ASSOCIATED GOVERNMENTS OF NORTHWEST COLORADO

AGNC Economic Emergency Recovery and Resiliency Plan

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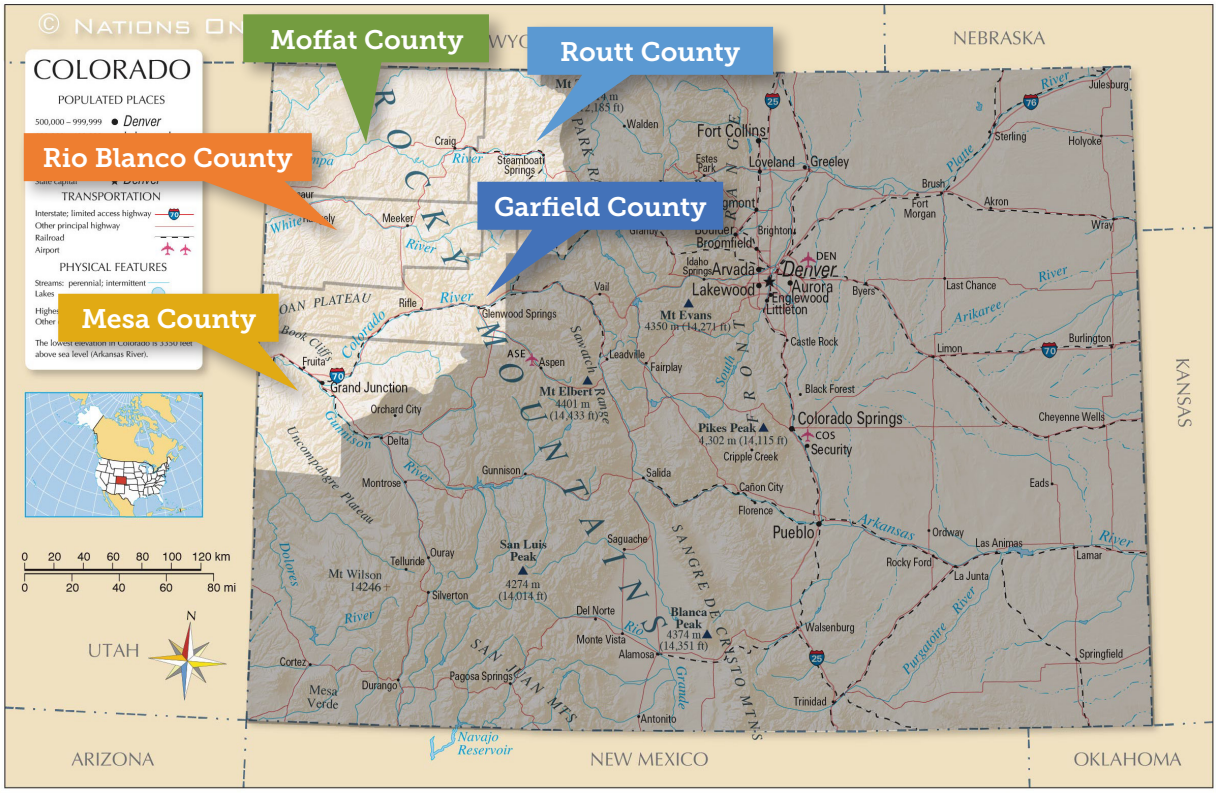
Tables

Map of Colorado



Map: https://www.nationsonline.org/oneworld/map/USA/colorado_map.htm

Introduction

This Emergency Economic Resiliency and Recovery Report (ERRP) discusses the economic vulnerabilities highlighted by the COVID-19 pandemic in the AGNC region. The ERRP provides overviews of the economic impact of the pandemic in Moffat, Routt, Rio Blanco, Garfield, and Mesa Counties in northwestern Colorado. Additionally, it suggests strategic industries that the region can participate in to diversify local economies and encourage job creation in sectors that make the larger regional economy more resilient.

The ERRP is organized in five chapters. Chapter 1 discusses the impact of the COVID 19 pandemic in each of the five counties. This includes impact summaries, most affected and most resistant economic sectors, industry trends, augmented economic challenges, affected groups and job creation, and lasting challenges that the pandemic contributed to. The intent here was to provide a picture of how the AGNC fared during the pandemic and what sectors were most and least affected by it.

Chapter 2 and 3 discuss some other disasters that the region is prone to and the potential economic challenges they could cause. This includes climate change related disasters like droughts, wildfires, and floods. It also includes other potential disasters like major earthquakes and dam failures, which have potential to inflict widescale and localized economic challenges.

Chapter 4 discusses disaster phases and provides recovery and resiliency goals for the region. These include improving strategic supply capacity, encouraging innovation, infrastructure investment, downtown revitalization, and regional disaster readiness planning.

The final chapter (Chapter 5) discusses long-term resiliency through strategic industries. This includes overview of five industries in three areas: critical supply chains and materials, power generation, and recycling. It also discusses the economic potential of these industries for the region.

Ultimately, this ERRP provides a starting point for regional disaster readiness from an economic perspective. By understanding local challenges with COVID-19 and preparing for the future the region can be more prepared to effectively recover from disasters. Additionally, by focusing on industries of national strategic importance, the region can contribute to supply security while ensuring long term markets for the goods and services it provides. This will also help the region recover from perennial economic challenges that were present before the pandemic and ensure long term prosperity in the post-pandemic era.

Chapter 1: COVID-19 Disaster Overview

Moffat County

COVID Impact Summary

During 2020, Moffat County experienced a 0.48% GDP loss. The biggest contributors to this loss were arts, entertainment, recreation, and accommodation and food services. The total loss in these sectors was $4,771,000 in GDP. Since Q3 2020, accommodation and food services has recovered; however, arts, entertainment, recreation, mining, oil, and gas have not. The construction and finance and insurance industries had the biggest gains in 2020 (10.29% and 8.61%, respectively). Most jobs lost during the COVID-19 pandemic were in healthcare (-102), accommodation and food services (-41), and energy (-37).

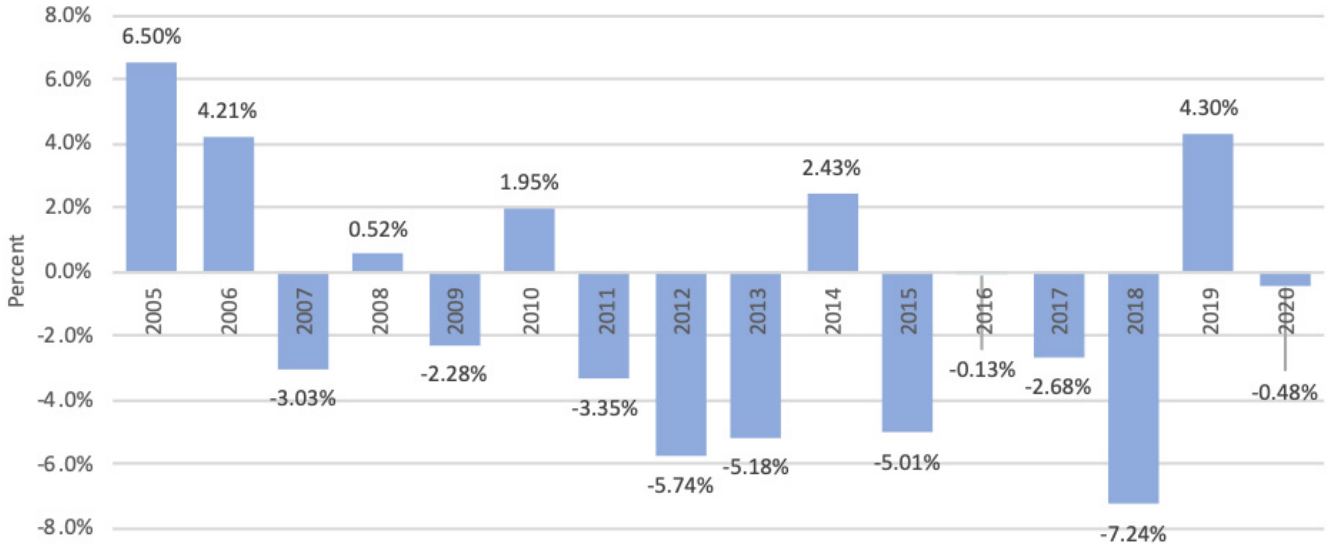
Most Affected and Most Resistant Sectors

The Moffat County economy lost 0.48% of its GDP during 2020. Major losses occurred in arts, entertainment, and recreation (-18.60%), accommodation and food services (-14.27) mining, quarrying, oil, and gas extraction (-5.87%). Although the percentage change shows that mining, quarrying, oil, and gas extraction only lost 5.87%, in terms of total GDP loss it was by far the largest. The total losses of this sector accounted for $12,027,000 in GDP. The next largest GDP loss occurred in utilities at $7,818,000 (-1.98%).

Due to the central role that coal extraction and power generation play in Moffat County, market forces related to those industries and other forms of fossil fuel extraction strongly influence its economy. Figure 2 illustrates the percentage of GDP that comes from coal, oil, and gas production (currently at 19.5%). Therefore, Moffat County extremely susceptible to swings in the energy industry and government policies that affect the energy. Figure 1 illustrates Moffat County real GDP growth rates and shows that Moffat County has struggled since the oil and gas boom of the late 2000s. Table 1 illustrates the gains and losses in GDP. Figure 3 illustrates Real GDP growth rates for the Western Slope when compared to Colorado and Pueblo County. Note that the higher GDP growth rates were in counties that do not rely heavily on tourism and energy production. The worse the GDP growth rate, the higher the dependency on these sectors, which were also the hardest hit during the pandemic.

Industries that performed well during the pandemic included construction, finance, and insurance. From a job number perspective, the biggest losses occurred healthcare and social assistance (-102), accommodation and food services (-41), and mining (-37) in 2020. The biggest gains were in construction (26) and retail trade (25).

Figure 1: Real GDP Growth Rate Moffat County[1]



1 Bureau of Economic Analysis.

Table 1: Real GDP Comparison Moffat County (in thousands), 2019 to 2020.[2]

	2019	2020	DIFFERENCE IN DOLLARS	PERCENTAGE DIFFERENCE	PERCENTAGE OF TOTAL GDP
All industry total	$993,518	$988,747	-$4,771	-0.50%	
Private industries	$925,575	$924,543	-$1,032	-0.11%	93.51%
Agriculture, forestry, fishing and hunting	$3,736	$30,524	$26,788	717.02%	3.09%
Mining, quarrying, and oil and gas extraction	$204,861	$192,834	-$12,027	-5.87%	19.50%
Utilities	$394,419	$386,601	-$7,818	-1.98%	39.10%
Construction	$15,305	$16,880	$1,575	10.29%	1.71%
Manufacturing	$6,635	$7,017	$382	5.76%	0.71%
Durable goods manufacturing	$769	$825	$56	7.28%	0.08%
Nondurable goods manufacturing	$6,355	$6,706	$351	5.52%	0.68%
Wholesale trade	$20,865	$20,031	-$834	-4.00%	2.03%
Retail trade	$49,332	$49,488	$156	0.32%	5.01%
Transportation and warehousing	N/A	N/A	N/A	N/A	N/A
Information	$6,778	$6,030	-$748	-11.04%	0.61%
Finance, insurance, real estate, rental, and leasing	$119,340	$125,159	$5,819	4.88%	12.66%
Finance and insurance	$12,793	$13,894	$1,101	8.61%	1.41%
Real estate and rental and leasing	$106,671	$111,344	$4,673	4.38%	11.26%
Professional and business services	N/A	N/A	N/A	N/A	N/A
Professional, scientific, and technical services	N/A	N/A	N/A	N/A	N/A
Management of companies and enterprises	N/A	N/A	N/A	N/A	N/A
Administrative and support and waste management and remediation services	$5,036	$4,872	-$164	-3.26%	0.49%
Educational services, health care, and social assistance	$56,443	$51,953	-$4,490	-7.95%	5.25%
Educational services	$387	$373	-$14	-3.62%	0.04%
Health care and social assistance	$56,042	$51,566	-$4,476	-7.99%	5.22%
Arts, entertainment, recreation, accommodation, and food services	$16,403	$13,911	-$2,492	-15.19%	1.41%
Arts, entertainment, and recreation	$3,683	$2,998	-$685	-18.60%	0.30%
Accommodation and food services	$12,765	$10,943	-$1,822	-14.27%	1.11%
Other services (except government and government enterprises)	$11,693	$10,855	-$838	-7.17%	1.10%
Government and government enterprises	$67,764	$64,354	-$3,410	-5.03%	6.51%

2 Bureau of Economic Analysis.

Figure 2: Mining, oil, and gas/GDP Moffat County[3]

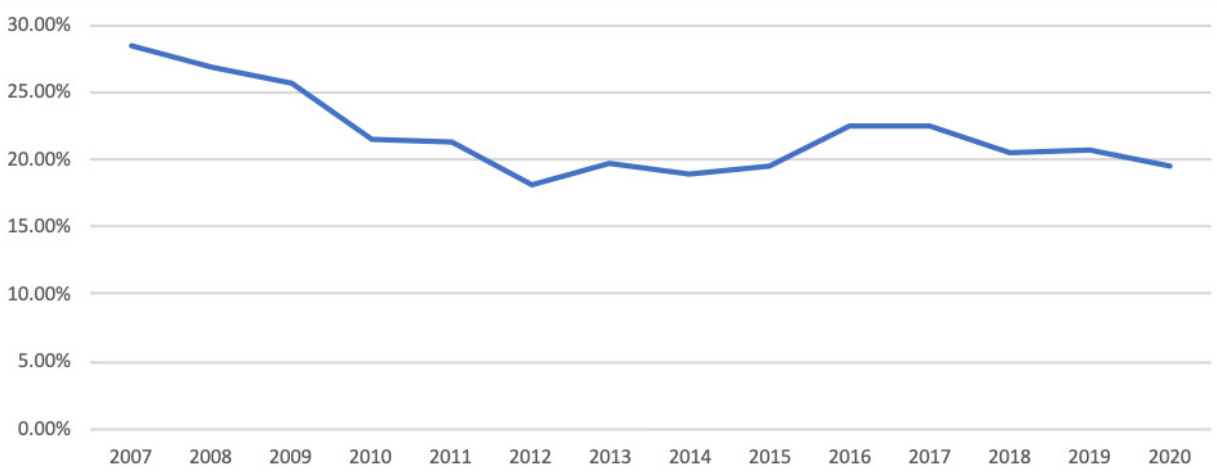
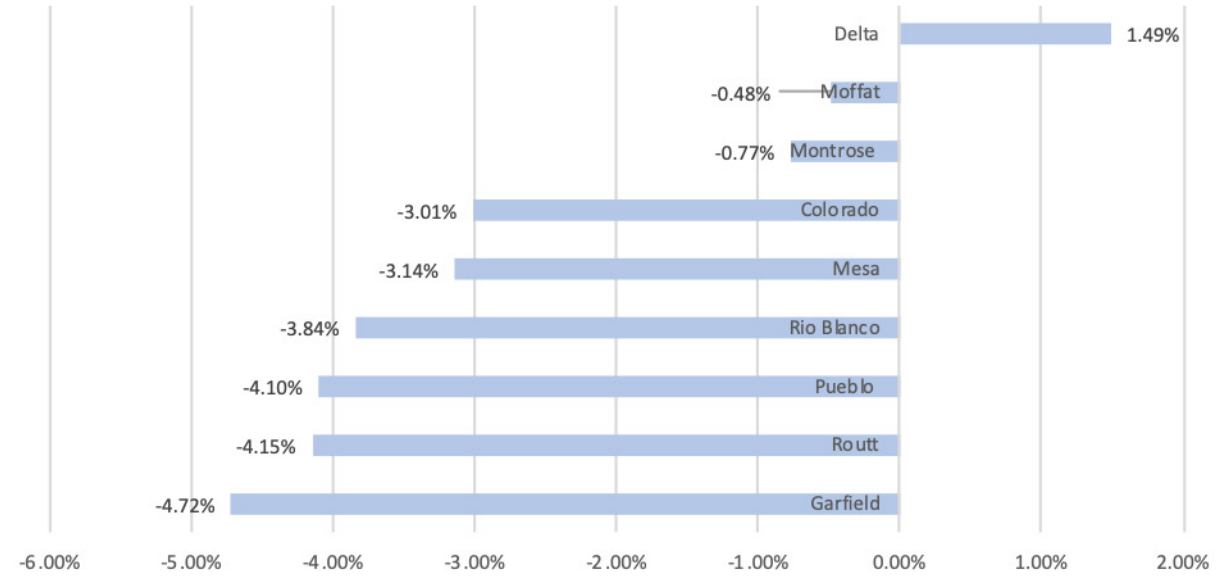


Figure 3: Western Slope Real GDP Growth Rate Comparison[4]



Industry Trends

The previous section discussed 2020 GDP estimates, which illustrate the losses from the COVID-19 induced recession. This section uses data from the Quarterly Census of Employment and Wages, a business survey that contained Q3 of 2021 data as of the writing of this report. This dataset provides insight on whether industries were recovering from 2020. Quarter 3 of that year could be considered the worst quarter of the pandemic, because it considers the stay-at-home orders and business restrictions that occurred during that time. Figure 4 and table 2 illustrate the recovery of accommodation and food services and retail trade from their April 2020 lows.

3 Bureau of Economic Analysis.
4 Bureau of Economic Analysis.

Although job gains in accommodation and food services was larger than other industries, wage recovery was not. This is due to the low weekly wages that sector pays. This is one of the reasons 2020 GDP data was not as bad as it could have been. Accommodation and food service jobs do not have high wages, and many of these workers received unemployment benefits that covered their wages. Figure 7 illustrates sales tax collection, which shows that Moffat County and Craig both had a positive trend of sales tax collection during the COVID-19 pandemic.

Figure 6 illustrates total job recovery with key COVID-19 impacted industries indexed at Q4 2019. Note that this figure shows percentage change in jobs. Of the key COVID-19 impacted industries, as of Q3 2021, mining as well as arts, entertainment, and recreation, have not recovered and are still substantially below their 2019 level. Healthcare struggled during the pandemic in Moffat County, falling from 725 jobs in Q4 2019 to 572 in Q3 2021.

Table 2: Q3 2021 Compared to Q3 2020 (QCEW)[5]

NAICS SECTOR	AVERAGE EMPLOYMENT 3RD QUARTER 2021	TOTAL QUARTERLY WAGES	AVERAGE WEEKLY WAGE	EMPLOYMENT CHANGE	WAGE CHANGE
Total, All Industries	4,552	$58,557,584	$990	24	-$1,970,476
Mining	373	$8,704,034	$1,795	-45	-$1,013,216
Health Care and Social Assistance	572	$8,125,075	$1,093	-7	-$2,523,782
Public Administration	532	$7,616,077	$1,101	-35	-$54,529
Retail Trade	762	$6,693,974	$676	7	$630,266
Construction	279	$4,003,753	$1,104	11	$196,425
Accommodation and Food Services	497	$2,567,370	$397	87	$479,688
Wholesale Trade	149	$2,050,816	$1,059	-12	-$5,486
Transportation and Warehousing	83	$1,181,427	$1,095	1	$105,395
Finance and Insurance	76	$1,146,506	$1,160	-3	-$109,143
Professional and Technical Services	96	$1,056,545	$847	3	$32,798
Other Services, Ex. Public Admin	140	$1,035,603	$569	11	$87,723
Administrative and Waste Services	144	$954,631	$510	47	$173,766
Arts, Entertainment, and Recreation	82	$934,677	$877	-20	-$186,098
Manufacturing	61	$824,134	$1,039	5	-$77,031
Real Estate and Rental and Leasing	36	$553,276	$1,182	-6	$85,574
Agriculture, Forestry, Fishing and Hunting	43	$358,509	$641	-3	$558
Information	26	$277,587	$821	1	$39,915

5 Colorado Department of Labor and Employment).

Figure 4: Moffat County Jobs, QCEW Q3 2020 compared to Q3 2021[6]

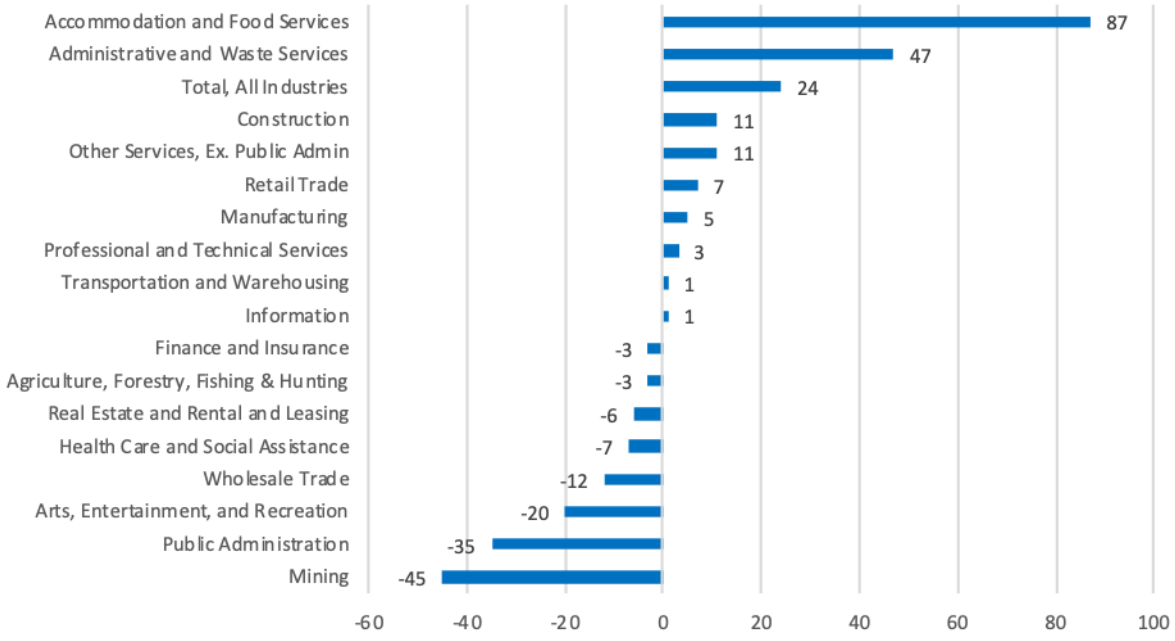
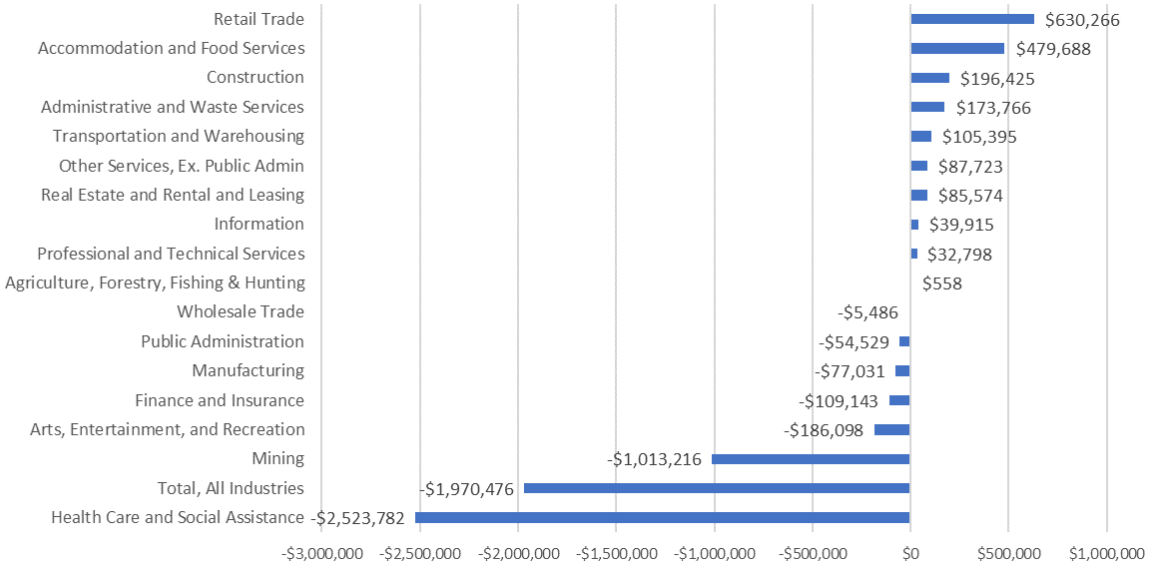


Figure 5: Moffat County Wages, QCEW Q3 2020 compared to Q3 2021[7]



6 Colorado Department of Labor and Employment.
7 Colorado Department of Labor and Employment.

Figure 6: Moffat County Job Recovery Percentage Change Key Industries[8]

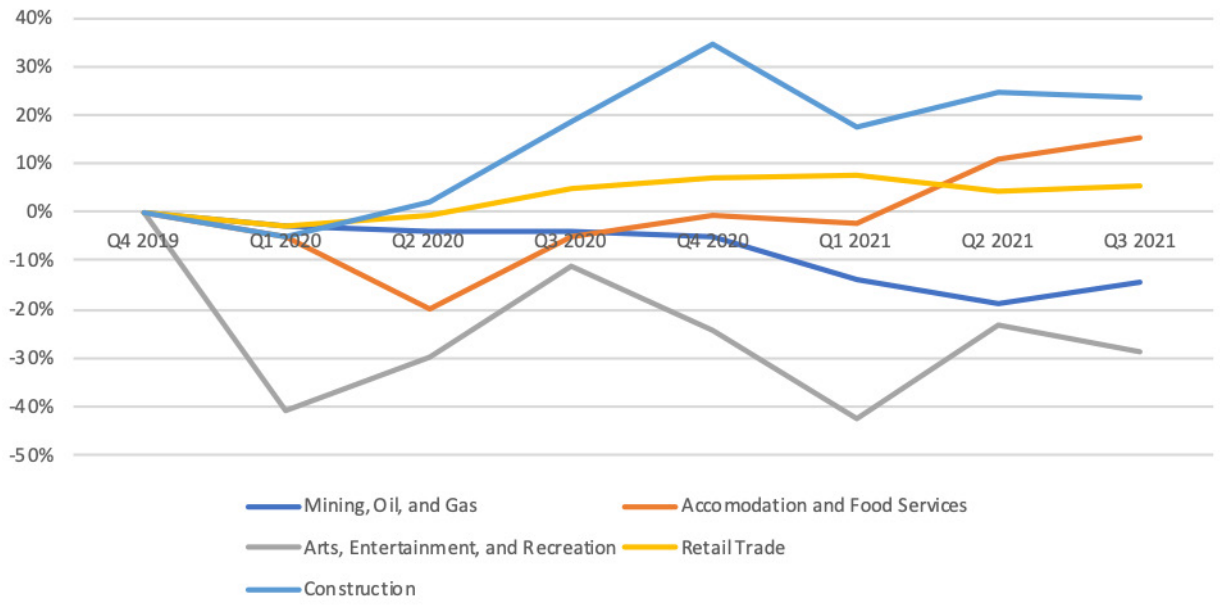
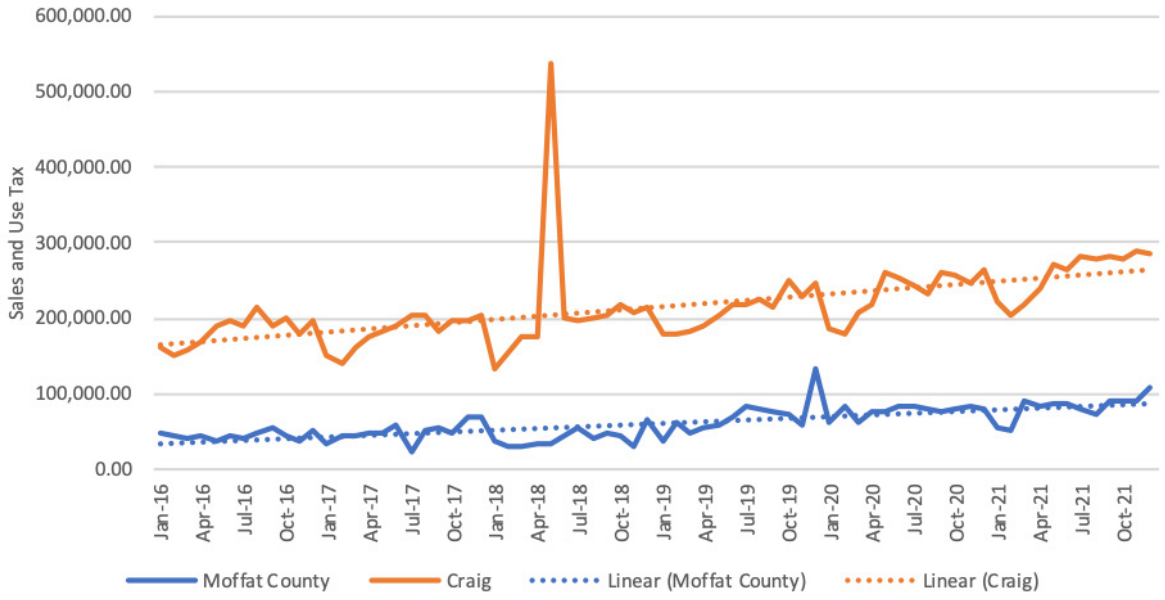


Figure 7: Moffat County and Craig Sales Tax[9]



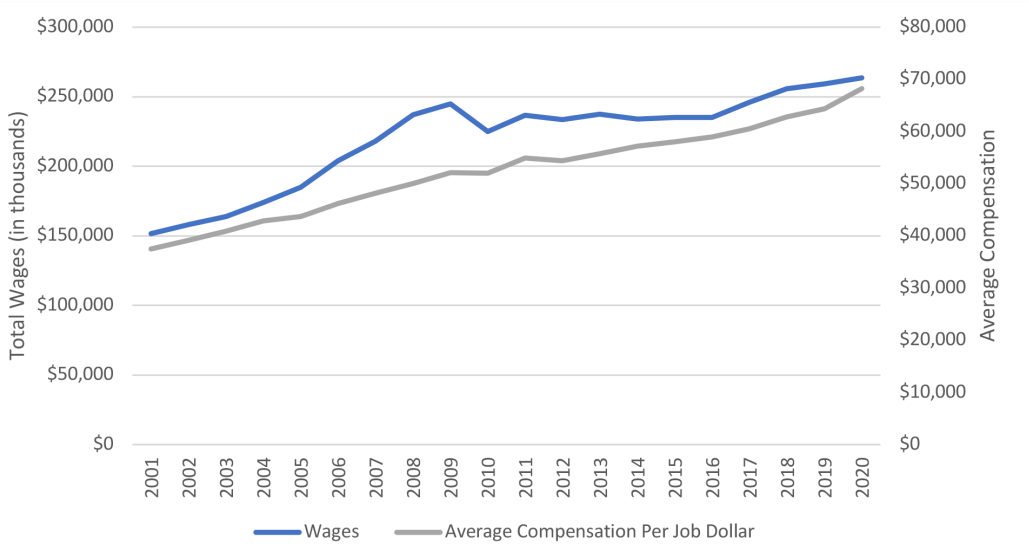
8 Colorado Department of Labor and Employment.
9 Data from Moffat County Finance Department and the Town of Craig Finance Department.

Augmented Economic Challenges

Wage Growth

In Q3, 2021, Moffat County saw an increase in wages, which rose from $259,141,000 to $263,570,000. The average compensation per job dollar also increased from $64,308 to $68,217. Wages were in a general downtrend from 2009 through 2016, finally increasing from 2016 to 2017 and beginning a new upward trend.

Figure 8: Moffat Wage Growth and Average Compensation Per Job[10]

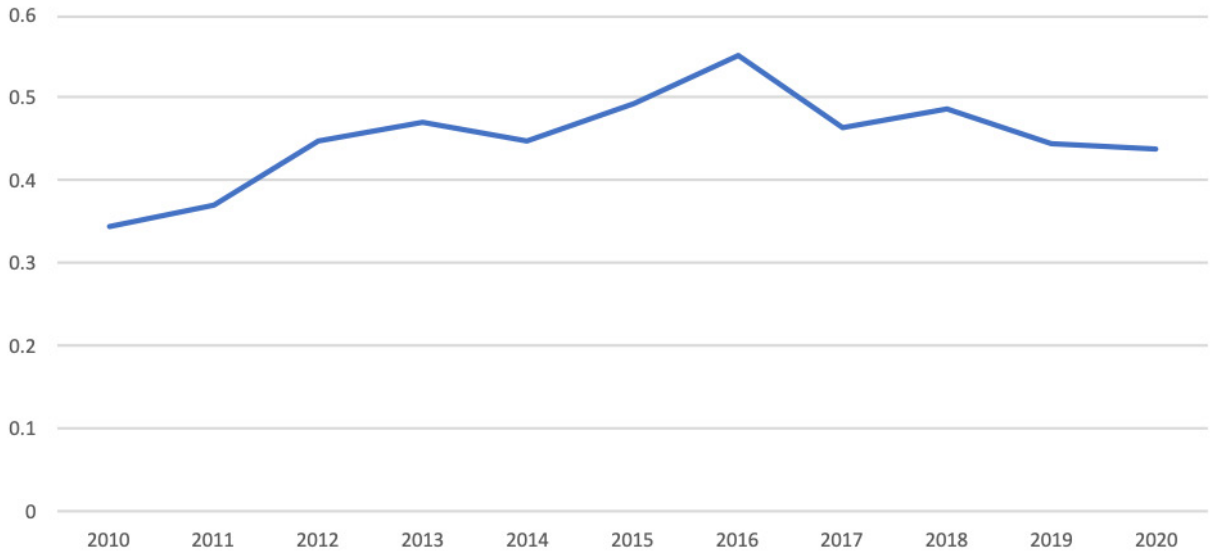


Economic Diversity

Although GDP fell, economic diversity increased in other parts of the Western Slope. However, this did not occur in Moffat County where industrial diversification declined as measured by the Hachman Index. Figure 9 illustrates the Hachman Index, which is a measure of industrial diversification. A higher Hachman Index shows higher industrial diversification compared to Colorado, while a lower one indicates less diversity. Although Moffat County's Hachman Index increased between 2010 and 2016, it fell between 2016 and 2020. However, it should be noted that the decline of industrial diversification in 2020, was part of a longer trend that began in 2016.

10 Bureau of Economic Analysis.

Figure 9: Hachman Index Mesa County[11]



Affected Groups and Job Creation

Moffat County employment fell from a peak of 7,119 in January of 2020 to an April 2020 low of 6,226, after which it rose to 7,060 by July of 2021. Currently, unemployment numbers are trending downwards and starting to move towards 200. In late 2019, unemployment was in the 170-220 range.

Figure 13 illustrates initial and continued unemployment claims during 2020. Moffat County's initial claims peaked in early April and continued claims peaked in early May. Table 3 shows the Colorado industry share of unemployment claims. Unfortunately, industry level unemployment claims are not available at the county level. However, Table 3 provides a picture of general trends within Colorado that are similar. Accommodation and food services had the largest share of initial claims at 21.7%. Healthcare at 11.7% and retail trade at 11.5% were the sources of the next largest numbers of claims.

Largest share of unemployment claims during 2020

Accommodation and food services 21.7%

Healthcare 11.7%

Retail trade 11.5%

MOFFAT COUNTY

11 Author calculated with data from the Bureau of Economic Analysis.

Figure 10: Moffat County Yearly Employment Average[12]

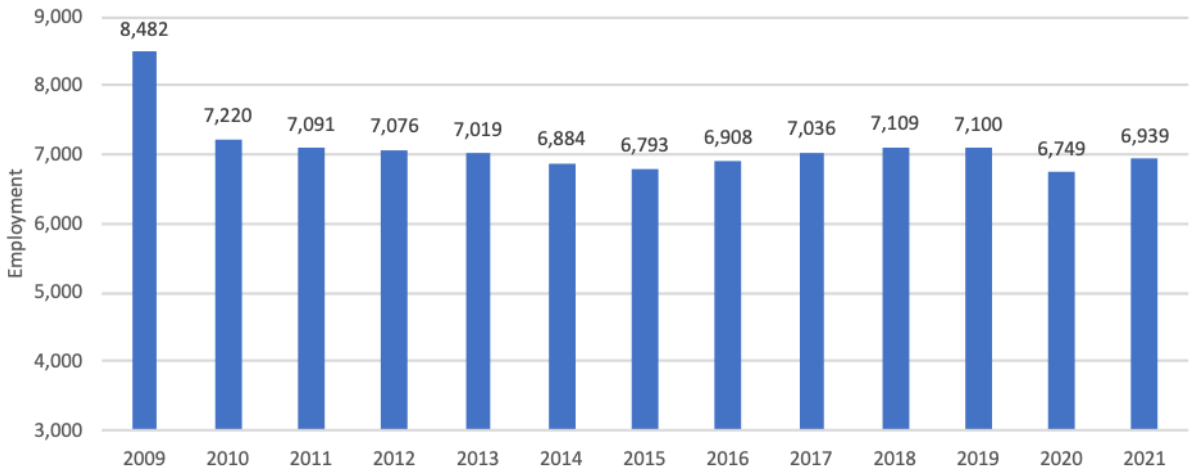
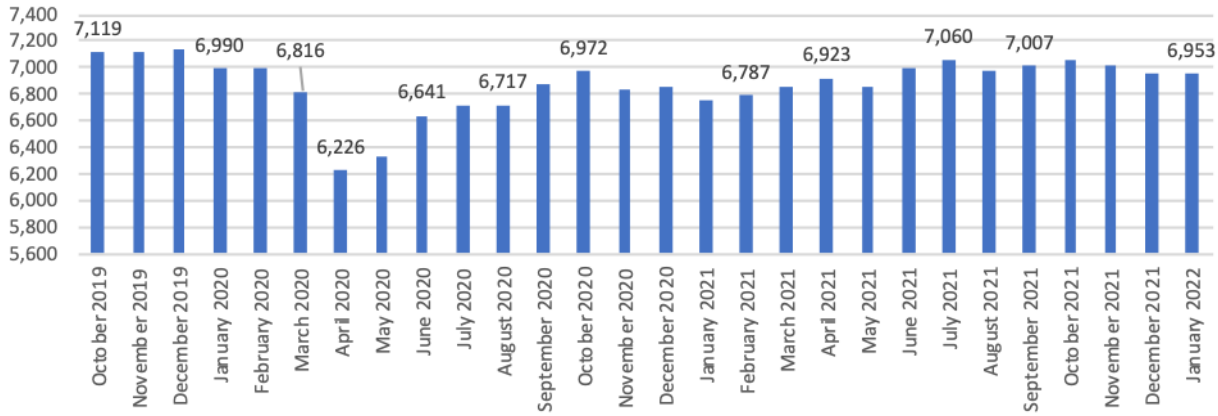


Figure 11: Moffat County Monthly Employment Estimates[13]



12 Colorado Department of Labor and Employment.
13 Colorado Department of Labor and Employment.

Figure 12: Moffat County Monthly Unemployment Estimates[14]

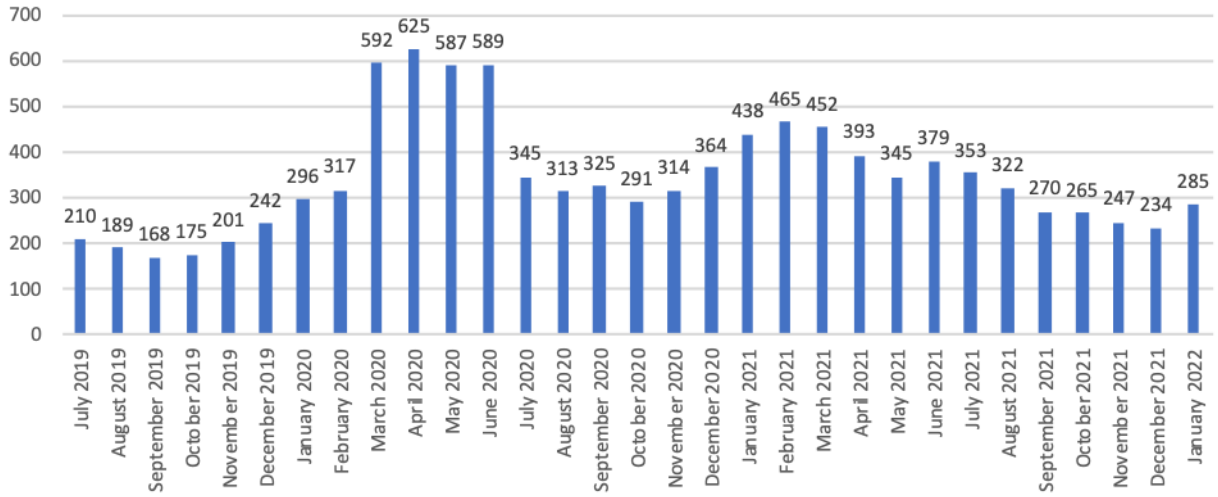
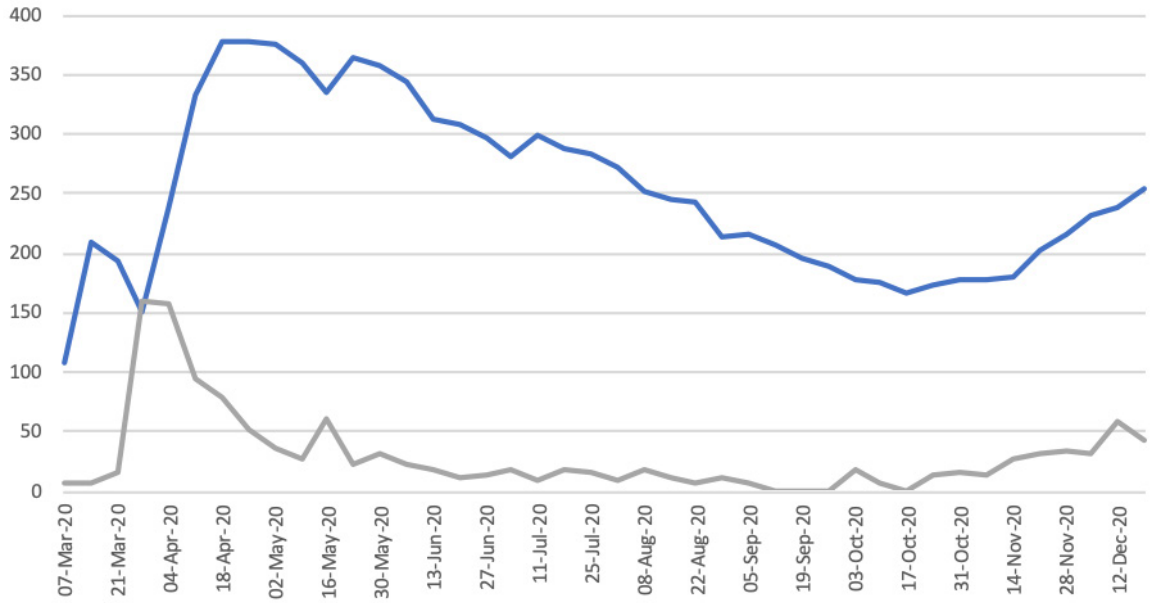


Figure 13: Initial and Continued Unemployment Claims for Moffat County[15]



14 Colorado Department of Labor and Employment.
15 Colorado Department of Labor and Employment.

Table 3: Colorado Industry Share of Initial Unemployment Claims[16]

INDUSTRY CODE	INDUSTRY SECTOR	TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	SHARE OF TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	WEEKLY AVERAGE INITIAL CLAIMS IN 2019	SHARE OF TOTAL INITIAL CLAIMS IN 2019	CHANGE IN SHARE POST COVID-19 PERIOD VS. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Pandemic Effects on the Coal Industry

Moffat has two coal mines (Trapper and Colowyo Mines), which they share with Rio Blanco County. Like all energy commodities, coal lost value in 2020. However, from the end of 2020 through the end of 2021 coal prices more than doubled. Despite the large increase in price, coal jobs held steady, despite increased production during late 2021. Overall, Trapper and Foidel Creek Mines have seen a decline in mining jobs since the beginning of the pandemic.

16 Colorado Department of Labor and Employment.

Figure 14: Global Price of Coal, Australia[17]

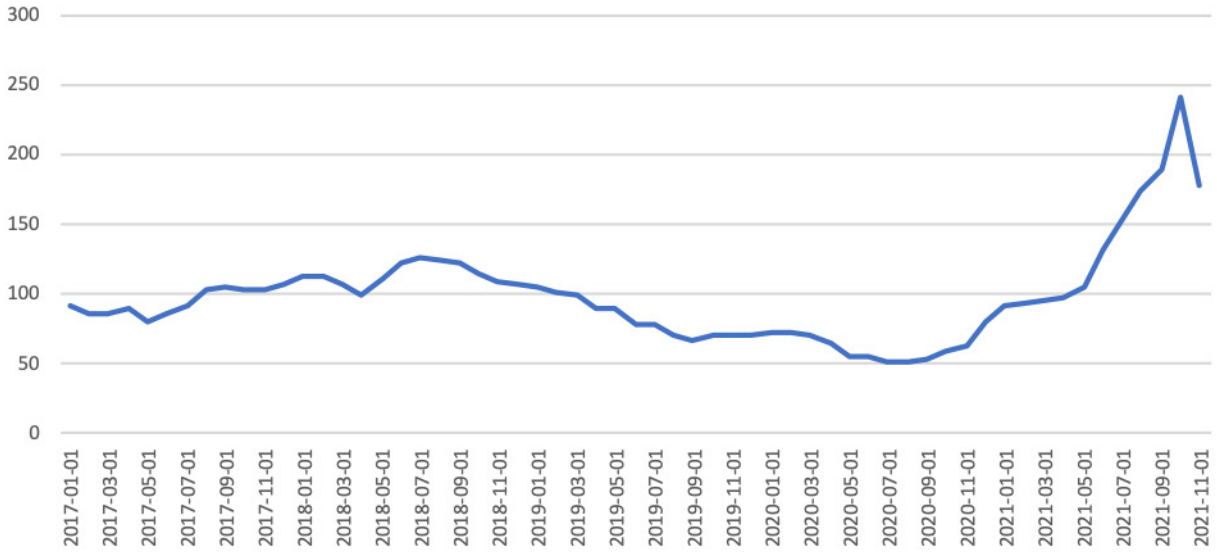
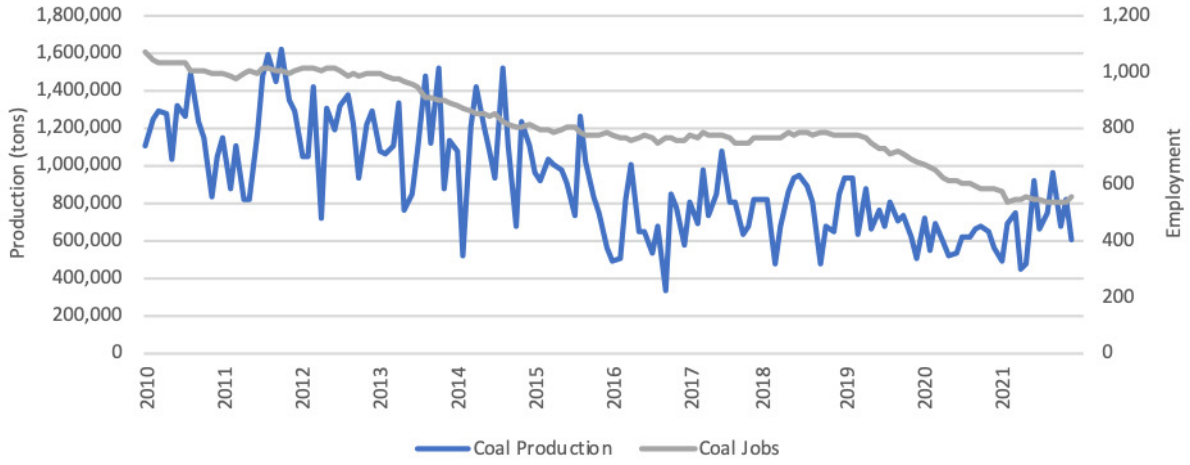
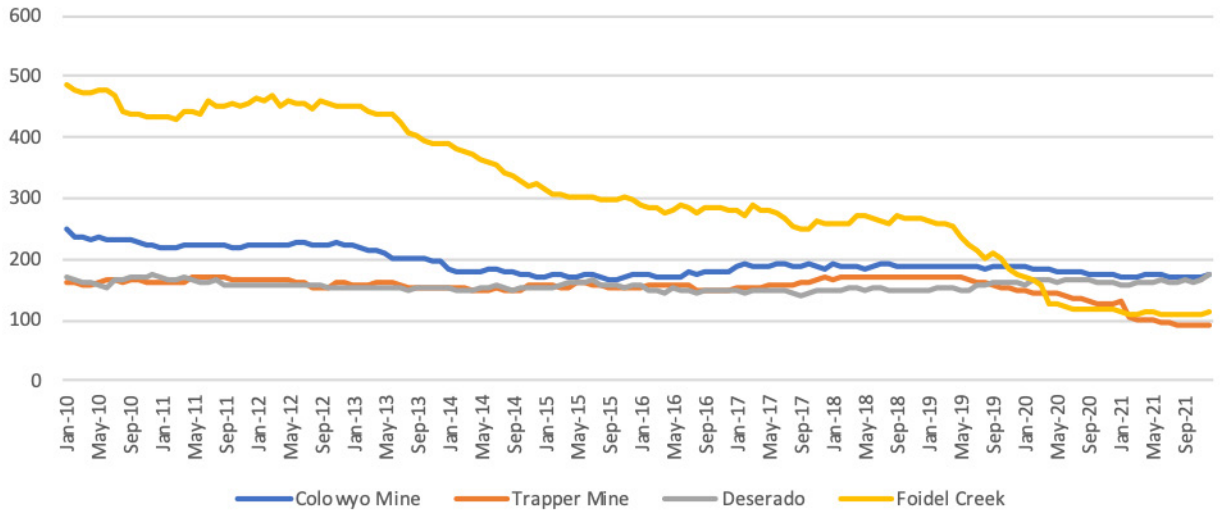


Figure 15: Coal Production and Jobs, NW Colorado[18]



17 International Monetary Fund.
18 Data from Colorado Division of Reclamation, Mining, and Safety.

Figure 16: Colowyo, Trapper, Deserado, and Foidel Creek Mine Jobs[19]



Lasting Challenges

Moffat County will experience several challenges over the next couple of decades, which result from the transition from coal. Although these are largely due to the transition away from coal, COVID 19 augmented these challenges. Below is a description of the challenges:

- Economic diversification to insulate from coal shocks: The primary challenge for Moffat County will be diversifying its economy against the eventual loss of the coal industry. With the loss of two coal mines and Craig's coal power generating station, Moffat County is set to lose a considerable amount of economic activity over the next decade.

- Replacing economic activity lost from coal power and mining: As coal mines and power plants close, replacing lost economic activity will be challenging. However, other sources of mining and extraction unrelated to coal may help replace some activity. Local governments also need to start preparing for less tax revenue due to the eventual loss of coal related industries.

- Preventing population declines: Because of the significant amount of economic activity the region will likely lose, both Moffat and Rio Blanco County are expected to see population declines. Therefore, encouraging enough economic activity to remain in these counties so that residents continue live within and migrate to them will become an important issue.

Rio Blanco County

COVID Impact Summary

The COVID-19 pandemic affected Rio Blanco County GDP in 2020, which resulted in a 3.84% GDP loss for the year. The biggest losses occurred in oil and gas at -8.6% (a total of $52,529,000). Further losses occurred in accommodation and food services (-19.53%), arts, entertainment, and recreation (-11.59%). Since Q3 2020, accommodation and food services have recovered; However, arts, entertainment, recreation, mining, oil, and gas have not. The

19 Data from the Colorado Division of Reclamation, Mining, and Safety.

finance and insurance industry had the biggest gains in 2020, growing 13.12%. Retail trade also performed well with a 4.27% increase in GDP. Most jobs lost during the COVID-19 pandemic were in construction (28), accommodation and food services (26), and administrative support services (23). Although GDP was down in 2020, job losses totaled 107 (approximately 2.5%) of jobs, which is proportionally smaller.

Most Affected Sectors and Most Resistant Sectors

The Rio Blanco County economy lost 3.84% of its GDP in 2020. During that year, the major losses occurred in mining, oil, and gas (-8.66%), professional and business services (-15.51%), and transportation and warehousing (-40.96%). It is important to note that accommodation and food services, as well as arts, entertainment, and recreation do not have 2019 data to compare to 2020. But comparing 2018 to 2020, Rio Blanco lost 11.59% and 19.53%, respectively. Although the percentage change shows oil, gas, and mining only lost 8.66%, in terms of total GDP loss it was by far the largest, accounting for $52,529,000 in GDP loss compared to the next largest loss in transportation and warehousing at $3,960,000. With coal, oil, and gas making up 71% of the counties' GDP, the county is extremely energy reliant. Figure 18 illustrates the percentage of GDP that comes from coal, oil, and gas production, which is currently at 71%. That makes Rio Blanco County extremely susceptible to swings in the energy industry, or government policies that affect the energy industry. Low oil and gas prices in early 2020 pushed the industry into a tailspin. However, declines in oil and gas in the region started during late 2019. Figure 17 illustrates Rio Blanco County real GDP growth rates and shows that Rio Blanco County has struggled since the oil and gas boom of the late 2000's. Figure 19 illustrates Real GDP growth rates for the Western Slope, with the comparison of Colorado and Pueblo County. The higher GDP growth rates were in counties that do not rely on tourism and energy production. The worse the GDP growth rate, the higher the dependency on tourism and energy, which were the two hardest hit sectors during the COVID-19 pandemic.

Industries that performed well in Rio Blanco County during the pandemic were finance and insurance, government and government enterprises, and retail trade. Note that this is from a GDP perspective, as almost all industries lost jobs during 2020. Retail trade performed well due to incomes increasing during the pandemic, which resulted from government policy and increased values of homes and equities. This "wealth affect" was also partially due to a low interest rate policy. These industries were positive, but their contribution was dwarfed by the negative numbers seen from the energy industry. Ultimately when a region loses wages in an industry like oil and gas, other industries suffer from consumer spending and supply chain effects. Oil and gas have an average weekly wage of $1,716, which is the highest in the county.

GDP from coal, oil , and gas production is 71%

With coal, oil, and gas making up 71% of the counties GDP, the county is extremely energy reliant and susceptible to swings in the energy industry or government policies that affect the industry.

RIO BLANCO COUNTY

Figure 17: Real GDP Growth Rate Rio Blanco County[20]

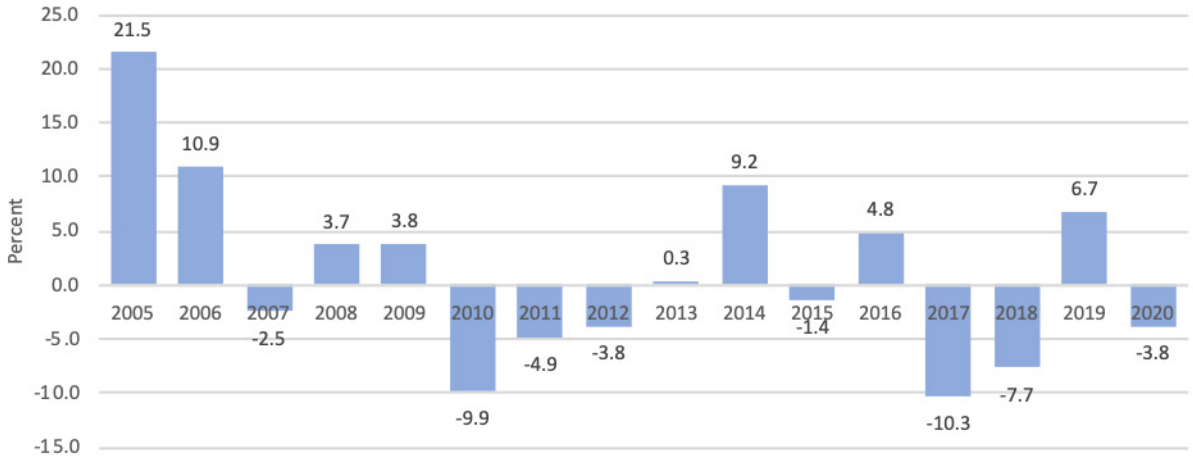


Table 4: Real GDP Comparison Rio Blanco County, 2019 to 2020[21]

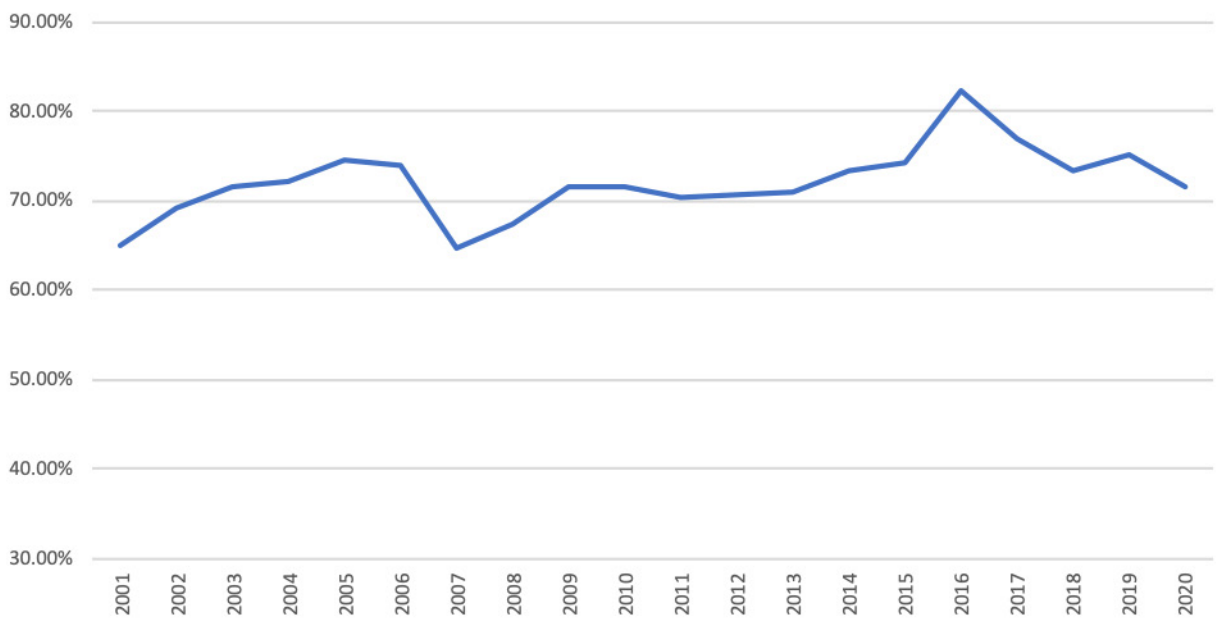
	2019	2020	DIFFERENCE IN DOLLARS	PERCENTAGE DIFFERENCE	PERCENTAGE OF TOTAL GDP
All industry total	$807,105	$776,121	-$30,984	-3.84%	
Private industries	$732,665	$700,225	-$32,440	-4.43%	90.22%
Agriculture, forestry, fishing and hunting	$1,949	(D)	N/A	N/A	N/A
Mining, quarrying, and oil and gas extraction	$606,628	$554,099	-$52,529	-8.66%	71.39%
Utilities	$6,788	(D)	N/A	N/A	N/A
Construction	$13,600	$13,967	$367	2.70%	1.80%
Manufacturing	$2,818	$2,843	$25	0.89%	0.37%
Durable goods manufacturing	(D)	(D)	N/A	N/A	N/A
Nondurable goods manufacturing	(D)	(D)	N/A	N/A	N/A
Wholesale trade	(D)	$938	N/A	N/A	0.12%
Retail trade	$9,248	$9,643	$395	4.27%	1.24%
Transportation and warehousing	$9,669	$5,709	-$3,960	-40.96%	0.74%
Information	$2,362	(D)	N/A	N/A	N/A
Finance, insurance, real estate, rental, and leasing	$59,823	$62,423	$2,600	4.35%	8.04%
Finance and insurance	$4,610	$5,215	$605	13.12%	0.67%
Real estate and rental and leasing	$55,649	$57,550	$1,901	3.42%	7.42%
Professional and business services	$15,810	$13,358	-$2,452	-15.51%	1.72%

20 Bureau of Economic Analysis.
21 Bureau of Economic Analysis. Data that is asterisked compares 2018 to 2020 due to missing 2019 data points.

Table 4: Real GDP Comparison Rio Blanco County, 2019 to 2020 *continued*

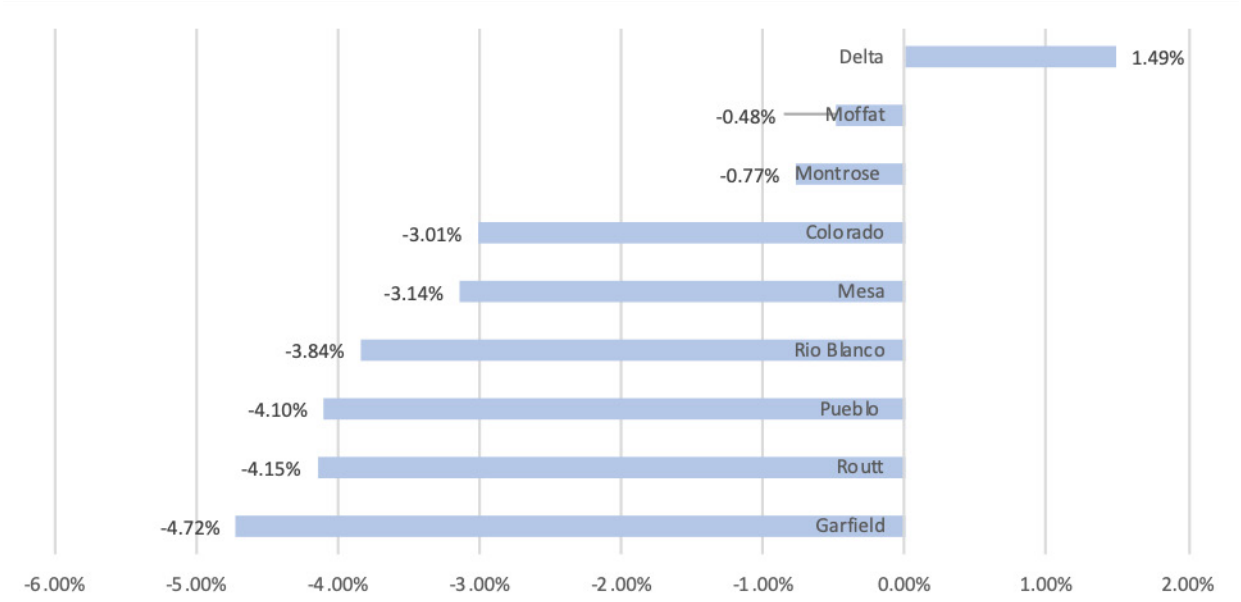
Professional, scientific, and technical services	$3,131	$2,823	-$308	-9.84%	0.36%
Management of companies and enterprises	$0	$0	$0	#DIV/0!	0.00%
Administrative and support and waste management and remediation services	$12,690	$10,572	-$2,118	-16.69%	1.36%
Educational services, health care, and social assistance	$2,235	$2,275	$40	1.79%	0.29%
Educational services	$18	$14	-$4	-22.22%	0.00%
Health care and social assistance	$2,222	$2,267	$45	2.03%	0.29%
Arts, entertainment, recreation, accommodation, and food services*	(D)	$7,487	N/A	-17.33%*	0.96%
Arts, entertainment, and recreation*	(D)	$2,311	N/A	-11.59%*	0.30%
Accommodation and food services*	(D)	$5,225	N/A	-19.53%*	0.67%
Other services (except government and government enterprises)	$4,924	$4,656	-$268	-5.44%	0.60%
Government and government enterprises	$70,338	$69,934	-$404	-0.57%	9.01%

Figure 18: Mining, oil, and gas/GDP Rio Blanco County[22]



22 Bureau of Economic Analysis.

Figure 19: Western Slope Real GDP Growth Rate Comparison[23]



Industry Trends

The previous section discussed 2020 GDP estimates, which showed losses due to the COVID-19 induced recession. This section utilized data from the Quarterly Census of Employment and Wages, a business survey that as of the writing of this document has Q3 of 2021 data. This dataset provides insight on industry recovery from 2020. Quarter 3 of 2020 could be considered the worst quarter of the COVID-19 pandemic because it reflects the stay-at-home orders, gathering restrictions, and mandated business closures that occurred during April of that year.

Figure 20 and Table 5 illustrate the recovery of accommodation and food services, retail trade, and oil and gas from their lows in April of 2020. Although job gains in accommodation and food services were larger than that of other industries, according to figure 21 that industry is lower on the list in terms of wage recovery. This is due to the low weekly wages that accommodation and food services pay. This is one of the reasons 2020 GDP data was not as bad as it could have been, as accommodation and food service jobs do not have high wages, and many workers received unemployment benefits that covered their wages when they lost their jobs. Figure 23 illustrates sales tax collection, showing that Meeker sales taxes have increased at a faster rate than that of Rangely. However, neither deviated from their trend due to the COVID-19 pandemic.

Figure 22 illustrates total job recovery with key COVID-19 impacted industries indexed at Q4 2019. This figure shows percentage change in jobs. As of Q3 2021, oil, gas, and mining, as well as arts, entertainment, and recreation, have not recovered and are still substantially below their 2019 level. Additionally, retail trade is slightly below its Q4 2019 level. The oil and gas industry started its slowdown before the COVID-19 pandemic in Q4 2019. Only a few months later, oil prices turned negative on the futures market for a brief time, which was followed by very low energy prices in the subsequent months.

23 Bureau of Economic Analysis.

Table 5: Q3 2021 Compared to Q3 2020 (QCEW)[24]

NAICS SECTOR	AVERAGE EMPLOYMENT 3RD QUARTER 2021	TOTAL QUARTERLY WAGES	AVERAGE WEEKLY WAGE	EMPLOYMENT CHANGE	WAGE CHANGE
Total, All Industries	2,851	$38,245,220	$1,032	10	$1,234,330
Mining	452	$10,080,601	$1,716	-47	-$706,035
Health Care and Social Assistance	387	$5,112,624	$1,016	14	$653,465
Public Administration	393	$4,661,208	$912	-36	-$311,613
Educational Services	286	$3,113,038	$837	19	$132,676
Administrative and Waste Services	189	$3,034,989	$1,235	67	$1,362,180
Construction	155	$2,073,007	$1,029	-43	-$635,793
Accommodation and Food Services	223	$1,569,934	$542	28	$304,074
Retail Trade	199	$1,287,414	$498	11	-$14,601
Utilities	43	$1,256,808	$2,248	-1	-$1,659
Other Services, Ex. Public Admin	71	$1,234,078	$1,337	-17	$59,179
Transportation and Warehousing	68	$1,034,847	$1,171	-4	-$49,383
Arts, Entertainment, and Recreation	150	$975,143	$500	2	$36,975
Finance and Insurance	42	$682,502	$1,250	-1	$143,799
Manufacturing	49	$650,996	1,022	7	$208,242
Agriculture, Forestry, Fishing and Hunting	49	$527,106	$827	-2	-$37,578
Professional and Technical Services	32	$367,009	$882	0	-$23,648
Real Estate and Rental and Leasing	21	$218,178	$799	2	$22,051
Information	24	$166,978	$535	2	$16,103
Wholesale Trade	16	$158,589	$762	8	$35,725
Total, All Industries	2,851	$38,245,220	$1,032	10	$1,234,330

24 Colorado Department of Labor and Employment.

Figure 20: Rio Blanco County Jobs, QCEW Q3 2020 compared to Q3 2021[25]

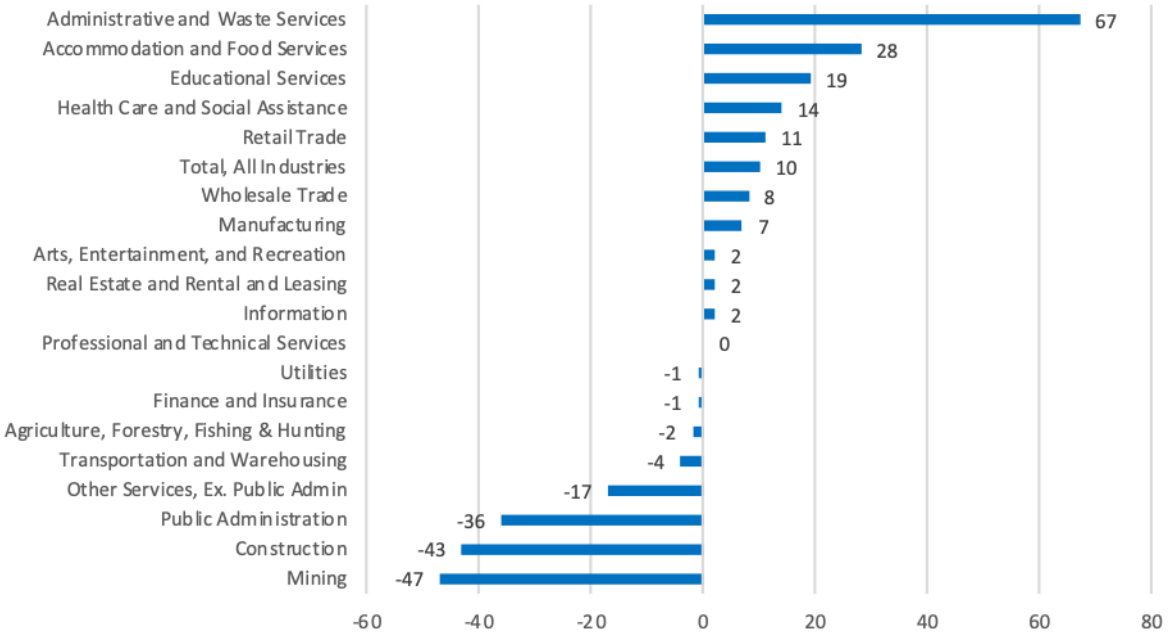
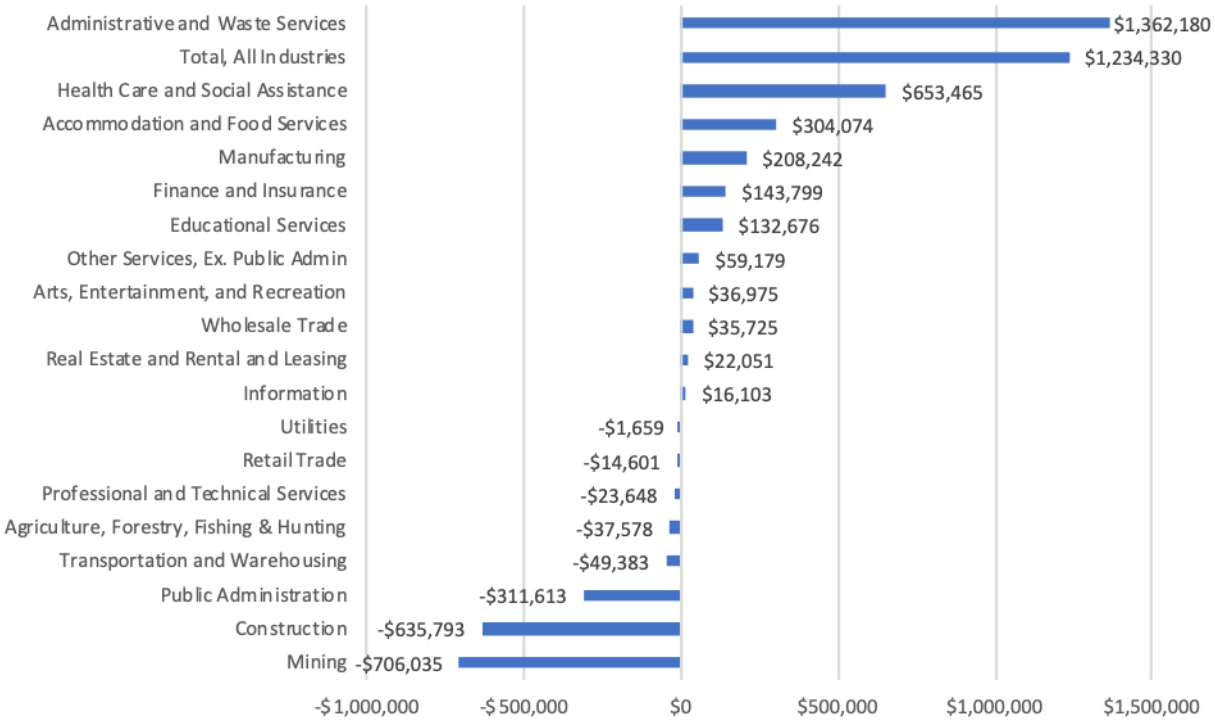


Figure 21: Rio Blanco County Wages, QCEW Q3 2020 compared to Q3 2021[26]



25 Colorado Department of Labor and Employment.
26 Colorado Department of Labor and Employment.

Figure 22: Rio Blanco County Job Recovery Percentage Change Key Industries[27]

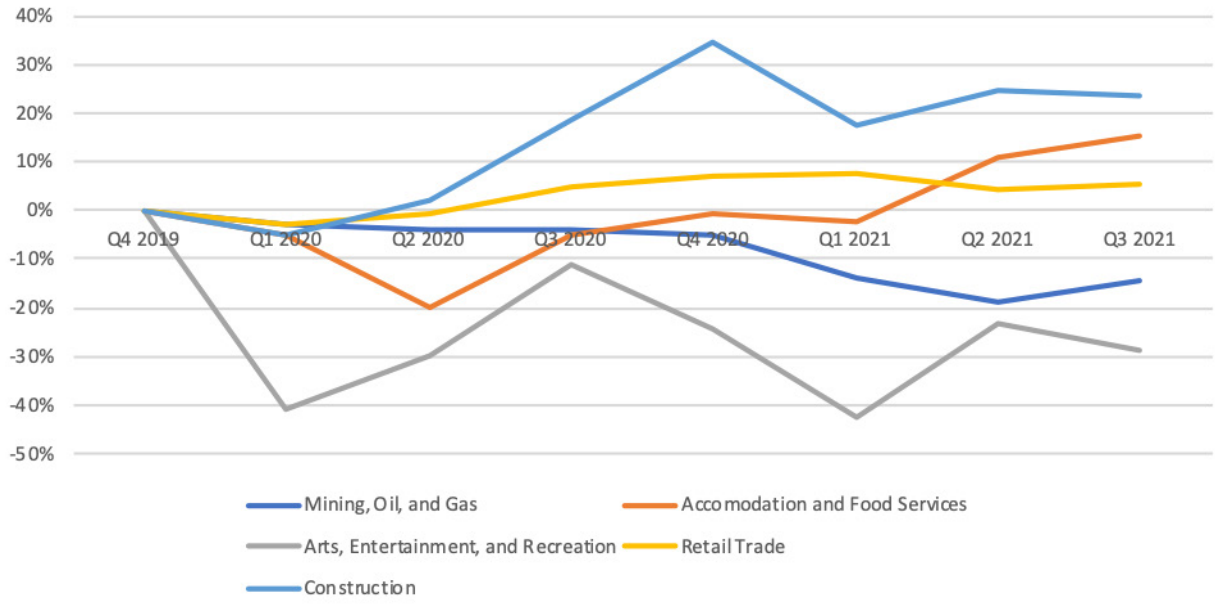
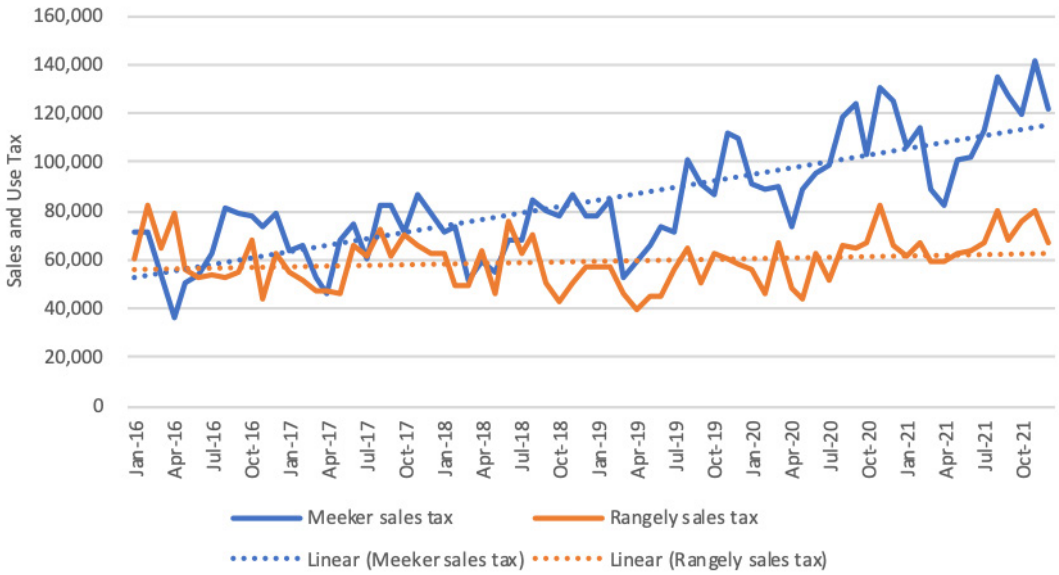


Figure 23: Rio Blanco County, Meeker and Rangely Sales Tax[28]



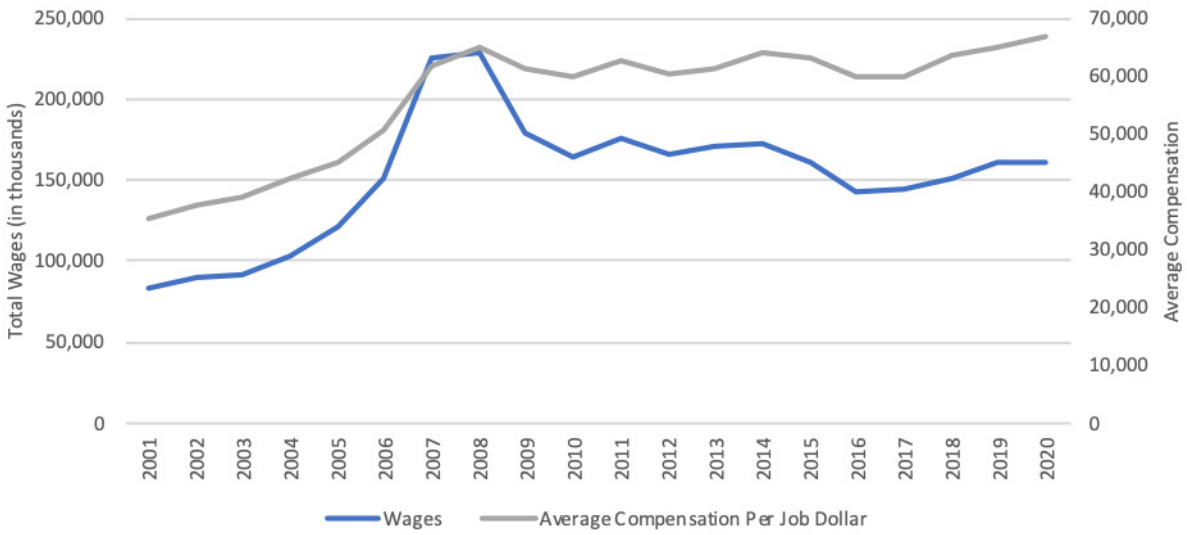
27 Colorado Department of Labor and Employment.
28 Data from Rio Blanco County.

Augmented Economic Challenges

Wage Growth

Overall, Rio Blanco County saw a slight decrease in wages, falling from $161,575,000 to $160,276,000. However, the average compensation per job dollar increased from $65,117 to $66,621. Overall, wages are still below their peak in 2008 and have been trending down since. There was a slight upward trend from 2016 through 2019, but 2020 put a stop to that trend.

Figure 24: Rio Blanco County Wage Growth and Average Compensation Per Job[29]



Economic Diversity

Although GDP fell, economic diversity increased in other parts of the Western Slope. However, that was not the case in Rio Blanco County where industrial diversification declined as measured by the Hachman Index. Figure 25 illustrates the Hachman Index, a measure of industrial diversification. A higher Hachman Index shows higher industrial diversification compared to Colorado, while a lower Hachman Index indicates less diversity than Colorado. Rio Blanco's Hachman Index has had a slight positive trend occur over the past 10 years, which fell sharply during the pandemic.

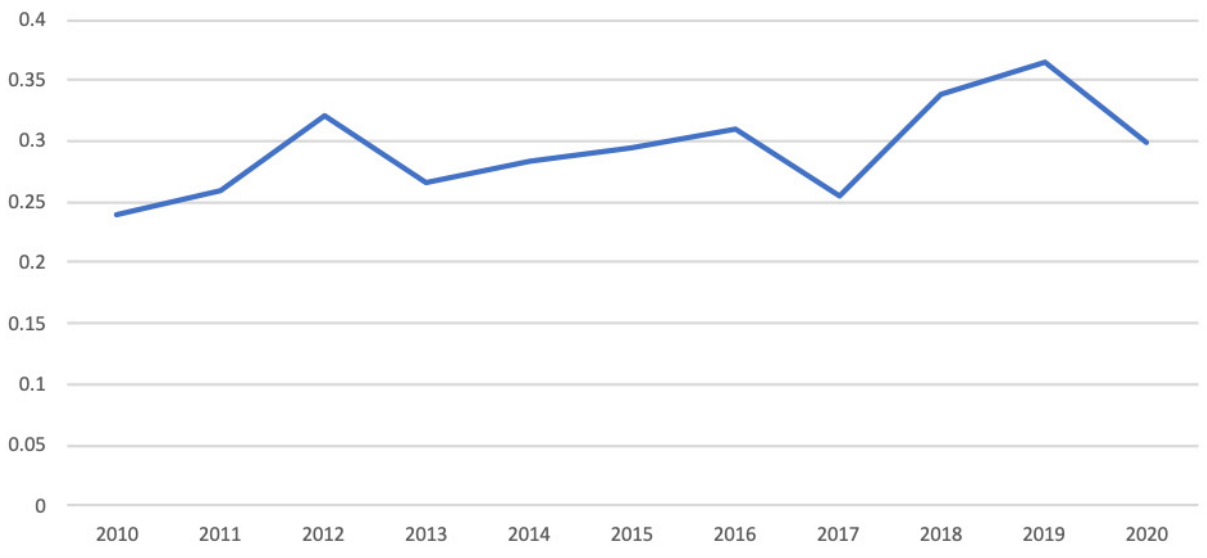
Wages are below the 2008 peak and are still trending down.

Industrial diversification had a slight positive trend over the past 10 years but fell sharply during the pandemic.

RIO BLANCO COUNTY

29 Bureau of Economic Analysis.

Figure 25: Hachman Index Mesa County[30]



Affected Groups and Job Creation

Rio Blanco County employment fell from a peak of 3,013 in January of 2020 to an April 2020 low of 2,676. After that is increased to 2,936 by October of 2021. However, unemployment numbers are now trending downwards and starting to move towards 100, closer to the late 2019 unemployment of 80-100.

Figure 29 illustrates initial and continued unemployment claims during 2020. Rio Blanco County initial claims peaked in early April while continued claims peaked in early May. Table 6 shows the Colorado industry share of unemployment claims. Unfortunately, industry level unemployment claims are not available at the county level, but we can use table 6 to understand the general trends for Colorado. Accommodation and food services is the biggest share of initial claims filings at 21.7%, while health care is next at 11.7%, followed by retail trade at 11.5%.

Largest share of unemployment claims during 2020

Accommodation and food services 21.7%

Healthcare 11.7%

Retail trade 11.5%

COLORADO

30 Author calculated with data from the Bureau of Economic Analysis.

Figure 26: Rio Blanco County Yearly Employment Average[31]

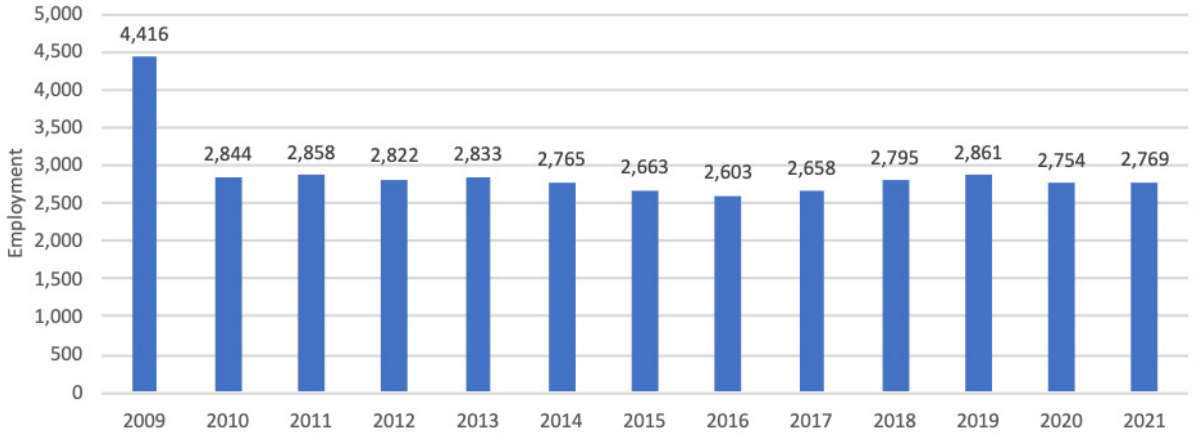
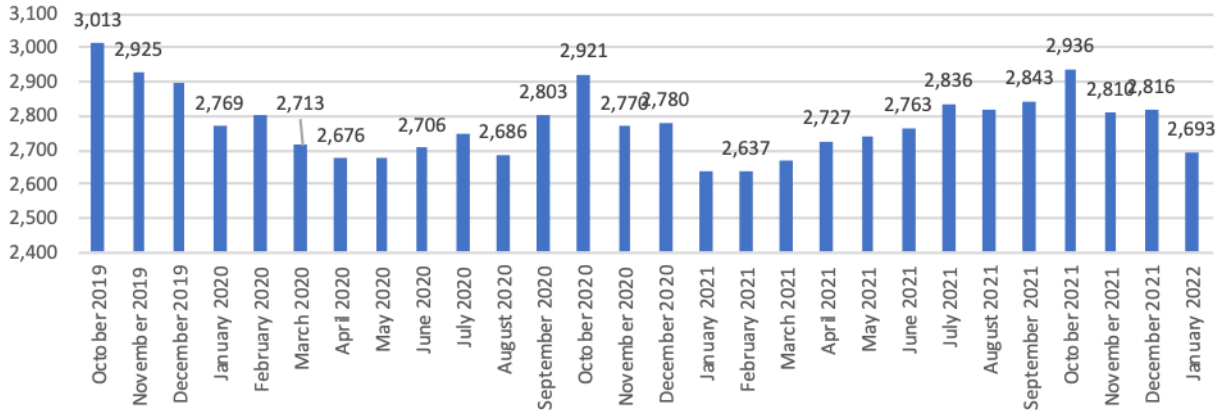


Figure 27: Rio Blanco County Monthly Employment Estimates[32]



31 Colorado Department of Labor and Employment.
32 Colorado Department of Labor and Employment.

Figure 28: Rio Blanco County Monthly Unemployment Estimates[33]

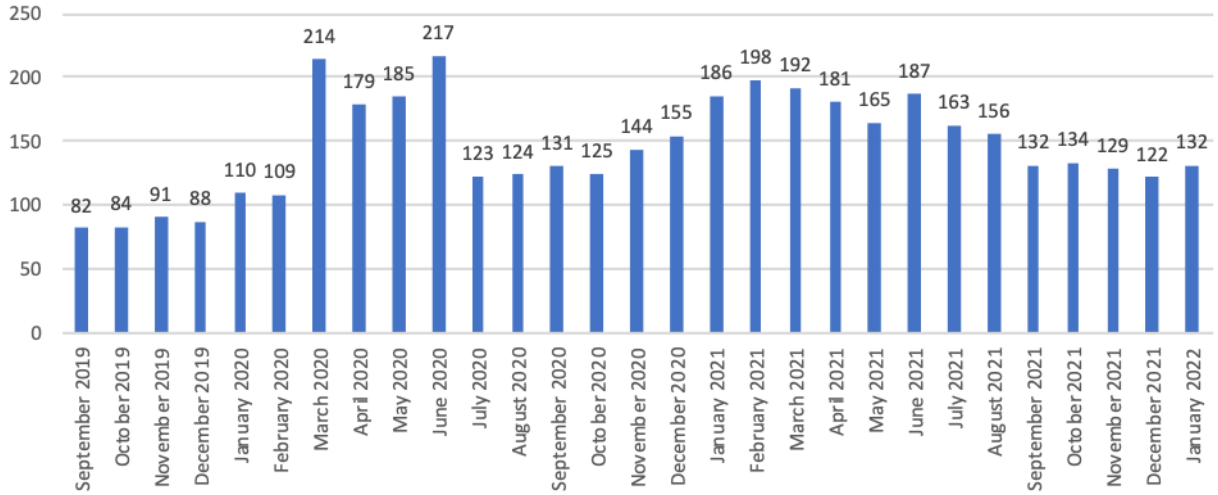
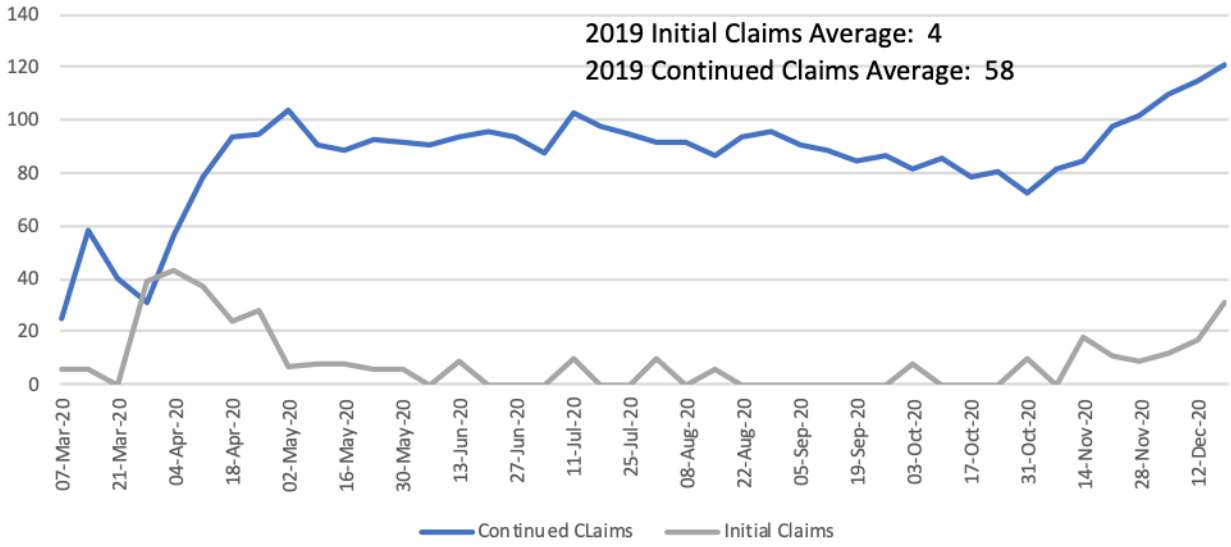


Figure 29: Initial and Continued Unemployment Claims for Rio Blanco County[34]



33 Colorado Department of Labor and Employment.
34 Colorado Department of Labor and Employment.

Table 6: Colorado Industry Share of Initial Unemployment Claims[35]

INDUSTRY CODE	INDUSTRY SECTOR	TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	SHARE OF TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	WEEKLY AVERAGE INITIAL CLAIMS IN 2019	SHARE OF TOTAL INITIAL CLAIMS IN 2019	CHANGE IN SHARE POST COVID-19 PERIOD VS. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Pandemic Effect on the Coal Industry

Rio Blanco has three coal mines near or within its county borders: Colowyo Mine which is shared with Moffat County, Deserado Mine, which is entirely within the county, and Trapper Mine, which is in Moffat County but is close to the Rio Blanco/Moffat border and employs people from Rio Blanco County. .Like all energy prices, coal prices fell in 2020, but from the end of 2020 through the end of 2021 coal prices more than doubled. Despite the large increase in prices, coal jobs held steady, though coal production did begin to increase in late 2021. However, both Trapper and Foidel Creek Mines have seen a decline in mining jobs since the beginning of the COVID-19 pandemic.

35 Colorado Department of Labor and Employment.

Figure 30: Global Price of Coal, Australia[36]

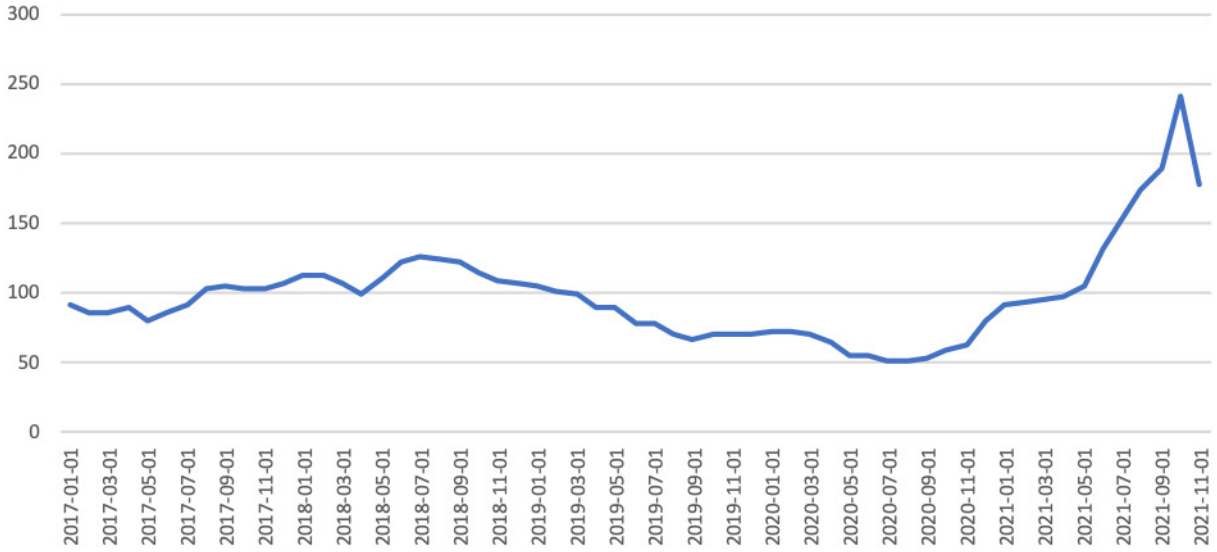
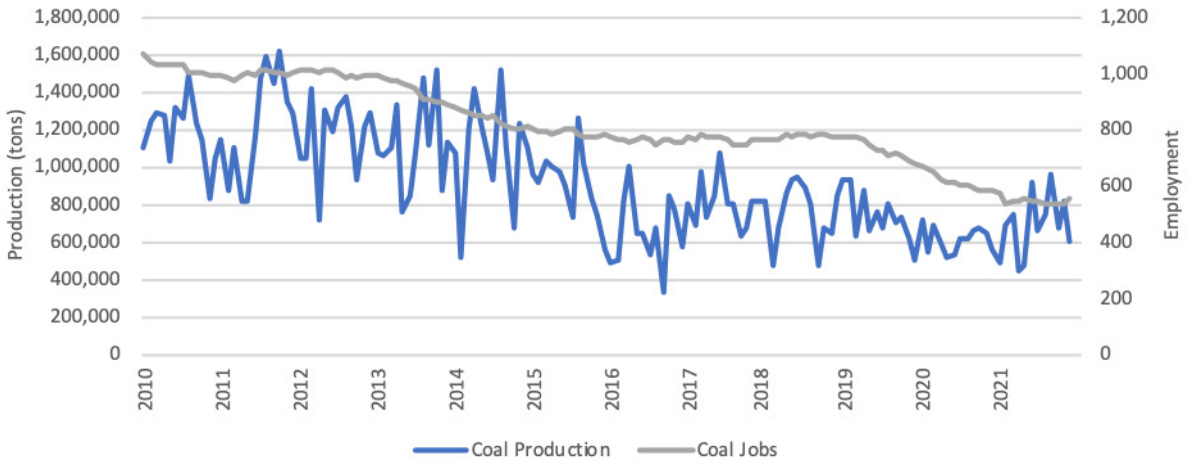
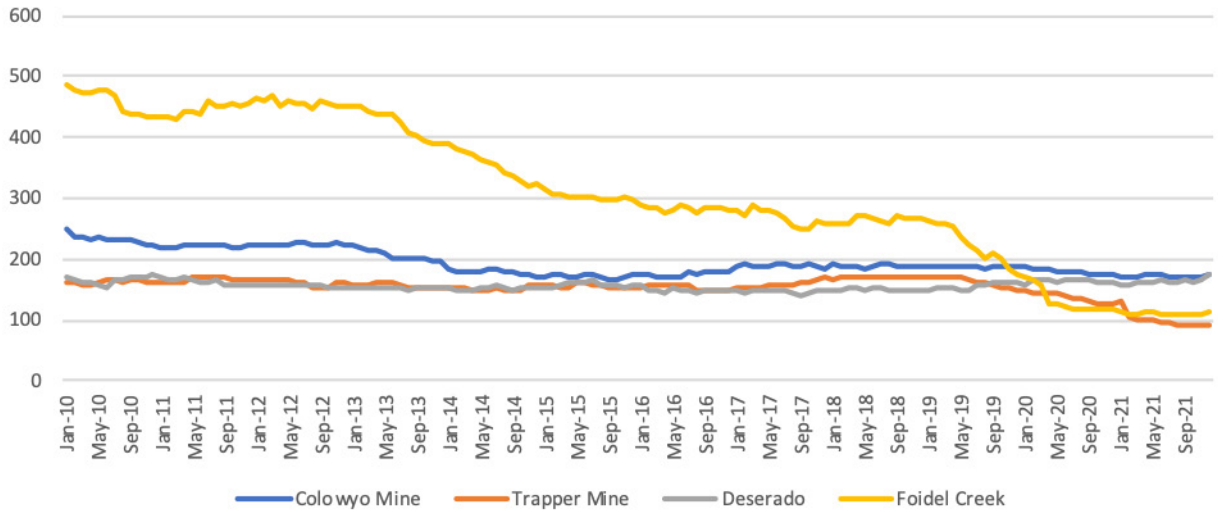


Figure 31: Coal Production and Jobs, NW Colorado[37]



36 International Monetary Fund.
37 Data from Colorado Division of Reclamation, Mining, and Safety.

Figure 32: Colowyo, Trapper, Deserado, and Foidel Creek Mine Jobs[38]



Lasting Challenges

Rio Blanco will experience several challenges over the next couple of decades, which result from the transition from coal. Although these are largely due to the transition away from coal, COVID 19 augmented these challenges. Below is a description of these challenges:

- Economic diversification to insulate from energy shocks: The primary challenge for Rio Blanco County will be diversifying its economy to insulate it from shocks associated with oil, gas, and coal. However, there has been longstanding challenges within the county related to economic diversification. The history of economic swings in the county has been defined by the energy industry in which a catastrophic collapse occurred during the 1980s. These challenges were augmented by the energy and housing bubble of the late 2000s. Currently more than 70% of Rio Blanco's GDP comes from mining, oil, and gas.

- Replacing economic activity lost from coal power and mining: As coal mines and power plants close, replacing lost economic activity will be challenging. However, other sources of mining and extraction unrelated to coal exist, namely Natural Soda's production of NaCO2 and CO2. However, local governments should begin to prepare for less tax revenue from extraction related industries.

- Preventing population declines: Due to the loss of economic activity, Rio Blanco and Moffat Counties are expected to see population declines in the future. Therefore, keeping the economy viable enough to attract new residents and enable existing ones to remain will become a priority.

Population declines

Loss of economic activity from coal power and mining will be associated with decreasing population. Keeping the economy viable enough to attract new residents and enable existing ones to remain will become a priority.

RIO BLANCO COUNTY

38 Data from Colorado Division of Reclamation, Mining, and Safety.

Routt County

COVID Impact Summary

The pandemic caused a 4.15% GDP loss in Routt County during 2020. These losses primarily occurred in the tourism industry (accommodation and food services, arts, entertainment, and recreation), the energy sector, and transportation. Since Q3 2020, accommodation and food services have recovered. However, arts, entertainment, and recreation, as well as mining, oil, and gas have not. The construction industry experienced the largest gains in 2020, during which time it grew by 1.18%. Most jobs lost during the pandemic were in arts, entertainment, and recreation (-447), accommodation and food services (-407), and real estate, rental, and leasing (-153).

Most Affected and Most Resistant Sectors

The Routt County economy lost 4.15% of its GDP in 2020. Major losses occurred in arts, entertainment, and recreation (-22.67%), transportation and warehousing (-22.62%), mining, oil, and gas (-16.38%), and accommodation and food services (-15.46%). I in terms of total GDP losses alone, accommodation and food services followed by mining, oil and gas were the top two losses.

Most jobs lost during the pandemic

Arts, entertainment, and recreation ..... -447

Transportation and warehousing ..... -407

Accommodation and food services ..... -153

ROUTT COUNTY

This trend has occurred in other areas of the region where COVID-19 triggered losses in tourism and energy. Routt county (like Garfield County) has an energy focus in the west and a tourism focus in the east. Therefore, it was no coincidence that Routt and Garfield had the lowest GDP's in the region. Figure 34 illustrates the percentage of GDP that comes from coal, oil, and gas production (5.39%). Routt County is less susceptible to swings in the energy industry than its neighbors, but still relies on mining, oil, and gas for a significant portion of GDP.

Low oil and gas prices in early 2020 caused a tailspin in the oil and gas industry into a tailspin. However, declines in this industry began occurring in late 2019. Figure 33 illustrates Routt County real GDP growth rates, showing that GDP has been relatively volatile the past 15 years.

Table 7 illustrates the gains or losses in GDP and figure 35 illustrates Real GDP growth rates for the Western Slope (with the comparison of Colorado and Pueblo County). The higher GDP growth rates occurred in counties that do not rely heavily on tourism and energy production. The worse the GDP growth rate is, the higher the dependency of the location on tourism and energy is, which were the two hardest hit sectors in the pandemic.

In Routt County, there were very few industries that performed well during the pandemic. However, the top performing industry in the county was construction, which grew by 5.18%. The next biggest gain occurred in administrative and support and waste management/remediation services at 2.18%. Note that this is from a GDP perspective, as almost all industries lost jobs during 2020. From a jobs perspective, the biggest losses were in arts, entertainment, and recreation (-447), accommodation and food services (-407), and real estate, rental, and leasing (-153).

Figure 33: Real GDP Growth Rate Routt County[39]

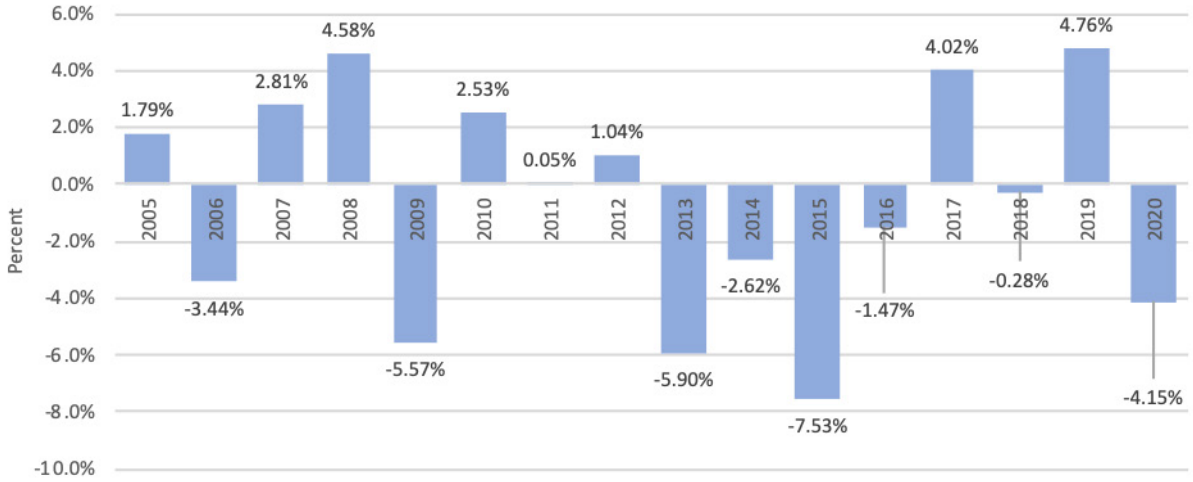


Table 7: Real GDP Comparison Routt County, 2019 to 2020[40]

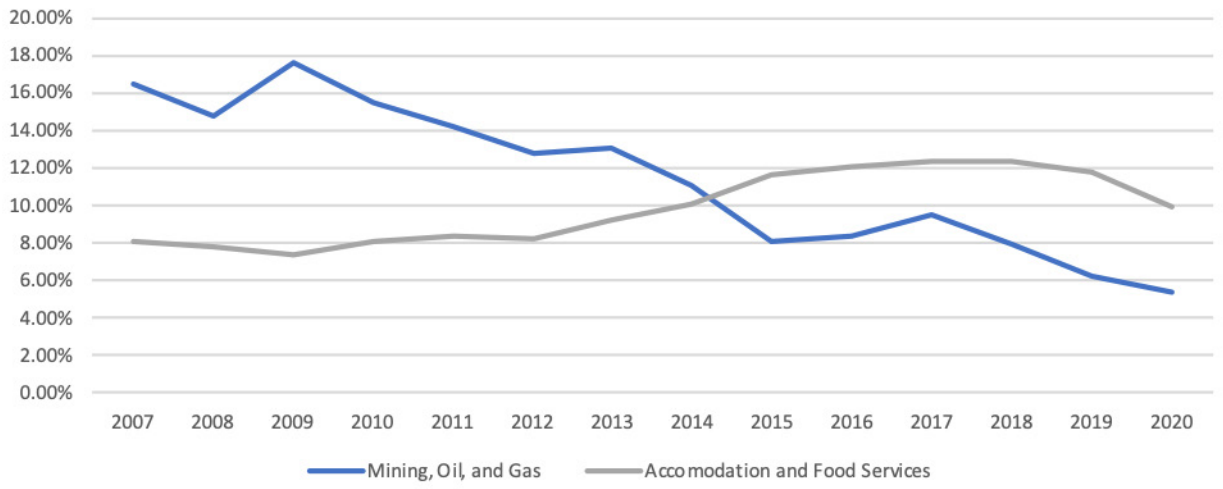
	2019	2020	DIFFERENCE IN DOLLARS	PERCENTAGE DIFFERENCE	PERCENTAGE OF TOTAL GDP
All industry total	$1,803,011	$1,728,212	-$74,799	-4.15%	
Private industries	$1,627,261	$1,553,544	-$73,717	-4.53%	89.89%
Agriculture, forestry, fishing and hunting	$1,972	$21,184	$19,212	974.24%	1.23%
Mining, quarrying, and oil and gas extraction	$111,357	$93,119	-$18,238	-16.38%	5.39%
Utilities	$134,731	$120,998	-$13,733	-10.19%	7.00%
Construction	$115,680	$121,668	$5,988	5.18%	7.04%
Manufacturing	$12,511	$11,985	-$526	-4.20%	0.69%
Durable goods manufacturing	$8,413	$8,078	-$335	-3.98%	0.47%
Nondurable goods manufacturing	$4,059	$3,870	-$189	-4.66%	0.22%
Wholesale trade	$44,535	$42,717	-$1,818	-4.08%	2.47%
Retail trade	$119,023	$116,488	-$2,535	-2.13%	6.74%
Transportation and warehousing	$44,648	$34,549	-$10,099	-22.62%	2.00%
Information	$25,679	$24,741	-$938	-3.65%	1.43%
Finance, insurance, real estate, rental, and leasing	$459,452	$452,826	-$6,626	-1.44%	26.20%
Finance and insurance	$37,682	$37,965	$283	0.75%	2.20%
Real estate and rental and leasing	$425,220	$418,034	-$7,186	-1.69%	24.19%
Professional and business services	$202,102	$204,628	$2,526	1.25%	11.84%

39 Bureau of Economic Analysis.
40 Bureau of Economic Analysis.

Table 7: Real GDP Comparison Routt County, 2019 to 2020 *continued*

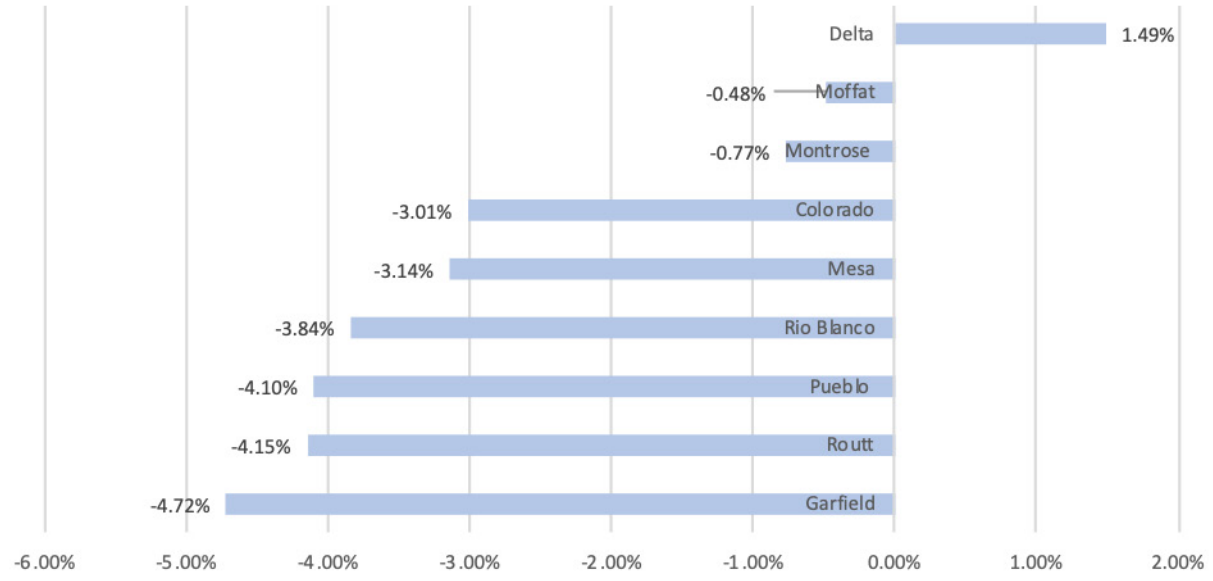
Professional, scientific, and technical services	$81,885	$82,310	$425	0.52%	4.76%
Management of companies and enterprises	$33,668	$33,251	-$417	-1.24%	1.92%
Administrative and support and waste management and remediation services	$84,565	$86,851	$2,286	2.70%	5.03%
Educational services, health care, and social assistance	$96,316	$92,387	-$3,929	-4.08%	5.35%
Educational services	$14,021	$12,125	-$1,896	-13.52%	0.70%
Health care and social assistance	$81,980	$80,088	-$1,892	-2.31%	4.63%
Arts, entertainment, recreation, accommodation, and food services	$210,991	$170,551	-$40,440	-19.17%	9.87%
Arts, entertainment, and recreation	$111,705	$86,376	-$25,329	-22.67%	5.00%
Accommodation and food services	$99,733	$84,315	-$15,418	-15.46%	4.88%
Other services (except government and government enterprises)	$33,656	$30,912	-$2,744	-8.15%	1.79%
Government and government enterprises	$173,037	$171,802	-$1,235	-0.71%	9.94%

Figure 34: Mining and Accommodation and Food Services as a Percentage of GDP Routt County[41]



41 Bureau of Economic Analysis.

Figure 35: Western Slope Real GDP Growth Rate Comparison[42]



Industry Trends

The previous section discussed 2020 GDP estimates, which illustrate the losses in GDP from the COVID-19 induced recession. This section uses data from the Quarterly Census of Employment and Wages, which is a business survey that as of the writing of this document provided 2021 Q3 data. This dataset provided some insight on whether certain industries were recovering from the 2020 downturn. Q3 of 2020 could be considered the worst quarter of the COVID-19 pandemic because it reflects the period when government induced shutdowns, stay at home orders, and other restrictions were in force. Figure 37 and figure 38 illustrate the recovery of accommodation and food services, arts, entertainment, and recreation, and oil and gas from their lows in April of 2020.

One interesting point is that although job gains from in accommodation and food services was larger than other industries, in figure 38 that industry is further down the list in wage recovery. This is due to the low weekly wage that accommodation and food services pays. The low wages in this sector and fact that many workers received expanded unemployment are two reasons why 2020 GDP data was not as bad. Figure 40 shows sales tax collections, illustrating that Steamboat Springs collections have increased faster than that of the county. Note the larger downswing for Steamboat Springs in April of 2020, which was follows by a major upswing in late 2021.

Figure 39 illustrates total job recovery with key COVID-19 impacted industries indexed at Q4 2019. Note that this figure shows percentage change in jobs. As of Q3 2021, the key COVID-19 impacted industries (oil, gas, mining, arts, entertainment, and recreation) have not recovered and are still substantially below their 2019 levels. However, retail trade is only slightly below its Q4 2019 level, while construction has increased from the indexed period.

42 Bureau of Economic Analysis.

Table 8: Q3 2021 Compared to Q3 2020 (QCEW)

NAICS SECTOR	AVERAGE EMPLOYMENT 3RD QUARTER 2021	TOTAL QUARTERLY WAGES	AVERAGE WEEKLY WAGE	EMPLOYMENT CHANGE	WAGE CHANGE
Total, All Industries	15,029	$198,234,528	$1,015	796	$20,589,320
Health Care and Social Assistance	1,983	$31,235,484	$1,212	179	$4,224,521
Accommodation and Food Services	2,511	$22,683,259	$695	364	$5,772,596
Construction	1,464	$22,526,296	$1,184	6	$1,530,664
Retail Trade	1583	$17,022,994	$827	6	$2,011,001
Public Administration	961	$14,985,820	$1,200	18	$1,153,377
Professional and Technical Services	697	$14,562,600	$1,607	95	$5,170,396
Real Estate and Rental and Leasing	792	$10,780,112	$1,047	34	$1,629,751
Educational Services	880	$9,607,117	$840	34	$856,163
Arts, Entertainment, and Recreation	1,037	$8,750,759	$649	249	$2,458,420
Finance and Insurance	343	$8,490,441	$1,904	33	$1,943,769
Administrative and Waste Services	796	$8,486,206	$820	-348	-$9,969,878
Wholesale Trade	316	$5,354,478	$1,303	-6	-$27,505
Other Services, Ex. Public Admin	483	$4,656,944	$742	38	$628,738
Utilities	176	$4,212,211	$1,841	5	$265,877
Mining	168	$3,680,119	$1,685	11	$123,683
Transportation and Warehousing	256	$2,950,243	$886	55	$533,442
Management of Companies and Enterprises	88	$2,346,125	$2,051	-28	$1,298,920
Manufacturing	179	$2,205,639	$948	17	$467,554
Information	155	$2,061,289	$1,023	18	$83,033
Agriculture, Forestry, Fishing and Hunting	156	$1,551,211	$765	12	$349,617

Figure 37: Routt County Jobs, QCEW Q3 2020 compared to Q3 2021[43]

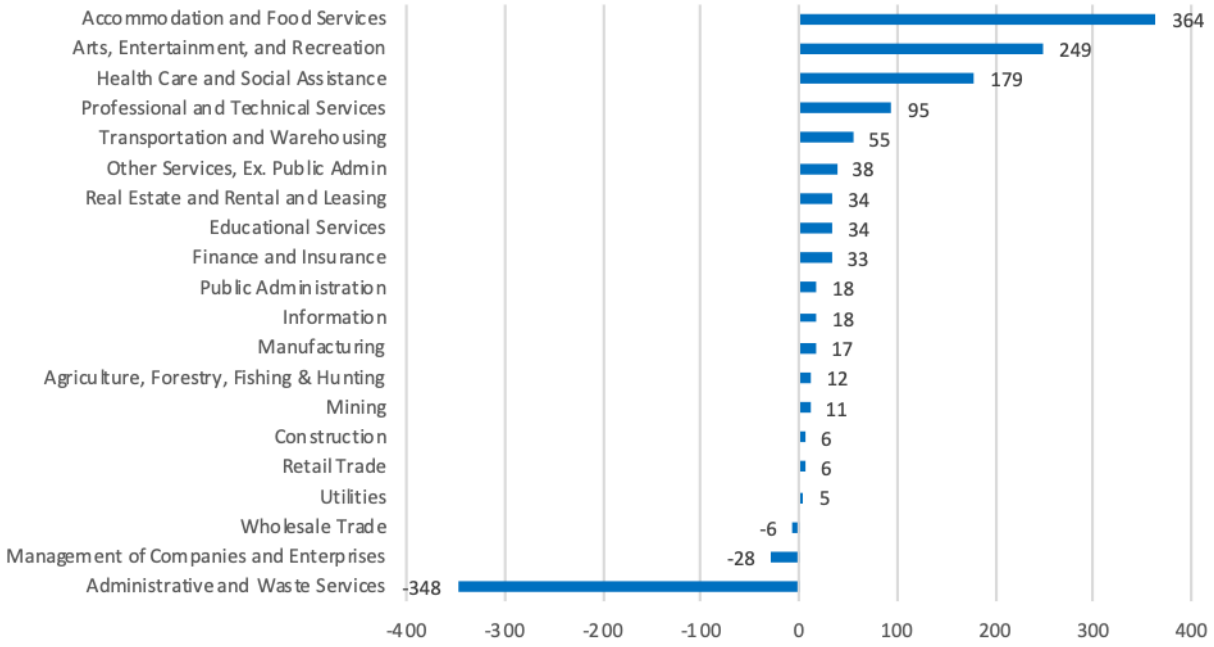
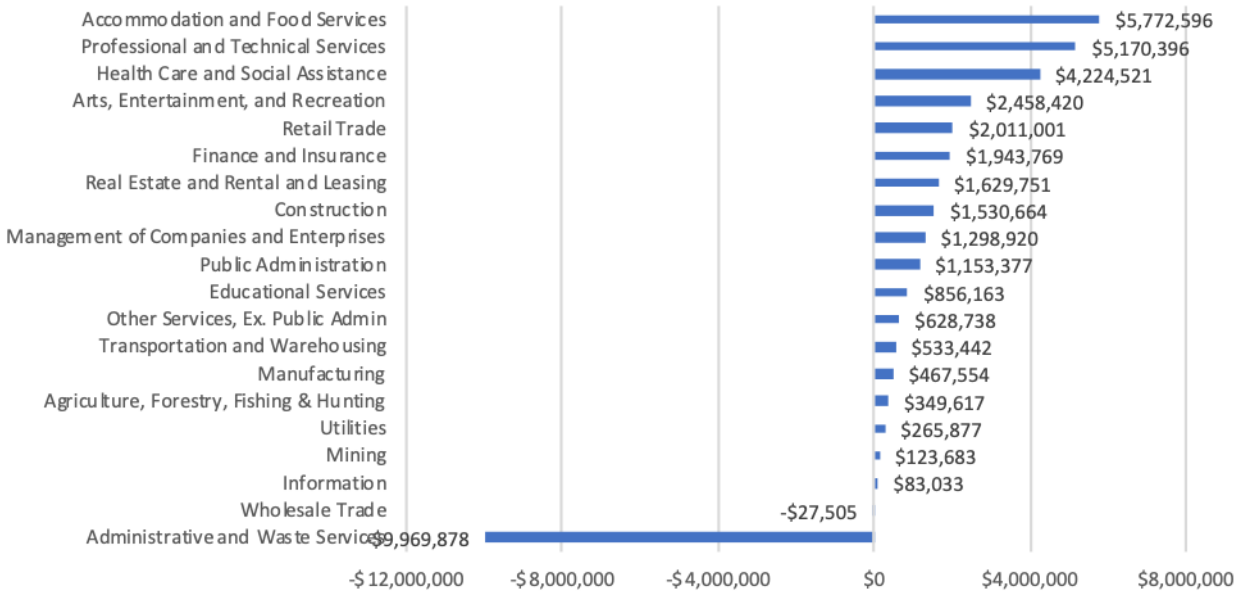


Figure 38: Routt County Wages, QCEW Q3 2020 compared to Q3 2021[44]



43 Colorado Department of Labor and Employment.
44 Colorado Department of Labor and Employment.

Figure 39: Routt County Job Recovery Percentage Change Key Industries[45]

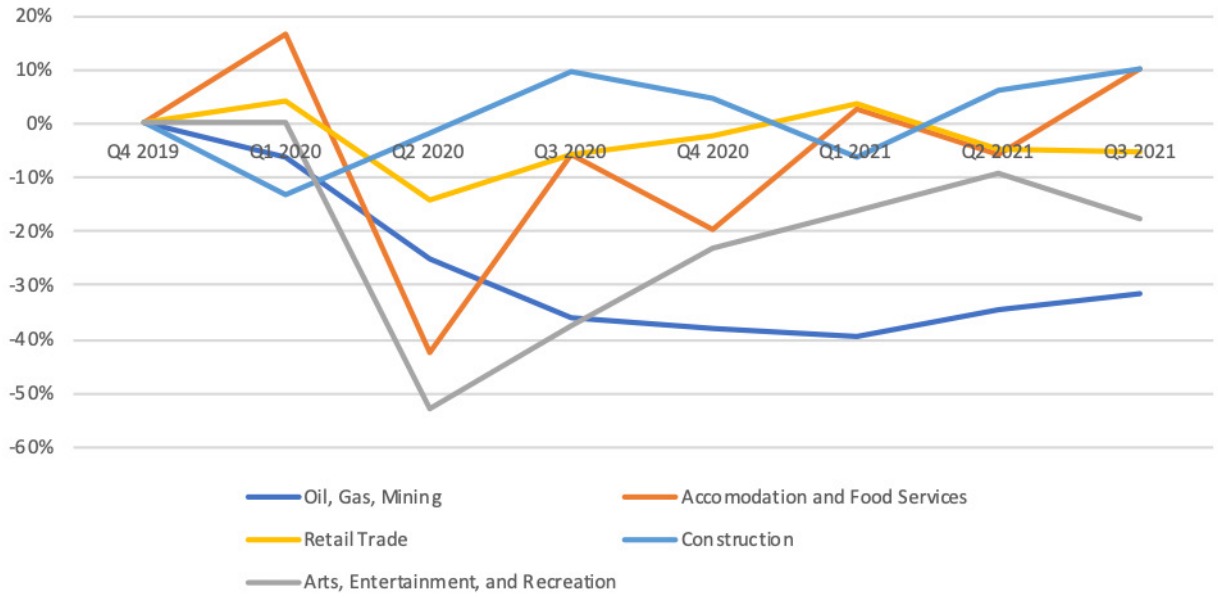
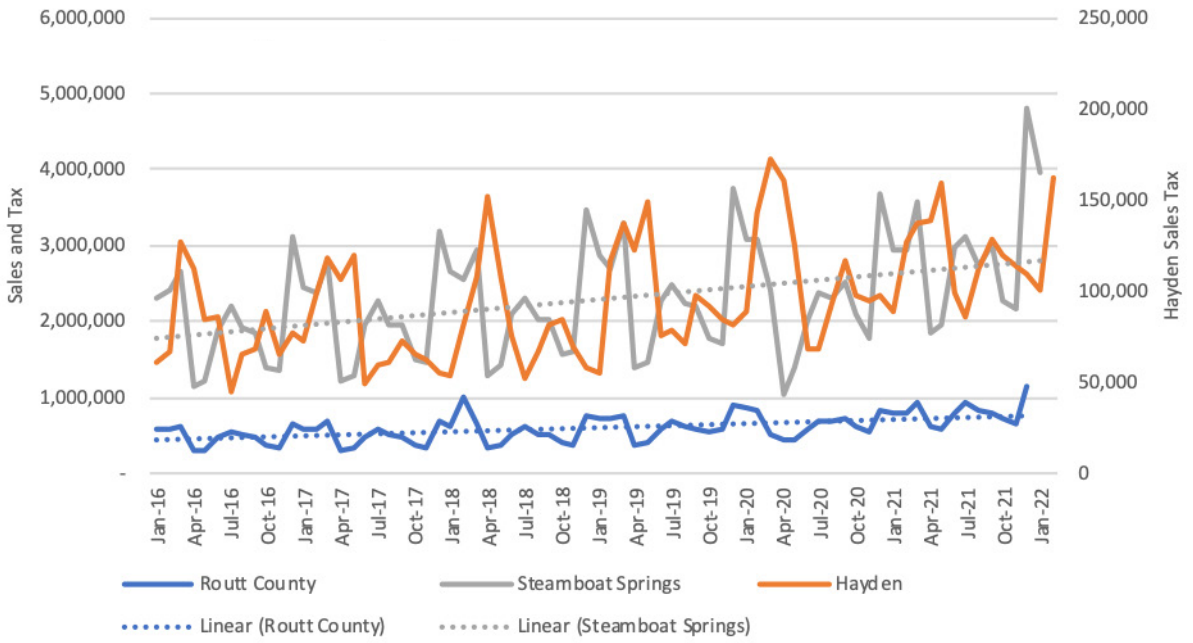


Figure 40: Routt County and Steamboat Springs Sales Tax[46]



45 Colorado Department of Labor and Employment. Note that Q4 and Q1 data are not available for arts, entertainment, and recreation. To create the line graph for this industry, arts, entertainment, and recreation were indexed for Q3 2019 and Q4 and Q1 data were averaged from the two closest data points.

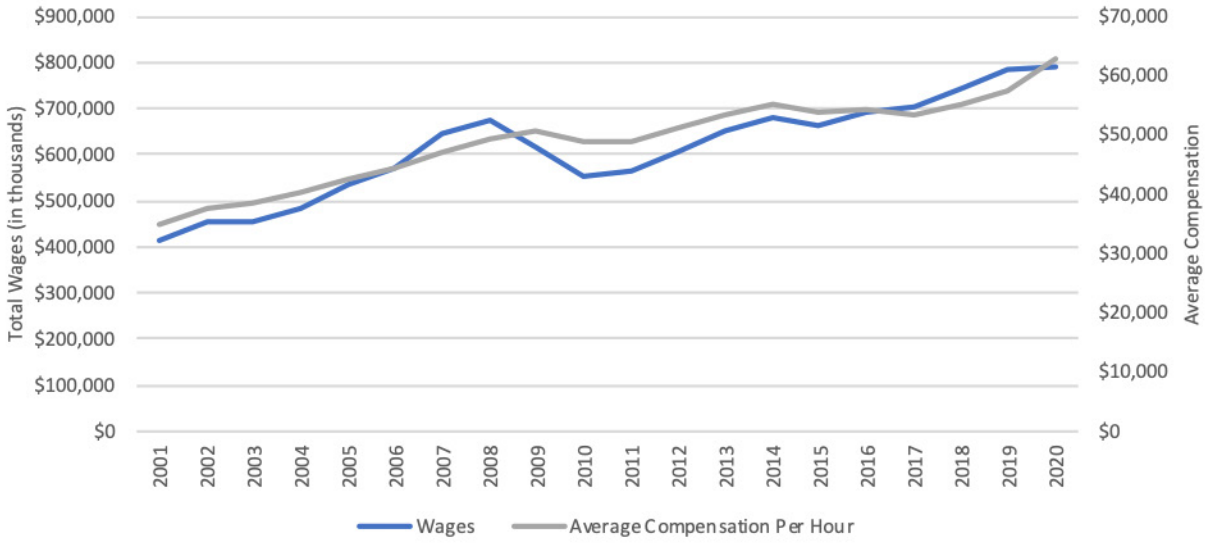
46 Data from Routt County, City of Hayden, City of Steamboat Springs.

Augmented Economic Challenges

Wage Growth

Despite many negative datapoints for 2020, Routt County saw an increase in total wages ($784,401,000 to $791,429,000) and in the average compensation per job dollar ($57,352 to $62,716). Overall, wages have steadily increased in the county since 2010.

Figure 41: Routt Wage Growth and Average Compensation Per Job[47]



Economic Diversity

Although GDP fell, economic diversity increased in other parts of the Western Slope primarily because the industries that many counties are undiversified in, such as energy and oil and gas, fell. Routt County saw industrial diversification increase as measured by the Hachman Index. Figure 42 illustrates the Hachman Index, a measure of industrial diversification. A higher Hachman Index depicts higher industrial diversification compared to Colorado, while a lower one indicates less diversity. Routt's Hachman Index has been relatively stable for the last 10 years, with a sharp relative increase in 2020, but a still relatively small total increase in diversification.

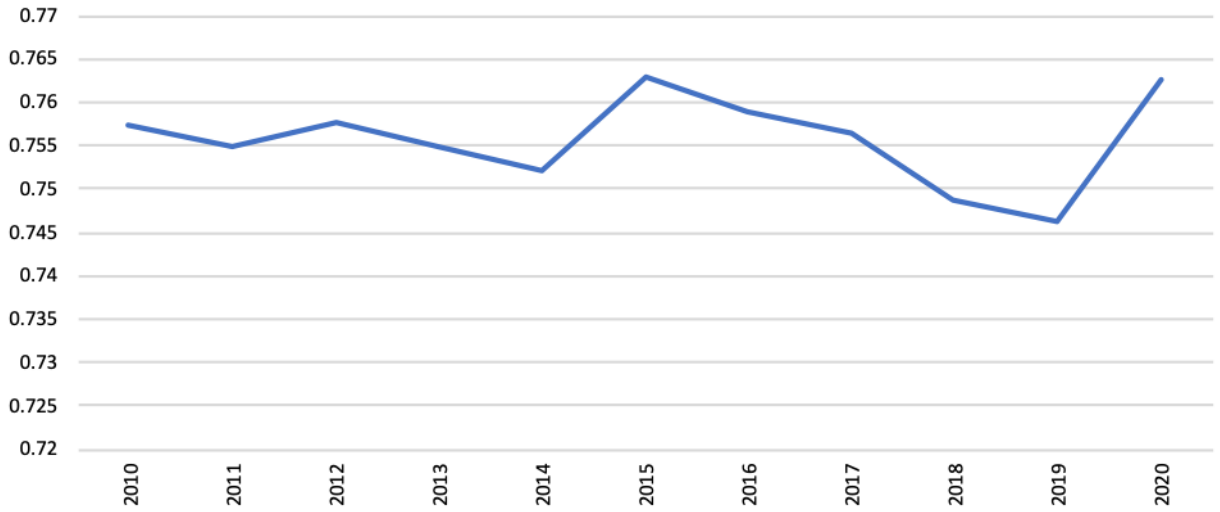
Wages increased in 2020 and have steadily increased since 2010.

Industrial diversification has stayed relatively constant in Routt, with a small but sharp increase in diversification in 2020.

ROUTT COUNTY

47 Bureau of Economic Analysis.

Figure 42: Hachman Index Routt County[48]



Affected Groups and Job Creation

Routt County employment fell from a peak of 16,848 in February of 2020, to a low of 12,114 in April 2020, after which it rose to 16,276 by February of 2022. Unemployment numbers are now trending downwards with a February 2022 number of 492. As a comparison, late 2019 unemployment was in the 250-350 range.

Employment

Late 2019.....250-350
February 2020.....16,848
April 2020.....12,114
February 2022.....16,276

ROUTT COUNTY

Figure 46 illustrates initial and continued unemployment claims during 2020. Routt County's initial claims peaked in early April while continued claims peaked in early May. Table 8 shows the Colorado industry share of unemployment claims. Unfortunately, industry level unemployment claims are not available at the county level, but we can use table 8 to understand the general trends for Colorado. Accommodation and food services is the biggest share of initial claims filings at 21.7%, while health care is next at 11.7%, followed by retail trade at 11.5%.

48 Author calculated with data from the Bureau of Economic Analysis.

Figure 43: Routt County Yearly Employment Average[49]

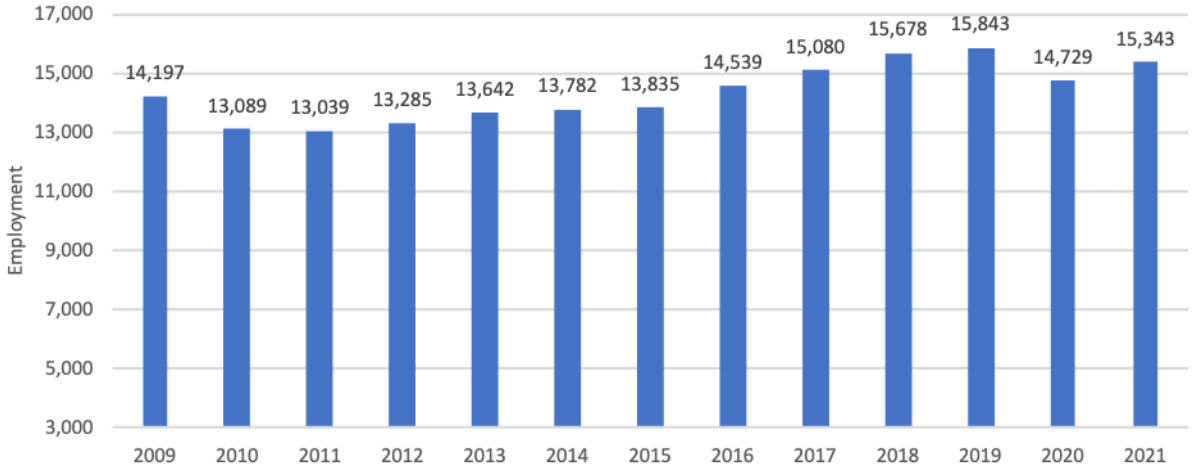
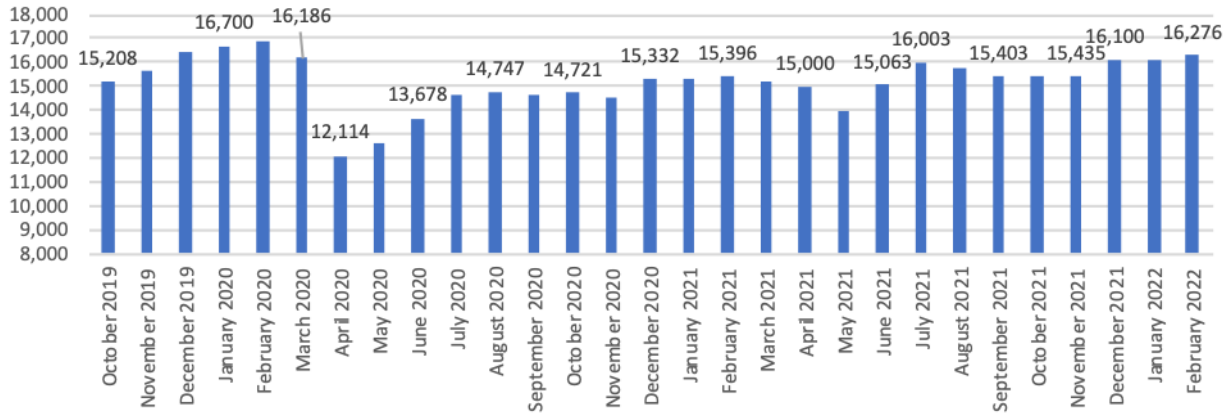


Figure 44: Routt County Monthly Employment Estimates[50]



49 Colorado Department of Labor and Employment.
50 Colorado Department of Labor and Employment.

Figure 45: Routt County Monthly Unemployment Estimates[51]

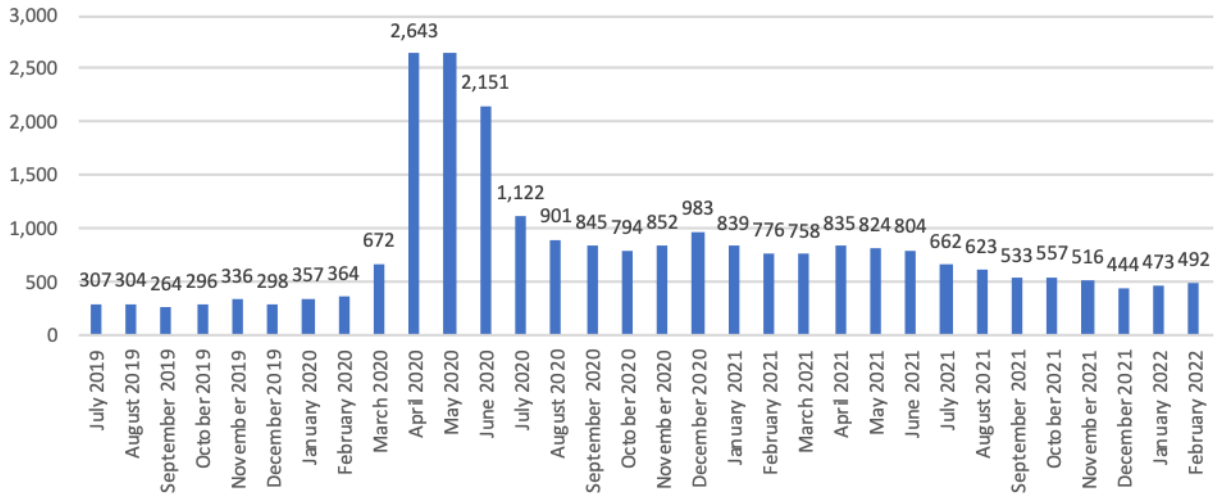
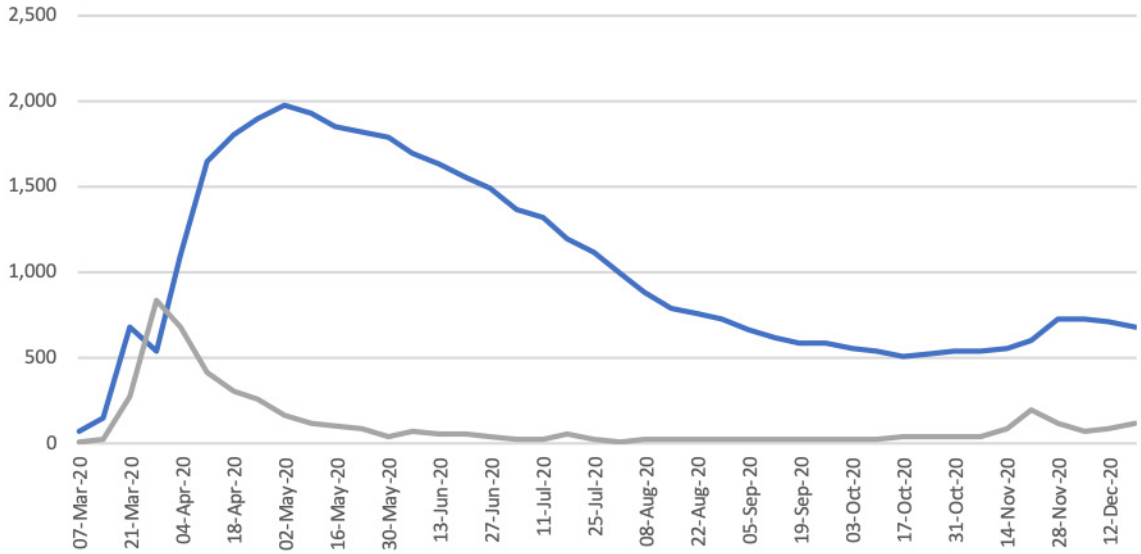


Figure 46: Initial and Continued Unemployment Claims for Routt County[52]



51 Colorado Department of Labor and Employment.
52 Colorado Department of Labor and Employment.

Table 9: Colorado Industry Share of Initial Unemployment Claims[53]

INDUSTRY CODE	INDUSTRY SECTOR	TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	SHARE OF TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	WEEKLY AVERAGE INITIAL CLAIMS IN 2019	SHARE OF TOTAL INITIAL CLAIMS IN 2019	CHANGE IN SHARE POST COVID-19 PERIOD VS. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Pandemic Effect on the Coal Industry

Routt County has one coal mine in its region (the 20 Mile Mine) and the coal-fired Hayden Power Station. Like all energy commodities, coal fell in value in 2020. However, from the end of 2020 through the end of 2021prices more than doubled. Despite the large price increase, coal jobs held steady with an increase in production during late 2021. Figure 49 shows that both Trapper and Foidel Creek Mine have experienced a decline in mining jobs since the spring of 2019, which continued through the beginning of the pandemic.

53 Colorado Department of Labor and Employment.

Figure 47: Global Price of Coal, Australia[54]

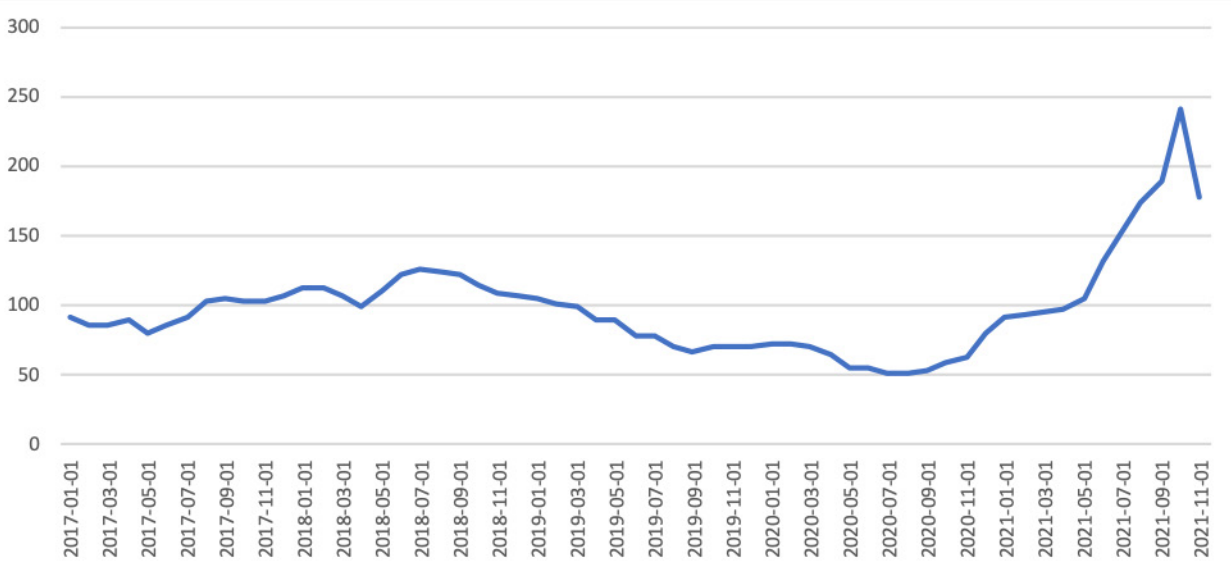
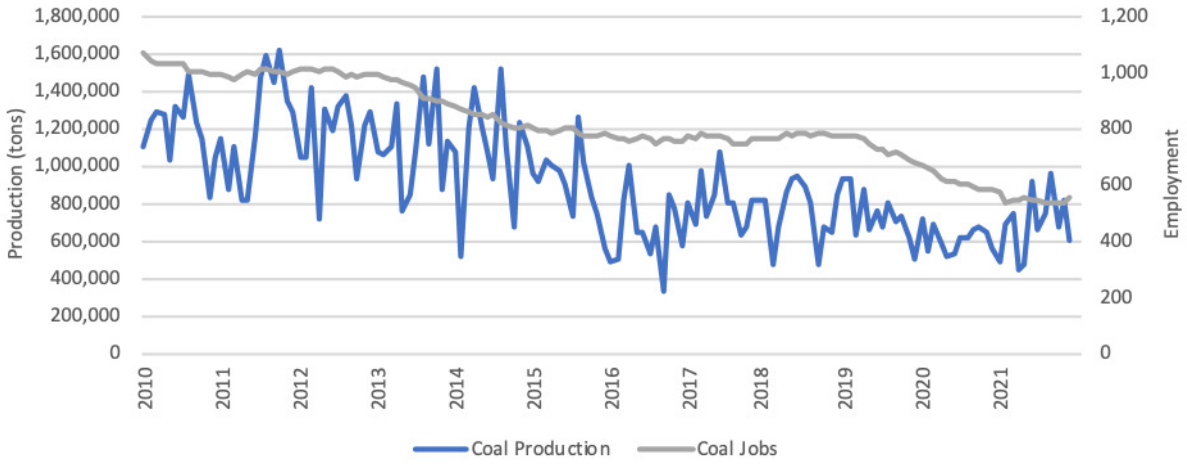
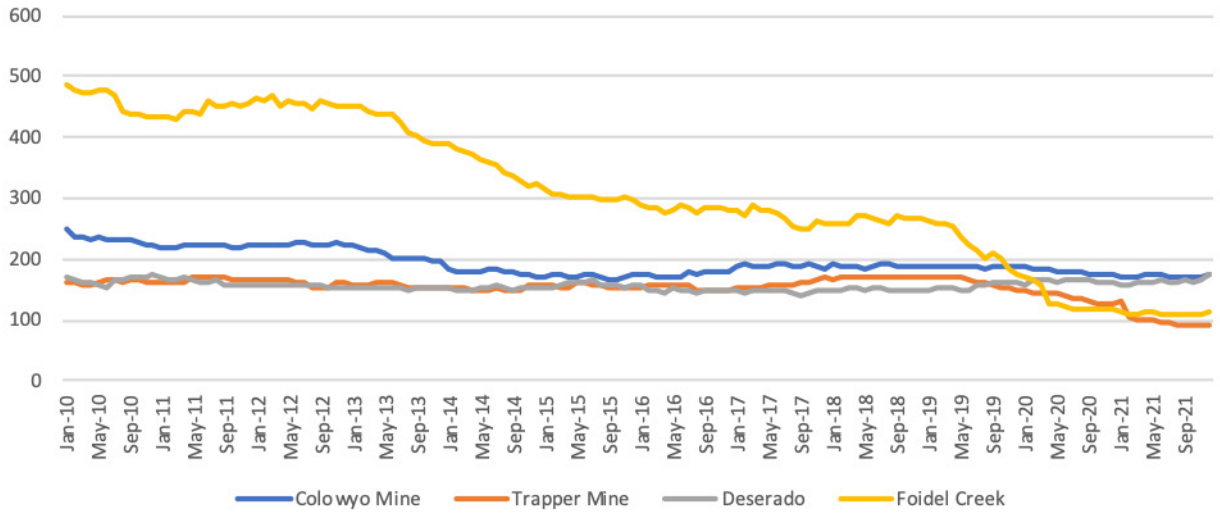


Figure 48: Coal Production and Jobs, NW Colorado[55]



54 International Monetary Fund.
55 Data from Colorado Division of Reclamation, Mining, and Safety.

Figure 49: Colowyo, Trapper, Deserado, and Foidel Creek Mine Jobs[56]



Lasting Challenges

Routt County will experience several challenges over the next couple of decades, which result from the transition from coal. The COVID-19 pandemic was particularly challenging for Routt County due to its impact on energy and tourism. Below is a description of lasting challenges the county will face:

The western and eastern portions of the county have unqiue diversification problems. One is dependent on energy and the other is dependent on tourism.

ROUTT COUNTY

- Economic diversification to insulate from energy industry and tourism related shocks: Routt County is much more insulated from energy shocks than Moffat and Rio Blanco Counties, because the percentage of GDP that comes from energy is significantly smaller. However, Hayden is significantly more dependent on energy than the rest of the county. Steamboat Springs, on the other hand, is highly dependent on tourism, which includes arts, entertainment, recreation, accommodations, and food services. Therefore, the western and eastern portions of the county have unique economic diversification problems.

- Replacing economic activity lost from coal power and mining: As coal mines and power plants close, replacing lost economic activity will be challenging. This is more important for the Hayden area, which is far more reliant on the coal industry than Steamboat Springs where a larger portion of Routt County's economy is located.

56 Data from Colorado Division of Reclamation, Mining, and Safety.

Mesa County

COVID Impact Summary

The pandemic resulted in a 3.14% GDP loss in Mesa County for 2020. The biggest losses occurred in oil and gas (-57.2%), accommodation and food services (-17.3%), and arts, entertainment, and recreation (-19.5%). Since Q3 2020, accommodation and food services, arts, entertainment, and recreation have made a full recovery. However, oil and gas has not. During 2020, the finance and insurance industry experienced the biggest gains (28.5%). Retail trade also performed well with a 4% increase. Most jobs lost during the COVID-19 pandemic were in oil and gas (1,028), followed by accommodation and food services (842). However, the oil and gas industry produce the highest wages in the county, while accommodation and food services produce the lowest.

Most Affected and Most Resistant Sectors

In 2020, Mesa County lost 3.14% of its GDP. Major losses occurred in mining, oil and gas, arts, entertainment and recreation, and accommodation and food services. Low oil and gas prices in early 2020 caused a tailspin in the oil and gas industry into a tailspin. However, declines in this industry began occurring in late 2019. Figure 50 illustrates Mesa County real GDP growth rates, showing that after positive 2017, 2018, and 2019 GDP growth rates, a negative one occurred in 2020. Table 9 illustrates the gains or losses in GDP, and figure 51 illustrates these gains and losses by industry in terms of 2020 GDP output. Figure 52 illustrates the Real GDP growth rates for the Western Slope, using Colorado and Pueblo County as comparison. The higher GDP growth rates occurred in counties that are not heavily reliant on tourism and energy production. Therefore, the worse the GDP growth rate, the higher the dependency on tourism and energy.

Although oil and gas as a percentage of total jobs in Mesa County has fallen for the last 12 years, the average wage and output for industry is so high that swings in the sector can still impact yearly GDP numbers. However, this occurs to a much smaller degree than in the past, as the industry has shrunk in terms of total size while non-oil and gas industries have grown.

Industries that performed well during the COVID-19 pandemic included real estate and retail trade. Low interest rates kept real estate-related sectors very strong during the pandemic nationally. Additionally, retail trade performed well, due to income increases during the pandemic, which resulted from government policies and increased home and equity values. This "wealth affect" as it is called, was also in part due to low interest rates.

3.14% GDP loss for 2020

Oil and gas ..... -57.2%

Accommodation and food services ..... -17.3%

Arts, entertainment and recreation ..... -19.5%

MESA COUNTY

Oil and gas jobs

Oil and gas jobs have fallen for the last 12 years but the average wage is so high that swings in the sector can still affect yearly GDP numbers.

MESA COUNTY

Figure 50: Real GDP Growth Rate Mesa County[57]

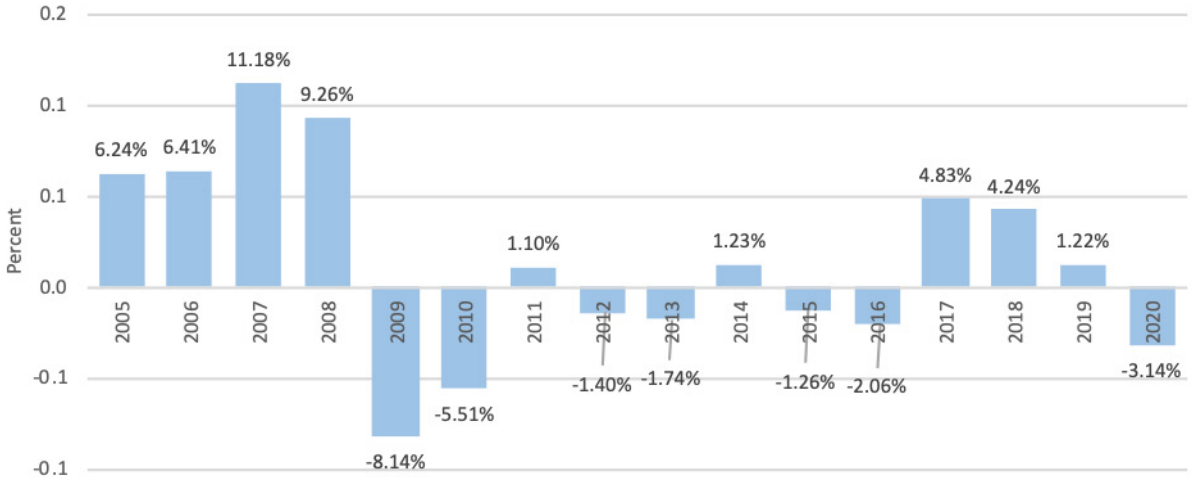


Table 10: Real GDP Comparison Mesa County (in thousands), 2019 to 2020[58]

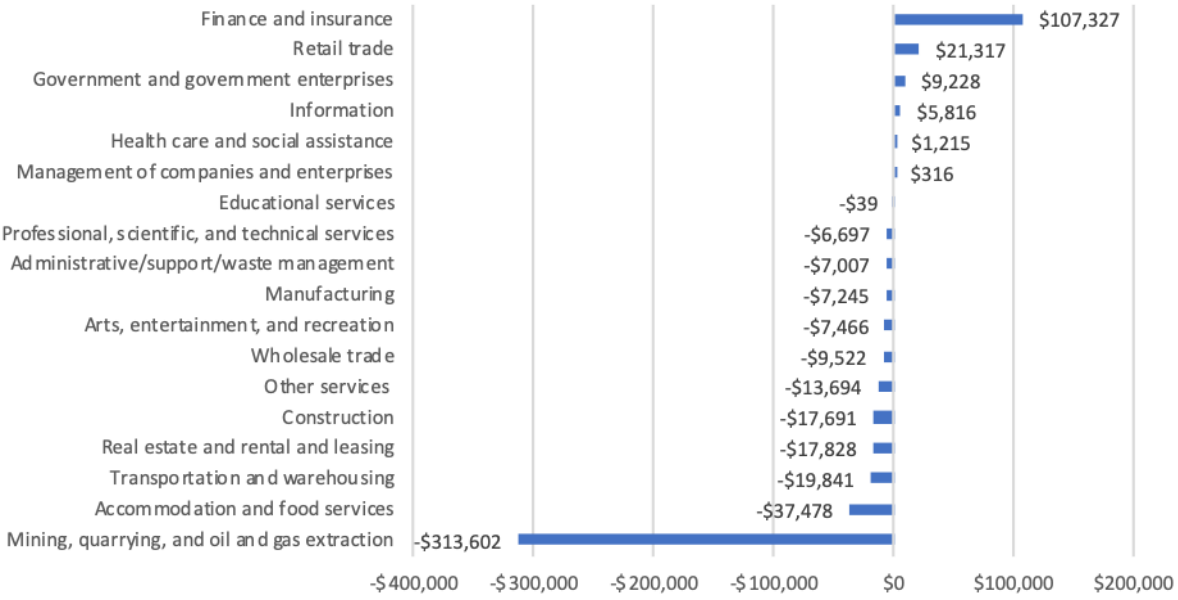
	2019	2020	DIFFERENCE IN DOLLARS	PERCENTAGE DIFFERENCE	PERCENTAGE OF TOTAL GDP
All industry total	$6,039,762	$5,849,815	-$189,947	-3.14%	
Private industries	$5,270,783	$5,069,837	-$200,946	-3.81%	86.67%
Agriculture, forestry, fishing and hunting	$8,527	N/A	N/A	N/A	N/A
Mining, quarrying, and oil and gas extraction	$547,984	$234,382	-$313,602	-57.23%	4.01%
Utilities	$25,839	N/A	N/A	N/A	N/A
Construction	$389,044	$371,353	-$17,691	-4.55%	6.35%
Manufacturing	$276,832	$269,587	-$7,245	-2.62%	4.61%
Durable goods manufacturing	$172,474	$163,016	-$9,458	-5.48%	2.79%
Nondurable goods manufacturing	$99,005	$102,518	$3,513	3.55%	1.75%
Wholesale trade	$268,150	$258,628	-$9,522	-3.55%	4.42%
Retail trade	$530,158	$551,475	$21,317	4.02%	9.43%
Transportation and warehousing	$187,206	$167,365	-$19,841	-10.60%	2.86%
Information	$130,897	$136,713	$5,816	4.44%	2.34%
Finance, insurance, real estate, rental, and leasing	$1,315,236	$1,411,289	$96,053	7.30%	24.13%
Finance and insurance	$376,604	$483,931	$107,327	28.50%	8.27%
Real estate and rental and leasing	$935,254	$917,426	-$17,828	-1.91%	15.68%
Professional and business services	$440,280	$426,522	-$13,758	-3.12%	7.29%

57 Bureau of Economic Analysis.
58 Bureau of Economic Analysis.

Table 10: Real GDP Comparison Mesa County (in thousands), 2019 to 2020 *continued*

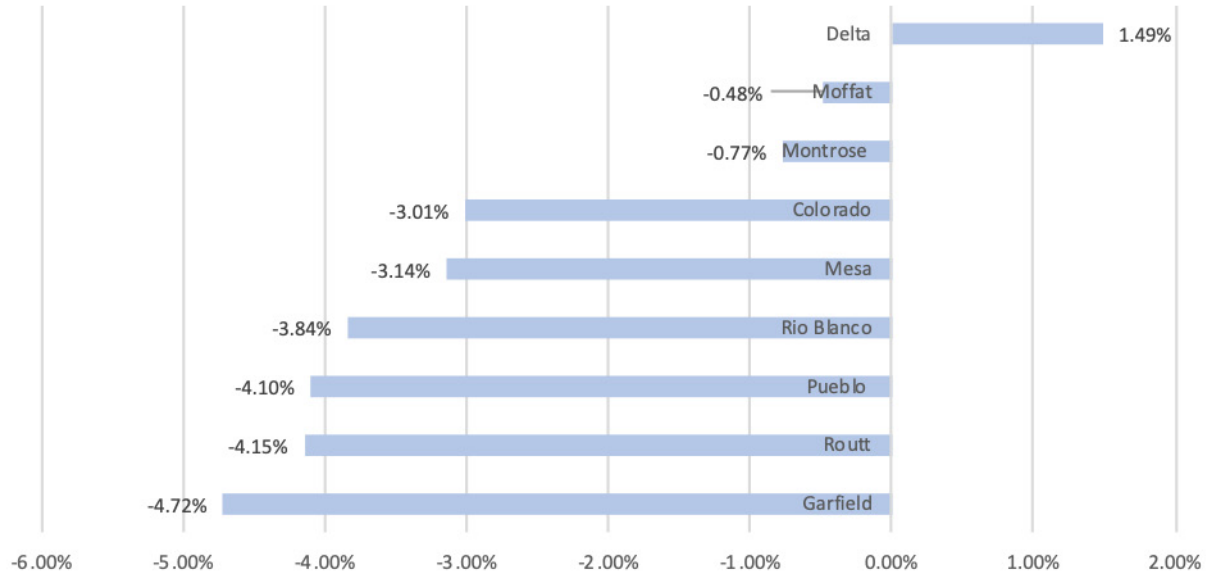
Professional, scientific, and technical services	$226,543	$219,846	-$6,697	-2.96%	3.76%
Management of companies and enterprises	$45,330	$45,646	$316	0.70%	0.78%
Administrative and support and waste management and remediation services	$169,353	$162,346	-$7,007	-4.14%	2.78%
Educational services, health care, and social assistance	$747,447	$748,618	$1,171	0.16%	12.80%
Educational services	$20,978	$20,939	-$39	-0.19%	0.36%
Health care and social assistance	$726,426	$727,641	$1,215	0.17%	12.44%
Arts, entertainment, recreation, accommodation, and food services	$254,732	$209,820	-$44,912	-17.63%	3.59%
Arts, entertainment, and recreation	$38,295	$30,829	-$7,466	-19.50%	0.53%
Accommodation and food services	$216,335	$178,857	-$37,478	-17.32%	3.06%
Other services (except government and government enterprises)	$152,063	$138,369	-$13,694	-9.01%	2.37%
Government and government enterprises	$768,031	$777,259	$9,228	1.20%	13.29%

Figure 51: Mesa County Real GDP Gains and Losses[59]



59 Bureau of Economic Analysis.

Figure 52: Western Slope Real GDP Growth Rate Comparison[60]



Industry Trends

The Quarterly Census of Employment and Wages (QCEW) provides quarterly data by industry on jobs and wages. Q3 of 2020 could be considered the worst quarter of the COVID-19 pandemic because it reflects the period when government induced shutdowns, stay at home orders, and other restrictions were in force. As of the writing of this report, Quarter 3 2021 is the most recent QCEW data point.

Figure 53 illustrates the recovery of accommodation and food services, retail trade, and oil and gas from their April 2020 lows. Although job gains in accommodation and food services was larger than other industries, figure 54 shows the sector further down the list in terms of wage recovery. This is due to the low weekly wages typically earned in that sector. This and the enhanced unemployment many workers in this sector received are two of the reasons why 2020 GDP data was not as bad as it could have been.

Figure 55 illustrates total job recovery within key COVID-19 impacted industries indexed at Q4 2019. Note that this figure shows percentage change in jobs. As of Q3 2021, only oil, gas, and mining have not recovered and are still substantially below their 2019 level. This industry began to show signs of weakness in late 2019 and fell sharply after energy prices dropped in spring 2020.

60 Bureau of Economic Analysis.

Figure 53: Mesa County Jobs, QCEW Q3 2020 compared to Q3 2021[61]

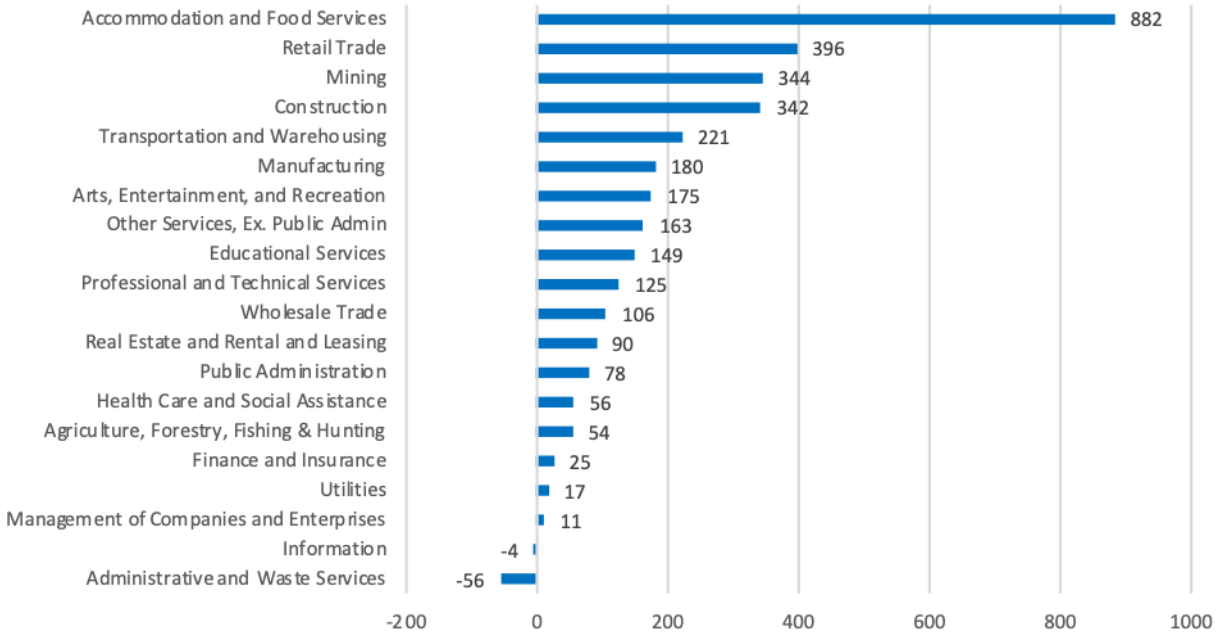
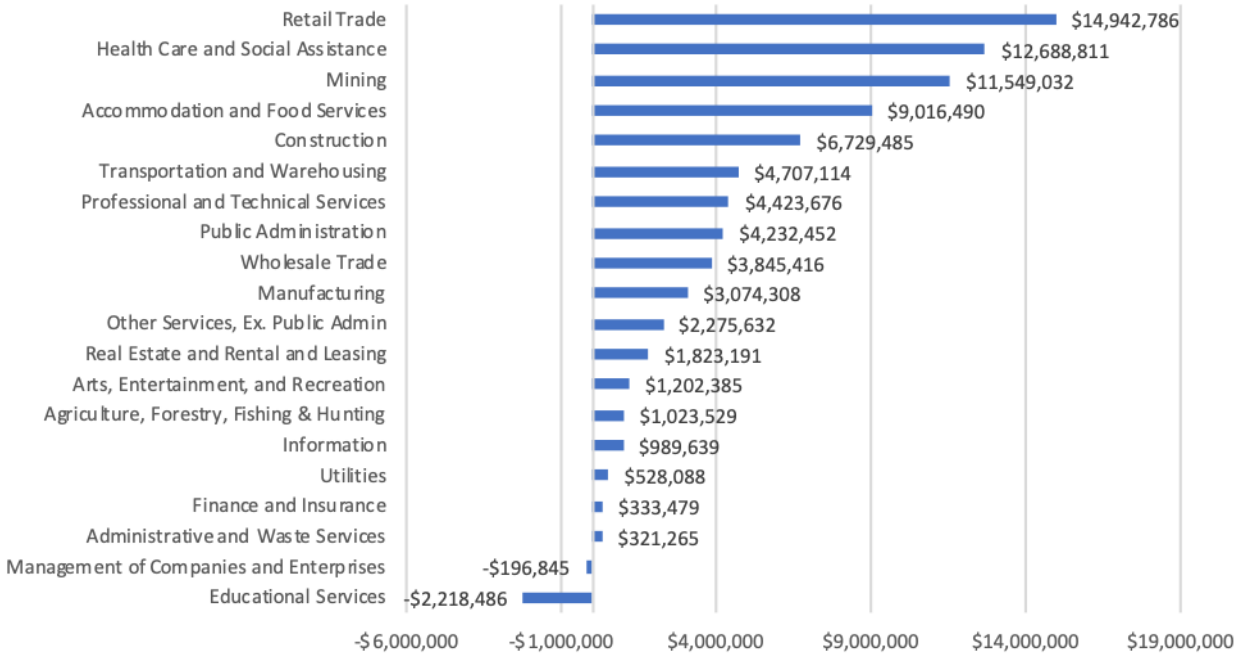
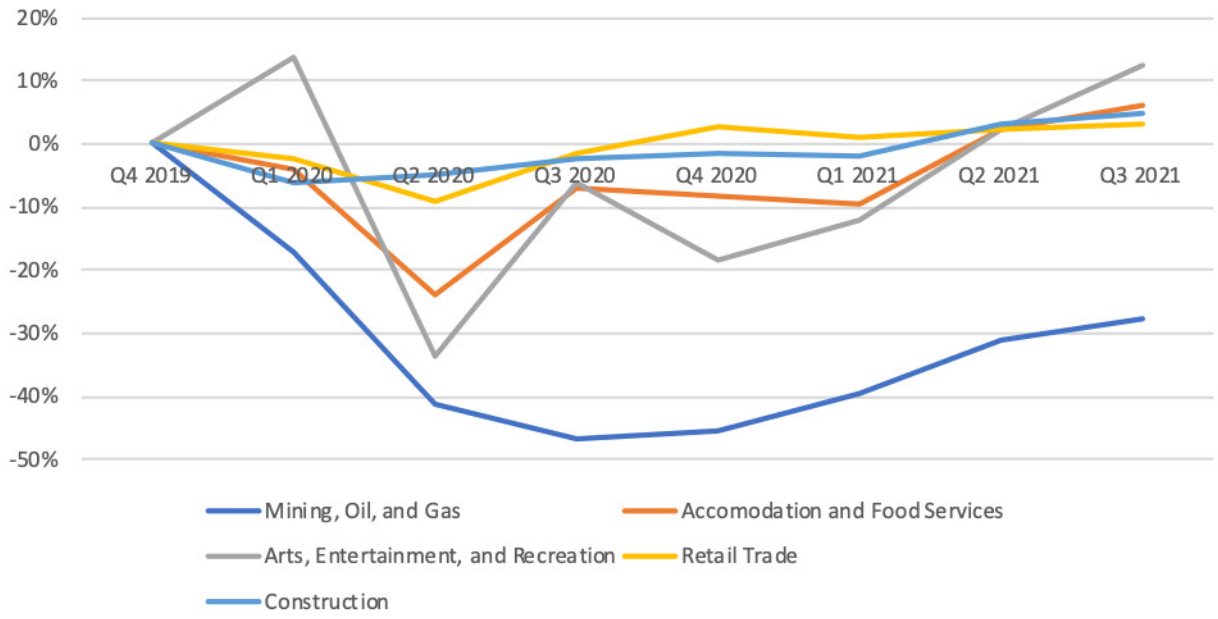


Figure 54: Mesa County Wages, QCEW Q3 2020 compared to Q3 2021[62]



61 Colorado Department of Labor and Employment.
62 Colorado Department of Labor and Employment.

Figure 55: Mesa County Job Recovery Percentage Change Key Industries[63]



Augmented Economic Challenges

Wage Growth

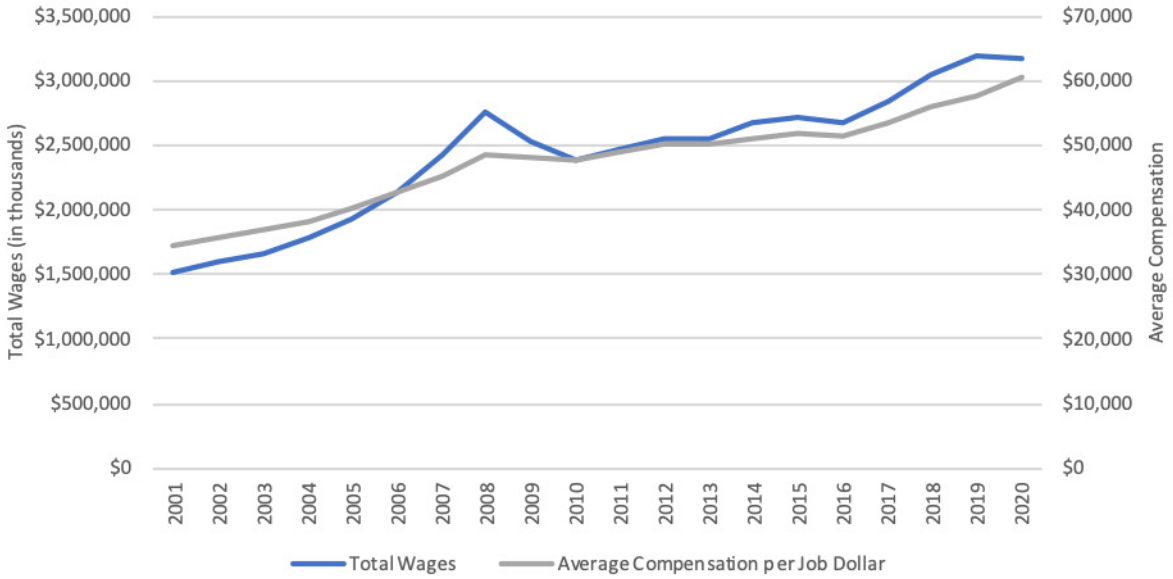
Overall, the pandemic created challenges for Mesa County. However, as of Q3 2021, the county overcame all of them except the recovery of the oil and gas industry. During 2020, wages held steady, only falling from $3,180,766,000 to $3,174,187,000, while average compensation per job rose from $57,741 to $60,440.

The county overcame all challenges created by the pandemic except for oil and gas. During 2020, wages held steady and average compensation per job rose.

MESA COUNTY

63 Colorado Department of Labor and Employment.

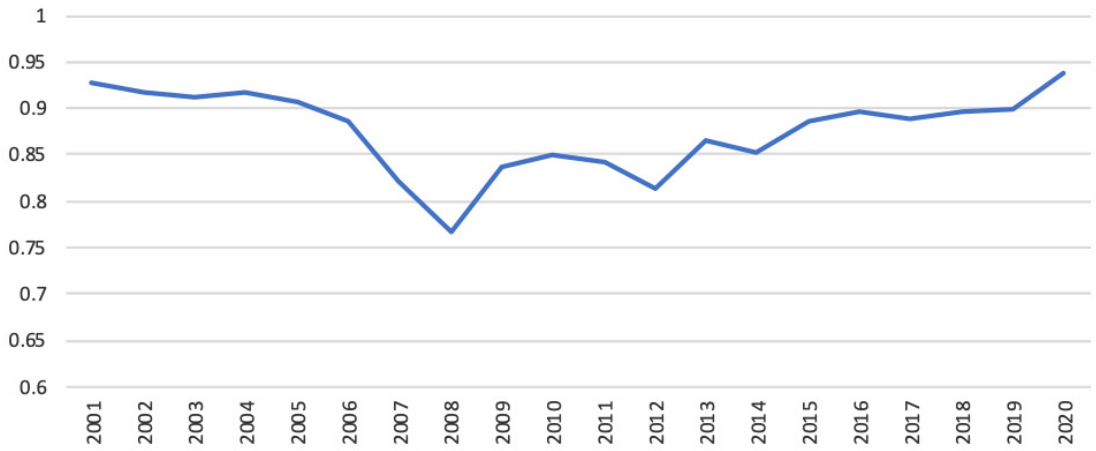
Figure 56: Wage Growth and Average Compensation per Job[64]



Economic Diversity

Although GDP fell in 2020, economic diversity increased in Mesa County. Figure 57 illustrates the Hachman Index, a measure of industrial diversification. A higher Hachman Index shows higher industrial diversification compared to Colorado, while a lower one indicates less. Mesa County has been on an uptrend of economic diversity since 2008, which increased sharply during the pandemic.

Figure 57: Mesa County Hachman Index[65]



Affected Groups and Job Creation

Mesa County employment fell from a peak of 74,143 in September of 2019 to a low of 63,279 in April 2020, after which it rose to 76,041 by March of 2022. Unemployment numbers are trending downwards and starting to move below 3,000 (between 1,000 and 2019 lows).

64 Bureau of Economic Analysis.
65 Data from the Bureau of Economic Analysis, author calculated.

Figure 61 illustrates initial and continued unemployment claims during 2020. Mesa County's initial claims peaked in early April while continued claims peaked in early May. Table 10 shows the Colorado industry share of unemployment claims. Unfortunately, industry level unemployment claims are not available at the county level, but we can use table 10 to understand the general trends for Colorado. Accommodation and food services had the biggest number of initial claims (21.7%,) with healthcare second (11.7%) followed by retail trade (11.5%.).

Figure 58: Mesa County Yearly Employment Average[66]

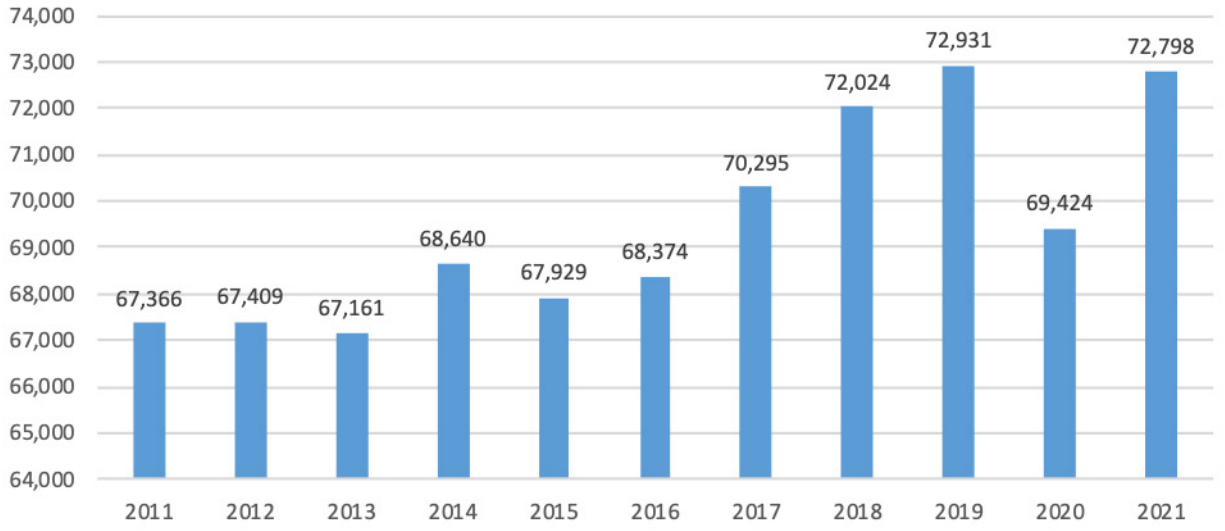
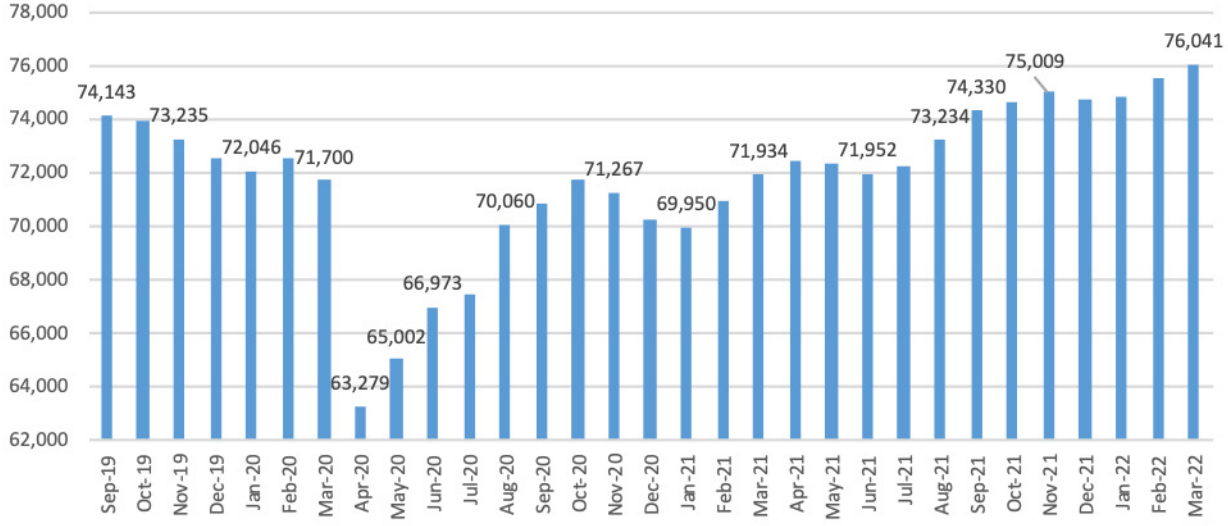


Figure 59: Mesa County Monthly Employment Estimates[67]



66 Colorado Department of Labor and Employment.
67 Colorado Department of Labor and Employment.

Figure 60: Mesa County Monthly Unemployment Estimates[68]

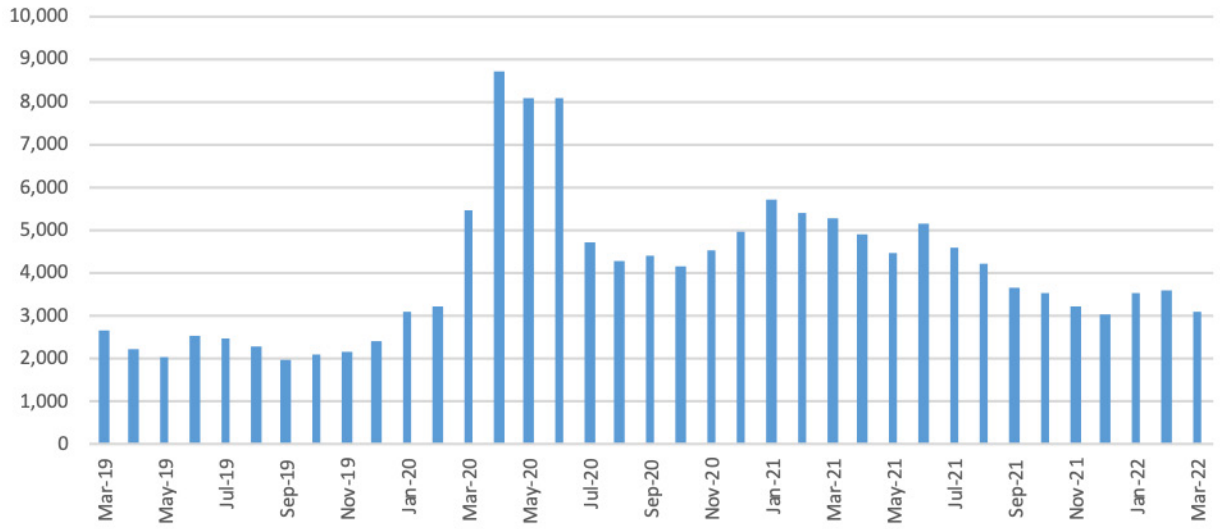
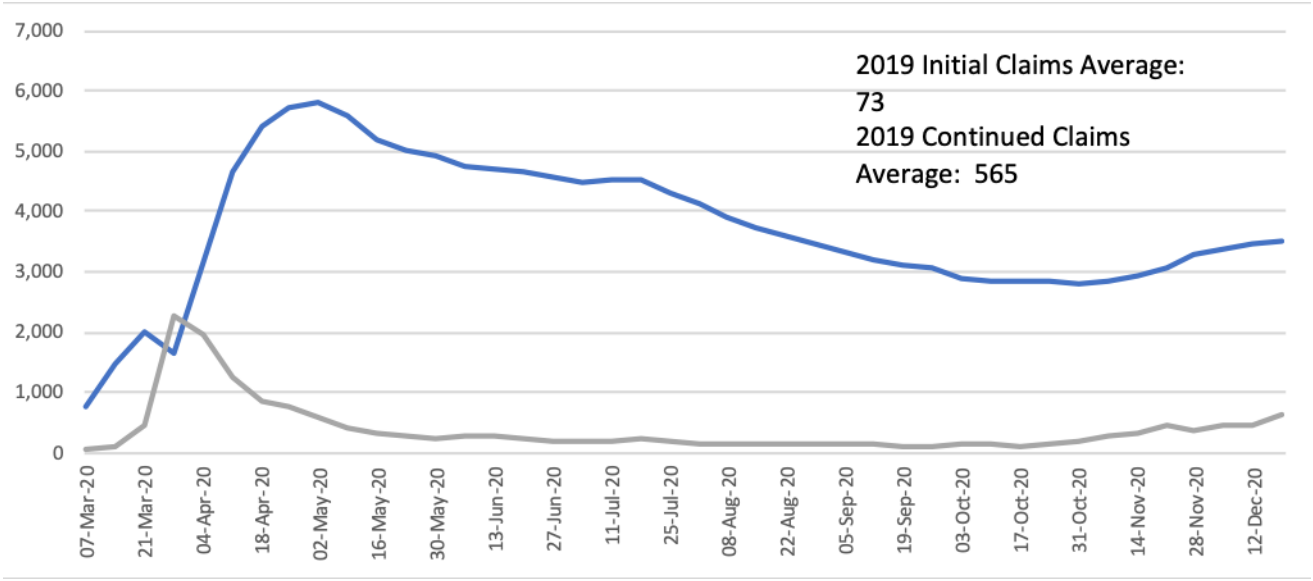


Figure 61: Initial and Continued Unemployment Claims for Mesa County[69]



68 Colorado Department of Labor and Employment.
69 Colorado Department of Labor and Employment.

Table 11: Colorado Industry Share of Initial Unemployment Claims[70]

INDUSTRY CODE	INDUSTRY SECTOR	TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	SHARE OF TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	WEEKLY AVERAGE INITIAL CLAIMS IN 2019	SHARE OF TOTAL INITIAL CLAIMS IN 2019	CHANGE IN SHARE POST COVID-19 PERIOD VS. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
62	Health Care and Social Assistance	61,614	11.7%	161	8.8%	1.3
44	Retail Trade	60,750	11.5%	141	7.7%	1.5
56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Lasting Challenges

Mesa County will experience several challenges over the next couple of decades, which result from the transition from coal. The pandemic was challenging for Mesa County due to its impact on energy and healthcare. Below is a description of lasting challenges the county will face.

- Economic diversification to insulate from economic shocks: The history of economic swings in the county has been defined by the energy industry, which experienced a catastrophic collapse during the

70 Colorado Department of Labor and Employment.

1980s. This was augmented by the energy and housing bubble of the late 2000s. However, jobs outside of the energy sector have steadily grown in Mesa County since 2010 and only fell in 2020 due to the COVID-19 pandemic. Additionally, the percentage of GDP and jobs that oil and gas represent has fallen. These two combined factors have resulted in more economic diversification and insulation against energy swings.

- Dependence on a single industry: The healthcare industry has been growing steadily in the county, making up more than 15% of the total jobs. This could be a diversification risk if it were another industry, but healthcare is generally stable in terms of jobs and wages. However, it did experience a slight downturn during the beginning of pandemic when people delayed surgeries and doctor visits. The general population and demographic trends dictate the need for healthcare in Mesa County will be strong as Mesa County has the advantage of serving as the regional healthcare center.

Garfield County

COVID Impact Summary

Garfield County experienced challenges caused by the pandemic that affect the energy and tourism industries. This is because the county relies heavily on oil and gas production in the west and tourism in the east. To these ends, the county lost 285 oil and gas jobs and 557 accommodation and food services jobs. These sectors were the highest hit in the region. These losses and others resulted in Garfield County losing 4.72% of its GDP, which was the highest loss in the region. The job losses were large for accommodation and food services, but the GDP loss was relatively small. However, this was the opposite with the oil and gas industry. As of mid 2021 (except oil and gas) have made a strong recovery.

Most Affected and Most Resistant Sectors

In 2020, the Garfield County economy lost 4.72% of its GDP. Major losses occurred in mining, oil, and gas, arts entertainment, recreation, and accommodation and food services. In 2020, Garfield County had one of the worst GDP

Jobs outside the energy sector have steadily grown, creating more economic diversification and insulation against energy swings.

The healthcare industry is growing steadily — making up more than 15% of total jobs.

MESA COUNTY

Jobs lost in 2020

Mining, oil and gas..... 285

Accommodation and food services 557

4.72% GDP loss for 2020
(highest loss in the region)

Largely due to strong reliance on oil and gas in the west and tourism in the east (the two hardest hit industries of the pandemic).

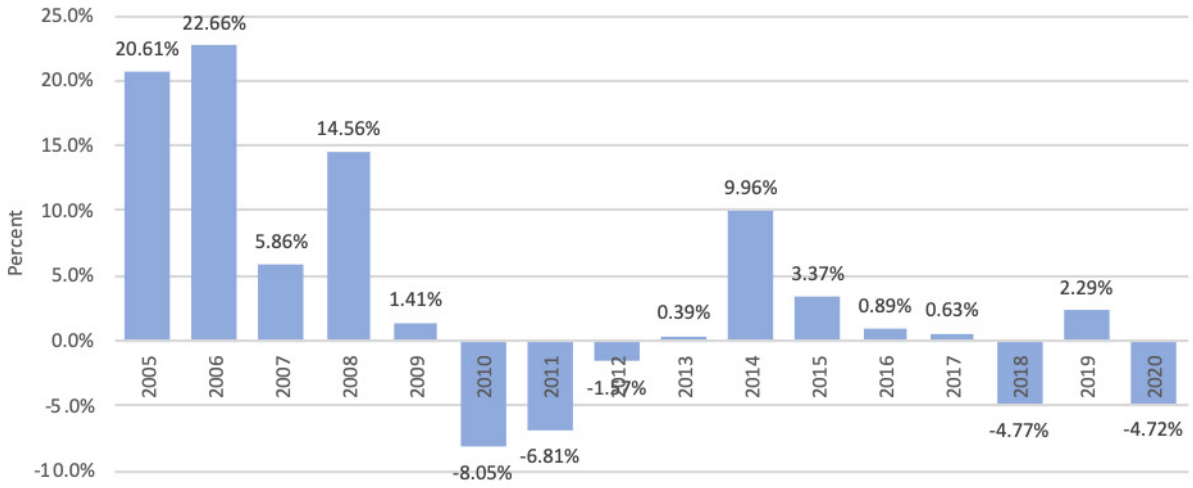
GARFIELD COUNTY

numbers in Western Colorado. This was largely due to its strong reliance on oil and gas in the west and tourism in the east (the two hardest hit industries of the pandemic). Low oil and gas prices in early 2020 pushed the industry into a tailspin. However, regional declines in oil and gas began in late 2019. Figure 62 shows that the county has struggled since the oil and gas boom of the late 2000s.

As of 2020, oil, gas, and mining made up 33.88% of Garfield County's GDP, making the county very susceptible to swings in this industry. Although accommodation and food services and arts, entertainment, and recreation only make up 3.3% of GDP, they make up 10.8% of jobs and help represent the sizeable tourism industry in Garfield County. Table 11 illustrates the gains or losses in GDP, while figure 63 illustrates the gains and losses in GDP by industry for 2020. Figure 64 illustrates Real GDP growth rates for the Western Slope, using Colorado and Pueblo County for comparison. The higher GDP growth rates were in counties that do not rely on tourism and energy production while the lower ones were in counties that do.

Industries that performed well during the pandemic included agriculture, forestry, fishing, and hunting, as well as finance and insurance. Although these industries were positive, their contribution is dwarfed by the negative numbers seen in figure 63. Ultimately when a region loses the wages of a major industry like oil and gas, other industries suffer from reduced consumer spending and supply chain effects. Oil and gas produce the highest average weekly wage ($1,729).

Figure 62: Real GDP Growth Rate Garfield County[71]



71 Bureau of Economic Analysis.

Table 12: Real GDP Comparison Garfield County, 2019 to 2020[72]

	2019	2020	DIFFERENCE IN DOLLARS	PERCENTAGE DIFFERENCE	PERCENTAGE OF TOTAL GDP
All industry total	$4,427,385	$4,218,575	-$208,810	-4.72%	
Private industries	$4,054,444	$3,850,772	-$203,672	-5.02%	91.28%
Agriculture, forestry, fishing and hunting	$2,552	$25,140	$22,588	885.11%	0.60%
Mining, quarrying, and oil and gas extraction	$1,607,850	$1,429,412	-$178,438	-11.10%	33.88%
Utilities	$32,072	$31,326	-$746	-2.33%	0.74%
Construction	$287,559	$262,030	-$25,529	-8.88%	6.21%
Manufacturing	$61,397	$62,912	$1,515	2.47%	1.49%
Durable goods manufacturing	$25,002	$24,701	-$301	-1.20%	0.59%
Nondurable goods manufacturing	$36,278	$38,140	$1,862	5.13%	0.90%
Wholesale trade	$72,910	$68,335	-$4,575	-6.27%	1.62%
Retail trade	$245,897	$251,507	$5,610	2.28%	5.96%
Transportation and warehousing	$42,664	$39,368	-$3,296	-7.73%	0.93%
Information	$30,036	$31,359	$1,323	4.40%	0.74%
Finance, insurance, real estate, rental, and leasing	$667,223	$659,303	-$7,920	-1.19%	15.63%
Finance and insurance	$72,380	$81,234	$8,854	12.23%	1.93%
Real estate and rental and leasing	$596,545	$577,422	-$19,123	-3.21%	13.69%
Professional and business services	$270,598	$261,506	-$9,092	-3.36%	6.20%
Professional, scientific, and technical services	$146,988	$145,253	-$1,735	-1.18%	3.44%
Management of companies and enterprises	$42,376	$41,095	-$1,281	-3.02%	0.97%
Administrative and support and waste management and remediation services	$82,055	$76,246	-$5,809	-7.08%	1.81%
Educational services, health care, and social assistance	$261,513	$249,477	-$12,036	-4.60%	5.91%
Educational services	$26,499	$20,651	-$5,848	-22.07%	0.49%
Health care and social assistance	$235,049	$229,191	-$5,858	-2.49%	5.43%
Arts, entertainment, recreation, accommodation, and food services	$162,911	$131,875	-$31,036	-19.05%	3.13%
Arts, entertainment, and recreation	$39,603	$32,726	-$6,877	-17.36%	0.78%

72 Bureau of Economic Analysis.

Table 12: Real GDP Comparison Garfield County, 2019 to 2020 *continued*

Accommodation and food services	$123,491	$99,337	-$24,154	-19.56%	2.35%
Other services (except government and government enterprises)	$72,640	$65,240	-$7,400	-10.19%	1.55%
Government and government enterprises	$361,469	$352,673	-$8,796	-2.43%	8.36%

Figure 63: Garfield County Real GDP Gains and Losses (in thousands)[73]

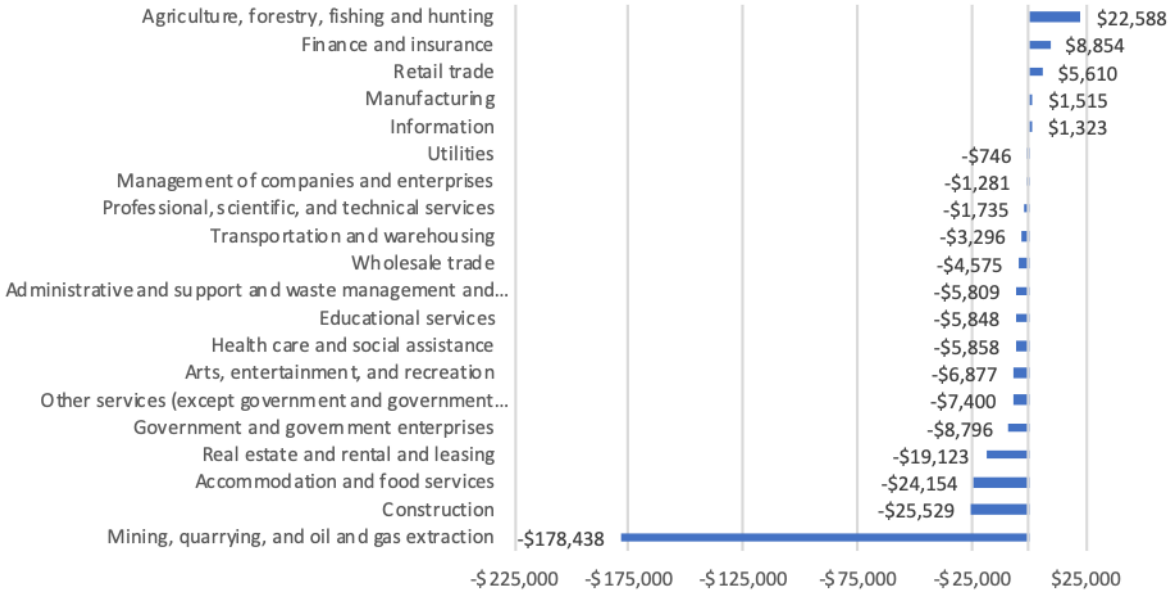
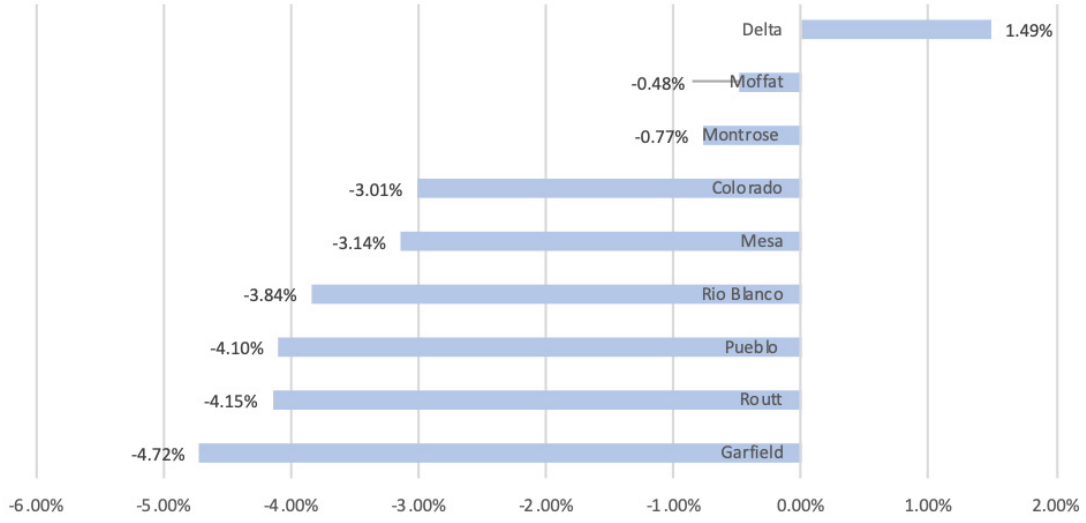


Figure 64: Western Slope Real GDP Growth Rate Comparison[74]



73 Bureau of Economic Analysis.
74 Bureau of Economic Analysis.

Industry Trends

The previous section discussed 2020 GDP estimates, which illustrated the damage caused by the COVID-19 induced recession. This dataset utilized Quarterly Census of Employment and Wages, a business survey that as of the writing of this document had Q3 of 2021 data. This dataset provided some insight about whether industries were recovering from 2020. Q3 of 2020 could be considered the worst quarter of the COVID-19 pandemic because it reflects the period when government induced shutdowns, stay at home orders, and other restrictions were in force. Figure 65 and Table 12 illustrate the recovery of accommodation and food services, retail trade, and oil and gas from their lows in April of 2020. Although job gains in accommodation and food services were larger than other industries, that industry is further down the list in terms of wage recovery in Figure 66. This is because of the low weekly wages that accommodation and food services pay. This and the expanded unemployment many displaced workers received were some of the major reasons why 2020 GDP data was not as bad as it could have been. Figure 68 illustrates sales tax collections, showing that Glenwood Springs had a much larger dip during the spring of 2020 than Rifle and the rest of the county. This implies that Glenwood Springs is much more susceptible to declines than the rest of the county, which is likely due to its focus on tourism.

Sales tax collections show Glenwood Springs had a much larger dip during the spring of 2020 than Rifle — likely due to its focus on tourism.

GARFIELD COUNTY

Figure 67 illustrates total job recovery with key COVID-19 impacted industries indexed at Q4 2019. Note that this figure shows percentage change in jobs. As of Q3 2021, only oil, gas, and mining have not recovered and are still substantially below their 2019 level. However, the oil and gas industry in the county started to show signs of weakness in late 2019, after which it fell sharply after energy prices dropped in spring 2020.

Table 13: Q3 2021 Compared to Q3 2020 (QCEW)[75]

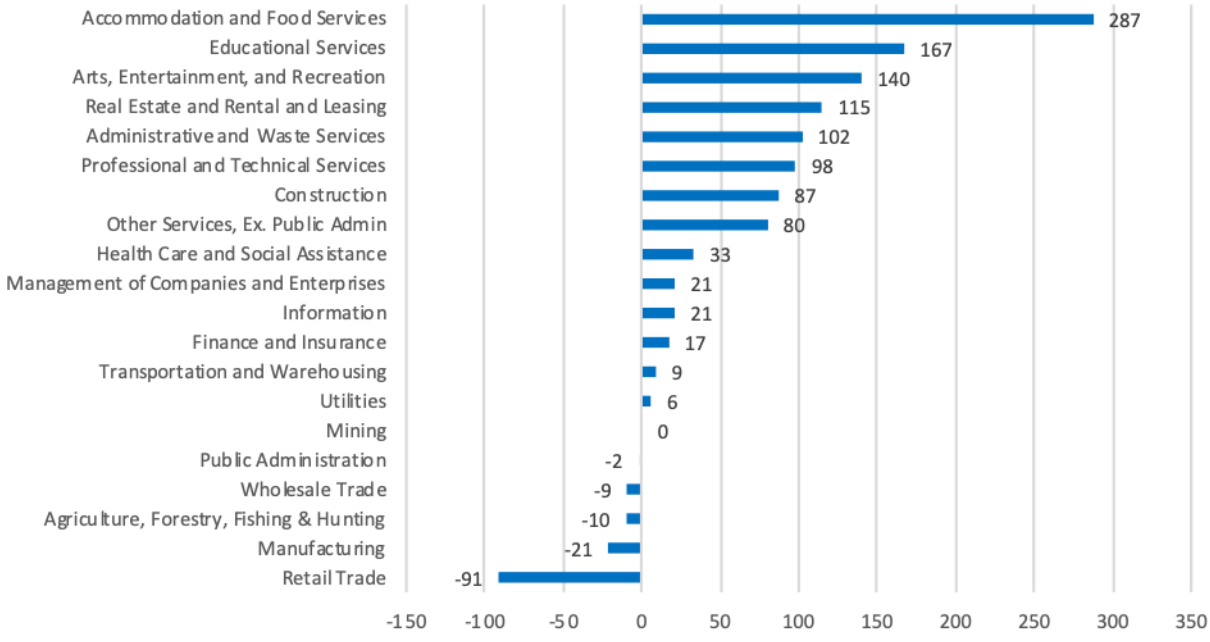
NAICS SECTOR	AVERAGE EMPLOYMENT 3RD QUARTER 2021	TOTAL QUARTERLY WAGES	AVERAGE WEEKLY WAGE	EMPLOYMENT CHANGE	WAGE CHANGE
Total, All Industries	26,124	$357,110,454	$1,052	1,056	$31,614,772
Health Care and Social Assistance	3,522	$60,740,470	$1,327	33	$3,017,715
Construction	3,370	$52,266,040	$1,193	87	$4,117,538
Retail Trade	3,018	$32,523,926	$829	-91	$3,191,088
Public Administration	1,812	$29,391,505	$1,248	-2	$1,142,757
Educational Services	2,492	$28,215,888	$871	167	$1,226,044
Professional and Technical Services	1,345	$24,976,173	$1,428	98	$2,738,565
Accommodation and Food Services	3,165	$22,491,351	$547	287	$3,756,502

75 Colorado Department of Labor and Employment.

Table 13: Q3 2021 Compared to Q3 2020 (QCEW) *continued*

Administrative and Waste Services	1,343	$16,199,520	$928	102	$2,442,801
Mining	710	$15,956,791	$1,729	0	$1,115,803
Real Estate and Rental and Leasing	710	$11,547,364	$1,251	115	$3,276,320
Finance and Insurance	546	$11,002,704	$1,550	17	$57,714
Transportation and Warehousing	626	$8,898,880	$1,093	9	$393,001
Other Services, Ex. Public Admin	783	$8,606,694	$846	80	$1,629,892
Wholesale Trade	551	$8,061,697	$1,125	-9	$339,276
Utilities	307	$6,783,192	$1,700	6	$475,191
Arts, Entertainment, and Recreation	886	$6,366,348	$553	140	$1,244,947
Manufacturing	356	$4,820,137	$1,042	-21	$132,250
Management of Companies and Enterprises	171	$3,277,134	$1,474	21	$710,724
Information	224	$2,783,644	$956	21	$417,090
Agriculture, Forestry, Fishing and Hunting	179	$2,107,803	$906	-10	$96,361

Figure 65: Garfield County Jobs, QCEW Q3 2020 compared to Q3 2021[76]



76 Colorado Department of Labor and Employment.

Figure 66: Garfield County Wages, QCEW Q3 2020 compared to Q3 2021[77]

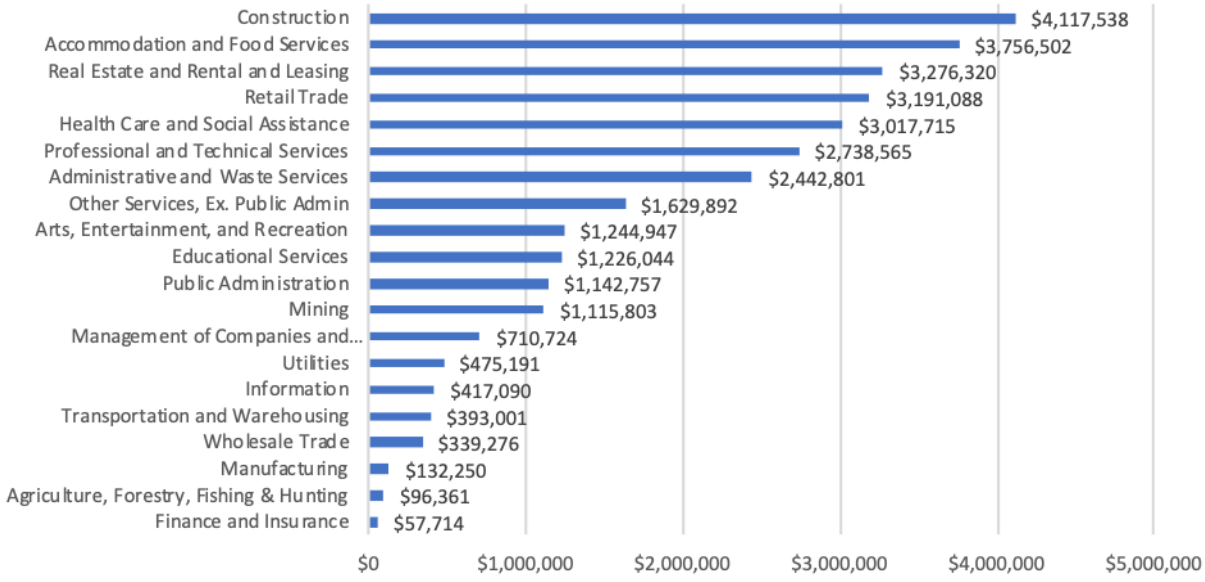
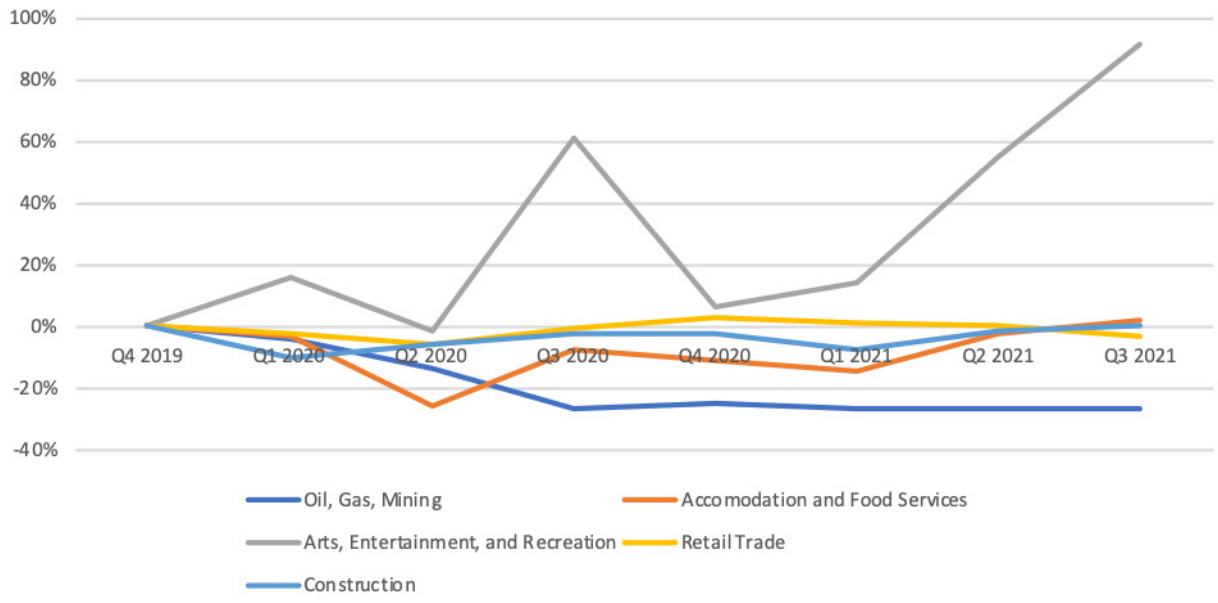
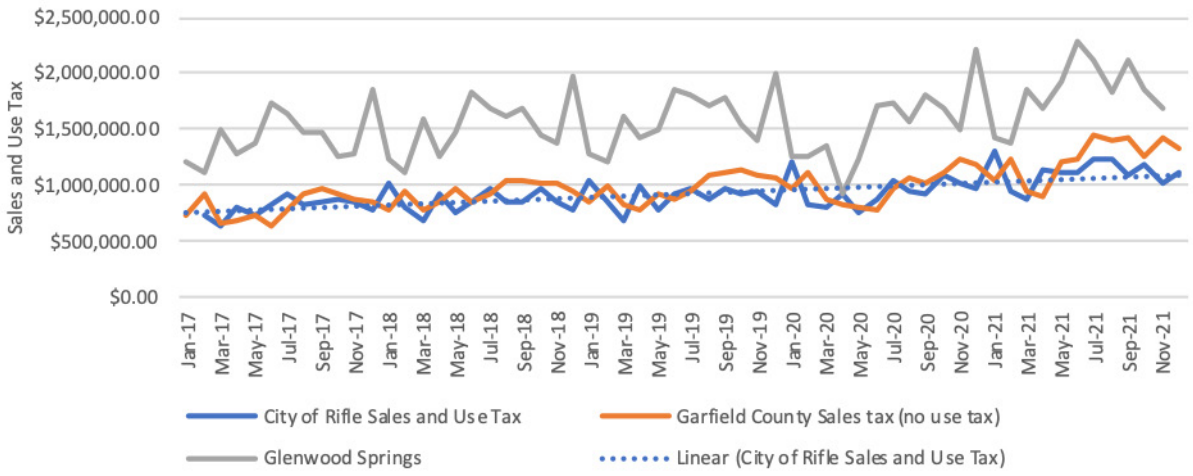


Figure 67: Garfield County Job Recovery Percentage Change Key Industries[78]



77 Colorado Department of Labor and Employment.
78 Colorado Department of Labor and Employment.

Figure 68: Garfield County, Rifle, and Glenwood Springs Sales Tax[79]

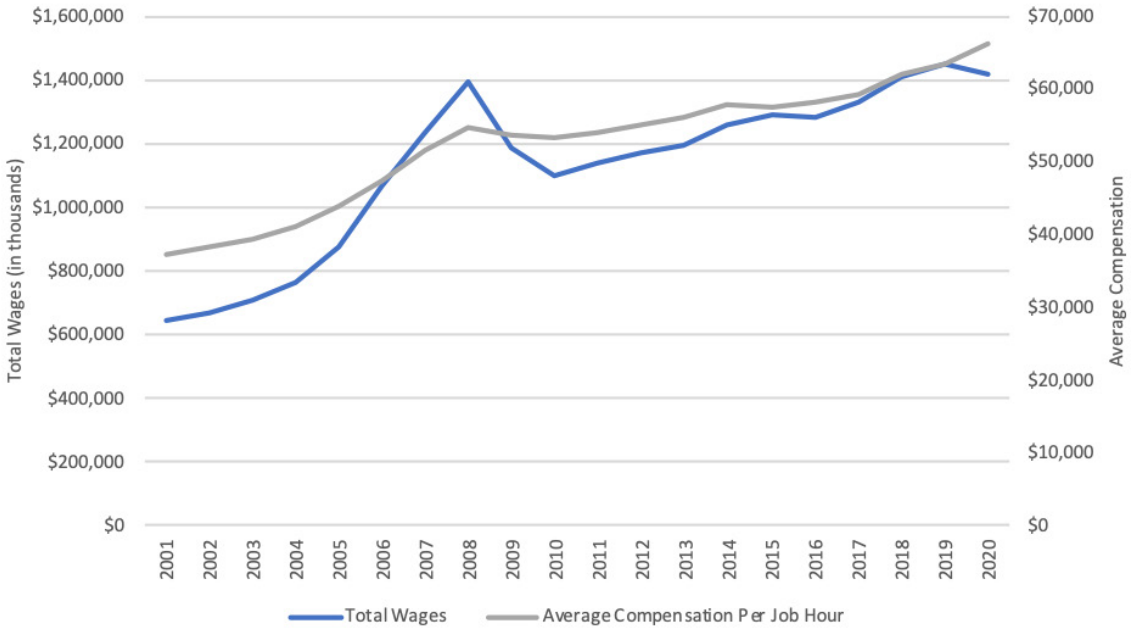


Augmented Economic Challenges

Wage Growth

Overall, the pandemic created wage growth challenges for Garfield County economy. However, most industries have recovered, except for the oil and gas industry. Wages held steady during 2020 and only fell from $1,449,107,000 to $1,420,014,000 (2%). Average compensation per job rose from $63,243 to $66,029.

Figure 69: Wage Growth and Average Compensation Per Job[80]

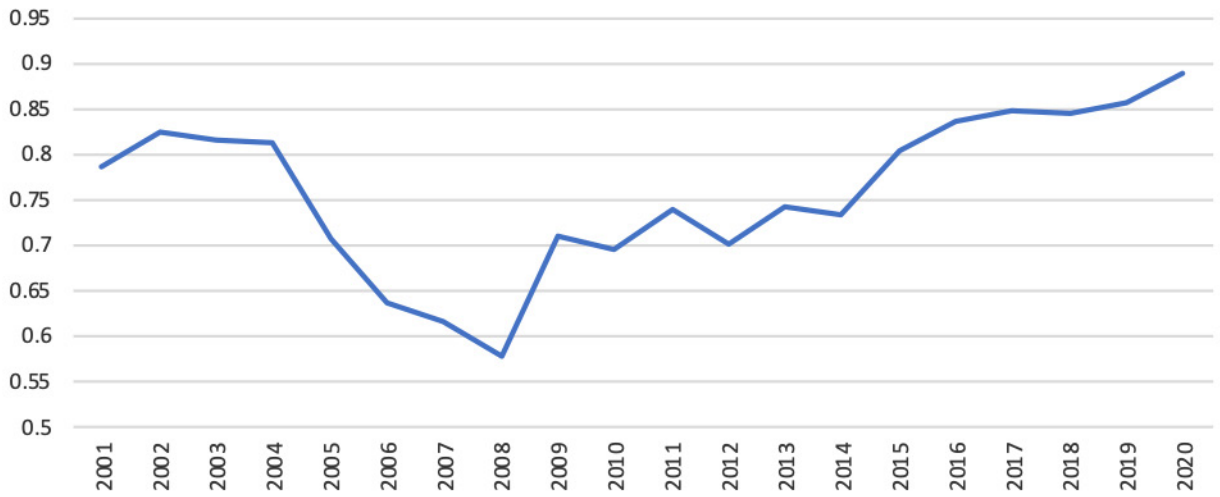


79 Data from Garfield County, City of Rifle, City of Glenwood Springs.
80 Bureau of Economic Analysis.

Economic Diversity

Although GDP fell during 2020 in Garfield County, economic diversity increased. Figure 70 illustrates the Hachman Index for the county, which is a measure of industrial diversification. A higher Hachman Index shows higher industrial diversification than Colorado, while a lower one indicates less diversification. Economic diversity has been trending upward in Garfield County since 2008, after which it increased sharply during the pandemic. This increase is likely due to the energy and tourism industry declines experienced in 2020 due to the pandemic.

Figure 70: Hachman Index Mesa County[81]



Affected Groups and Job Creation

Labor Market

Garfield County employment fell from a peak of 32,194 in January 2020 to a low of 25,477 in April 2020 and rose to 32,600 by March of 2022. Currently, unemployment numbers are trending downwards and starting to move towards 1,000. In late 2019, unemployment was in the 500-900 range.

Figure 74 illustrates initial and continued unemployment claims during 2020. Garfield County's initial claims peaked in early April while continued claims peaked in early May. Table 13 shows the Colorado industry share of unemployment claims. Unfortunately, industry level unemployment claims are not available at the county level. However, we can

Unemployment claims, 2020

Accommodation and food services 21.7%

Retail trade 11.5%

Employment

January 2020 32,194

April 2020 25,477

March 2022 32,600

GARFIELD COLORADO

81 Author calculated with data from the Bureau of Economic Analysis.

use table 13 to understand the general trends for Colorado. Accommodation and food services experienced the biggest share of initial claims (21.7%), health care was next (11.7%) followed by retail trade at 11.5%. Eastern Garfield felt the biggest impact in the decline in tourism due to COVID-19.

Figure 71: Garfield County Yearly Employment Average[82]

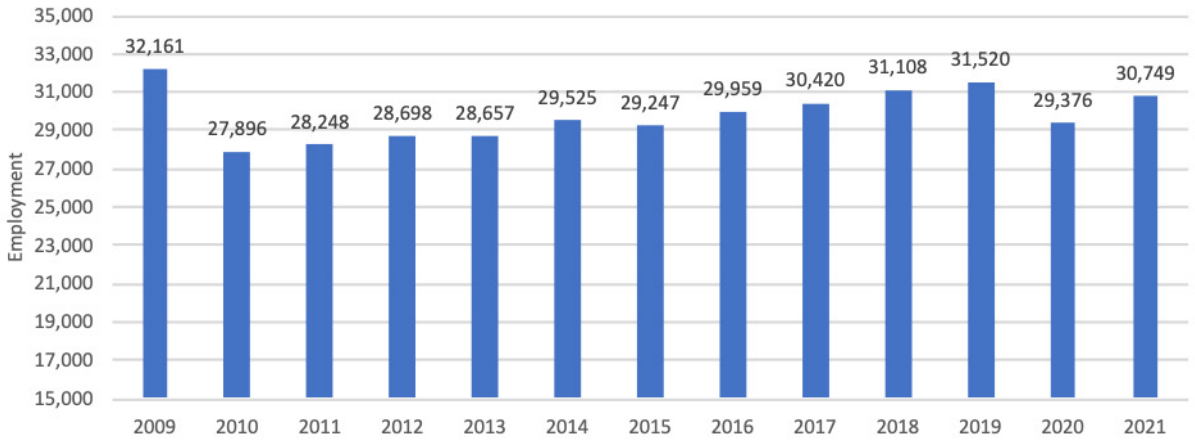
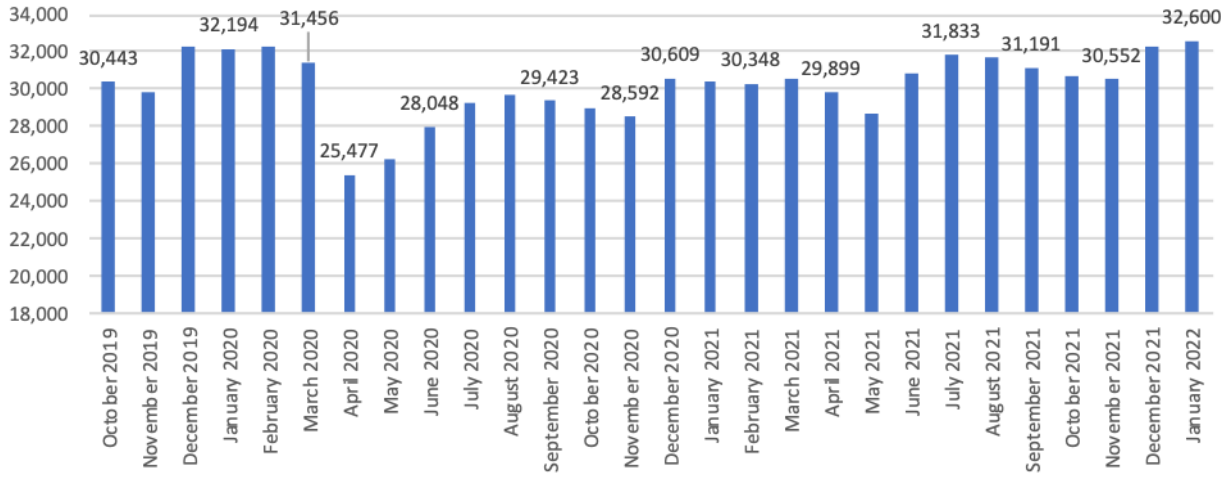


Figure 72: Garfield County Monthly Employment Estimates[83]



82 Colorado Department of Labor and Employment.
83 Colorado Department of Labor and Employment.

Figure 73: Garfield County Monthly Unemployment Estimates[84]

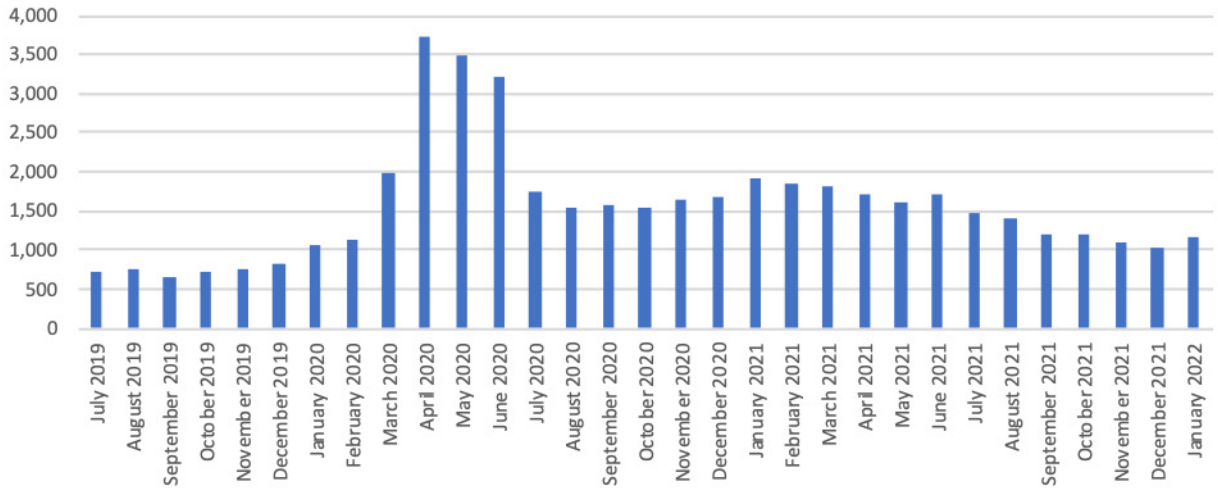
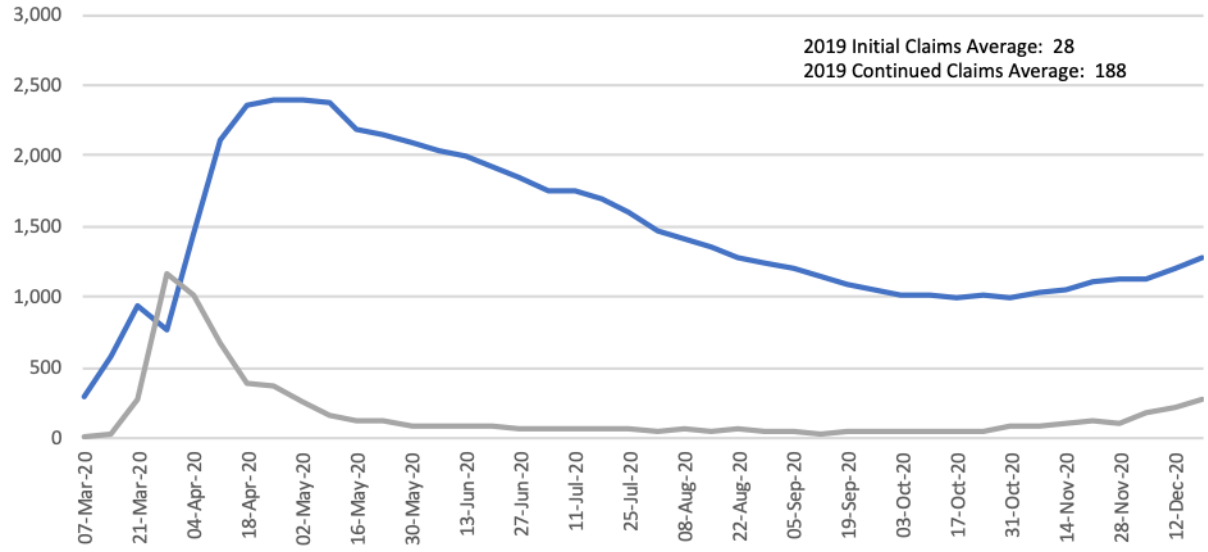


Figure 74: Initial and Continued Unemployment Claims for Garfield County[85]



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84 Colorado Department of Labor and Employment.
85 Colorado Department of Labor and Employment.

Table 14: Colorado Industry Share of Initial Unemployment Claims[86]

INDUSTRY CODE	INDUSTRY SECTOR	TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	SHARE OF TOTAL INITIAL CLAIMS 3/15/20 - 12/19/20	WEEKLY AVERAGE INITIAL CLAIMS IN 2019	SHARE OF TOTAL INITIAL CLAIMS IN 2019	CHANGE IN SHARE POST COVID-19 PERIOD VS. 2019
72	Accommodation and Food Services	114,104	21.7%	154	8.4%	2.6
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56	Administrative and Waste Services	37,989	7.2%	214	11.7%	0.6
23	Construction	32,695	6.2%	317	17.3%	0.4
31	Manufacturing	27,666	5.3%	104	5.7%	0.9
54	Professional and Technical Services	26,375	5.0%	150	8.2%	0.6
81	Other Services	26,264	5.0%	43	2.3%	2.1
71	Arts, Entertainment, and Recreation	26,250	5.0%	49	2.7%	1.9
61	Education Services	20,954	4.0%	44	2.4%	1.7
48	Transportation and Warehousing	18,878	3.6%	63	3.4%	1.0
42	Wholesale Trade	18,663	3.5%	76	4.2%	0.9
53	Real Estate, Rental, and Leasing	11,618	2.2%	37	2.0%	1.1
92	Public Administration	9,913	1.9%	90	4.9%	0.4
51	Information	9,771	1.9%	51	2.8%	0.7
52	Finance and Insurance	7,440	1.4%	62	3.4%	0.4
21	Mining	7,422	1.4%	29	1.6%	0.9
55	Management of Companies and Enterprises	4,620	0.9%	29	1.6%	0.6
11	Agriculture, Forestry, Fishing and Hunting	2,410	0.5%	17	1.0%	0.5
22	Utilities	625	0.1%	2	0.1%	0.9

Lasting Challenges

The pandemic was particularly challenging for Garfield County due to its reliance on energy and tourism. Below is a description of lasting challenges the county will face:

- Economic diversification to insulate from economic shocks: The history of economic swings in the county has been defined by the energy industry, which experienced a catastrophic collapse during the 1980s. This was augmented by the energy and housing bubble of the late 2000s. However, jobs outside of the energy

86 Colorado Department of Labor and Employment.

sector in Garfield County have increased since 2010 and only fell in 2020 due to the COVID-19 pandemic. Additionally, the percentage of GDP and jobs that oil and gas represent has fallen. These two combined factors have resulted in more economic diversification and insulation against energy swings.

- Vulnerability of tourism related industries to future pandemic events. The tourism sector (represented by accommodation and food services, and arts, entertainment, and recreation) is a large part of Garfield County's economy. If another large-scale pandemic event were to occur, the county would be just as susceptible to shocks in this industry.

Jobs outside the energy sector have increased since 2010 and only fell in 2020 due to the pandemic. Additionally, the oil and gas GDP and jobs have fallen resulting in economic diversification and insulation against energy swings.

Tourism is a large part of the economy and will continue to cause susceptibility if another pandemic event occurred.

GARFIELD COUNTY

Chapter 2: Other Disasters to Consider

The section below discusses other disasters that the region is at risk to, which have potential to disrupt economic activity. These include challenges like droughts and wildfires, which are occurring more frequently. They also include disasters like earthquakes and major flooding, which are not as frequent, but still pose potential threats. Although these are addressed in the hazard mitigation plans produced by most of AGNC's counties, these mainly discuss the probabilities of a given disaster and how to address them as emergencies. Therefore, a need to discuss the potential economic impacts these disasters present and strategies for making the region more resilient to them. The report that follows accomplishes this.

Wildfires

As temperatures trend upward and dryness increases in Colorado, so will wildfire danger. This danger is not only an issue during the summer months, but during dry winters as well. During late 2021, a dry winter fire occurred in Boulder County resulting in the loss of over 500 structures.[87]

A "double-hazard" zone* exists near the Utah-Colorado border in Mesa, Garfield, and Rio Blanco counties.

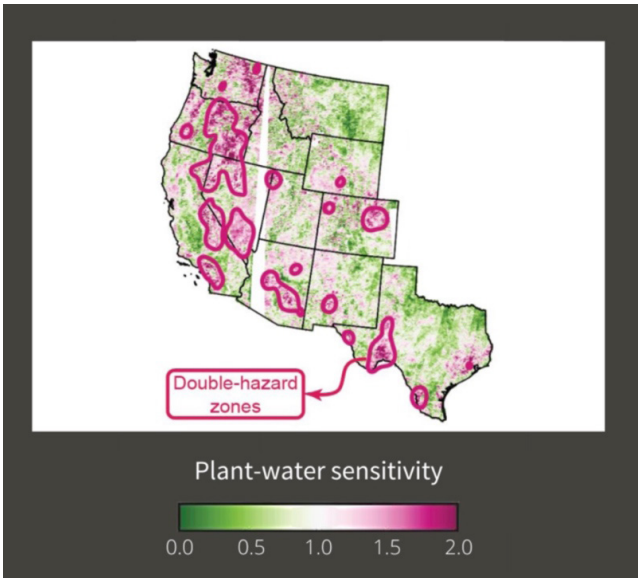
***Fire danger is at an increased risk due to intense drought conditions and highly vulnerable vegetation existing at the same time.**

NW COLORADO

87 Cindy Shiner, "We Lost Everything: Colorado Wildfire Destroys Hundreds of Homes," January 1, 2022, *The Guardian*, https://www.theguardian.com/us-news/2022/jan/01/colorado-wildfires-destroy-hundreds-homes (Accessed February 11, 2022).

AGNC is another fire prone region in Colorado. Figure 76 shows the burn probability in Colorado's counties as of 2017. Burn probability considers several factors such as wind, dryness, vegetation, and temperature, all of which contribute to wildfires. It should be noted that conditions have only become worse for fires since this map was produced. Therefore, a "double-hazard" zone where fire danger is at increased risk exists near the Utah-Colorado border in the Mesa, Garfield, and Rio Blanco County area (see Figure 75). A double-hazard zone is where intense drought conditions and highly vulnerable vegetation exist at the same time. The population percentage of each of AGNC's counties that lives in wildfire prone areas is illustrating in the Table 15 on the following page. In total between 16% and 50% of AGNC's population lives in a wildfire danger area depending on the county.[88]

Figure 75: Double-Hazard Zones in the American West
Courtesy of Stanford University



16% and 50% of AGNC's population lives in a wildfire danger area depending on the county.

Due to the high risk of wildfires in the AGNC region, each county has a Wildland Fire Operating Plan addressing wildfire emergencies. To enhance these plans, regional coordination should take place on an AGNC level. This will help coordinate efforts to combat fire, evacuate residents, and rebuild after wildfire emergencies occur.

NORTHWEST COLORADO

88 Technosylvia, Inc., "2017 Colorado Wildfire Risk Assessment Update," Final Report, Colorado State Forestry Service, December 2018, https://coloradoforestatlas.org/manuals/CO-WRA_2017_Final_Report.pdf (Accessed February 11, 2022); Josie Garthwaite, "Stanford Researchers Identify Double-Hazard Zones for Wildfire in the West," Stanford University, February 7, 2022, https://www.eurekalert.org/news-releases/942655 (Accessed February 14, 2022).

Figure 76: Colorado Burn Probability (2017)
Courtesy of Colorado State Forestry Service

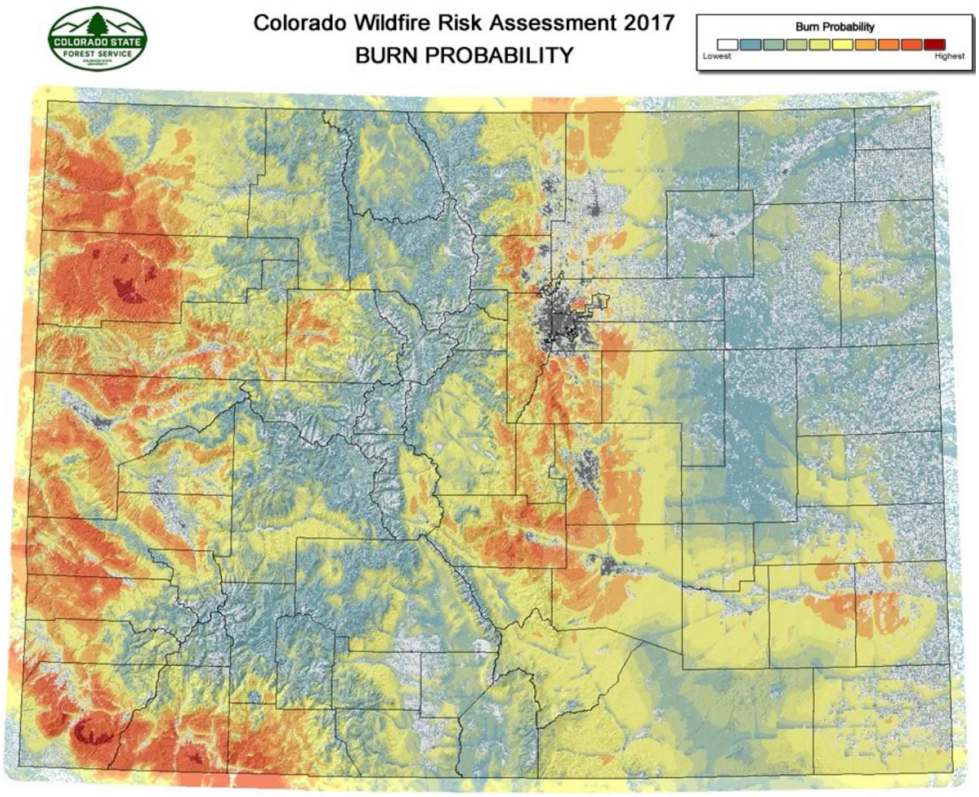


Table 15: Percentage of AGNC Population and Risk to Wildfires[89]

COUNTY	POPULATION	% OF POPULATION IN WILDFIRE PRONE AREAS (EXTREME)	% OF POPULATION IN WILDFIRE PRONE AREAS (MODERATE TO EXTREME)
Routt County	24,841	27%	50%
Garfield County	58,934	28%	45%
Rio Blanco County	6,545	27%	45%
Moffat County	13,106	19%	30%
Mesa County	150,919	6%	16%

Due to the high risk of wildfires in the AGNC region, each county has Wildland Fire Operating Plan. Routt, Rio Blanco, and Moffat Counties produced updated plans as of 2021 while Garfield and Mesa Counties produced their plans in 2012. These plans discuss protocol for addressing wildfire emergencies. To enhance these plans, regional coordination should take place on an AGNC level. This will help coordinate efforts to

89 Data taken from Wildfire Risk Public Viewer, Colorado State Forestry Service, https://co-pub.coloradoforestatlas.org/#/.

combat fire, evacuate residents, and rebuild after wildfire emergencies occur.[90]

Economic Vulnerabilities

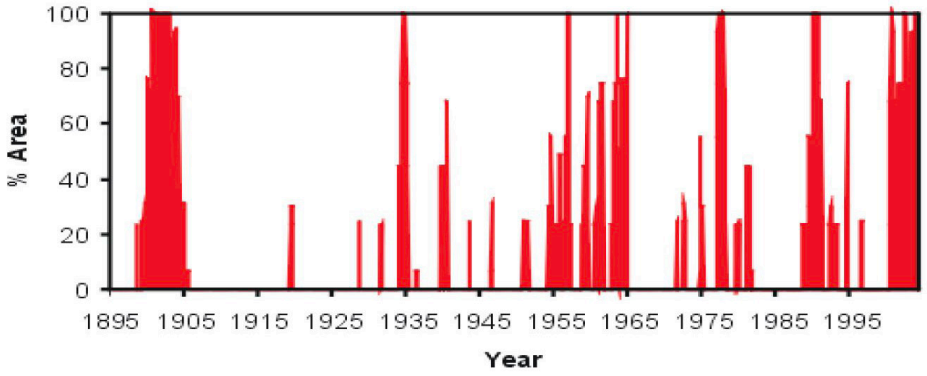
Drought

Due to the semiarid climate of the AGNC region, drought is a natural occurrence. However, recent climate trends make it more frequent and sometimes more severe. In this region, drought is usually preceded by a winter that lacked snowfall at higher elevations. Drought has a direct impact on the agricultural sector and is something the economies of rural communities needs to prepare for. Preparations include innovative water management, economic diversity, innovation, and drought resistant crops.[91]

At the time of this writing, Colorado is experiencing an extreme drought event. This occurrence is negatively impacting the agricultural industry, particularly in the eastern portion of the state. However, with drought conditions persistent in northwestern Colorado, this will likely be felt in the AGNC region as well. This coupled with increased production costs creates the need for resiliency in the agricultural sector.[92]

Below is Figure 77 that illustrates the drought trends in Upper Colorado Basin where the AGNC region is located. Figure 78 shows the drought conditions across Colorado as of March 2021. In the former image, the occurrence of multi-year droughts that are near or full region events. In the latter image, observe the presence of 'extreme' and 'exceptional' drought across the five counties that make up AGNC.

Figure 77: Percent Area of the Upper Colorado River Basin Experiencing Severe to Extreme Drought, January 1895–March 2004
Courtesy of the National Drought Mitigation Center



90 Routt County, "2021 Routt County Wildland Operating Plan," 2021, https://www.co.routt.co.us/DocumentCenter/View/2230/2021-Routt-County-Wildland-Fire-Operating-Plan---FINAL?bidId= (Accessed February 11, 2022); Rio Blanco County, "2021 Rio Blanco County Wildland Operating Plan," 2021, https://gacc.nifc.gov/rmcc/dispatch_centers/r2crc/dispatch/Plans%20and%20Guides/County%20AOPs/Rio%20Blanco%20AOP.pdf (Accessed February 11, 2022); Moffat County, "2021 Moffat County Wildland Operating Plan," 2021, https://gacc.nifc.gov/rmcc/dispatch_centers/r2crc/dispatch/Plans%20and%20Guides/County%20AOPs/Moffat%20AOP.pdf (Accessed February 11, 2022); Walsh Environmental Scientists and Engineers, Garfield County Wildfire Protection Plan, Garfield County Office of Emergency Management, November 2012, https://www.garfield-county.com/emergency-management/filesgcco/sites/15/2019/07/Garfield-County-Community-Wildfire-Protection-Plan.pdf (Accessed February 11, 2022); SWCA Environmental Consultants, Mesa County Wildfire Protection Plan, Mesa County, March 2012, https://www.mesacounty.us/globalassets/planning/codes-plans-policies--standards/plans/mesa-county-community-wildfire-protection-plan.pdf (Accessed February 11, 2022).

91 Mesa County, "Mesa County Hazard mitigation Plan," Mesa County, CO, 2020, https://sheriff.mesacounty.us/globalassets/divisions/emergency-services/2020-mesa-county-hazard-mitigation-plan---public-review.pdf (Accessed February 14, 2022).

92 Tyne Morgan, "Drought Robs Colorado Farmer's Wheat, Now it May be Too Dry to Plant Corn This Spring," Farm Journal, AG Web, April 1, 2022, https://www.agweb.com/news/crops/planting/drought-robs-colorado-farmers-wheat-now-it-may-be-too-dry-plant-corn-spring (Accessed April 7, 2022).

Figure 78: Drought Conditions in the American West (March 2021)
Courtesy of USDA

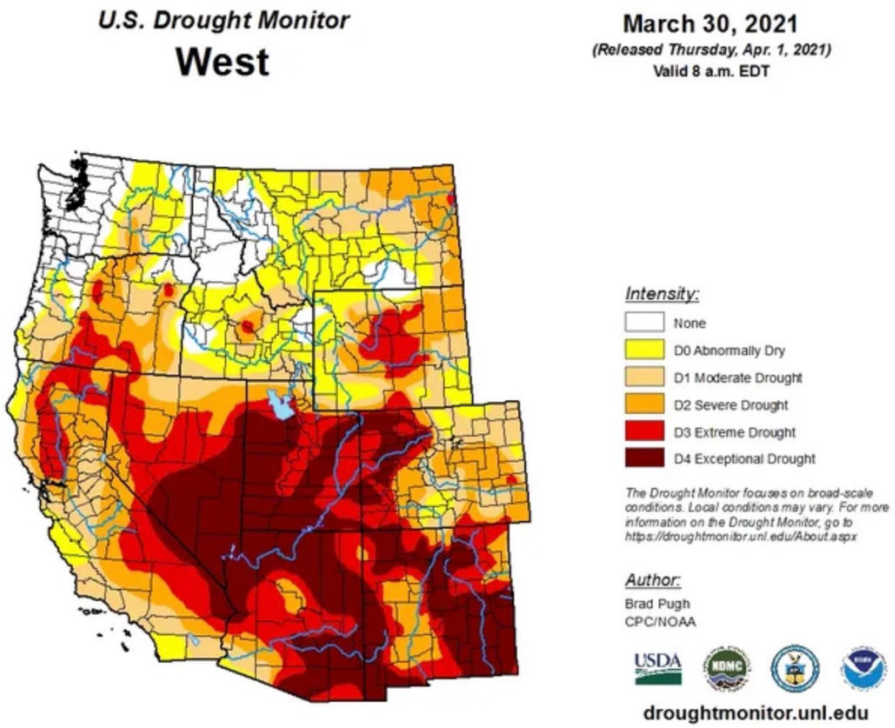
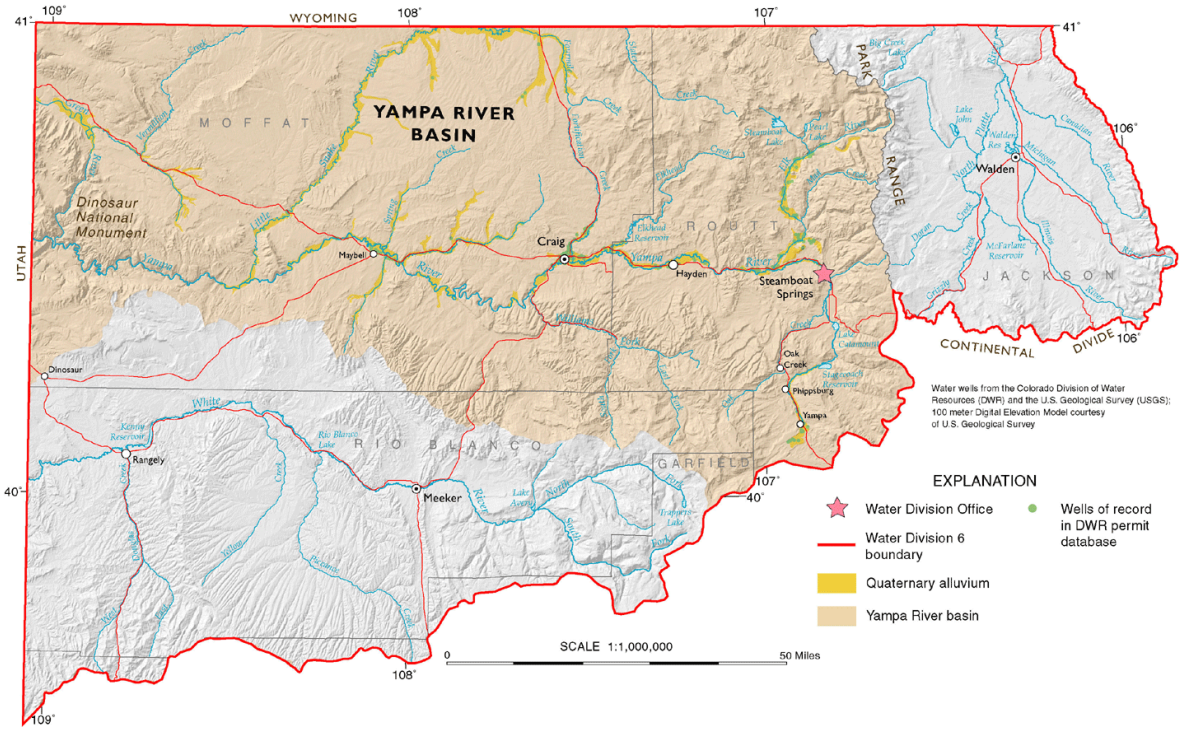


Figure 79: The Yampa River Basin
Courtesy of Friends of the Yampa



Flooding and Mudslides

Another disaster that some areas of the AGNC region are at risk to is flooding. This includes seasonal flooding in major rivers systems like the Yampa. It also includes burn scar flooding, which is often associated with mud slides and other hazards. The former of these occurs when wildfires create hydrophobic (hardened) soils that do not absorb water. The latter can occur in steep areas that experience significant vegetation loss in conjunction with flash flooding, heavy snow melt, or periods of intense precipitation. Flooding and mudslides can have a major impact on housing, economic activity, and community infrastructure when they occur.[93]

Flooding can occur at reoccurring intervals (100-year, 10-year floods, etc.) or seasonally. Seasonal floods are at the greatest risk in the spring when rivers reach full capacity due to snow and ice melt at higher elevations. This type of flooding occurs frequently along the Yampa River, White River, and their tributaries. For information on flood zones and flood probability in specific areas of the region, visit https://www.fema.gov/flood-maps . This website operated by FEMA contains a lot of useful information on floods, as well as tools for viewing floodplain maps and other resources to determine flood risks.

Other types of flooding that can occur within the region are flash floods, rain related flooding, and ice jams. These types of floods are shorter duration than seasonal floods but can form rapidly and be destructive. County level plans for responding to these events can be found in their FEMA approved disaster preparedness plans. All the counties in the AGNC region except Moffat County have produced these plans. Garfield, Mesa, and Routt Counties updated their plans in 2020 while Rio Blanco provided and updated plan in 2017. These plans address flooding along with other hazards such as wildfires and earthquakes. As with the other disasters discussed, coordination of these plans on a regional level would enhance the ability to respond to larger challenges that involve more than one county.[94]

Dam Failures

According to FEMA, there are over 100 dams in the AGNC region that present a hazard if they fail. Dam failures are caused by the following:

- Prolonged rainfall, resulting in overtopping
- Seismic activity
- Inadequate spillway capacity
- Internal erosion
- Poor design
- Poor operation
- Lack of maintenance
- Failure of upstream dams
- Levee opening or breaching

FEMA defines 'high hazard' dams and those that likely result in the loss of human life if failure occurs. Significant hazard dams are those that will unlikely result in loss of human life, but may cause economic losses in the event of a failure. Below is Table 16 that shows how many dams of concern are in the AGNC region. For further details, visit the National Inventory of Dams operated by FEMA: https://nid.sec.usace.army.mil/#/.

93 Routt County Planning Department, Routt County Multi-Hazard Mitigation Plan, http://www.co.routt.co.us/DocumentCenter/View/2229/Routt-County-Multi-Hazard-Mitigation-Plan---Final-FEMA-Approved---December-28-2010 (Accessed February 11, 2022), 47-48; Olivia Prentzel, "Mudslides and Flash Flooding Along Colorado's Burn Scars Could Cause Disasters, or Mere Travel Delays, all Summer Long. Here's Why," July 23, 2021, The Colorado Sun, https://coloradosun.com/2021/07/23/mudslides-along-colorado-burns-scars-could-cause-disasters-all-summer/ (Accessed February 11, 2022).

94 Tetra Tech, Routt County Colorado Hazard Mitigation Plan, Routt County, December 17, 2020, https://drive.google.com/file/d/1WmnE4AjRiTjgho27IypV-n3SuM5En39t/view (Accessed February 11, 2022); Mesa County, Mesa County Hazard Mitigation Plan, Mesa County, Colorado, 2020, https://sheriff.mesacounty.us/globalassets/divisions/emergency-services/2020-mesa-county-hazard-mitigation-plan---public-review.pdf (Accessed February 11, 2022); Wright Waters Engineers, Inc., Garfield County Hazard Mitigation Plan, Garfield County, Colorado, August 2017, https://www.garfield-county.com/emergency-management/filesgcco/sites/15/2019/07/2017-combined-Garfield-County-hazard-mitigation-plan-final.pdf (Accessed February 11, 2022); Rio Blanco County, Rio Blanco Hazard Mitigation Plan, Rio Blanco County, Colorado, January 2020, https://drive.google.com/file/d/12TrRQgGeVQmhYlDmLF508b2hfj9Zp_pm/view (Accessed February 11, 2022).

Table 16: AGNC Hazardous Dams

COUNTY	HIGH HAZARD DAMS	SIGNIFICANT HAZARD DAM	TOTAL DAMS PRESENTING HAZARDS
Mesa County	25	32	57
Garfield County	10	11	21
Routt County	8	4	12
Rio Blanco	3	3	6
Moffat	2	3	5
AGNC Region Total	48	53	101

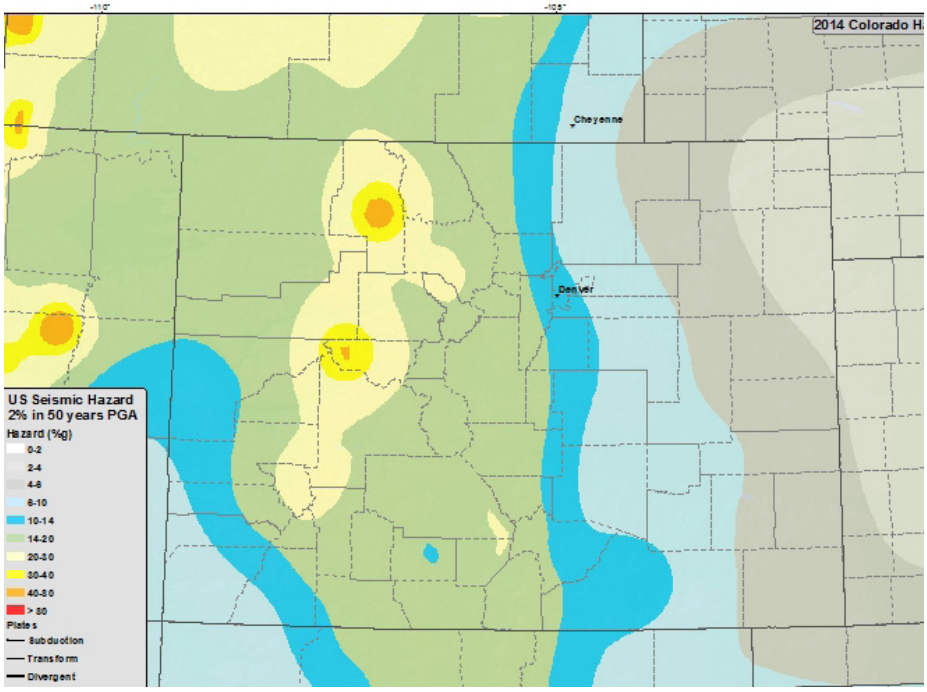
Earthquakes

Colorado is considered an active tectonic province with over 90 potential active faults and more than 700 earthquakes of magnitude 2.5 or higher since recording efforts have taken place. Although earthquake threats here are less than more seismically active states like Alaska and California, large earthquakes (6.5 magnitude and higher) have been recorded. Therefore, the state will continue to experience periodic earthquakes in the future.

Although the risk of earthquakes is not extreme in Colorado, risks are noticeably higher on the Western Slope where the AGNC region is located. In this part of the state, the risk of a significant earthquake in the next 50 years ranges from 10%-50%. However, the risk on the Front Range is somewhere between 2% and 14%.[95]

Figure 80: Earthquake Probability in Colorado

Courtesy of USGS



95 Jesse Paul, "Parts of Colorado May Have Higher Quake Hazard than Previously Thought, The Denver Post, July 17, 2022, https://www.denverpost.com/2014/07/17/parts-of-colorado-may-have-higher-quake-hazard-than-previously-thought/ (Accessed March 31, 2022); USGS, "2014 Seismic Hazard Map-Colorado," Charts or Graphs, USGS, https://www.usgs.gov/media/images/2014-seismic-hazard-map-colorado (Accessed March 31, 2022).

Chapter 3: Disaster-Related Economic Vulnerabilities

Wildfires

Research from the University of Oregon shows that in general, local employment and wages increase during large wildfires. This is due to the surge in employment from the fire suppression effort, which outweighs the employment losses seen in the short term. However, there is some evidence that wildfires lead to more volatility in the labor market, as the authors found that the "seasonal variation in employment over the subsequent year" is amplified.[96]

Tourism and Outdoor Recreation

There are not county level estimates for the contribution of outdoor recreation. However state and national estimates exist. According to the Bureau of Economic Analysis, outdoor recreation contributes 2.5% to Colorado GDP. Outdoor recreation is affected by wildfires and wildfire smoke. This is because activities like mountain biking, hiking, river rafting, hunting, etc., becoming less desirable or even present health risks when smoke is thick enough. This can be observed with California wildfires and how they impact tourism in the neighboring Sierra, Nevada region.[97]

Table 17: 2019 Tourism Sector Job data[98]

COUNTY	ACCOMMODATION AND FOOD SERVICES JOBS	ARTS, ENTERTAINMENT, RECREATION JOBS	% OF TOTAL JOBS THAT ARE ACCOMMODATION AND FOOD SERVICE	% OF JOBS THAT ARE ARTS, ENTERTAINMENT, AND RECREATION
Mesa	7,370	2,033	8.1%	2.2%
Garfield	3,026	1,166	9%	2.9%
Rio Blanco	247	67	5.7%	1.5%
Moffat	481	135	6.7%	1.9%
Routt	2,585	1,196	10.9%	8.4%

Table 17 illustrates 2019 job data on accommodation and food service, arts, entertainment, and recreation jobs. 2019 was used instead of 2020, because 2020 was a down year for these industries due to COVID. The columns to the right show the percentage of total jobs that each industry encompasses. Note Routt County and the percentage of arts, entertainment, and recreation jobs at 8.4% (by far the highest in the region). Routt County also has the highest percentage of jobs that are accommodation and food services and is highly susceptible to fluctuations or disasters that impact these industries. Of the AGNC counties, Rio Blanco would be the least impacted in terms of tourism, as they have the least percentage of jobs in these industries.

Wildfires can also cause costly damage to oil and gas fields and potentially worsen wildfires if they catch fire. Therefore, oil and gas operators are often forced to shut down wells during wildfire events, which reduces production.

96 *Ecosystem Workforce Program*. The Economic Impacts of Large Wildfires. (n.d.). Retrieved May, 2022, from https://ewp.uoregon.edu/largefires/content.

97 *Outdoor Recreation Satellite Account, U.S. and States, 2020. U.S. Bureau of Economic Analysis*. Retrieved from: https://www.bea.gov/news/2021/outdoor-recreation-satellite-account-us-and-states-2020.

98 Data from the Bureau of Economic Analysis.

Figure 81: Colorado Oil and Gas Wells[99]

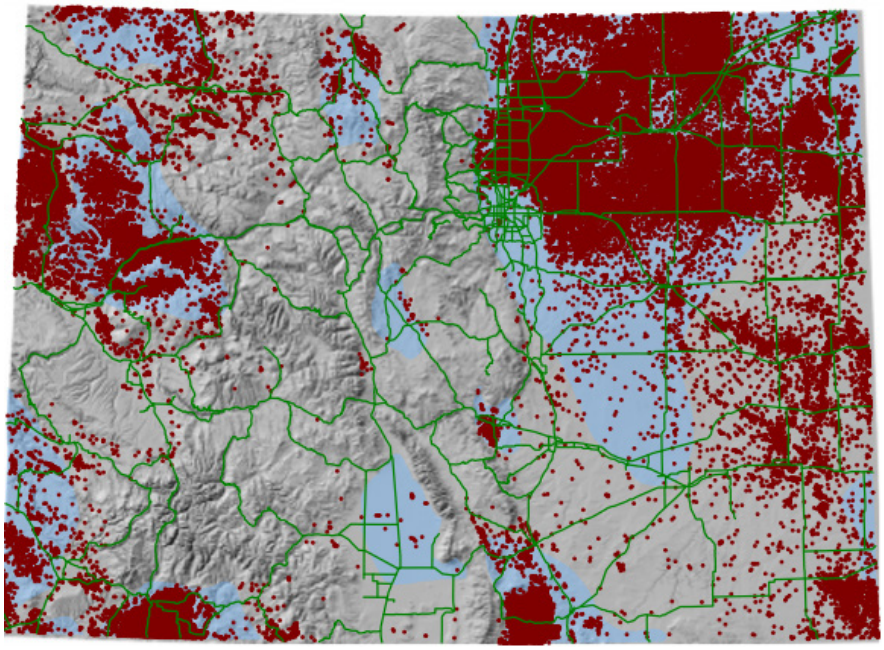


Table 18 illustrates the direct GDP contribution, jobs, and percentage of total GDP that oil and gas contribute to each county in the AGNC region. A wildfire in the Garfield County region (where most of the drilling and wells exist in the Piceance Basin) would cause considerable damage to GDP.

Table 18: 2019 Oil and Gas Direct Contribution to GDP

COUNTY	GDP	JOBS	PERCENTAGE OF GDP
Mesa[100]	$359,410,954	2694.61	5.3%
Garfield[101]	$1,429,412,000	1,010	33.88%
Moffat	$808,302.22	34.20	.001%
Routt	$92,948,903	178.83	4.8%
Rio Blanco	$5,277,134	340.99	1.8%

Drought

A Colorado State University study estimated the economic impact of the southern Colorado drought was $83-$100 million dollars. This was primarily due to losses in the agricultural sector (Bauman et. al, 2013).[102] Other estimates show the drought caused $633 million worth of damage to Colorado's agricultural producers, measured from 2011-2013.[103] Agriculture consumes more water by volume than any other industry in

99 *COGCC GISOnline*. (n.d.). Cogccmap.state.co.us. Retrieved May, 2022, from https://cogccmap.state.co.us/cogcc_gis_online/.
100 Data for Mesa, Moffat, Routt, and Rio Blanco Counties in Table 16 is from IMPLAN. Each estimate is the direct impact of oil and gas extraction, oil and gas support services, and oil and gas drilling.
101 Data for Garfield from the Bureau of Economic Analysis.
102 Bauman, A., Goemans, C., Pritchett, J., & McFadden, D. T. (2013). Estimating the Economic and Social Impacts from the Drought in Southern Colorado. *Journal of Contemporary Water Research & Education*, 151(1), 61–69. https://doi.org/10.1111/j.1936-704x.2013.03152.x.
103 *How Drought Affects Colorado's Agriculture Industry*. (n.d.). ArcGIS StoryMaps. Retrieved from: https://storymaps.arcgis.com/stories/e57766caa53e4adbace7871867e8ebaf.

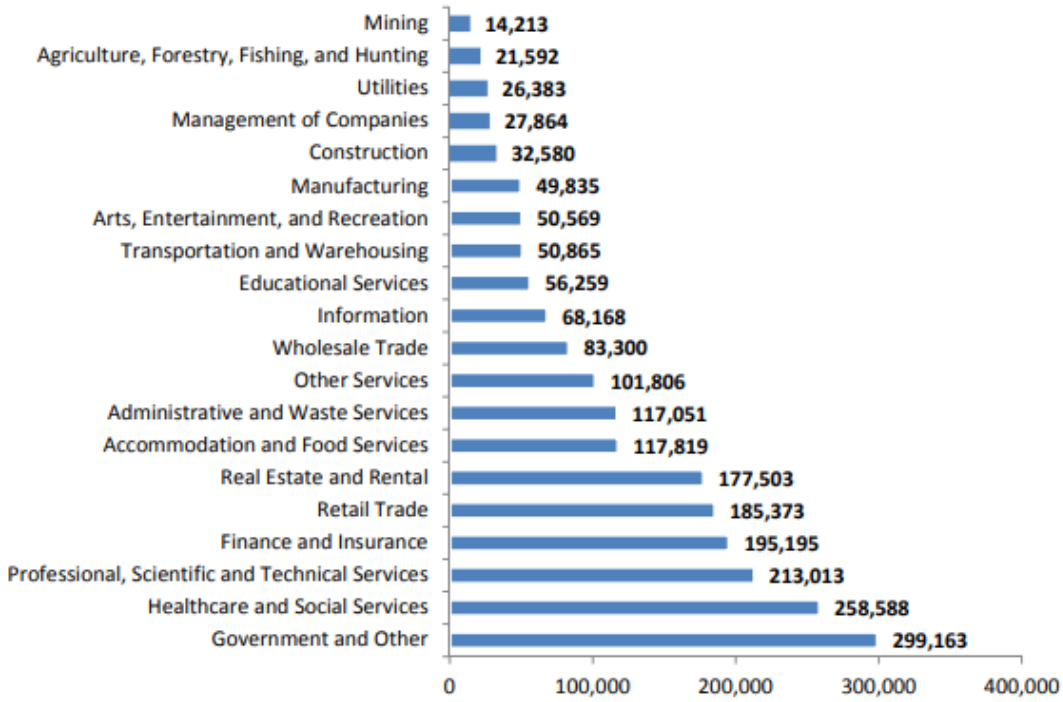
Colorado; therefore, it is the most impacted from drought. The State of Colorado estimates approximately $460,000,000 crop revenue was left on the table due to drought conditions.[104]

James et al. (2014) provided estimates of the economic impact of the Colorado River for several states. The study starts with the assumption that no water flows from the Colorado River for one year, and that there are no substitutes for that water. The study looks at the impact on both agriculture, municipal, and industrial usage of water, and finds that Colorado would be expected to lose $188.95 billion and 2,147,141 jobs.[105] Figure 83 shows the estimated job losses by sector for Colorado from James et al. (2014).

Table 19: Estimated Economic of Colorado River Water Loss for the State of Colorado Economy from James et al. (2014).

ECONOMIC IMPACT TYPE	GROSS STATE PRODUCT (BILLIONS 2014$)	EMPLOYMENT (JOB YEARS)	LABOR INCOME (BILLIONS 2014$)
Direct Losses	96.60	1,112,291	60.49
Indirect Losses	28.29	288,423	17.48
Induced Losses	64.06	746,427	38.00
Total estimated economic losses	188.95	2,147,141	115.97

Figure 83: Estimated Job Losses by Sector for One Year in the State of Colorado from James et al. (2014)



104 *How Drought Affects Colorado's Agriculture Industry*. (n.d.). ArcGIS StoryMaps. Retrieved from: https://storymaps.arcgis.com/stories/e57766caa53e4adbace7871867e8ebaf.

105 James, T., Evans, A., Madley, E., & Kelly, C. (2014). The Economic Importance of the Colorado River to the Basin Region. Retrieved from: https://businessforwater.org/wp-content/uploads/2016/12/PTF-Final-121814.pdf.

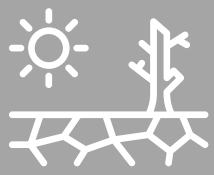
Table 20: 2020 Agriculture Jobs in the AGNC Region[106]

COUNTY	AGRICULTURE JOBS	% JOBS AGRICULTURE
Mesa	2,758	3.1%
Garfield	869	2.3%
Rio Blanco	434	10.3%
Moffat	595	8.7%
Routt	917	4.4%

Regionally, the Western Slope has a varying degree of agriculture as a total percent of jobs. Table 20 illustrates agriculture jobs, with Mesa County having the most at 2,758, but it being a smaller percentage of total jobs 3.1% than Rio Blanco County, whose job base agriculture makes up 10.3%. Garfield has the smallest percentage of jobs from agriculture at 2.3%. In relative terms, Rio Blanco and Moffat would be the counties hardest hit if agriculture declined due to drought. Mesa County has the most jobs to lose, but has a much larger economy to rely on.

Agriculture consumes more water by volume and therefore is the most impacted from drought.

Rio Blanco and Moffat counties would be hardest hit if agriculture declined due to drought.



Winter Sports

Wlostowski et. al (2021) citing Hock et al., (2019)[107] notes that the Intergovernmental Panel on Climate Change (IPCC) "expresses high confidence that the ski industry will experience a reduction in financial viability by the end of the 21st century."[108] Steamboat Springs, Glenwood Springs, and Eastern Mesa County all have a considerable ski industry and winter sports impact. Research by the state of Colorado shows that when evaluating the 2012 drought, of Colorado's estimated $62.5 billion outdoor recreation industry, the 2012 drought resulted in lost revenue of $250 million for ski and river outfitting industries.[109] Water and snow-based activities account for 40% of outdoor recreation consumer spending in Colorado.[110] In 2012, the ski season was 22 days shorter than usual. Additionally, resort visitation was 7% lower and river outfitter customer visits were 12% below average.[111]

Population Migration Growth

The Western Slope is expected to grow in population. However, with the potential threat of drought and

106 Data from the Bureau of Economic Analysis.

107 Hock, R., Rasul, G., Adler, C., Caceres, B., Gruber, S., Hirabayashi, Y., Jackson, M., Kääb, A., Kang, S., Kutuzov, S., Milner, A., Molau, U., Morin, S., Orlove, B. & Steltzer, H. (2019). Chapter 2: High mountain areas. In: H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.), IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. In press.

108 Wlostowski, A. N., Jennings, K. S., Bash, R. E., Burkhardt, J., Wobus, C. W., & Aggett, G. (2021). Dry landscapes and parched economies: A review of how drought impacts nonagricultural socioeconomic sectors in the US Intermountain West. *WIREs Water,* 9(1). https://doi.org/10.1002/wat2.1571.

109 *How Drought Affects Colorado's Agriculture Industry*. (n.d.). ArcGIS StoryMaps. Retrieved from: https://storymaps.arcgis.com/stories/e57766caa53e4adbace7871867e8ebaf.

110 *How Drought Affects Colorado's Agriculture Industry*. (n.d.). ArcGIS StoryMaps. Retrieved from: https://storymaps.arcgis.com/stories/e57766caa53e4adbace7871867e8ebaf citing Colorado Parks and Wildlife. The 2019 Statewide Comprehensive Outdoor Recreation Plan (2019).

111 *How Drought Affects Colorado's Agriculture Industry*. (n.d.). ArcGIS StoryMaps. Retrieved from: https://storymaps.arcgis.com/stories/e57766caa53e4adbace7871867e8ebaf.

wildfire, its desirability may change in the future. Population increases in the area are primarily the result of in-migration (especially for Mesa County). If summer smoke, drought that leads to water restrictions, and lack of outdoor recreation availability, become a major problem, people may change their migration preferences. As a result, this long run growth factor could change.

Table 21: Forecasted Population Trends for the AGNC Region[112]

	MESA	GARFIELD	RIO BLANCO	MOFFAT	ROUTT
2020	155,910	61,723	6,532	13,283	24,840
2025	163,909	65,826	6,475	13,086	26,584
2030	178,153	71,854	6,378	12,812	29,138
2035	192,979	78,614	6,196	12,540	31,459
2040	206,155	85,227	6,020	12,259	33,462
2045	217,325	90,959	5,825	11,910	35,106
2050	226,584	94,886	5,611	11,537	36,381

Dam Failures, Floods, and Mudslides

Transportation

Flooding and mudslides can lead to shutdowns on transportation routes. In Mesa County, the I-70 route from Grand Junction to Denver has been affected by these events. This became an issue on July 29, 2021 when mudslides near Glenwood Springs shut down I-70 for several days. During this time, Mesa County experienced shortages of goods that come from Denver.

In addition to shortages, the mudslide impacted the agricultural industry. Jenny Beiermann, a CSU Agricultural Economist pointed out that livestock are the number one agricultural good in Colorado and that I-70 is a widely used transportation route for livestock.[113] When I-70 was closed, farmers were routed to Highway 13 through northwestern Colorado, which added 80-150 miles to the trip and up to five additional hours of transportation time. Hauling costs for cattle range between $4.00 and $5.00 per loaded mile and sold at destinations based on current weights. Long transportation times increase animal stress, which can cause weight loss, reducing profitability while increasing costs.[114]

Dam failures also can result in economically harmful consequences, which include agricultural water supply loss. Additionally, they can result the loss of outdoor recreation related to the reservoir, as well as recreation related to fish and wildlife. However, the greatest threat they pose is to property, homes, and communities that are located down river from the dam.

40–60% of businesses close permanently after a major disaster.

112 Data from Colorado State Demography Office.

113 *Economic impact of Glenwood Canyon flooding for cattle producers in western Colorado*. (2021, August 11). Morning Ag Clips. https://www.morningagclips.com/economic-impact-of-glenwood-canyon-flooding-for-cattle-producers-in-western-colorado/.

114 *Economic impact of Glenwood Canyon flooding for cattle producers in western Colorado*. (2021, August 11). Morning Ag Clips. https://www.morningagclips.com/economic-impact-of-glenwood-canyon-flooding-for-cattle-producers-in-western-colorado/.

Earthquakes

At the country level, Lackner (2018) finds that earthquakes reduce GDP per capita by 1.6% eight years later. Lower and middle-income countries experience the longest long run damages, while high income countries do not experience these effects, and in fact may experience positive rebuilding effects.[115]

For disasters in general, small businesses have a more challenging time recovering. FEMA estimates that 40-60% of small businesses close permanently after a major disaster.[116] However, for northwest Colorado, the biggest impacts may be felt in power generation and transmission. An earthquake could disrupt power production and transmission at Craig and Hayden Stations (coal), as well as the Rifle Generating Station (natural gas. This would reduce access to power during the emergency period and beyond, which would affect local industry and economic output. It should be noted that the highest earthquake risk in the AGNC region is just east of Hayden Station.

The economic impact of an earthquake induced power generation reduction is difficult to measure. This is because the effects go beyond the temporary loss of the economic contribution of power generation stations. To understand this, a measure of the regional loss of power to businesses, their ability to receive power from other sources, and the losses that would experience due to a lack of power would have to take place. However, a measure utilizing the percentage of power generation and electric power transmission that would be at loss in the event of power disruption can be used to estimate the economic impact. The total direct employment (without indirect and induced effects) equates to 322 jobs, and $171,752,807 in GDP. This equates to 6.3% of Moffat and Routt's combined GDP.

In addition to losses associated with power disruption, The tourism sectors would experience losses from potential earthquake damage in the Steamboat Springs area. This includes road systems, airport infrastructure, and attractions that could take years to replace or bring back to full capacity.

Chapter 4: Disaster Phases and Goals

Phases of a Disaster

The Four Phases of Disaster Management

Disaster management is about more than just emergency aid distribution, yet most of the activities emergency managers spend their time on fall within the response phase.

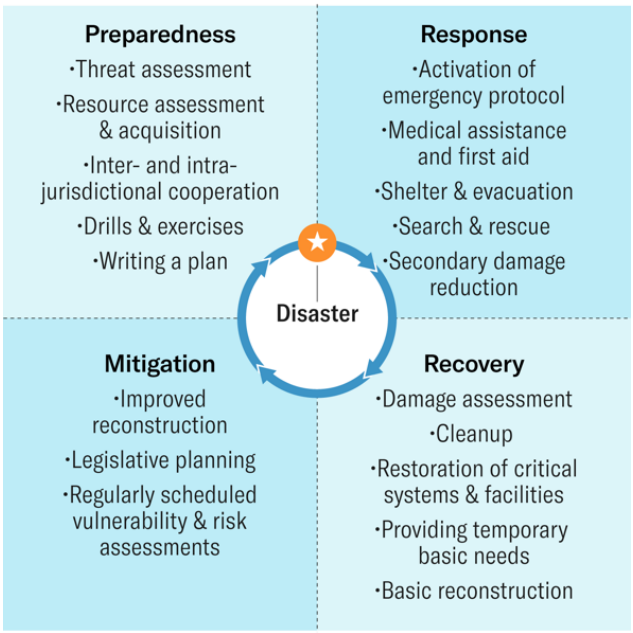


Figure 84: The Four Phases of Disaster Management
Courtesy of the Harvard Business Review

115 Lackner, S. (2018). Earthquakes and Economic Growth. FIW Working Paper No. 190, December 2019. Retrieved from: https://www.econstor.eu/bitstream/10419/194225/1/1043719490.pdf.

116 *Managing Disaster Recovery for Your Small Business*. (n.d.). Extension.sdstate.edu. Retrieved June 16, 2022, from https://extension.sdstate.edu/managing-disaster-recovery-your-small-business#:~:text=Unfortunately%2C%20according%20to%20".

The U.S. National Governor's Association created a four-phase model to help emergency managers respond to disasters and help their jurisdictions recover from them. The four phases include the following:[117]

- Mitigation: steps taken to reduce disaster vulnerabilities such as loss of life and property. This includes regulations, building codes, infrastructure improvements, and measures that make a community more resilient to a given disaster.

- Preparedness: this focuses on how a disaster could impact a community and how education, outreach, and training can increase the ability of a community to respond to and recover from disaster.

- Response: this phase addresses the threat posed by the disaster. This includes rescue efforts, humanitarian needs, mitigation efforts, cleanup, damage assessment, and the beginning of resource distribution.

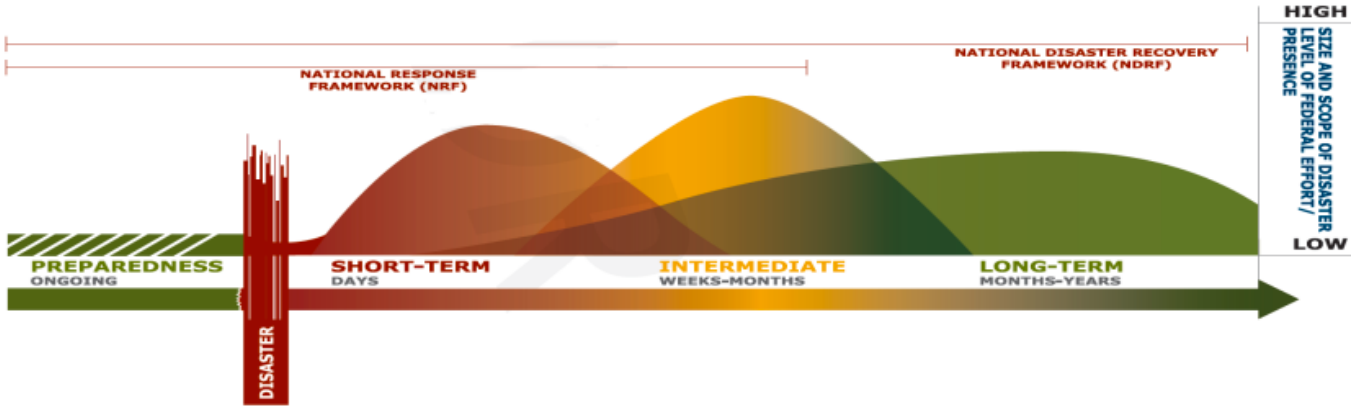
- Recovery: this phase represents the restoration of what was lost during a disaster within a community and moving beyond it to a degree of physical, environmental, economic, and social stability (see Figure 85). Recovery can be broken into three phases:[118]

  - » Short-term recovery starts immediately following the incident when community and business leaders organize for long-term redevelopment activities.

  - » Intermediate recovery represents a transitionary period where activities are undertaken to return essential government and business, critical infrastructure, and residents to a functional state.

  - » Long-Term recovery represents the period following all of this were rebuilding, clean up, and reconstruction take place.

Figure 85: The Recovery Continuum from Disaster Preparedness to Long-Term Recovery
Courtesy of the International Economic Development Council



117 Economic Developers Alberta, "Community Toolkit for Economic Recovery and Resiliency," Economic Disaster Recovery, 2019, https://www.edaalberta.ca/resources/Documents/Community%20ToolKit%202019%20Final%20Email.pdf (Accessed April 1, 2022).

118 International Economic Development Council, "A Toolkit for Economic Recovery and Resiliency," International Economic Development Council, Washington, DC: 2015., https://restoreyoureconomy.org/clientuploads/2015/03/IEDC-Leadership-in-Times-of-Crisis-Toolkit.pdf (Accessed April 1, 2022).

Recovery and Resiliency Goals

Improve Strategic Supply Capacity

1. Increase capacity for manufacturing, processing, and extracting strategically important supplies and materials.

Encourage Innovation

2. Encourage innovation through collaboration among AGNC counties, businesses, and educational institutions.

Infrastructure Investment

3. Invest in infrastructure that supports innovation, business development, and workforce development within the AGNC Region.

Downtown Revitalization

4. Encourage economic development, business diversity, and tourism through downtown revitalization.

Regional Disaster Readiness Planning

5. Formulate a regional disaster readiness plan to aid the AGNC region in responding to disasters and national emergencies.

Chapter 5: Long-Term Resiliency Through Strategic Industry

The first recovery and resilience goal recommended in this report is increasing the regional capacity to produce critical supplies and materials. Doing so has several advantages. First, it provides opportunity for investment and business growth in areas the American supply chain currently depends on and will do so well in the future. This will help ensure profitability, job creation, and long-term growth around more stable industries. Second, it will encourage resiliency through economic diversity. Third it will also help benefit other Colorado industries that depend on these supplies and materials, thereby strengthening the state economy. Lastly, it will help the national supply chain become more resilient in the process. These broader economic benefits will, in turn, enable the region to prosper and recover more quickly from disaster related shocks.

Long-term resiliency through strategic industry includes:

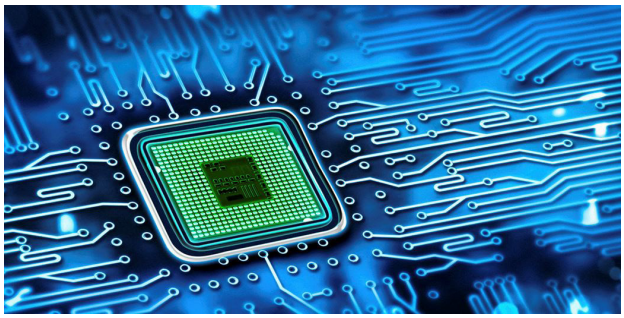
- **Critical supply chains and materials**
- **Power generation and supportive manufacturing**
- **Recycling**

Initiatives for developing these industries can follow the "Steps to General Innovation" as outlined in *A Playbook for Innovation: Coal-to-Products and General Innovation in Northwestern Colorado*. The Steps to General Innovation provide a workable strategy that can be applied to any of the recommended areas of focus outlined in this section. We recommend utilizing this publication along with the *Data Intensive Economic Report (DIER)* produced for this region under the Colorado-Utah Coal Communities innovation project.

Critical Supply Chains and Materials

The occurrence of the COVID-19 pandemic and subsequent shortages highlighted the fragility of the United States supply chain. In 2021, the Biden administration conducted a 100-Day Supply Chain Review to identify critical material vulnerabilities in the domestic supply chain. The section that follows discusses critical supply chains and materials that the AGNC region could focus on based on local competitive advantage.

Figure 86: Semiconductor
Courtesy of Citywire Selector



Semiconductors

Although semiconductor manufacturing is specialized and requires sterile facilities for manufacturing, it is reliant on raw materials that the region could produce, which are largely imported from abroad. Below are essential materials that the region should investigate producing in partnership with semiconductor manufactures that are expanding domestic production:

- Gallium: this metal is an important ingredient of gallium arsenide, which is used to produce semi-conductors. Currently, the United States imports most of this metal from countries like Russia where it is a byproduct of the aluminum industry. It is important to note that all gallium produced is a biproduct, since it only exists as a trace mineral. However, it is found in certain coal deposits in economically viable concentrations. Therefore, potential sources for this valuable mineral include coal bottom and fly ash. Gallium concentrations vary from one deposit to the next, but the metal could be extracted along with rare earth elements and other trace elements in coal.[119]

- Germanium: this is another trace metal that can be found in coal deposits. Like gallium, germanium is used to produce semiconductors. Currently, Apex Mine in Washington County, Utah is the only Germanium mine in the United States. However, it could be produced from certain coal deposits and ash along with rare earths and other materials.[120]

- Fluoropolymers: these are plastics that are resistant to chemicals, perform well in high temperatures, and are very pure. This makes fluoropolymers like polytetrafluoroethylene (PTFE) very important for making tubes, fittings, and valve seats in the semiconductor industry. Therefore, opportunity exists to produce these specialized plastics in conjunction with other polymer materials and chemicals in the AGNC region.[121]

Economic recovery and resiliency can be achieved by:

- **Producing raw materials for semiconductors**
- **Participating in the high-capacity batteries supply chain**
- **Producing active phamaceutical ingredients**
- **Mining rare earth elements used in modern technologies**
- **Resuming uranium mining for nuclear power and potential nuclear arms races**

In terms of economic impact, the NAICS code "semiconductor and other electronic component manufacturing" has an annual mean wage of $45,660. Other industry codes related to this employment type include "electronic and precision equipment repair and maintenance" which has an annual mean wage of $85,080. According to IBISWorld, the average semiconductor and circuit

119 Shenjun Qin, Yuzhuang Sun, Yanheng Li, Jinxi Wang, Cunliang Zhao, Kang Gao, "Coal Deposits as Promising Alternative Sources for Gallium," *Earth-Science Review*, Vol. 150: 95-101 (November 2015), https://doi.org/10.1016/j.earscirev.2015.07.010 (Accessed April 6, 2022).
120 Tiasia Stadnichenko, K.J. Murata, Peter Zubovic, and Elizabeth L. Hufschmidt, *Concentration of Germanium in the Ash of American Coals A Progress Report*, U.S.G.S., Washington D.C.: 1953,1., https://pubs.usgs.gov/circ/1953/0272/report.pdf (Accessed April 6, 2022).
121 Savillex Blog, "Daikin Discussion: Fluoropolymers, Purity, and the Semiconductor Industry," Life Sciences, https://blog.savillex.com/fluoropolymers-and-the-semiconductor-industry/ (Accessed April, 6 2022).

manufacturing facility in the United States has 126 employees.[122] Using this simple metric, a very basic economic impact model was created for a semiconductor facility in Moffat County, Colorado. Using average employment number and the mean wage of the industry, the economic impact would be approximately $7.8 million to GDP.

Figure 87:
The largest lithium battery power storage installation in the world in 2017 (located in San Diego, CA)
Courtesy of ArsTechnica

High-Capacity Batteries

As sustainable power technologies and electric vehicle usage expand, so will the need for high-capacity batteries. Therefore, opportunity exists to participate in the high-capacity battery supply chain. This supply chain consists of the following:[123]

1. Raw material production (graphite, lithium, cobalt, etc.)
2. Material refinement and processing
3. Battery material manufacturing and cell fabrication
4. Battery pack and end use product manufacturing
5. End of life recycling for batteries

Based on local competitive advantage, supply chain steps 1-2 and 5 present the most opportunity for the AGNC region. Below are specific activities in this supply chain that the region should investigate:

<u>Raw Material Production</u>

- Graphite Production: According to Benchmark Mineral Intelligence in December of 2021, there will be a global graphite deficit starting in 2022. Additionally, the United States has no manufacturing plans and China controls 84% of the world supply. Graphite is an essential component of batteries like as those found in electric vehicles. The increased demand of graphite and lack of secure supplies for critical industries presents an opportunity for the region to produce graphite from coal. For further information on graphite from coal and other coal-to-products information, refer to the Data Intensive Economic Report (DIER) produced for the AGNC region in March 2022.[124]

<u>Material Refinement and Processing</u>

Partnering with a battery producer like Syrah Resources may provide an opportunity for the AGNC region to process battery grade materials. These could then be utilized for a local battery production or exported by rail or truck to areas where battery production takes place.

122 IBISWorld, "Semiconductor and Circuit manufacturing in the U.S." IBISWorld (December 1st, 2021). https://www.ibisworld.com/industry-statistics/employment/semiconductor-circuit-manufacturing-united-states/#:~:text=How%20many%20people%20does%20the,the%20US%20has%20126.0%20employees. Accessed May 24th, 2022).

123 The White House, "Revitalizing American Manufacturing, and Fostering Broad-Based Growth, 100-Day Review Under Executive Order 14017, A Report by the White House, Including Reviews by Department of Commerce, Department of Energy, Department of Defense, and Department of Health and Human Services, June 2021, https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf (April 11, 2022).

124 Michelle Lewis, "Graphite Will be in Deficit from 2022-Here's What EV Battery Makers Need to do to Secure the Critical Mineral, *Electrek*, December 20, 2021, https://electrek.co/2021/12/20/graphite-will-be-in-deficit-from-2022-heres-what-ev-battery-makers-need-to-do-to-secure-the-critical-mineral/ (Accessed April 8, 2022); Ashley Theron, "Canadian Firm Turns Coal to Graphite," ESI Africa, https://www.esi-africa.com/regional-news/international/canadian-firm-turns-coal-to-graphite/ (Accessed April 8, 2022).

- Graphite Processing: mined graphite is usually processed to 95%-96% carbon purity on site. However, it must be processed further into a spherical, coated 99.95% purity substance for use in battery cells. Nearly every facility that does this is in China and there is acute need for such facilities in the United States. Graphite/battery producers outside of China like Syrah Resources located in Australia have invested in graphite facilities. One of these is the Vidalia battery anode material facility located in Louisiana, which they are expanding to process natural graphite from their mining site in Mozambique.[125]

Battery Recycling

Due to the rising costs of materials used in high-capacity batteries, opportunity exists to mine these materials from spent out battery cells. Batteries used in devices like old cell phones and in larger batteries used in electric cars are rich in these materials.

Battery recycling is a supply chain priority in the United States due to the expansion of electric vehicles and sustainable power technologies. Therefore, funding would likely exist on federal levels from entities like EDA and DOE to construct and equip facilities. Additionally, state funding programs are other options due to policy alignment. Below are materials a battery recycling operation could harvest:

- Cobalt: This metal is used to increase the rate in which power is delivered in a battery. Cobalt is generally a byproduct of copper and nickel mining. However, over half of the world supply comes from Congo where child labor is used to mine it. These ethical concerns and the ever-increasing cost of the metal make extracting through recycling a viable option.[126]

- Lithium: Together with cobalt, lithium is used in the cathodes of high-capacity batteries. Lithium is ideal for this purpose, because of its ability to store and transmit electricity. Due to the role lithium plays in high-capacity batteries, it is in high demand worldwide. This presents opportunity for the AGNC region to harvest this metal through a battery recycling initiative.[127]

- Graphite: This is another mineral essential to high-capacity battery production where it serves as the choice material for anodes. As mentioned previously, graphite is a high demand material and increasing in value. Harvesting graphite through recycling efforts would be a good precursor to producing it from coal on a regional level and even after that point, considering the value of battery grade graphite.[128]

- Nickle: This metal increases the energy density of a battery, resulting in greater energy storage. Most of the nickel consumed in the United States is imported with only one mining project dedicated to its production as a primary mineral. Therefore, supply security concerns and the increasing price of this metal presents another opportunity to the AGNC region to harvest a material through battery recycling.[129]

125 S&P Global Commodity Insights, "Feature: Graphite Supply a Concern in Meeting Growing Battery Demand," February 16, 2022, https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/energy-transition/021622-feature-graphite-supply-a-concern-in-meeting-growing-battery-demand (Accessed April 8, 2022).

126 Amory Lovins, "Six Solutions to Battery Mineral Challenges," RMI Article 2022, https://rmi.org/insight/six-solutions-to-battery-mineral-challenges/ (Accessed April 11, 2022); Kevin Clemens, "Understanding the Role of Cobalt in Batteries," Design News, March 22, 2018, https://www.designnews.com/electronics-test/understanding-role-cobalt-batteries (Accessed April 11, 2022).

127 University of Washington, "What is a Lithium-Ion Battery and How Does it Work," Lithium-Ion Battery, Clean Energy Institute, https://www.cei.washington.edu/education/science-of-solar/battery-technology/ (Accessed April 12, 2022); Lovins, "Six Solutions to Battery Mineral Challenges," https://rmi.org/insight/six-solutions-to-battery-mineral-challenges/ (Accessed April 12, 2022).

128 Ibid.; University of Washington, "What is a Lithium-Ion Battery and How Does it Work," ,https://www.cei.washington.edu/education/science-of-solar/battery-technology/ (Accessed April 12, 2022).

129 Ibid.; Lovins, "Six Solutions to Battery Mineral Challenges," https://rmi.org/insight/six-solutions-to-battery-mineral-challenges/ (Accessed April 12, 2022); Melissa Pistilli, "Top 9 Nickel-Producing Countries (Updated 2022), Investing News Network, March 3, 2022, https://investingnews.com/daily/resource-investing/base-metals-investing/nickel-investing/top-nickel-producing-countries/ (Accessed April 12, 2022).

The economic impact of raw material production, refinement, and processing would be similar to the current economic impact of the coal industry, as the general process and skillset remains the same. However, the impact of a battery recycling facility would likely be smaller than the extraction component, with IBISWorld showing the average battery recycling facility employing 15.6 people.[130] The Bureau of Labor Statistics does not have a NAICS code that is representative of battery recycling, but the broad NAICS category "recyclable material merchant wholesalers" has an average salary of $47,688.[131]

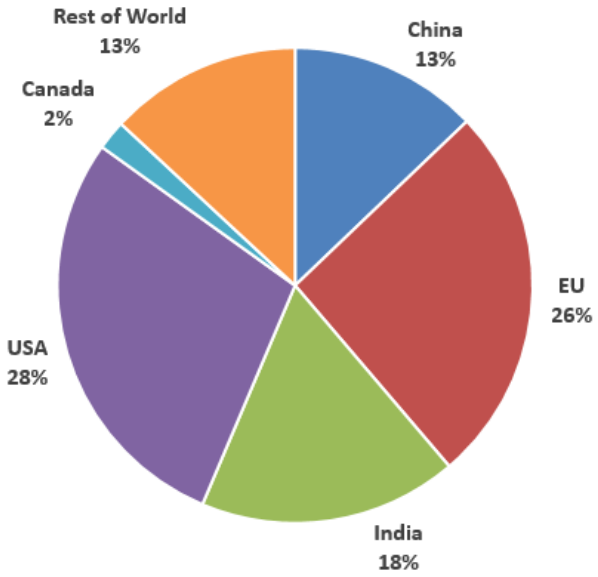
Power Grid Scale Battery Storage

In addition to manufacturing efforts surrounding the battery supply chain, utilizing existing power generation infrastructure in conjunction with power high-capacity batteries may be another opportunity for the AGNC region. Grid-scale battery storage serves several purposes. It provides backup for power in the event outages and increased power reserves for improved peaking capacity. It also provides a way to store energy developed through wind and solar to provide greater consistency in power availability.[132]

Pharmaceuticals and Active Ingredients

The COVID-19 pandemic highlighted the fragility of the U.S. supply chain when it came to medical supplies as well. One aspect of this supply chain that the United States has become increasing reliant on are active pharmaceutical ingredients (APIs). Some of the main reasons why this has occurred is that the manufacture of these ingredients usually requires large sites, access to cheap labor, and have environmental liabilities that make domestic production more costly. However, offshoring this part of the supply chain makes it challenging to secure types of drugs and reagents during health emergencies like COVID-19. This occurred in early 2020 when over forty major manufactures of APIs were under lockdown in China. Further shortages occurred with generic medication when India temporarily halted the export of 26 medicines, which included acetaminophen and many antibiotics.[133]

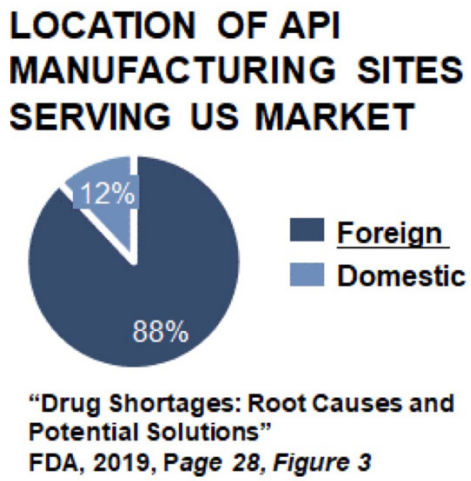
Figure 88: Manufacturing Sites of APIs for U.S. Market (August 2019)
U.S. Food & Drug Administration



130 IBISWorld, Retrieved from: https://www.ibisworld.com/industry-statistics/employment/recycling-facilities-united-states/. Accessed May 24th, 2022.
131 Data from Datausa.io. Source: https://datausa.io/profile/naics/recyclable-material-merchant-wholesalers. Accessed 5/24/22.
132 Thomas Bowen, Ilya Chernyakhovskiy, Paul Denholm, National Renewable Energy Laboratory, "Grid-Scale Battery Storage Frequently Asked Questions, Greening the Grid, https://www.nrel.gov/docs/fy19osti/74426.pdf (Accessed April 12, 2022), 1-2.
133 The White House, "Revitalizing American Manufacturing, and Fostering Broad-Based Growth, 100-Day Review," https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf (April 13, 2022); Anthony Sardella, "The US Active Pharmaceutical Ingredient Infrastructure: The Current State and Considerations to Increase US Healthcare Security," Center for Analytics and Business Insights, Olin Business School at Washington University, August 1, 2021., 2, https://www.fdanews.com/ext/resources/files/2021/08-26-21-USActivePharmaIngredientInfrastructure.pdf?1630013957 (Accessed April 26, 2021); U.S. Food and Drug Administration, "Safeguarding Pharmaceutical Supply Chains in a Global Economy," Testimony of Janet Woodcock M.D., Director-Center for Drug Evaluation and Research, October 29, 2019, https://www.fda.gov/news-events/congressional-testimony/safeguarding-pharmaceutical-supply-chains-global-economy-10302019 (Accessed April 13, 2021).

Figure 89: Location of API Manufacturing Sites Serving U.S. Market

Courtesy of the Center for Analytics and Business Insights



Another problem created by offshoring APIs and generic medication is quality control. Challenges associated with quality control can lead to inferior products, potential consumer dangers, and costly product recalls. This occurred in 2015 when the FDA discovered that certain batches of baclofen, a muscle relaxant often used as an injectable was contaminated. A similar incident occurred in August 2018 when a Chinese firm that produces porcine thyroid medication recalled certain lots of porcine (pig) thyroid, which is the main ingredient of the medication. The reason for the recall were inconsistencies with the strength of the active ingredient, which could result in over or under treatment of hypothyroidism.[134]

Despite quality control issues and supply insecurity, manufacturing APIs in places like China and India is cheaper when utilizing traditional methods. However, advanced manufacturing technology has potential to change this by reducing the footprint, environmental impact, and human resources necessary to produce APIs. Technologies like automation and additive manufacturing could make API production profitable domestically, presenting an opportunity for regions like AGNC.[135]

The region could draw off of local labor and facilities to produce certain APIs in partnership with larger pharmaceutical industries such as CordenPharma, which has API manufacturing facilities in Boulder. Due to the lower cost of living in the AGNC area and other incentives, CordenPharma and other companies like them may be interested in helping support the manufacture of select APIs. For further information on CordenPharma, visit https://www.cordenpharma.com/facilities/boulder/.[136]

Below are essential pharmaceuticals that the AGNC region should explore:

- APIs: Reagents, injectables, and the active ingredients of medications based on formulas provided by drug companies.
- Generic Medication: Over the counter medications like acetaminophen and ibuprofen and generic prescription drugs like antibiotics.
- Base Chemicals: Active chemicals and reagents used in the drug manufacturing process.

The Bureau of Labor Statistics shows that the average wage of Pharmaceutical and Medicine Manufacturing is $76,490.[137] Using an employment estimate of 200 for a large pharmaceutical manufacturing plant for a plant in Moffat County would likely result in an economic impact of

Pharmaceutical industries may be interested in helping support the manufacture of select APIs in the AGNC area due to the lower cost of living and other incentives.

134 Ibid.
135 Ibid.
136 CordenPharma, CordenPharma Boulder, Co, U.S., https://www.cordenpharma.com/facilities/boulder/ (Accessed April 26, 2022).
137 Data from the Bureau of Labor Statistics.

approximately $18.8 million. Also, in addition to directly employing 200 people, the facility would likely result in 44 jobs due to induced impacts for a total of 244.[138]

Rare Earth Elements

Rare earth elements are naturally occurring minerals that are used in many modern technologies. Although most of these are mined in China, natural deposits can be found in coal and ash by products from power generation. For further information on the potential of rare earth element production from coal, refer to Chapter 4 of the *Date Intensive Economic Report (DIER)*. This report was produced for the AGNC region under the Colorado-Utah Coal Communities Innovation Project, which took place from September 2019-March 2022.

There is a fast-growing demand for rare earth elements. The NAICS code that best describes rare earth element mining would be "nonmetallic mineral product manufacturing," which has an annual mean wage of $51,010.[139]

Uranium

The Western Slope of Colorado has a long history of uranium mining and the whole region has uranium and vanadium deposits. To these ends, the Uravan mineral belt (which comprises of portions of Mesa County) was considered one of the most important uranium deposits in the United States during the nuclear era. Although no active uranium or vanadium mines exist in the region, increased nuclear power usage and a potential nuclear arms race may increase demand enough to warrant a resumption of mining. Uranium extraction would not only benefit the Western Slope region, but nearby southeastern Utah as well. Uranium mining has an annual mean wage is $67,840 according to the Bureau of Labor Statistics, meaning it would likely result in well-paying jobs.

Power Generation and Supportive Manufacturing

The AGNC region has relied on coal power generation for electricity and economic growth for decades. Although Colorado is in the process of transitioning away from coal power, opportunities exist to replace coal power with low-carbon emission generation such as small-scale nuclear power, solar power, and manufacturing components for sustainable power technologies. The section that follows discusses power generation and supportive manufacturing that the AGNC region could focus on based on local competitive advantage.

Small-Scale Nuclear Power

The following is partly from Chapter 5 of the *Date Intensive Economic Report (DIER)*.

TerraPower recently announced its plan to build its Natrium reactor at a coal mine set for retirement in Kemmerer, Wyoming. The small nuclear power plant will generate 345 MW of power, which would provide enough power for 250,000 homes, with enough capacity to produce 500 MW of power during peak demand. TerraPower says that they will employ approximately 2,000 workers during the construction phase of the project, with 250 people working at the plant during the operational phase. Based on previous research, 250 jobs in nuclear energy would create an additional 165 jobs in the local community, for a total of 415 jobs. The jobs created from a nuclear power plant range from skilled trades (welder, electricians, sheet metal workers) to professional jobs (accountants,

Small nuclear power plants can be built at retired coal mine sites as shown in Kemmerer, Wyoming which can generate construction and operational jobs.

138 Author calculated using IMPLAN.
139 Data from the Bureau of Labor Statistics.

lawyers), to nuclear specific jobs (nuclear engineer, civil engineer, scientists, chemists).

In general, nuclear worker salaries are 50% higher on average than other electricity generation occupations. In the context of northwestern Colorado, this is significant because coal-fired power plant jobs already pay above average and nuclear jobs would likely pay more. Additionally, with locally available energy infrastructure, adequate water from the Yampa River, and uranium mining potential in the region, Craig Station has potential to support small-scale nuclear power generation.[140]

Although the same power generation does not exist in Mesa County, the area would benefit from uranium mining. Additionally, because all the components for nuclear power are produced in the United States, it is a viable option for increasing low-carbon emission domestic energy security.

Solar Power

The following is partly from Chapter 5 of the *Date Intensive Economic Report (DIER)*.

The existing power infrastructure and the political climate make solar a viable option for NW Colorado. The National Renewable Energy Lab (NREL) annual average daily solar irradiance maps show that Moffat and Rio Blanco average 4.75 to 5.00 kWh/m2/day, which is in the middle of the scale. However, Tri-State Generation and Transmission Association have contracted to build a 145 MW solar facility set in between Meeker and Craig. Economic impact modeling performed by Perry (2020) show a few scenarios for solar employment within the region. Scenario one uses a regression approach based on previous literature suggests that a 145 MW solar plant will create 192.38 jobs during the construction phase and 6.67 jobs during operation on a yearly basis thereafter. The second modeling technique was using the economic impact software IMPLAN in conjunction with the NREL's Jedi estimates for solar. This model predicts that a 145 MW solar plant would create 163.98 direct jobs during construction and 263.84 jobs post-construction (considering indirect and induced effects). The operations and maintenance phases of the solar plant itself would create 6.72 direct jobs and 11.53 jobs on a yearly basis thereafter. Non-employment impacts include revenue that municipalities could generate by selling their solar power to the grid, which could help offset the loss of ad valorem tax revenue as coal production is reduced.[141]

Table 22 illustrates IMPLAN modeling for three different sizes of solar plants, and shows their estimated employment, labor income, regional GDP, and total output estimates. This table is broken down by the construction phase and the operations and maintenance phase. Table 23 shows employment estimates for each nameplate size for both the statistical approach and the IMPLAN approach.

In addition to construction and operational jobs, solar power facilities can generate additional revenue by selling their solar power to the grid.

140 *Next-Gen Nuclear Plant and Jobs Are Coming to Wyoming*. (n.d.). Energy.gov. Retrieved May, 2022, from https://www.energy.gov/ne/articles/next-gen-nuclear-plant-and-jobs-are-coming-wyoming#:~:text=TerraPower%20will%20build%20its%20Natrium., Hughes, T. (n.d.). *A $4B nuclear power plant backed by Bill Gates and Warren Buffett is set for construction in Wyoming*. USA TODAY. Retrieved June 16, 2022, from https://www.usatoday.com/story/news/nation/2021/11/16/warren-buffett-bill-gates-build-nuclear-power-plant-wyoming/8634699002/., Jobs. (n.d.). Nuclear Energy Institute. Retrieved May, 2022, from https://www.nei.org/advantages/jobs#:~:text=The%20.

141 (2017). Nrel.gov. https://www.nrel.gov/gis/assets/images/solar-annual-ghi-2018-usa-scale-01.jpg., Carney, J. (n.d.). *Tri-State to invest in solar with next Northwest Colorado projects*. www.craigdailypress.com. Retrieved June 16, 2022, from https://www.craigdailypress.com/news/tri-state-to-invest-in-solar-wind-with-next-northwest-colorado-projects/., Perry, N. (2020). Economic transition in Northwest Colorado: The economic contribution of coal power and coal mining, and the economic impact of solar power and natural gas power. Prepared for and funded by the Unconventional Energy Center at Colorado Mesa University. Retrieved from: https://www.coloradomesa.edu/energy/documents/economic-impact-of-coal-solar-gas-nw-co.pdf., Carney, J. (n.d.). *Tri-State to invest in solar with next Northwest Colorado projects*. www.craigdailypress.com. https://www.craigdailypress.com/news/tri-state-to-invest-in-solar-wind-with-next-northwest-colorado-projects/.

In addition to the economic impacts of solar in Tables 22 and 23, there are non-employment impacts, which include the revenue that municipalities could create by selling their solar power to the grid. This could help offset the loss of ad valorem tax revenue as coal mines shut down.

Table 22: Economic Contribution of Solar Power (IMPLAN Model Produced by Perry (2020)

	NAMEPLATE SIZE	EMPLOYMENT	LABOR INCOME	REGIONAL GDP	OUTPUT
Construction	145 MW	263.84	$19,278,482	$28,920,444	$37,132,226
	600 MW	1,092.16	$79,792,165	$119,699,011	$153,705,389
	1200 MW	2,184.51	$159,592,870	$239,411,436	$307,437,080
O&M	145 MW	11.53	$800,927	$1,910,438	$3,702,644
	600 MW	47.79	$3,319,154	$7,912,314	$15,334,640
	1200 MW	95.61	$6,639,610	$15,826,768	$30,673,523

Table 23: Employment Estimates for Solar Power Produced by Perry (2020)

MODEL	DIRECT EMPLOYMENT	145 MW	600 MW	1200 MW
Statistical model	Construction Phase (Yearly)	192.38	514.83	940.05
	O&M Phase (Yearly)	6.67	18.55	34.21
IMPLAN model	Construction Phase (Yearly)	163.98	678.56	1,357.12
	O&M Phase (Yearly)	6.72	27.81	55.61

Solar Panel/Wind Turbine Manufacture

As Colorado and the nation focus increasingly on low-carbon emission energy, solar and wind power component manufacturing will be a growth industry. Additionally, as of 2019 80% of the worlds solar panels are made in China.[142] This poses an energy security risk to the United States, especially in the current geopolitical climate. However, this creates an opportunity for solar panel manufacturing in the United States as well.

Northwestern Colorado coal miners have a transferable skill set that with some retraining could enable them to work on solar panel and wind turbine manufacture. Additionally, the transportation infrastructure exists to transport rail lines to both Salt Lake City and Denver. Although solar power production is not labor intensive and does not create many jobs per megawatt, solar manufacturing can result in significant job creation. Furthermore, it could provide a much-needed new industry for the transitioning economies of the region. For wind turbines, there is less of a national energy security risk, as most wind turbine components are manufacturing in the United States.[143] In fact, one of the fastest growing job markets is for wind turbine

142 Wu, Henry. (2021). The United States can't afford the brutal price of Chinese solar panels. Foreign Policy. Retrieved from: https://foreignpolicy.com/2021/07/14/us-chinese-solar-panels-green-tech-strategy/#:~:text=In%202019%2C%20China%20made%2080,coal%2Dpowered%20electricity%20in%20Xinjiang.

143 *Wind Manufacturing and Supply Chain*. (n.d.). Energy.gov. Retrieved June 16, 2022, from https://www.energy.gov/eere/wind/wind-manufacturing-and-supply-chain#:~:text=The%20wind%20supply%20.

technician. According to the American Wind Energy Association, an estimated 85,000 Americans are employed in the wind and wind power industry.[144]

Table 24 is reproduced from the Bureau of Labor Statistics and shows the scope of salaries that would accompany a wind turbine technician. The annual mean wage for engine, turbine, and power transmission equipment manufacturing is $71,670.[145]

Table 24: Reproduced Table of Power Engineers (Bureau of Labor Statistics)[146]

TYPE OF ENGINEERS	MEDIAN ANNUAL WAGES
Aerospace engineers	$94,780
Civil engineers	$76,590
Electrical engineers	$83,110
Electronics engineers, except computer	$89,310
Environmental engineers	$77,040
Health and safety engineers, except mining safety engineers and inspectors	$74,080
Industrial engineers	$75,110
Materials engineers	$83,190
Mechanical engineers	$77,020
Engineers, all other	$89,560
Engineering technicians, except drafters	$50,130

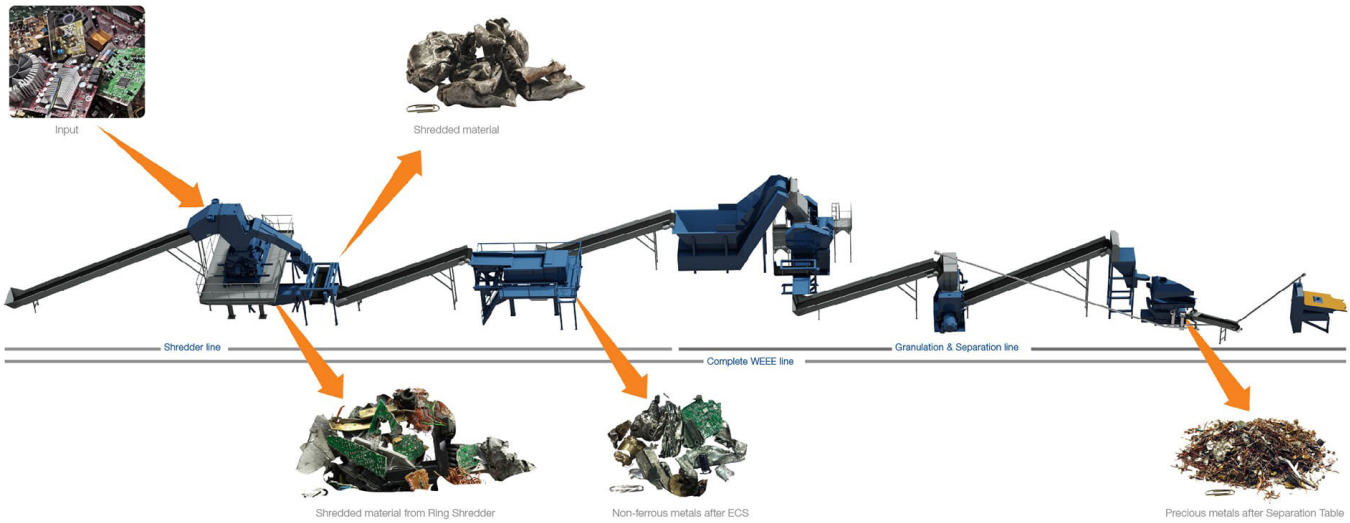
Recycling

nother industry related to manufacturing and extraction is recycling—more especially electronics recycling. This industry would enable the region to process electronics waste from Denver and other nearby urban areas into critical materials and precious metals that could be used in other industries. The section that follows discusses electronics recycling, which is an industry that the AGNC region could focus on based on local competitive advantage.

Electronics recycling would enable the region to supply critical metals to multiple industries while helping Colorado and nearby areas manage waste.

144 Hamilton, J., and Liming, D. (2017, June 30) *Careers in Wind Energy: U.S. Bureau of Labor Statistics*. Retrieved from: https://www.bls.gov/green/wind_energy/.
145 Data from the Bureau of Labor Statistics.
146 Hamilton, J., and Liming, D. (2017, June 30) *Careers in Wind Energy: U.S. Bureau of Labor Statistics*. Retrieved from: https://www.bls.gov/green/wind_energy/.

Figure 90: Electronics Recycling Process
Courtesy of Eldan Electronics



Electronics Recycling

As consumers upgrade technology and old electronics wear out, they either end up in landfills or are recycled. Disposing of electronics in landfills creates environmental hazards. However, this waste contains valuable metals such as aluminum, copper, brass, and even precious metals like gold, silver, platinum, and palladium.

Drawing off local skills in manufacturing and the extraction industries, the AGNC region could encourage an electronics recycling industry. A plant like the example above operated by Eldon Recycling in Denmark could transform electronic waste into metals for commercial sale. This industry could draw off waste available in more populous areas of Colorado such as Denver and the Boulder area. It could also serve as a regional hub for electronics waste disposal and processing.

The electronics recycling process involves the following:[147]

- Collecting refuse electronics
- Transporting refuse electronics to a processing facility
- Shredding the electronics for metal extraction
- Non-ferrous metal extraction
- Precious metal separation
- Casting scrap metals into ingots, bars, and slabs for sale and transport
- Transport to end user

Although metals are typically extracted at high heat in a furnace, more innovative extraction methods have recently become available. Two examples are the methods developed by the Canadian corporation, Excir in partnership with the Royal Mint in Great Britain and Mint Innovation in New Zealand. The former method uses chemical extraction, while the latter uses microbes to recover metals from powdered electronic waste.

147 Eldan Recycling, "Electronics Recycling," https://eldan-recycling.com/electronics-recycling/ (Accessed May 18, 2022).

This type of recycling could take place in conjunction with battery recycling. Additionally, it would enable the region to supply critical metals to multiple industries while helping Colorado and nearby areas manage waste.[148] As stated previously, the broad NAICS category "recyclable material merchant wholesalers" has an average salary of $47,688, with the average recycling facility employing 15.9 people.[149]

For further information on Excir and Mint Innovation, visit https://www.excir.com and https://www.mint.bio/.

Conclusion

This ERRP discussed the economic challenges experienced by the AGNC region during the COVID-19 pandemic. This included impact summaries of the pandemic, as well as discussions on the most affected and most resistant economic sectors, industry trends, augmented economic challenges, affected groups, and lasting challenges resulting from the pandemic.

Following this overview, the ERRP discussed other disasters the region is at risk to. These include climate change related disasters like droughts, wildfires, and floods. It also includes disasters like major earthquakes and dam failures.

The ERRP also introduced five recovery and resiliency goals for the region. These include improving strategic supply capacity, encouraging innovation, infrastructure investment, downtown revitalization, and regional disaster readiness planning. Lastly, it introduced five industries in three strategic areas and discussed their economic potential for the region.

Ultimately this report serves as a starting point for regional economic disaster readiness. By utilizing the information contained within this report, the region can become more resistant to future disasters and minimize their long-term economic impact. This will not only contribute to economic diversity, it will also help the region recover from economic challenges that predate the pandemic. In the end, this will ensure that the AGNC region remains a desirable place to live, a positive environment for job growth, and a location where long-term prosperity can take place.

148 Rachel Pannett, "Britain's Royal Mint to Turn Trash into Treasure by Recovering Gold from Discarded Electronics, Washington Post, October 20, 2021, https://www.washingtonpost.com/world/2021/10/20/royal-mint-electronic-waste-precious-metals/ (Accessed May 18, 2021); Excir, "Sustainably Sourced Ethically Refined," Corporate Homepage, https://www.excir.com/ (Accessed May 18, 2022).

149 *Recyclable material merchant wholesalers*. Data USA. (n.d.). Datausa.io. Retrieved May 24th, 2022, from https://datausa.io/profile/naics/recyclable-material-merchant-wholesalers.