171,023
General Service Foundation	\$2,117,180
Telluride Foundation	\$2,114,270
TYL Foundation	\$1,770,215
Hill Foundation	\$1,754,625
The Summit Foundation	\$1,750,358
The Mercy and Sharing Foundation	\$1,742,247
Saeman Family Foundation, a Charitable Trust	\$1,698,691
Western Colorado Community Foundation	\$1,652,195
Morris Animal Foundation	\$1,516,915

Source: The Grantsmanship Center (<https://www.tgci.com/funding-sources/CO/top>)

Colorado is home to four foundations that are members of the Sustainable Agriculture and Food Systems Funders network (SAFSFN), all of which are located along the Front Range: Gates Family Foundation, the Marcus Foundation, Chef Ann Foundation, and the First Nations Development Institute. The SAFSFN work to create networking, educational, and collaboration opportunities for the philanthropic community working to support vibrant, healthy and just food and farm systems.

9.4 ACADEMIC AND RESEARCH INSTITUTIONS

Historically, the agricultural and food system issues of the state were a focus point of the Land Grant University, Colorado State University (CSU), including its Experiment Stations and Extension offices. This four-year institution was supported by a system of community colleges that offered two-year degree programs that provided teaching and research for agricultural trades, and acted as feeder programs to CSU. Nevertheless, as natural resource, agriculture and food topics are considered in a more systematic way, the whole array of Colorado Higher Education Institutions play a more vital role in research, education and Outreach in this system.

Of particular relevance to the value chain of Colorado food and agriculture, the Colorado Agricultural Experiment Station (CAES) is committed to finding practical solutions to food and natural resources challenges facing the people of Colorado. CAES efforts involve faculty and staff from the main CSU campus in Fort Collins as well as seven off-campus research centers located around the state. The mission includes research that addresses the evolving business, climate, and policy conditions that affect farmers, ranchers and rural communities.

Many of the four-year institutions engage in research and educational activities in the fields of agriculture, agribusiness, food science, food service, nutrition, public health, community development and natural resources. These include the campuses of the Colorado State University system, the University of Colorado system, Colorado School of Mines, Adams State College, University of Denver, Colorado Mesa University, Fort Lewis College, Metro State University, University of Northern Colorado and Western State Colorado University.

As one example of linkages to support food system issues, the Colorado School of Public Health was established across University of Colorado, University of Northern Colorado and CSU. The Colorado School of Public Health mission states it is uniquely defined by our history, collaborative identity and collective strengths. Each day our faculty, students, alumni, and community partners work together to fulfill a commitment to protect and promote health across Colorado, nationally, and globally.

Table 9.3 includes the community college system that supports the other four-year institutions through community-driven education programs. As one example of a strengthening connection between the community college and 4-year system, the Northeast Regional Engagement Center was established in Sterling, Colorado, to better link the Northeast Junior College, CSU Extension, and a wide range of community partners in that region.

Figure 9.3 Overview of the the higher education system in Colorado




PUBLIC 2-YEAR AND 4-YEAR				PRIVATE AND SEMINARY		PRIVATE OCCUPATIONAL		
								
	Total	4-Year	2-year		Total		Enrollment	Awards
Institutions	31	14	17	Institutions	103	Institutions	354	305
Students	251,778	156,934	94,844	Students	122,994	Students/Awards	31,265 (1 Qtr)	27,131
Gender	53% Female, 47% Male			Awards	16,217	Demographics Unavailable		
Residency	85% Resident, 15% Non-Res			Gender	56% Female, 44% Male			
Level	89% Undergrad, 11% Grad			Level	72% Undergrad, 28% Grad			
Awards	55,165	35,717	19,448					

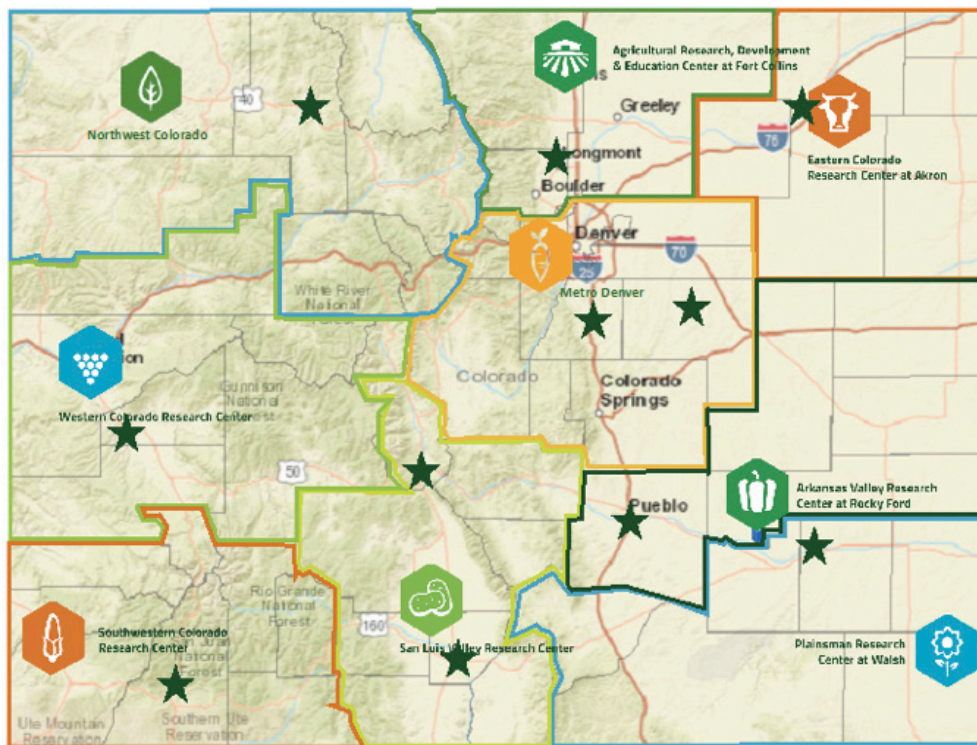
Table 9.3 The community college system in Colorado

Community colleges
Arapahoe Community College
Colorado Northwestern Community College
Community College of Aurora
Community College of Denver
Front Range Community College
Lamar Community College
Morgan Community College
Northeastern Junior College
Otero Junior College
Pikes Peak Community College
Pueblo Community College
Red Rocks Community College
Trinidad State Junior College

CROSS-CUTTING ISSUES

To validate and enhance findings compiled from available secondary data, the Colorado Blueprint of Food and Agriculture also included an extensive public engagement process. To assure geographical representation, the above-mentioned key organizations divided the State into nine regions, loosely based on the location of the state’s agricultural experiment stations/research centers, plus several additions to ensure representation of all corners of the state (see Figure 10.1). Nine regional advisory teams were assembled to identify previous food system assessments, engage important regional stakeholders and voices, and help coordinate a regional townhall meeting. The regional advisory teams included representatives from the Agricultural Experiment Station, Colorado State University Extension, Colorado’s Food Policy Network, and the Colorado Food Systems Advisory Council.

Figure 10.1 Map of the nine regions, including the locations of each of the Blueprint Townhall meetings



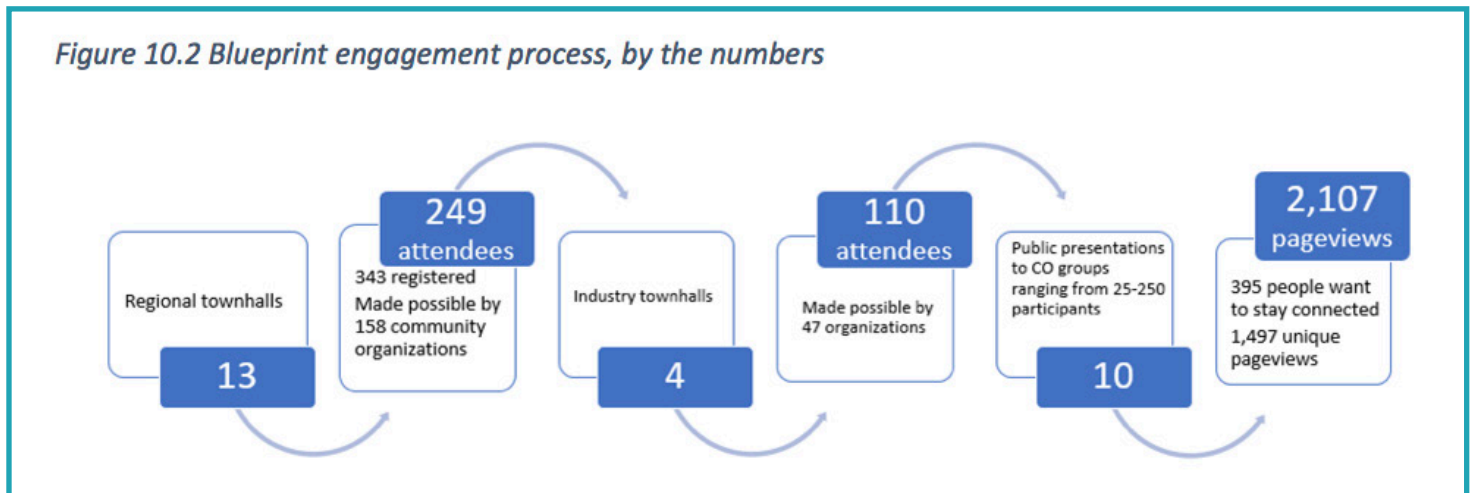
For each of the townhall meetings, members of the regional advisory team were asked to select up to four key, cross-cutting issues that influenced, but transcended, any one industry sector across the food system. These could be topics on which the regions were already working or areas they saw as key opportunities to address (for example, workforce development and retention to support the next generation of agriculture). These issues were used to guide the townhall discussions. Below summarizes the selected cross cutting issues and opportunities by region:

- Access to healthy food (all regions)
- Institutional food procurement (Western and Northeast)

- Access to land and/or water to support the food system and next generation (Southwest, Gunnison, Front Range, Southeast, Denver, South Central)
- Opportunities and challenge to support food system infrastructure (Southwest, Gunnison, Front Range, Denver, Northeast, Northwest, South Central, Southeast, Western, Eastern)
- Leveraging federal resources (Northwest)

In total, almost 249 people attended 13 regional townhalls, representing 158 organizations across the state. In addition, 4 industry townhalls were held with over 110 attendees, representing 47 organizations. And, 10 public presentations, each of which included 25 to 250 participants helped to spread the word about the process. As evidence of the interest in the process, 395 individuals asked to stay connected to what was happening with the Blueprint, 1,497 unique page views were recorded on the project website, with a total of 2,107 total views between January and December 2017, from 93 different communities across Colorado. At the presentation of the draft report at the CSU Ag Innovation Summit in September 2017, we had nearly 100 attendees. In addition, 74 people provided public comments via our online system.

Figure 10.2 Blueprint engagement process, by the numbers



Stakeholders who attended the regional townhalls include a broad range of job or personal affiliation categories, including: media, healthcare, funder, student, food industry intermediary, food retailer, planner, educator, University personnel, rancher, farmer, public health personnel, government professional, Extension specialist, food service provider, and non-profit staff.

Based on the extensive outreach and engagement process, we classified recommendations and priorities under the umbrellas of eight areas of opportunity, these include:

1. Create, retain and recruit agricultural and food firms;
2. Develop workforce and youth to support agricultural and food sectors;
3. Promote the Colorado brand, ensuring it reflects the unique qualities of the agriculture and food sectors;
4. Support a business- and consumer-friendly regulatory environment;
5. Address how scale impacts market performance, access, and opportunities;
6. Innovate and support new technology for agricultural and food businesses;
7. Improve access to resources and capital for agriculture and food firms; and,
8. Integrate agriculture and food with healthy, vibrant communities.

10.1 CREATE, RETAIN, AND RECRUIT AGRICULTURAL AND FOOD FIRMS

In an increasingly competitive global economy, attracting and retaining businesses and talent are key. In 2015, Colorado was the second fastest growing state, including net migration of over 70,000 individuals. The majority of these individuals are settling along the Front Range, which is also where most of the state's

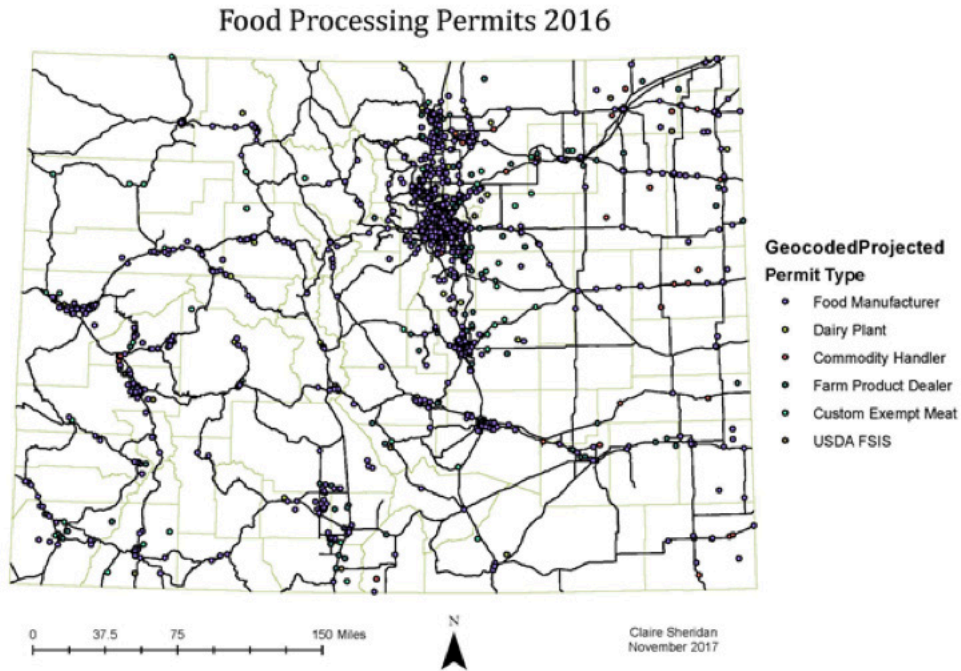
Figure 10.3 A term map of issues that arose in the regional townhall meetings for Colorado food and agriculture

food businesses are located. Though this presents an opportunity to support the state's metro-based food businesses, the skills, education and location of new Coloradans may not adequately meet the workforce and labor needs of the state's farmers and ranchers that are located in more rural counties, many of which lost population between 2010 and 2015 (particularly the Southeast, Northeast, and Northwest).

10.1.1 COOPERATIVE EFFORTS AND FULLER UTILIZATION OF INFRASTRUCTURE AND ASSETS.

enhanced collaboration between hunters, ranchers, and guides there may be opportunities to strengthen and diversify revenue streams for both small and mid-scale meat processing facilities while supporting the outdoor recreation and ranch-based tourism sector. Additionally, some land and water assets are underutilized, and could be leveraged to support new or more profitable farming and ranching operations.

Figure 10.4 Map of meat and poultry, dairy, and food processing/manufacturing firms in Colorado that purchase product and/or manufacture items from Colorado farmers and ranchers.



Action items that emerged for this opportunity include:

- Create and continually update a database of existing agricultural and food supply chain firms and integrate the information into a visible and navigable web-based platform.
- Develop cooperative knowledge sharing, network programming and events across the food system.
- Encourage existing farmers and/or land owners to lease underutilized property to Young, Beginning, or Small (YBS) or veteran producers.
- Engage OEDIT to take a more active role in matching infrastructure assets to food businesses, particularly in rural parts of the State.
- Streamline the regulatory and paperwork burden of food supply chain co-packing relationships in the State.
- Encourage fuller utilization of existing infrastructure before providing tax incentives or other public support for new brick and mortar investments.

10.1.2 FRAME ZONING, MARKET, AND TAX INCENTIVES TO TARGET EARLY-STAGE FARM, RANCH AND FOOD BUSINESS DEVELOPMENT

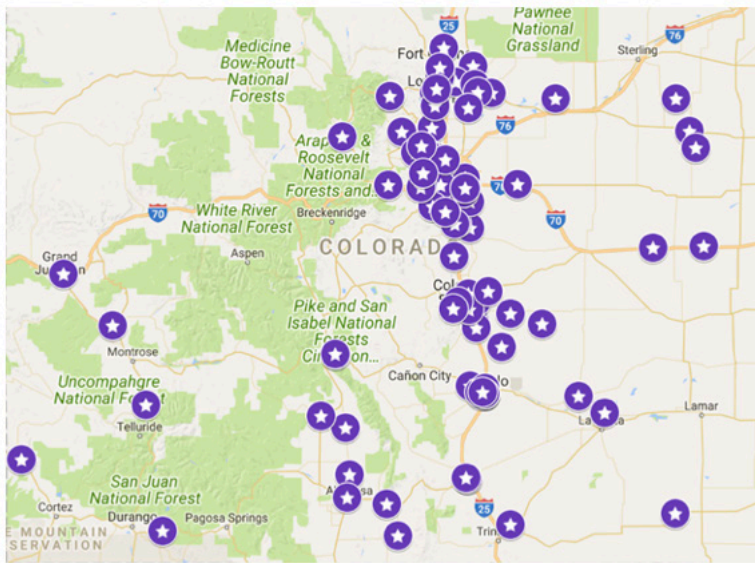
Opportunities exist across the state to leverage the buying power of state institutions and retailers to support early-stage farm, ranch and food businesses. As an example, Colorado has several school nutrition programs including the afterschool snack program, the fresh fruit and vegetable program, the national school lunch program, the school breakfast program, the special milk program, and the summer food service program. The Colorado Department of Agriculture already works to support several of these programs through its school meal day, where Colorado Proud items are featured on school menus across the state (see Figure 10.5). These programs could begin and/or strengthen their current marketing efforts regarding purchases

sourced from start up, veteran, and beginning farmers, ranchers, and food businesses throughout the school year.

Action items include:

- Work with retailers and government food procurement policies to feature beginning and veteran farms/ranches and emerging food businesses in their buy local promotion programs.
- Create a portfolio of government-based incentives that support Colorado farms and food businesses, but also serve other public interests garnering strong citizen support – leasing land, donations to food relief organizations, agricultural utilization of open space.
- Develop markets (including local procurement by public entities) and increase access to existing markets with promotions that benefit early-stage farm and food businesses and reflect local conditions.

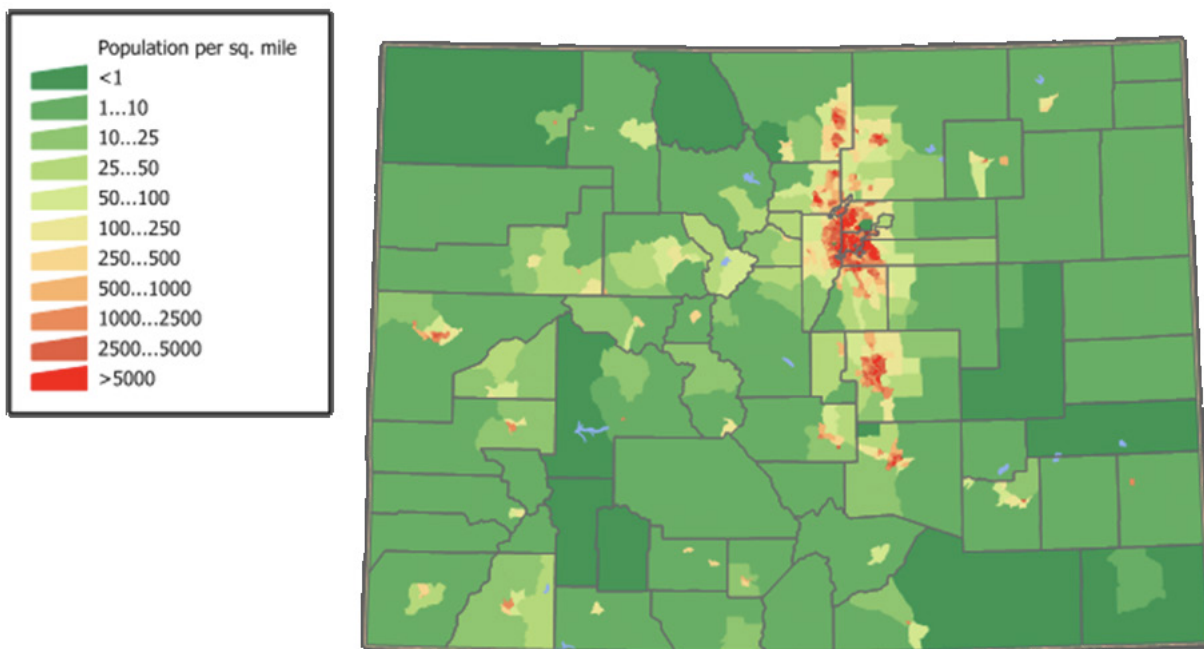
Figure 10.5 Map of schools that participated in 2016 Colorado Proud School Meal Day



10.1.3 CUSTOMIZE BUSINESS PROGRAMS AND TECHNICAL ASSISTANCE IN RECOGNITION THAT DIFFERENT PLACES FACE DIFFERENT BARRIERS TO SUCCESS

Food systems and agricultural economic development efforts cannot be one size fits all across the state. Colorado is extremely diverse; microclimates, transportation, and demographics are all major drivers of agricultural and food system market performance. More work is needed to provide communities with data and information necessary to make educated investments and decisions regarding their unique food and agricultural systems. Further, there is substantial opportunity to better communicate and appropriately match supply and demand across urban and rural regions of the state. Colorado is perhaps unique in that its population is so concentrated in one region of the state (see Figure 10.6). This population density could be better leveraged to establish market opportunities for farms and ranches, therein reducing transportation and other transaction costs.

Figure 10.6 Population density map, Colorado, 2010



Action items include:

- Work with DOLA and other county, regional, and statewide planning and economic development offices to target agricultural and food system interventions likely to work in their community.
- Conduct a feasibility study of establishing public markets in Denver and Colorado Springs (and other population centers) that focus on showcasing Colorado agriculture, including its heritage.
- Assess the potential to bring short- and mid-haul rail transport back in key parts of the state, including support for shared aggregation and marketing to achieve greater economies of scale.
- Encourage existing and new industry associations as business capacity builders, resources and champions for business stakeholders (e.g., CFVGA, Colorado Cattleman's Association, Colorado Corn Growers Association).

10.2 DEVELOP WORKFORCE AND YOUTH TO SUPPORT AGRICULTURAL AND FOOD SECTORS

In 2015, Colorado experienced net in-migration of 68,000 people. Most of these people are locating along the Front Range, and have had little to no exposure to the state's unique agriculture or the food system, other than as eaters (see Figure 7.13). Developing the workforce and youth to support food and agricultural sectors requires exposure to these sectors, and knowledge that they present opportunities for viable careers. Luckily, Colorado has vibrant Future Farmers of America (FFA), 4H, Colorado Young Farmer Education, Colorado Ranching Legacy, Beginning Farmer and Rancher, and Colorado Association for Career and Technical Education programs. Opportunities exist to ensure these organizations and programs are working together, leveraging resources, expertise, and opportunities. Under the umbrella of developing workforce and youth to support the food and agricultural sectors, three key areas of opportunity were identified through the regional townhalls: 1) develop and promote agricultural and food curriculum well suited for all stages of education; 2) support innovative educational approaches to transitioning workers into agriculture across all life stages; and, 3) strengthen connections between allied youth development and workforce programs.

10.2.1 DEVELOP AND PROMOTE AGRICULTURAL AND FOOD CURRICULUM AND LIFE SKILLS WELL SUITED FOR DIVERSE LEARNERS AND ALL STAGES OF EDUCATION.

Throughout the listening sessions, stakeholders espoused the benefits of innovative 4H and FFA programming. Yet, there remain opportunities to expand these programs, as well as to integrate more widely scoped, food systems programming. As an example, experiential learning opportunities could bridge greenhouse production, small-scale food manufacturing, and culinary arts curriculum. 4H, FFA, and agricultural education more broadly provide important opportunities to highlight connections to STEM and careers in the agricultural or food sectors, including the development, manufacturing and operation of emerging ag technology. As several stakeholders pointed out, agricultural education is STEM education.

Action items include:

- Expand 4H and FFA programming to nontraditional agricultural regions/households including urban and underserved communities, and developing and integrating curriculum that aligns with employment trends in the food industry.
- Support FFA and 4H programming that prepares youth for careers in ag technology.
- Explore how Colorado Education Standards could integrate knowledge of food systems in science and social studies content areas.
- Invest in more widely scoped food systems based training programs in high school as well as at the community college and University levels.
- Expand farm to school programming throughout the state, integrating food systems education.

10.2.2 SUPPORT INNOVATIVE TRAINING, OUTREACH AND CONTINUING EDUCATIONAL APPROACHES TO TRANSITIONING WORKERS INTO AGRICULTURE IN ALL LIFE STAGES

Much of the focus of agricultural workforce development is on youth, however many new farmers, for example, are not young. Opportunities exist to expand farmworker training and beginning farmer and rancher programs to midcareer professionals. Further, there has been a proliferation of support programs – including mentoring, incubation, apprenticeships, and rehabilitation services. For example, Fort Lewis College started a Market Garden Incubator in 2009. Since its inception, 9 farms have graduated from the program, with 5 current farmers. In addition to the incubator, there is also a farmer in training program to support those who need more business skills before starting their own farm. There have been several attempts to replicate this successful model, yet more information is needed to understand how to best tailor these programs based on regional needs, existing market stakeholders, demographics, and climactic conditions. More evaluation is needed to assess outcomes associated with these programs so that effective, targeted investments can be made.

Action Items include:

- Assess the outcomes from mentoring, incubation, apprenticeship, and rehabilitation programs to identify best practices and remaining gaps. Assessment should include understanding of ongoing programs outside the state that could be replicated in Colorado.
- Expand farmworker training and beginning farmer programs – including beginning, midcareer and advanced programs, as well as those that support urban agriculture and veteran training.
- Create more opportunities for new farmers and ranchers to serve on Boards and in key leadership posts as a form of professional development. This should also include education these producers about the importance of engaging in the policy process.

10.2.3 STRENGTHEN CONNECTIONS BETWEEN ALLIED YOUTH DEVELOPMENT AND WORKFORCE PROGRAMS

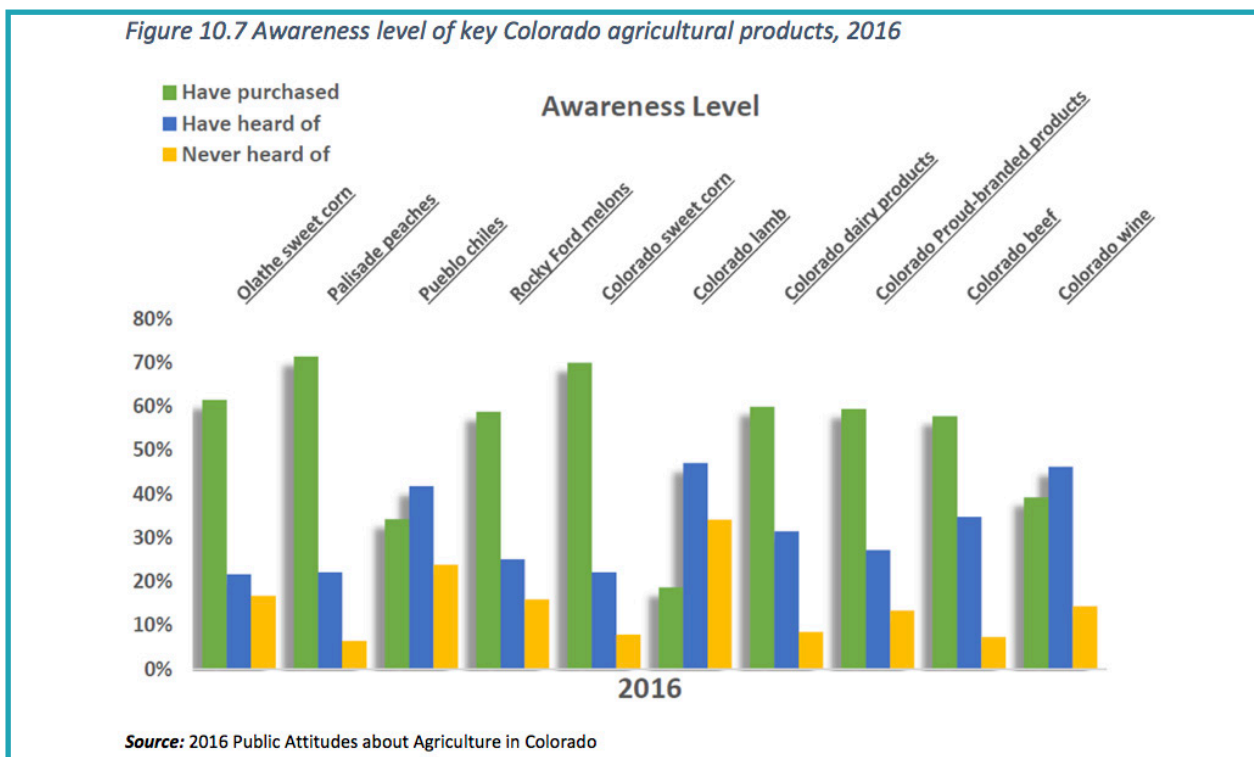
Many of the students who are involved in the state’s natural resource or recreational programs may have interest in agriculture. Opportunities exist to leverage these ongoing programs to introduce participants to agriculture, rural development, and the food system. For example, students working with the Conservation Core focused on a natural resource project experienced and recognized the value of their work to agricultural practices. This type of exposure may nurture greater interest in working on a farm. Likewise, workforce programs for veterans as well as for inmates in correctional facilities are starting to integrate greenhouse production. Understanding if these nontraditional workforce programs result in on-going agricultural careers is important moving forward.

Action items include:

- Develop projects and programs that would introduce those with only minimal background in agriculture, but with allied interests, to career opportunities in agriculture and food systems.
- Assess how ongoing correction facilities vocational programs (including those in Pueblo, the North east, and Canon City) have met current labor needs, and prepared those released from facilities to have career opportunities in the agricultural and food sectors.
- Support additional career guidance and technical assistance to access available federal educational resources and workforce training opportunities for veterans in the agricultural and food sectors.

10.3 PROMOTE THE COLORADO BRAND, ENSURING IT REFLECTS THE UNIQUE QUALITIES OF THE AGRICULTURE AND FOOD SECTORS

The Colorado brand is strong. The Colorado flag, for example, is ubiquitous. The Colorado tourism office reported that in 2015, for the fifth year in a row, Colorado broke its previous record for number of tourists – 77.7 million visitors to the state. However, awareness and purchasing of Colorado agricultural products among tourists and residents vary. Figure 6 presents results from the Colorado Public Attitudes Survey, showing that awareness level and purchasing of key agricultural products varies by product. For example, over 70% of respondents reported purchasing Palisade peaches compared to only about 20% purchasing Colorado lamb.



Under the umbrella of promoting the CO brand and ensuring it reflects the unique qualities of the agriculture, food and beverage sectors, three key areas of opportunity were identified through the regional townhalls: 1) promote Colorado food and agricultural businesses through developing market opportunities; 2) better position Colorado agricultural and food firms to exploit changing consumer and market trends; and, 3) support enhanced consumer education around the CO brand.

10.3.1 PROMOTE COLORADO FOOD AND AG BUSINESSES THROUGH DEVELOPING MARKET OPPORTUNITIES

Many opportunities exist to better unite the state's rural, agricultural regions with the majority of the state's inhabitants who mostly reside along the urban Front Range through developing market opportunities. These market opportunities can be located in urban places, or involve promoting agritourism and other occasions for urban inhabitants to travel to rural regions (see Figure 7). There are many benefits to agricultural and value added businesses associated with agritourism, for example, 1) consumers are often willing to pay a premium for items purchased at the farm or at a food/agricultural festival compared to in a retail grocery store, and producers generally receive a larger share of the retail dollar at these venues, 2) urban consumers learn more about rural regions and agriculture through these visits, and there is evidence that this may make them more willing to support agricultural and broader rural issues in the future, and 3) urban consumers may be more likely to purchase these Colorado branded food and agricultural products at urban retail stores in the future.

Action items include:

- Promote regional food festivals through regional and statewide tourism offices throughout the state, nationally, and internationally, including a matching grant program for destination development
- Invest in targeted agritourism promotion to outdoor recreation tourists, second home owners and retirees, and those interested in the heritage of Colorado as a promotional and educational tool.
- Support and enhance buyer-grower roundtables, as well as food and agricultural trade shows across the state, especially for retailers interested in promoting and featuring Colorado branded products through visible, year-round retail displays

Figure 10.8 Examples of agritourism promotion efforts in Colorado's agricultural regions



10.3.2 BETTER POSITION COLORADO AGRICULTURAL AND FOOD FIRMS TO EXPLOIT CHANGING CONSUMER AND MARKET TRENDS

There is strong evidence of growing consumer demand for products that are differentiated in the market place. Product differentiation can make a product more attractive to a particular market, differentiates it from its competitors, and can result in a premium price. For example, organically produced goods continue to show double-digit growth and are now available in nearly 20,000 food stores, including 3 of 4 conventional grocery stores. In fact, in 2014, Colorado was one of the top states in organic sales, with \$147 million. Similarly, global sales of gluten-free food increased 12.6 percent in 2016 to \$3.5 billion. Colorado is the largest grower of millet in the U.S. (a gluten free food), annually producing half of all the millet. However, much of Colorado's millet is not currently grown for human consumption (a higher value market), representing an opportunity to increase awareness among producers of changing consumers demand and connecting retailers with producers.

Action items include:

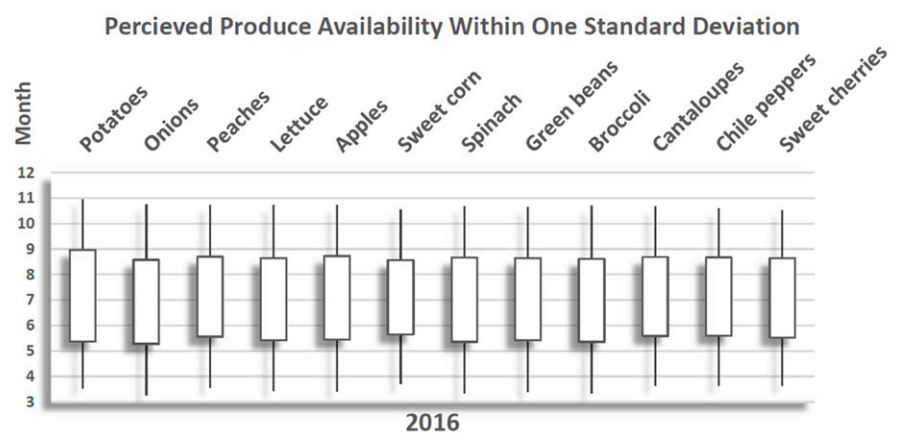
- Investigate the potential of a transparent, strong, and clear brand/message for CO grown and processed products.
- Create business development programming to support enhanced opportunities for product differentiation where consumer demand exists, including new crops and cultivars, value added products, and new labeling.
- Explore how school and institutional buyer procurement policies, nutrition standards, and propensity to buy raw goods may support or deter local sourcing.
- Continue support for joint marketing and promotion programs within and across commodity groups, including CO Proud as a flagship brand.

10.3.3 SUPPORT ENHANCED CONSUMER EDUCATION AROUND THE COLORADO BRAND

Increasing consumer awareness of Colorado's grown, raised and processed products has the potential to bolster financial and political support for the state's agricultural and food sectors. For example, a transparent and strongly linked agricultural and food sector can help consumers better understand areas that are intensively used for agriculture. As an example, Weld County is the fastest growing county in the state, but also the top agricultural county by sales. People may want to move to Weld County given its beautiful viewsapes and proximity to employment along the Front Range, but they may also be frustrated by the noise and smells that reflect normal agricultural activity. Consumer education can help to mitigate potential conflicts.

Further, enhanced consumer education around the Colorado brand may increase sales of locally-branded products to tourists and residents at restaurants, road side stands, and farmers markets. For example, tourists may be excited to try, and be willing to pay a premium for Colorado beef while visiting a ski resort if proper education ensues. Further, responses from the Colorado Public Attitudes Survey regarding consumer knowledge of typical season for availability of fresh produce indicates a lack of awareness among Coloradans (see Figure 10.9). Enhanced

Figure 10.9 Perceived produce availability within one standard deviation



Source: 2016 Public Attitudes about Agriculture in Colorado

consumer education may help to create excitement, and willingness to pay, for Colorado grown products when in season, as well as create increased interest in cooking among consumers.

Action Items include:

- Continue promoting CO Proud as a means to educate consumers about Colorado grown and raised products.
- Find opportunities to educate and integrate chefs into local sourcing given that Chefs are trusted influencers for a segment of food buyers.
- Begin consumer education early through curriculum that leverages farm to school, as well as school and community garden programs targeted towards youth and families.
- Integrate cooking education programming with food access programming, including Double Up Food Bucks and Farm to School programs to meet both food security and economic development goals.

10.4 SUPPORT A BUSINESS- AND CONSUMER-FRIENDLY REGULATORY ENVIRONMENT

Regulations and the regulatory environment continue to be a hot topic among agricultural and food system businesses. Many businesses have long complained about government regulations and how they restrict production, innovation, profits, and growth. Yet, some of these regulations can serve to protect Colorado consumers and the businesses themselves. Regulation should serve to support a safe agricultural and food system, without being overly burdensome for the food and agricultural businesses in the state. Win/win solutions happen at the intersection of agriculture, community, and government.

Under the umbrella of supporting a business and consumer friendly regulatory environment, three key areas of opportunity were identified through the regional townhalls: 1) work to ensure the regulatory environment is fair and effective in meeting its goals; 2) support state level initiatives that leverage Federal programs and resources; and, 3) develop and refine policies that incentivize innovations along the food supply chain.

10.4.1 WORK TO ENSURE THE REGULATORY ENVIRONMENT IS FAIR AND EFFECTIVE IN MEETING ITS GOALS

The goals of regulation often focus on protecting consumers and communities. Accordingly, it is important to ensure that regulations are meeting their goals in a manner that is fair to producers and not overly burdensome. Regulation often does not adapt at the pace of market changes, and better mechanisms are needed to ensure that regulators understand new, pressing concerns that are impeding innovation.

Action Items include:

- Assess how food safety requirements, environmental protection, zoning, and labor regulations affect the competitiveness and ability to innovate among farmers, food processors, restaurants, food banks, direct markets and retailers.
- Disallow or discourage non-compete clauses for retail food establishments, particularly in rural areas, to protect market access in less densely populated or underserved areas.
- Continue to provide training and technical assistance to alleviate the burden of regulatory compliance for young, beginning, and small entrepreneurial farmers, ranchers, and food businesses.

10.4.2 SUPPORT STATE LEVEL INITIATIVES THAT LEVERAGE FEDERAL PROGRAMS AND RESOURCES

Significant support programs exist at the Federal level to enhance the agricultural and food sector, support rural development, and improve access to healthy foods. Yet, there is more that can be done to ensure Colorado is taking advantage of these Federal programs to mitigate risk, support entrepreneurs, and provide safety nets for those who are hungry. As an example of the types of programs available, in 2016, the

U.S. Department of Agriculture's Rural Development Agency awarded 1,515 grants and loans to the state for \$747,403,624 (between 2009 and 2016 there were 14,635 grants and loans awarded to the state for \$5,255,189,992). One of the programs that four producers took advantage of in 2016 is the Value Added Producer Grant. Through this program, The American Grassfed Association received funding to develop a marketing plan and branding recognition for the group's 400 members that provide grass fed beef to the market. However, with 325 projects awarded throughout the U.S. in 2016, Colorado is not capturing its fair share of this funding (see: https://www.rd.usda.gov/files/RD_VAPG2016Chart.pdf). As another example where Colorado is not taking full advantage of Federal funding opportunities, Colorado is 45th in the nation for access to food stamps, and falls well below the national average of 74% for state enrollment (Colorado is at 59% enrollment). According to Hunger Free Colorado, 2 in 5 (41%) of those eligible for food stamps are not taking advantage of the program (see Figure 9). Colorado also ranks in the bottom ten states for eligible enrollment in the Women Infants and Children Program (WIC), and the number of eligible schools participating in the Community Eligible Provision that provides eligible schools free lunch to the entire student body.

Figure 10.10 Food Stamp Impact Reports and the Enrollment Gap



Source: Hunger Free Colorado. <https://www.hungerfreecolorado.org/impact-reports/>

Action Items include:

- Improve enrollment of eligible Coloradans in federal nutrition assistance programs.
- Simplify the application for SNAP, WIC, and other food assistance programs for retailers and provide more counseling and education to help with the burden of the application. This could include expanding Hunger Free Colorado's program in this area.
- Invest in a statewide center for beginning farmer and rancher development and a one-stop shop for Federal and State resources geared towards the next generation of producers.
- Improve awareness of federal grant, loan and technical assistance programs that could manage risk, share costs and bolster support for the state's food and agricultural sector, including rural infrastructure.
- Advocate for standardized best practices throughout the state to ensure that business processes and access to support programs is uniform regardless of the county in which an eligible participant applies.
- Use the CO Food Policy Network (COFPN) and local government partners to develop and facilitate healthy markets and retailers in communities that can and do accept SNAP, WIC, and Double Up Food Bucks, tracking locally-grown and processed products in the state via new metrics, and pursuing strat

egies that jointly consider economic development and health outcomes.

- Engage government in addressing enrollment gap for food assistance including reviewing opportunities to adopt state options that expand eligibility to more Coloradans and reduce the risk-reward gap for applying and enrolling in support programs.
- Create public will for change among nonprofits, public officials, and academic partners in by leveraging work from the Colorado Health Foundation's existing statewide task force, and advocate for clear measurable objectives and outcomes.
- Encourage community partners to amplify messaging regarding eligibility criteria and enrollment process so that organizations across the state can help publicize and navigate nutrition programs for eligible Coloradans experiencing hunger.
- Support the clear goals and measurable outcomes of the emerging Blueprint to End Hunger in Colorado that will address the enrollment gap in programs such as SNAP and WIC.
- Raise awareness amongst farmers and ranchers, as well as all scales of retailers about the economic benefits to the state of having higher participation in Federal food programs such as SNAP.

10.4.3 DEVELOP AND REFINE POLICIES THAT INCENTIVIZE INNOVATIONS ALONG THE VALUE CHAIN

Economic growth depends on technological progress. The public sector has long supported and subsidized research and development to support technological innovations. For these incentives to work, however, programs and policies need not just spur demonstration projects, but those innovations that can be used at scale. Further, some of these innovations will need to support rural communities in which many of the raw inputs for the food supply chain are produced. So, policies that encourage entrepreneurs and the next generation of agriculture to live and work in rural communities are important.

Action Items include:

- Develop competitive funding programs and prizes that help to spur research and the creation of food and ag products for widespread use.
- Create a mini-grant program housed in DOLA, OEDIT, and/or CDA to incentivize municipalities to integrate agriculture and food into their local land use plans, building upon existing community assets.
- Assess the potential for educational loan forgiveness for targeted employment needs in rural areas, similar to recent support for rural veterinarians. Targeted areas could be based on persistent poverty, declining populations, or high cost of living in adjacent amenity-rich areas.
- Continue programs that offer tax incentives for land owners leasing to new/beginning farmers and ranchers, as well as loan repayment programs with favorable terms for producers.

10.5 ADDRESS HOW SCALE IMPACTS MARKET PERFORMANCE, ACCESS AND OPPORTUNITIES

Profitability generally increases with scale. Along the value chain, larger firms have increasing market power, particularly as supply chains become more vertically integrated and consolidated. However, small-scale firms play important roles in the food and agricultural sector. Perhaps most importantly, smaller scale operations can respond to changing consumer demand and innovate more quickly than can larger operations. Accordingly, it is not a surprise that big food companies spent billions of dollars acquiring smaller food companies in 2014 and 2015. Providing support for these smaller scale, and/or start-up businesses is an important component of ensuring vibrant food and agricultural sectors in the long run. And, it is not just support for the firm itself, but also appropriately-scaled market and supply-chain infrastructure.

Under the umbrella of addressing how scale impacts market performance, access and opportunities, two key areas of opportunity were identified through the regional townhalls: 1) provide technical assistance and business support services for all scales of agricultural and food firms; and, 2) ensure appropriately-scaled, economically-viable assets are in place to support all scales of agricultural and food firms.

10.5.1 PROVIDE TECHNICAL ASSISTANCE AND BUSINESS SUPPORT SERVICES FOR ALL SCALES OF AGRICULTURAL AND FOOD FIRMS

Technical assistance and business support services can equip aspiring and established entrepreneurs with the skills and tools necessary to run and grow small businesses. Small business owners wear many hats. Management generally includes marketing, financial, supply chain and human resources – and it is rare to find a single person who is adept and knowledgeable about each of these functions. Accordingly, until a business scales to a point at which they can hire additional people, technical assistance and business support services can help to provide temporary support and guidance in the decision-making process that can help position the business for long-term success.

Action Items include:

- Develop pitch competitions, mentorship opportunities, and co-working spaces for new food businesses such that they can take advantage of economies of agglomeration.
- Provide market research, outreach, and mentoring programs to improve the viability of farms and food businesses by scale, commodity, and market channel. This should include careful documentation of successes to promote best practices, successful business models and key benchmark metrics.
- Support succession planning both for farm families and veterans interested in taking over an existing farm or food business operation. This should include finding opportunities to build equity prior to taking over the operation.
- Deliver education and technical assistance programming for food safety training, risk management, taxes, human resources, and other paperwork to support smaller scale farms and ranches (example: replicate Kentucky's MarketReady Training).
- Continue to provide cottage food training for nascent food businesses, including continual evaluation of curriculum based on technological advances and changes in regulation, and integration of business planning principles.

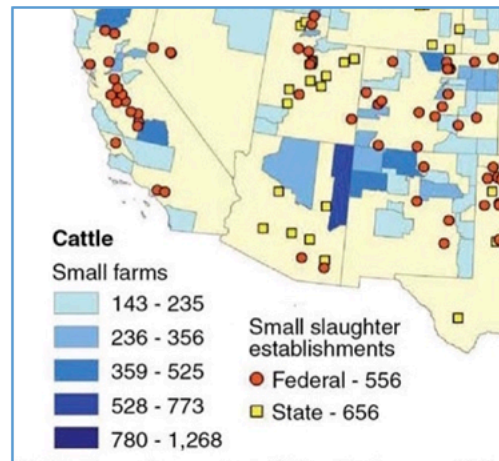
10.5.2 ENSURE APPROPRIATELY-SCALED, ECONOMICALLY-VIABLE ASSETS ARE IN PLACE TO SUPPORT ALL SCALES OF AGRICULTURAL AND FOOD FIRMS

Opportunities exist to support small and mid-scale farms, ranches, and food businesses through product differentiation. Farmers and ranchers, however, note that limited processing infrastructure restricts supply and sales. For small and mid-scale ranchers interested in selling their products via freezer trade, Community Supported Agriculture, farmers market, or other direct marketing arrangements the challenge is particularly acute (see Figure 10). Appropriately scaled processing facilities with the skills, inspection status, and reliability to prepare these products safely, legally, and to customer satisfaction is integral to the success of these operations.

Action items include:

- COFSAC should provide leadership on a white paper on the economics of small scale meat processing to distribute to communities. Almost every regional townhall discussed the need for additional small scale meat processing, but there may be opportunities to leverage existing processing infrastructure without additional capital investments.
- Support regional food testing and certification labs that provide food safety, quality assurance, and other key business services for all scales of food and ag businesses, including the beverage sector.
- Continue to support collaboration between CSU Quality Meats Lab, Extension, CSU Vet Med, CDA and others to encourage safe and economically-viable small-scale poultry processing regulation in the state.

Figure 10.11 Counties in western U.S. with no small scale slaughter establishments and yet a significant number of small cattle farms



Source: USDA, Food Safety and Inspection Service (FSIS). Farm size based on the 2007 Census of Agriculture conducted by USDA, National Agricultural Statistics Service. Slaughter establishment data are for 2010 from USDA/FSIS.

10.6 INNOVATE AND SUPPORT NEW TECHNOLOGY FOR AGRICULTURAL AND FOOD BUSINESSES

Colorado, with a booming tech industry – including being third in the nation for high tech workers, has a key opportunity to marry technological with food and agricultural innovation. Big data apps can allow consumers to make more informed choices at the grocery store about how their food is produced, technological innovations in distribution can support food delivery by drone, sensors can help farms to target water usage, and crowdfunding platforms can help new businesses access capital. And, there are already several areas where this is happening. Naturally Boulder, for example, brings together entrepreneurs with investors through mentorship programs, pitch slams, networking nights, and educational seminars.

Under the umbrella of innovating and supporting new technology for food and agricultural businesses, three key areas of opportunity were identified through the regional townhalls: 1) nurture an environment where Colorado is a leader in several subsectors of agricultural technology; 2) enhance education, outreach, and networking to the investor community so that they better understand opportunities to provide capital in the agricultural innovation space; and 3) support curriculum, youth and workforce development programs that provide the skills and experiential learning for the jobs that will be available in both the entrepreneurial and high tech sectors of food and agriculture.

10.6.1 NURTURE AN ENVIRONMENT WHERE COLORADO IS A LEADER IN SEVERAL SUBSECTORS OF AGRICULTURAL TECHNOLOGY

Napa Valley, CA, is known for its wine, Hartford, CT, for its insurance, Las Vegas, NV, for its casinos – all of which are examples of industry clusters. Industry clusters are regional concentrations of related industries. By locating in proximity to each other they can take advantage of a trained workforce, access to shareable inputs, and educational opportunities, which improves regional competitiveness and opportunities for economic development. In Colorado, there are several agricultural subsectors where continued support and investment could boost its cluster and regional dominance, these include: water technology, animal health, alternative energy, beverage industry, wheat breeding, beef seed stock, humane animal handling processes, healthy and natural food products, and fast casual restaurant concepts. Through nurturing an environment in which Colorado continues to invest in its strengths, the state can become an unparalleled leader in many of these critical areas.

Action Items include:

- Create financing and incentive programs at the local and state levels to nurture regional industry clusters in a variety of sectors.
- Document available infrastructure (for example, co-packers or sensory labs) that might provide shared access to entrepreneurs during their start up phases.

10.6.2 ENHANCE EDUCATION, OUTREACH AND NETWORKING TO INVESTOR COMMUNITY SO THAT THEY UNDERSTAND OPPORTUNITIES TO PROVIDE CAPITAL IN THE AGRICULTURAL INNOVATION SPACE

Money flowing to food start-ups in Boulder County is third only to two other regions of the US: New York and Silicon Valley. Interestingly, whereas the financial investments in New York and Silicon Valley have gone to just a handful of companies, in Boulder, the money is more widely spread across dozens of companies. This precedent, and the networks already established, provide an opportunity to attract more investment/investors. And, the investor community is not just limited to private individual and firms. The Federal government, for example, is investing in hoop houses through the Natural Resource Conservation District to meet shared goals. Similarly, the Kitchen Community (its CEO and co-founder is Kimbal Musk) is investing in school gardens in the hopes of catalyzing long-term change including interest in food and agriculture among schoolchildren.

Action Items include:

- Replicate investor network, including educational and outreach opportunities in two other locations throughout the State.
- Provide statewide matching grant program (through OEDIT) to leverage investment in key food and agricultural sectors, particularly for startups.

10.6.3 SUPPORT CURRICULUM, YOUTH AND WORKFORCE DEVELOPMENT PROGRAMS THAT PROVIDE THE SKILLS AND EXPERIENTIAL LEARNING FOR THE JOBS THAT WILL BE AVAILABLE IN BOTH THE ENTREPRENEURIAL AND HIGH TECH SECTORS OF FOOD AND AGRICULTURE

To excite youth about careers in agriculture and the food system, opportunities exist to more fully integrate STEM and tech training into all aspects of 4-H and FFA curriculum. Through experiential learning – hands-on activities and projects in the field – youth may gain appreciation for the ways in which technology is integrated into all aspects of agriculture and the food system. Ongoing activities in 4-H include environmental science and alternative energy, engineering and technology, and plant and animal science. Further, Colorado can leverage its well established tech industry to support skill development for youth working with 4-H and FFA. Google, for example, is already partnering with the National 4-H Council to support computer science, computational thinking, communication, and collaboration to kids across the country.

Action items include:

- Support collaborations between 4H, FFA, and the tech industry to foster innovative curriculum development in ag tech that reflect where careers in this sector will be in high demand.
- Emphasize that the use of technology in agricultural 4H and FFA curriculum, as technological innovation may be more likely to retain youth. Opportunities exist to jointly honor Colorado's traditional primary agriculture industries, while understanding new sectoral career opportunities and entrepreneurial business models.

10.7 IMPROVE ACCESS TO RESOURCES AND CAPITAL FOR AGRICULTURAL AND FOOD FIRMS

Access to capital – including financial capital and natural capital (land and water) – can be difficult for young, beginning, and small farmers and ranchers, as well as new, entrepreneurial start up food businesses. Yet, access to capital in order to finance a new start-up, expand, purchase land or equipment, or build inventories to support a market expansion are all critical to enabling long-term business success.

Under the umbrella of improving access to capital for agriculture and food firms, two key areas of opportunity were identified through the regional townhalls: 1) facilitate relationships between young, beginning, small and veteran farmers and ranchers and lending institutions with Young, Beginning, Small (YBS) farmer and rancher programs and/or nontraditional fundraising; and, 2) support innovative ways to provide access to natural capital (land and water) for YBS farmers and ranchers.

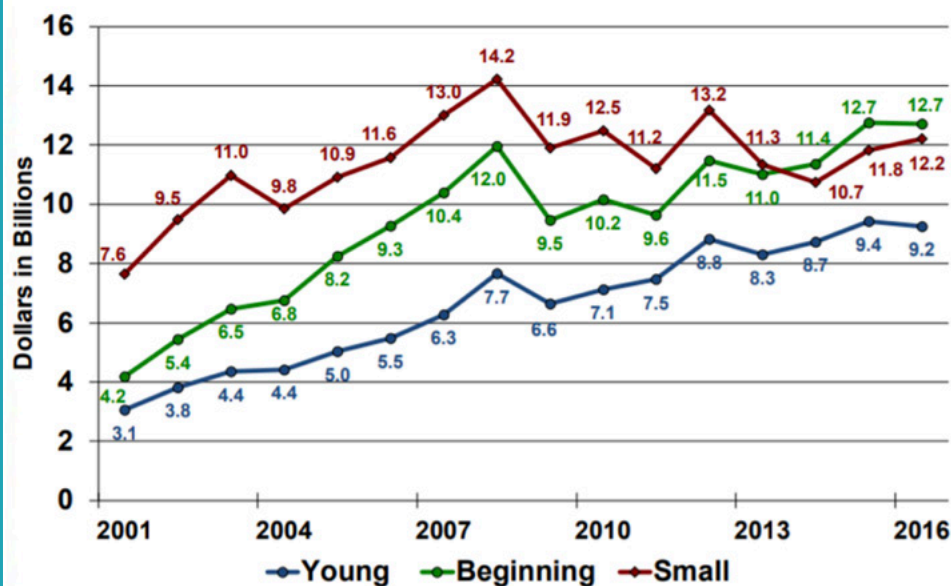
10.7.1 FACILITATE RELATIONSHIPS BETWEEN YOUNG, BEGINNING, SMALL (YBS) AND VETERAN FARMERS AND RANCHERS AND LENDING INSTITUTIONS WITH YBS PROGRAMS AND/OR NONTRADITIONAL FUNDRAISING

Access to credit for farmers and ranchers is often a scale issue. Smaller scale, beginning farmers and ranchers often have more difficulty accessing traditional credit compared to larger operations with more capital assets to use as collateral. Congress has mandated that the Farm Credit system serve the credit needs of all farmers and ranchers, including those classified as young, beginning, and small (YBS), believing that the diversity of agricultural products produced in the U.S. depends in part on the financial success of this segment of agriculture. Accordingly, Farm Credit system members are now required to report on YBS data lending annually (see Figure 11). The Farm Credit system also has specific tools to facilitate this lending including guarantees, reduced rates, and customized standards that can be used to extend credit to YBS producers. However, many future farmers and ranchers, particularly those that did not grow up in and around agriculture, may not be aware of these opportunities. For example, Colorado has a Veterans to Farmers program that was started in 2011 and trains military veterans in organic and hydroponic production. Most of these veterans have no previous agricultural experience, and little exposure to their unique opportunities for securing debt financing. In addition to increasing educational opportunities about traditional lending, exposing YBS and veteran farmers to nontraditional fundraising may be important. These might include gifts from individuals, crowdfunding, community-supported models, federal grant and loan programs, individual and angel investors, and foundations or philanthropic organizations.

Action items include:

- Educate farmers and ranchers about loan programs geared to small-scale farmers and ranchers.
- Provide resources to agricultural lenders so that they better understand realistic price premiums associated with non-commodity markets, as well as enterprise budgets, which

Figure 10.12 . New Loan Volume to Young, Beginning, and Small farms, reported by the Farm Credit Administration, 2001-2016



Source: Annual Young, Beginning, and Small Farmer Reports submitted by each System lender through the District Banks

can support sound lending decisions for YBS farmers and ranchers. This likely includes continuing CSU Extension and CDA's price reporting program for local food markets.

- Track farms and ranches using new insurance products to understand the financial implications of these products and producer investments and provide information to loan officers.
- Showcase successful YBS-lender relationships at annual meetings of agricultural commodity groups.
- Encourage statewide loan officers to attend Farm Credit's YBS loan officer convenings.
- Embed educational opportunities about nontraditional fundraising into beginning farmer and rancher programming.

10.7.2 CREATE MORE TRANSPARENT AND FLEXIBLE FUNDING/FINANCING MODELS TO SUPPORT NEW AND EMERGING BUSINESS VENTURES ALONG THE FOOD SUPPLY CHAIN

In addition to needing funding models to support small and midscale, young and beginning, and veteran farmers and ranchers, innovative funding and financing models are needed to support food supply chain businesses along the supply chain. Luckily, Colorado has several successful models that could be enhanced and scaled up. For example, the Colorado Fresh Food Financing Fund, with seed funding from the Colorado Health Foundation, partners with the Colorado enterprise Fund to finance small and innovative fresh food concepts. These partners work to finance grocery stores and other forms of healthy food retail in underserved communities. Other flexible funding or financing models include Slow Money and angel investor networks.

Action items include:

- Develop list of food business funding resources that could support emerging Colorado-based food businesses (expanding upon: http://www.canr.msu.edu/foodsystems/uploads/files/food_business_funding.pdf)
- Host networking opportunities and pitch competitions to facilitate relationships between small and emerging food businesses and potential funders and financiers.
- Promote 'preparing for financing' events for small and mid-scale entrepreneurs, similar to what is already offered by Naturally Boulder (see: <https://www.naturallyboulder.org/resource/preparing-for-financing/>)
- Expand investment efforts and increase availability of flexible funding and financing of agriculture and fresh retail options, particularly in rural and underserved communities.

10.7.3 CONSERVE, INVEST IN AND PROVIDE ACCESS TO NATURAL CAPITAL (LAND AND WATER) FOR YBS FARMERS AND RANCHER

According to the U.S. Department of Agriculture's National Agricultural Statistics Service, the average value per acre of farm real estate increased by 6.7% in Colorado from 2014-2015, compared to an average in the Mountain region of 2.8%. And, according to the American Farmland Trust, Colorado is losing more than 75 acres of farmland per day. At the same time, approximately 35.9% of Colorado's land is Federally-owned, and substantially more is owned by state and local government, or private conservation entities such as the Nature Conservancy. Working to support enhanced access of these public and conserved resources to the next generation of farmers and ranchers can lower barriers to entry, and increase the likelihood of long-term viability.

Action items include:

- Work with local municipalities, nonprofits, and land conservation districts in places where there are large numbers of second homeowners or retirees to explore opportunities to better link YBS farms and ranches with access to potentially underutilized land and water resources.
- Improve communication among land trusts, and between land trusts and future farmers and ranchers.

- Investigate the potential for enhanced utilization of publicly owned land for active farming and ranching working lands, and just not just for open space, addressing multiple public issues and goals
- Explore and evaluate the viability of cooperative and innovative land ownership models (such as Poudre Valley Community Farms).
- Invest in soil, water saving, technology to preserve the integrity of Colorado's natural resource base.

10.8 INTEGRATE AGRICULTURE AND FOOD WITH HEALTHY, VIBRANT COMMUNITIES

The 2016 Public Attitudes Survey shows that almost all Coloradans believe that agriculture is moderately or very important to their quality of life (see Figure 7.12). Agriculture can contribute to environmental preservation, protection of public and animal health, economic development, and community building. Providing opportunities to support dialogue, transparency, and engagement throughout the food system can ensure that the various aspects of our complex, global food system are working to support local people, communities, and economies.

Under the umbrella of improving access to integrating agriculture and vibrant communities, three key areas of opportunity were identified through the regional townhalls: 1) research and refine how land conservation policies influence farm viability, water transfers, community development, and quality of life of Coloradans; 2) strengthen healthy food access for Colorado communities and households; and, 3) more strongly connect Colorado citizens with Colorado foods while also raising their awareness of its potential benefits to their health, economy, and community.

10.8.1 RESEARCH AND REFINE HOW LAND CONSERVATION POLICIES INFLUENCE FARM VIABILITY, WATER TRANSFERS, COMMUNITY DEVELOPMENT, AND QUALITY OF LIFE OF COLORADANS

Many communities and organizations are pursuing land conversation policies. Yet it is unclear how these programs impact farm and ranch profitability (or viability), water transfers, community development, or quality of life. More research and evaluation is needed in order to provide recommendations of how and where land and water should be conserved for agriculture; this is particularly important given the state's current growth rate (1.9% from 2015 to 2016), the fact that the state lost farms between 2007 and 2012 (37,054 to 36,180), and rates of agricultural land converted to development land (601,700 acres from 1982-2012).

Action items include:

- Explore how public attitudes about agriculture as a quality of life driver may also influence the appearance and passage of open space referendum, support for CO agricultural programs, and propensity to buy CO products.
- Identify where open space and other conservation efforts are innovating ways to retain and manage shared access to sufficient water for some working lands production.
- Inventory current conservation practices by land type and geographic location.
- Access and document where land is currently protected, or not.

10.8.2 IMPROVE ACCESS TO HEALTHY, AFFORDABLE FOOD FOR COLORADO FAMILIES WHO ARE LOW-INCOME

Many Coloradoans do not have access to healthy, affordable food. In 2015, the USDA reported that 12.1% of households in Colorado were food insecure, a condition where households lack access to sufficient food because of limited resources. The percentage of food insecurity is much higher for households with children: almost 20% of kids may not always know when or where they will get their next meal. Food insecurity is associated with poorer physical and mental health, higher healthcare costs and poorer educational outcomes. Strategies that increase affordability of nutritious food, increase access to food by increasing enrollment in

federal nutrition assistance programs and increase nutritious value of food in the emergency food system can economically benefit food producers and food retailers, and can improve the health and well-being of food insecure households in Colorado.

Action Items include:

- Conduct research and evaluation of current strategies to improve healthy food access (transport, financial incentives, food offerings, corner stores, mobile markets, rural grocers, community food cellar, prescription programs, mobile farmers markets) and refine programming based on results.
- Lower the barriers and provide incentives and technical assistance for a variety of markets to procure local products, accept food assistance programming, and participate in food recovery partnerships. Double Up SNAP has been effective, but the majority of markets still cannot accept food assistance.
- Reframe food recovery and food waste programs so that both economic development and food security goals are addressed.
- Assess and pilot food additional RX programs (a prescription program piloted on the West Slope), as well as double up buck program availability at rural markets to assess both whether participants are healthier and whether purchases made influence local direct markets.
- Coordinate food bank purchases from local sources, tax incentives to those who donate, and effective/efficient gleaning programs so as to increase healthy food access at food banks and pantries.
- Improve coordination and communication across key food system stakeholders in the state, particularly focused on economic development, food access, and healthy communities (environmental and public health). This can be done through working with philanthropic organizations to create a data base of programming and financing provide to farm and food based orgs (could be through Community Commons).
- Connect more retailers with food rescue and redistribution organizations through partnerships and policies that incentivize donations.

10.8.3 MORE STRONGLY CONNECT COLORADO CITIZENS WITH COLORADO FOODS WHILE ALSO RAISING THEIR AWARENESS OF ITS POTENTIAL BENEFITS TO THEIR HEALTH, ECONOMY, AND COMMUNITY

Opportunities exist to better link programming that supports healthy eating with Colorado grown and raised products. Fostering a deeper connection to the foods that households are purchasing and consuming can increase awareness and appreciation of how food are produced, and can make linkages to natural resources and broader community benefits. Coloradans shared interest in and support for agriculture as important to quality of life helps to bind the state around shared values, which may help to build long-term resiliency and trust.

Action items include:

- Continue to update value chain, Community Commons, and Blueprint studies, integrating staff and planning processes of state agencies, industry organization, nonprofits, and CSU so as to track progress on key metrics that Coloradans note are important to their quality of life.
- Support and expand programs that highlight the faces of Colorado agriculture to the general public, including Colorado Proud, CSU Ag day, programming at the National Western Centers, and programs that integrate healthy food with Colorado grown products such as Farm to School, Double Up Food Bucks, and Cooking Matters.
- Highlight unique food cultures, heritages, and regions that make up the Colorado agricultural and food landscape through strengthening rural-urban linkages.

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RESOURCES

11.1 LINKS IN THE VALUE CHAIN: DATA TABLE OF VALUE FLOWS ALL ALONG THE VALUE CHAIN

Description	NAICS code	Revenues (millions)	Payroll Earnings (millions)	Data source
AGRICULTURAL PRODUCTION				
33 Corn sold		\$ 496	na	USDA Value Added
34 Hay sold		\$ 292	na	USDA Value Added
35 Other feed crops sold		\$ 128	na	USDA Value Added
36 Wheat sold		\$ 294	na	USDA Value Added
37 Oil crops sold		\$ 18	na	USDA Value Added
38 Potatoes sold		\$ 175	na	USDA Value Added
39 Other vegetable crops sold		\$ 71	na	USDA Value Added
40 Fruit crops sold		\$ 27	na	USDA Value Added
41 Sugar beets sold		\$ 46	na	USDA Value Added
42 Greenhouse / nursery crops sold		\$ 300	na	USDA Value Added
43 Forest products sold		\$ 5	na	USDA Value Added
44 Beef cattle marketings		\$ 3,100	na	USDA Value Added
45 Beef cattle production		\$ 1,900	na	USDA Value Added
46 Dairy production		\$ 655	na	USDA Value Added
47 Hog production		\$ 182	na	USDA Value Added
48 Other animal products		\$ 128	na	USDA Value Added
49 Eggs, chickens, turkeys		\$ 101	na	USDA Value Added
50 Equine sales		\$ 32	na	USDA Value Added
51 Trout aquaculture		\$ 2	na	USDA Value Added
52 Honeybees and honey		\$ 3	na	USDA Value Added
53 Machine hire and custom work		\$ 78	na	USDA Value Added
54 Agritourism		\$ 28	na	Van Sandt, CSU
55 Government payments		\$ 234	na	USDA Value Added
56 Crop insurance indemnities		\$ 106	na	USDA RMS
57 Value of home consumption		\$ 16	na	USDA Value Added
58 Imputed rental value of farm dwellings		\$ 321	na	USDA Value Added
TOTAL AGRICULTURAL PRODUCTION		\$ 6,838		

Description		NAICS code	Revenues (millions)	Payroll Earnings (millions)	Data source
AGRICULTURAL INPUTS (Capital and variable inputs)					
1	Farm labor expenses		\$ 542	\$ 542	USDA Value Added
2	Farm net rent expenditures to non-operator landlords		\$ 96		USDA Value Added
3	Grazing on public lands		\$ 2		USDA Value Added
4	Irrigation expenditures		\$ 53		USDA Value Added
5	Interest payments		\$ 307		USDA Value Added
6	Purchased seed		\$ 195		USDA Value Added
7	Purchased feed		\$ 1,160		USDA Value Added
8	Purchased animals		\$ 1,120		USDA Value Added
9	Fertilizer purchases		\$ 241		USDA Value Added
10	Pest control purchases		\$ 169		USDA Value Added
11	Fuel and oil products		\$ 198		USDA Value Added
12	Electricity		\$ 105		USDA Value Added
13	Water Supply and Irrigation Systems	221310	\$ 129	\$ 64	EMSI
14	Farm Machinery and Equipment Manufacturing	333111	\$ 126	\$ 25	EMSI
15	Lawn and Garden Tractor and Equipment Manufacturing	333112	\$ 108	\$ 12	EMSI
16	Farm and Garden Machinery and Equipment Merchant Wholesalers	423820	\$ 334	\$ 124	EMSI
17	Other Chemical and Fertilizer Mineral Mining	212393	\$ 8	\$ 3	EMSI
18	Nitrogenous Fertilizer Manufacturing	325311	\$ 18	\$ 2	EMSI
19	Phosphatic Fertilizer Manufacturing	325312	\$ 8	\$ 1	EMSI
20	Fertilizer (Mixing Only) Manufacturing	325314	\$ 142	\$ 15	EMSI
21	Pesticide and Other Agricultural Chemical Manufacturing	325320	\$ 13	\$ 2	EMSI
22	Farm Supplies Merchant Wholesalers	424910	\$ 624	\$ 232	EMSI
23	On farm repair and maintenance services		\$ 256	na	USDA Value Added
24	Farm marketing storage and transportation		\$ 183	na	USDA Value Added
25	Machine hire and custom work		\$ 67	na	USDA Value Added
26	Contract labor		\$ 75	na	USDA Value Added
27	Public servcies (county and state taxes and fees)		\$ 148	na	USDA Value Added
28	Motor vehicle registration fees		\$ 15	na	USDA Value Added
29	Misc business expenses		\$ 709	na	USDA Value Added
30	Crop insurance premium		\$ 69	na	USDA RMA
31	Health insurance premium		\$ 134	na	USDA ERS
32	Out of pocket health care expenses		\$ 82	na	USDA ERS
TOTAL AGRICULTURAL INPUTS			\$ 6,338		

Description		NAICS code	Revenues (millions)	Payroll Earnings (millions)	Data source
COMMODITY MARKETING, PROCESSING, FOOD AND BEVERAGE MANUFACTURING					
59	Grain and Field Bean Merchant Wholesalers	424510	\$ 132	\$ 49	EMSI
60	Livestock Merchant Wholesalers	424520	\$ 35	\$ 13	EMSI
61	Other Farm Product Raw Material Merchant Wholesalers	424590	\$ 31	\$ 12	EMSI
62	Farm Product Warehousing and Storage	493130	\$ 17	\$ 9	EMSI
63	Flour Milling	311211	\$ 239	\$ 19	EMSI
64	Malt Manufacturing	311213	\$ 8	\$ 1	EMSI
65	Fats and Oils Refining and Blending	311225	\$ 96	\$ 2	EMSI
66	Dog and Cat Food Manufacturing	311111	\$ 569	\$ 53	EMSI
67	Other Animal Food Manufacturing	311119	\$ 592	\$ 44	EMSI
68	Ethyl Alcohol Manufacturing	325193	\$ 141	\$ 8	EMSI
69	Beet Sugar Manufacturing	311313	\$ 81	\$ 12	EMSI
70	Sawmills	321113	\$ 80	\$ 14	EMSI
71	Animal (except Poultry) Slaughtering	311611	\$ 2,647	\$ 286	EMSI
72	Meat Processed from Carcasses	311612	\$ 674	\$ 71	EMSI
73	Rendering and Meat Byproduct Processing	311613	\$ 9	\$ 1	EMSI
74	Poultry Processing	311615	\$ 30	\$ 5	EMSI
75	Seafood Product Preparation and Packaging	311710	\$ 12	\$ 2	EMSI
76	Leather and Hide Tanning and Finishing	316110	\$ 13	\$ 2	EMSI
77	Fluid Milk Manufacturing	311511	\$ 691	\$ 72	EMSI
78	Creamery Butter Manufacturing	311512			EMSI
79	Cheese Manufacturing	311513	\$ 1,923	\$ 120	EMSI
80	Dry, Condensed, and Evaporated Dairy Product Manufacturing	311514	\$ 0		EMSI
81	Ice Cream and Frozen Dessert Manufacturing	311520	\$ 110	\$ 14	EMSI
82	Frozen Specialty Food Manufacturing	311412	\$ 190	\$ 29	EMSI
83	Fruit and Vegetable Canning	311421	\$ 74	\$ 10	EMSI

84	Specialty Canning	311422	\$	9	\$	1	EMSI
85	Dried and Dehydrated Food Manufacturing	311423	\$	42	\$	6	EMSI
86	Breakfast Cereal Manufacturing	311230	\$	90	\$	11	EMSI
87	Nonchocolate Confectionery Manufacturing	311340	\$	88	\$	13	EMSI
88	Chocolate and Confectionery Manufacturing from Cacao Beans	311351	\$	11	\$	2	EMSI
89	Confectionery Manufacturing from Purchased Chocolate	311352	\$	325	\$	46	EMSI
90	Retail Bakeries	311811	\$	174	\$	45	EMSI
91	Commercial Bakeries	311812	\$	489	\$	126	EMSI
92	Frozen Cakes, Pies, and Other Pastries Manufacturing	311813	\$	88	\$	23	EMSI
93	Cookie and Cracker Manufacturing	311821	\$	7	\$	1	EMSI
94	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	311824	\$	200	\$	31	EMSI
95	Tortilla Manufacturing	311830	\$	167	\$	27	EMSI
96	Roasted Nuts and Peanut Butter Manufacturing	311911	\$	154	\$	16	EMSI
97	Other Snack Food Manufacturing	311919	\$	371	\$	38	EMSI
98	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	311941	\$	112	\$	18	EMSI
99	Spice and Extract Manufacturing	311942	\$	85	\$	14	EMSI
100	Perishable Prepared Food Manufacturing	311991	\$	457	\$	74	EMSI
101	All Other Miscellaneous Food Manufacturing	311999	\$	60	\$	10	EMSI
102	Soft Drink Manufacturing	312111	\$	724	\$	102	EMSI
103	Bottled Water Manufacturing	312112	\$	156	\$	22	EMSI
104	Ice Manufacturing	312113	\$	46	\$	6	EMSI
105	Coffee and Tea Manufacturing	311920	\$	334	\$	40	EMSI
106	Breweries	312120	\$	3,874	\$	420	EMSI
107	Wineries	312130	\$	75	\$	14	EMSI
108	Distilleries	312140	\$	235	\$	17	EMSI
TOTAL PROCESSING/MANUFACTURING			\$ 16,768				

Description		NAICS code	Revenues (millions)	Payroll Earnings (millions)	Data source
WHOLESALE					
109	General Line Grocery Merchant Wholesalers	424410	\$ 877	\$ 327	EMSI
110	Packaged Frozen Food Merchant Wholesalers	424420	\$ 155	\$ 58	EMSI
111	Dairy Product (except Dried or Canned) Merchant Wholesalers	424430	\$ 72	\$ 27	EMSI
112	Poultry and Poultry Product Merchant Wholesalers	424440	\$ 48	\$ 18	EMSI
113	Confectionery Merchant Wholesalers	424450	\$ 244	\$ 91	EMSI
114	Fish and Seafood Merchant Wholesalers	424460	\$ 33	\$ 12	EMSI
115	Meat and Meat Product Merchant Wholesalers	424470	\$ 160	\$ 60	EMSI
116	Fresh Fruit and Vegetable Merchant Wholesalers	424480	\$ 215	\$ 80	EMSI
117	Other Grocery and Related Products Merchant Wholesalers	424490	\$ 749	\$ 279	EMSI
118	Beer and Ale Merchant Wholesalers	424810	\$ 293	\$ 109	EMSI
119	Wine and Distilled Alcoholic Beverage Merchant Wholesalers	424820	\$ 540	\$ 202	EMSI
120	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers	424930	\$ 99	\$ 37	EMSI
121	Tobacco and Tobacco Product Merchant Wholesalers	424940	\$ 93	\$ 35	EMSI
122	Refrigerated Warehousing and Storage	493120	\$ 76	\$ 41	EMSI
TOTAL WHOLESALE			\$ 3,654		

Description		NAICS code	Revenues (millions)	Payroll Earnings (millions)	Data source
RETAIL					
123	Supermarkets and Other Grocery (except Convenience) Stores	445110	\$ 3,470	\$ 2,776	EMSI
124	Warehouse Clubs and Supercenters	452311	\$ 2,345	\$ 1,173	EMSI
125	Convenience Stores	445120	\$ 85	\$ 68	EMSI
126	Gasoline Stations with Convenience Stores	447110	\$ 851	\$ 426	EMSI
127	Specialty Food Stores	445200	\$ 265	\$ 265	EMSI
128	Food (Health) Supplement Stores	446191	\$ 210	\$ 210	EMSI
	(adjustment to EMSI estimates)		\$ 6,071		
	<i>Estimated total at-home food expenditures</i>		\$ 13,297		USDA
129	Full-Service Restaurants	722511	\$ 7,202	\$ 2,868	EMSI
130	Limited-Service Restaurants	722513	\$ 5,604	\$ 1,487	EMSI
131	Cafeterias, Grill Buffets, and Buffets	722514	\$ 55	\$ 35	EMSI
132	Snack and Nonalcoholic Beverage Bars	722515	\$ 405	\$ 256	EMSI
133	Food Service Contractors	722310	\$ 342	\$ 216	EMSI
134	Caterers	722320	\$ 250	\$ 159	EMSI
135	Mobile Food Services	722330	\$ 84	\$ 53	EMSI
136	Vending Machine Operators	454210	\$ 58	\$ 21	EMSI
137	Community Food Services	624210	\$ 39	\$ 30	EMSI
	(adjustment to EMSI estimates)		\$ (326)		
	<i>Estimated total away-from-home food expenditures</i>		\$ 13,713		USDA
138	Beer, Wine, and Liquor Stores	445310	\$ 500	\$ 214	EMSI
	(adjustment to EMSI estimates)		\$ 1,133		
	<i>Estimated total at-home alcoholic beverage expenditures</i>		\$ 1,633		USDA
139	Drinking Places (Alcoholic Beverages)	722410	\$ 328	\$ 208	EMSI
	(adjustment to EMSI estimates)		\$ 1,143		
	<i>Estimated total away-from-home alcoholic beverage expenditures</i>		\$ 1,471		USDA
140	Ethanol contribution to gasoline retail sales		\$ 527		EIA
141	Pet and Pet Supplies Stores	453910	\$ 228	\$ 85	EMSI
142	Nursery, Garden Center, and Farm Supply Stores	444220	\$ 228	\$ 84	EMSI
143	Florists	453110	\$ 126	\$ 47	EMSI
144	Landscaping Services	561730	\$ 1,725	\$ 823	EMSI
	TOTAL RETAIL (based on adjusted estimates)		\$ 33,274		



**AGRICULTURAL AND
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