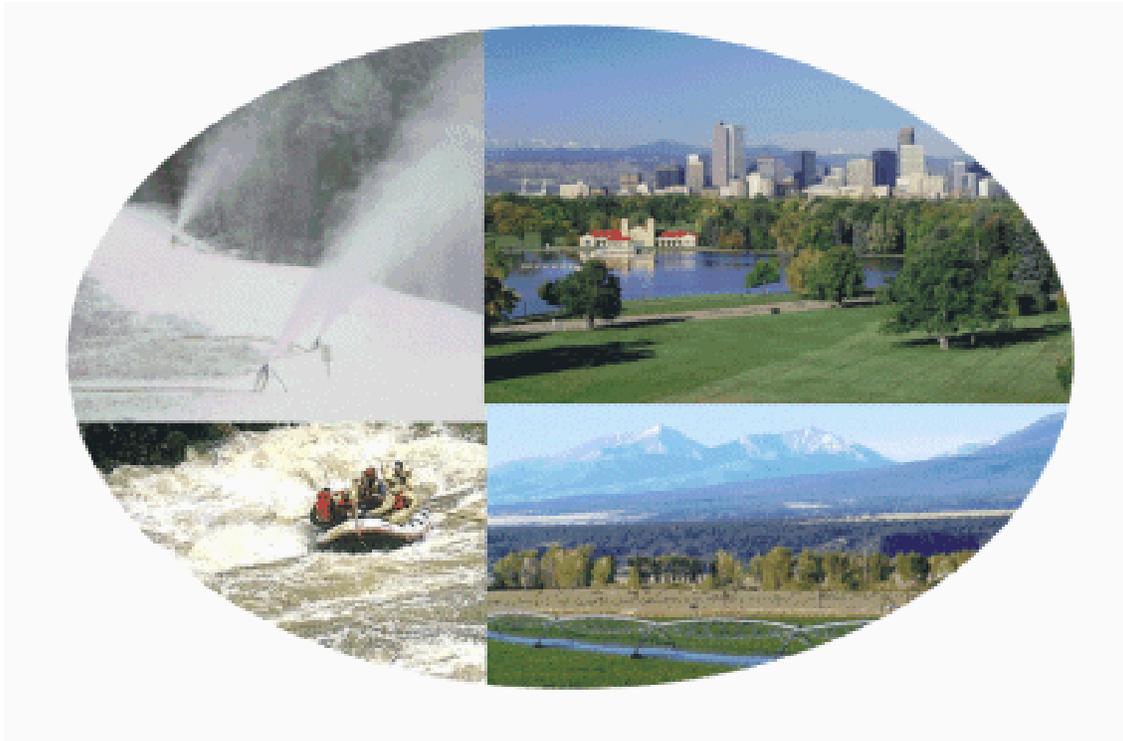


Water and the Colorado Economy



**Commissioned by:
Front Range Water Council**

Summit Economics and The Adams Group

December 2009

Water and the Colorado Economy

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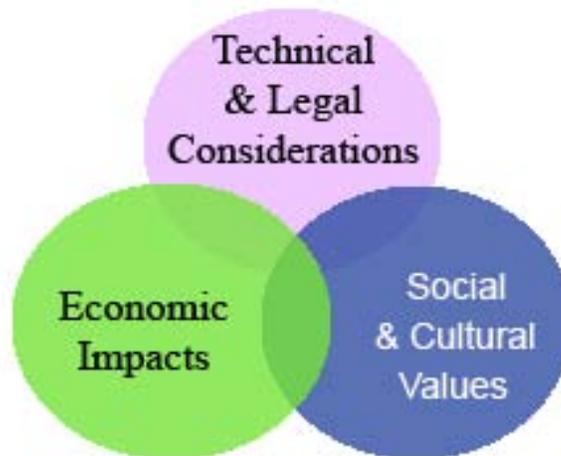
PURPOSE

In 2005 the Colorado Legislature passed and the Governor signed into law HB05-1177 - The Colorado Water for the 21st Century Act. The Act created the Interbasin Compact Committee and nine Basin Roundtables to bring all the water interests across the State of Colorado together into a framework that provides a permanent forum for broad-based water dialogue. Establishing and effectively implementing a statewide water policy is critical to the future of the State given the role water plays in the Colorado economy, culture, and environment. This economic analysis of the value of water use within Colorado is designed to provide data for collaborative decision-making, which can be utilized in assessing the future use and allocation of water resources.

While different interests have researched and documented the impact of water availability within their specific purview, no comprehensive economic analysis has considered the value of water resources either within sub-regions of the State or Statewide. Such an analysis is necessary to understand the contribution of water availability on the economy. The intent of this study is to help close that gap.

The economic impacts of water to Colorado are one facet of the “Water Balancing Act.” There are also legal/technical considerations associated with water use as well as social and cultural values that impact water decisions. Those technical and social components are not part of this study.

Water Balancing Act



This report was commissioned by the Front Range Water Council and was researched and written by Summit Economics in conjunction with The Adams Group.¹ Richard Adams, Professor Emeritus of Resource Economics at Oregon State University, performed a peer review of the report.²

The Front Range Water Council is comprised of the following members:

- Northern Colorado Water Conservancy District
- Southeastern Colorado Water Conservancy District
- Colorado Springs Utilities
- Aurora Water
- Pueblo Board of Water Works
- Denver Water
- Twin Lakes Reservoir and Canal Company

Key Topics Addressed in the Report

Following an Executive Summary, the following topics are included in this report.

- Background
- Colorado's Economy - Overview
- Regional contributions to the Colorado economy
- Economic interconnectedness of the different regions of Colorado
- The magnitude of water withdrawals and productivity of water in the Colorado economy

¹ The Adams Group is headed by Tucker Hart Adams, PhD. Summit Economics is a partnership of three applied economists, David Bamberger, Tom Binnings, and Paul Rochette. See Appendix A for resumes of the team of researchers.

² There is no relationship between the Adams group (Tucker Hart Adams) and the peer reviewer, Richard Adams.

EXECUTIVE SUMMARY

The major findings of this report can be summarized in the following points.

1. Historically, Colorado is above the national average in rates of job, per capita income, and population growth.
2. Colorado is well positioned in the global economy based upon its ability to attract skilled labor and capital. This strength, combined with national trends, transitioned the State's economy through the 20th Century from agriculture and mining to services.
3. The State's population is forecasted to increase approximately 60% by 2035 and double by 2050.
4. Most of population increase is forecasted to occur along the Front Range, however in contrast to recent decades when the Front Range grew at a higher rate than the rest of the State, the forecast for the coming decades is for the highest growth rate in Western Colorado. The Front Range will continue to receive the greatest magnitude of growth.
5. The State projects a significant future water supply gap, beginning to develop in the next 5 years and growing to over 1,000,000 acre feet (AF) by 2050.³ The gap will primarily result from municipal and industrial needs. By 2050, total municipal and industrial water demands are projected to double relative to current demands. The water gap is more immediate if development projects and processes, currently underway, are not achieved.
6. Statewide water withdrawals are 15.1 Million AF, of which 1.1 Million AF or 7.5% is withdrawn for municipal and industrial (M&I) purposes and 13.8 Million AF or 91% is withdrawn for agricultural purposes.
7. The Front Range average annual water withdrawn is 2.9 million AF (19.4% of state total) of which 962,000 AF (6.4% of state total) is for M&I and 1.9 million AF (13% of state total) is for agriculture.
8. The Front Range Water Council makes up the majority of the Front Range M&I water demand and contributes to Front Range agricultural water demands. Approximately 27% of the Front Range Water Council water withdrawals are from the Arkansas and South Platte River basins and 73% from the Colorado River basin.
9. While the Front Range withdraws 19.4% of the State's water, it generates 80-86% of the State's economy and tax revenue. Western Colorado withdraws 41% of the State's water and is the second largest region in the State comprising approximately 10% of the economy.
10. Front Range agriculture represents 33.4% of the State's agricultural output and 13.7% of the State's agricultural water withdrawals.
11. Colorado's economy generated \$450 billion in sales of goods and services in 2007. Of that amount, 70% stayed within the State and 30% was exported to other states.

³ An Acre-Foot (AF) of water is equal to 325,851 gallons -- enough water to provide for 3 average households for a year.

12. The Front Range generated \$386.8 billion in sales in 2007, 86% of the State's total.
13. For every acre foot of water withdrawn, the Front Range generates \$132,000 in sales of goods and services. This is 11 times more than the next most productive region which is the Central Mountains.
14. The Front Range agricultural sector is the most productive agricultural sector in the State generating \$1,240 per acre foot of water withdrawal. The next most productive agricultural region is Eastern Colorado which generates sales of \$919 per acre foot.
15. As populations continue to grow, water gaps are likely to drive up the price of water. This will transform current water usage paradigms. These paradigm shifts will result in dramatic increases in the economic productivity of each acre foot of water, as well as a reallocation of water from industry sectors of lower productivity to those with higher productivity.

This study demonstrates the economic impact of water in Colorado and the economic interconnectedness of the regions in the State. Colorado has a strong economic base and a promising economic future. As history has demonstrated in the arid West, water resources are essential and a prerequisite for economic prosperity. As we move from an era of water resources development to a future of water resources management, the State needs to consider how water uses are evaluated and prioritized. While municipal and industrial withdrawals of water generate much higher economic productivity than other uses, prioritization needs to consider all values cherished by Colorado citizens, including prosperity, lifestyles and the environment. In order to properly prioritize water resources we must consider technical and legal issues, social and cultural values, *and* integrate the economic impacts of maximizing the benefits of water throughout the State. Reasonable water resource management will come from balancing these three considerations with a proactive consideration of future possibilities and needs.

BACKGROUND

Colorado is well positioned economically to be a major participant, if not a world leader, in the future technology and information based global economy. According to the Brookings Institute, Colorado, as part of the southern intermountain west:

“... is experiencing some of the highest population growth rates and economic and demographic transition of any place in the country.”

There are two complementary factors driving this vitality – the State’s desirability both among businesses and among educated people. These two factors interact with one another creating a synergistic dynamic that has been self-perpetuating for at least the last half century. During the 20th Century, Colorado transitioned from a mining and agricultural economy that was relatively isolated from the world, due to significantly higher transportation and communications costs, to a largely service-based economy. Colorado’s natural environment, its central location both in North America and between Eastern Asia and Western Europe, dramatic declines in transportation and communications costs, and its reasonable cost of living drove this transition.

The outcome can be seen in Colorado’s high rank among states on a number of desirable attributes. The overall stature of the state suggests Colorado is well positioned economically to greatly participate in the future technology and information based global economy. Appendix B includes a full list of the many economic and quality of life accolades that Colorado has and is receiving, thereby pointing towards an attractive future.

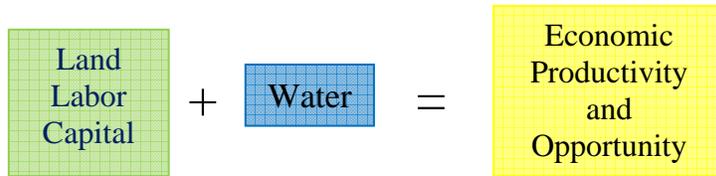
The economic trajectory of Colorado, when combined with historical trends, leads to population forecasts of approximately 10 million people by 2050 (Colorado State Demographer). Roughly half of the increase is expected to come from natural increase (births less deaths) as opposed to net in-migration of new residents. Today the State’s population is just under 5 million people. The forecasted doubling compares to a 36% forecasted national increase (US Census Bureau) and 40% global increase (United Nations).

Colorado’s National Economic Vitality Ranking out of 50 States

- 4th Most Preferred State to Live In (Harris Poll)
- 2nd in Entrepreneurial Activity (TIF Index)
- 3rd Highest Venture Capital per Capita (Beacon Hill State Competitiveness)
- 4th Best State for Business (Forbes Magazine)
- 4th Highest Research and Development Inputs (Milken Institute)
- 8th in High Tech Exports (AEA Cyberstates 2008)
- 10th Most Fortune 500 Company Headquarters (Fortune Magazine)

Source: Colorado Office of Economic Development and International Trade

Economics and Water



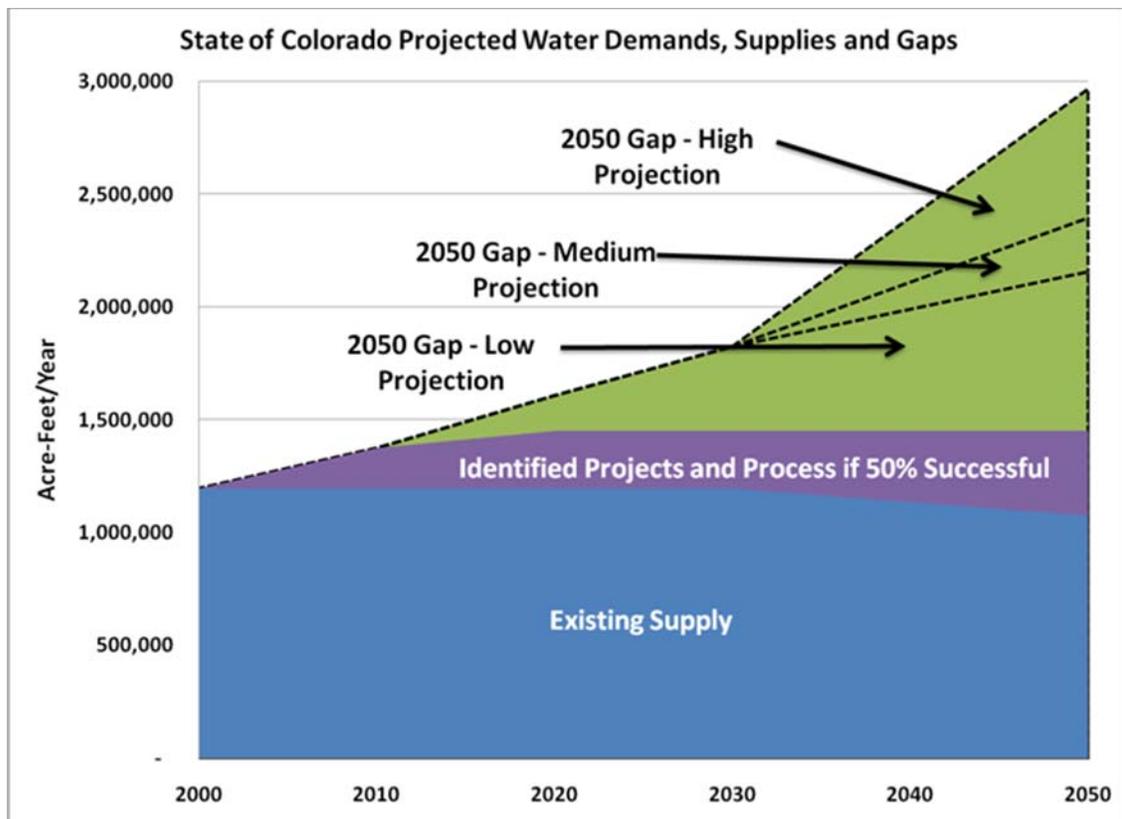
A fundamental concept in economics is that the ability of a region to produce is derived from the amount and quality of resources available to the region. In the simplest of terms, these resources include land, labor, and capital. In arid and semi-arid climates like the intermountain western United States, land is not a limiting constraint, as there are millions of undeveloped acres throughout

a large expanse of territory. The limiting factor is the availability of water. Given Colorado's ability to retain and attract skilled labor and capital, global communication and transportation cost decreases, and water's growing scarcity based on historical growth and usage patterns, it is a reasonable assertion that the allocation and patterns of usage for water must change in the coming years.

This reality is forecasted by the Colorado Department of Natural Resources. Currently, developed municipal and industrial (M&I) water supplies are forecasted to begin a slow decline statewide, largely due to potential climate change affects on hydrology and the impacts of pumping nonrenewable ground water. The forecasters show a M&I "Water Gap" beginning to develop within the next five years and increasing thereafter. This forecast assumes existing proposed projects, including new and currently underway water development activities (identified projects and processes), are 50% successful in full implementation and no new strategies are pursued to close the gap. The water gap becomes more immediate and urgent if those new and currently underway water development projects are unsuccessful.

By 2050, the water gap could grow, under high forecasts, to as much as 1.5 million acre-feet per year. The high forecast assumes significant oil shale development on the Western Slope of Colorado. It appears, however, that significant oil shale development is improbable due to high electrical and water requirements. If this were to occur, the gap would be greater than current total usage of municipal and industrial water in Colorado today. A more likely estimate of the M&I water gap is approximately 1 million acre feet by 2050.

The forecasted challenges around water are not unique to Colorado. The State, which by virtue of having winter snow pack in the Rockies and being the headwaters of river systems flowing both to the Atlantic and Pacific Oceans, would appear to have first claims to a lot of water. However, Federal compacts among the states and legal precedents create a complex system prohibiting Colorado from simply keeping all the water originating in the State. Hence, the State must carefully track and manage water. Colorado's most immediate neighboring states also face water gaps, existing and forecasted, either due to continued urban and/or agricultural growth, as well as depleting existing supplies in aquifers.



Source: State of Colorado Projected Water Demands, Supplies, and Gaps from Colorado Department of Natural Resources

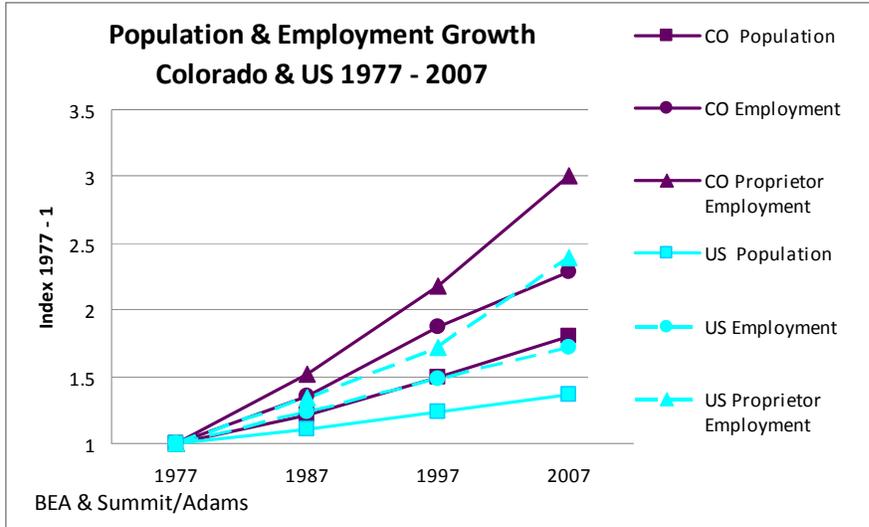
A water gap is also emerging on the national and global levels. In this sense, Colorado is not unique. The State's water challenges are simply amplified, serving somewhat as a precursor, or bellwether, for the rest of the nation and world.

Given this background, a central question that emerges is whether or not the State's water situation and policy will support or hinder future economic vitality. This is an important long-term issue as economic vitality impacts job opportunities, real personal incomes, and household wealth in the State.

THE COLORADO ECONOMY

Recent History – Performance Relative to the Nation

From 1977 to 2007 Colorado’s population increased from 2.7 million people to 4.8 million. This represents an 80% increase compared to a 37% increase in the United States as a whole. Since the 1990s, Colorado’s population has grown at an annual rate of 2% or better per year. When indexed and compared to employment trends, it becomes apparent that Colorado employment

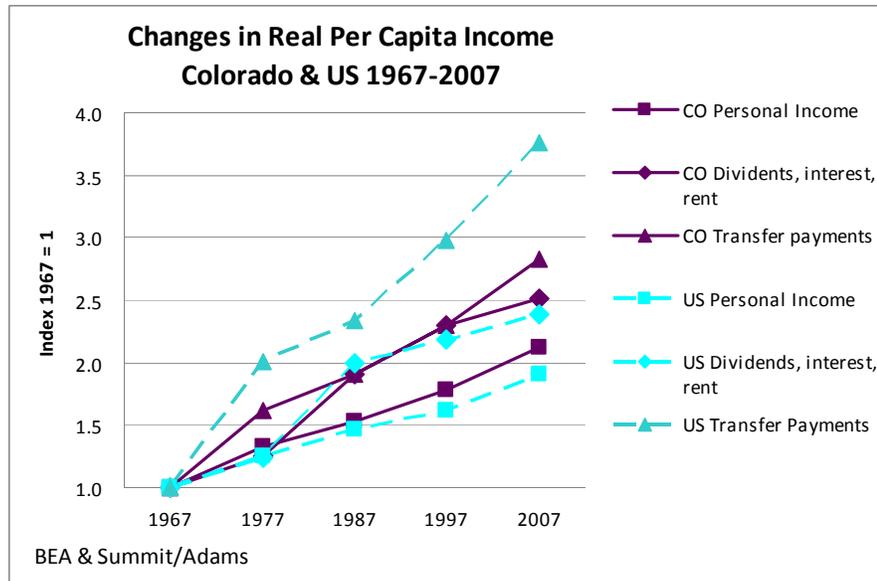


grew faster than population and that Colorado proprietor employment (self-employed independent contractors) grew even faster than total Colorado employment. Similar to population trends, the U.S. trailed Colorado in employment growth rates.

Personal income data are available going back 40

years to 1967. Looking at total personal income growth on a per capita and real (inflation adjusted) basis, personal income from transfer payments and dividends, interest, and rents has grown faster than total personal income, which is largely comprised of wages, salaries and proprietor’s income.

Real growth in per capita income is important to an economy as it translates into increases in standards of living and quality of life. As noted in the chart, Colorado outperformed the nation in total personal income as well as investment income from dividends, interest, and rent. The State did not come close to keeping up with the U.S. in transfer payment



growth, which is typically associated with social security, unemployment, welfare, and intra-family transfers for family member support.

Combined, these trends indicate Colorado, while generally mirroring national trends, excels as a working and employment based economy generating higher rates of income and wealth creation versus the national average.

The Economy's Structure – Magnitude of Different Sectors

Retail trade, health care and social assistance services, and accommodation and food services each comprise 9.9% or more of all Colorado jobs. Since 1990, the sectors that have at least doubled in size include construction, educational services, management of companies and enterprises, and arts, entertainment, and recreation. Non-farming proprietor employment has also doubled since 1990.

Colorado differs from the United States in its economic structure by having proportionately more jobs in the non-farm proprietor; professional, scientific, and technical services; construction; and real estate and rental and leasing sectors.

Average wages in a given sector depend on competitive situations, the training and skill sets required, and risk associated with the industry. According to the Bureau of Economic Analysis, in 2007, the highest paid sectors included management of companies and enterprises, information, utilities, and federal government. As shown in the following table, these sectors comprise a relatively small proportion of the State's total employment.

Distribution of Colorado's Employment by Sector, by Rank	
Retail Trade	11.1%
Health Care and Social Assistance	10.3%
Accomodation and Food Services	9.9%
Educational Services	8.1%
Construction	7.5%
Professional and Technical Services	7.5%
Administrative and Waste Services	6.6%
Manufacturing	6.4%
Public Administration	5.9%
Finance and Insurance	4.8%
Wholesale Trade	4.3%
Transportation and Warehousing	3.5%
Information	3.4%
Other Services, Ex. Public Admin	3.0%
Arts, Entertainment, and Recreation	2.2%
Real Estate and Retal and Leasing	2.1%
Management of Companies and Enterprises	1.2%
Mining	1.1%
Agriculture, Forestry, Fishing and Hunting	0.6%
Utilities	0.6%

Source: Bureau of Economic Analysis

Colorado Average Wage by Sector, 2007			
	# of Jobs	Compensation (\$,000)	Average Compensation per Wage & Salary Job
Total employment	3,215,903		
Wage and salary employment	2,475,048		
Proprietors employment	740,855		
Farm proprietors employment	30,829		
Nonfarm proprietors employment 2/	710,026		
Farm employment	43,488	\$513,087	\$11,798
Nonfarm employment	3,172,415	\$134,786,428	\$42,487
Private employment	2,748,702	\$110,109,909	\$40,059
Forestry, fishing, related activities, and other 3/	11,596	\$157,646	\$13,595
Mining	37,491	\$2,580,192	\$68,822
Utilities	8,475	\$811,614	\$95,766
Construction	254,743	\$9,524,442	\$37,388
Manufacturing	159,439	\$10,831,654	\$67,936
Wholesale trade	112,000	\$7,887,194	\$70,421
Retail trade	328,932	\$8,172,366	\$24,845
Transportation and warehousing	87,012	\$3,654,076	\$41,995
Information	88,597	\$7,310,468	\$82,514
Finance and insurance	166,838	\$9,226,554	\$55,302
Real estate and rental and leasing	181,568	\$2,498,562	\$13,761
Professional, scientific, and technical services	268,799	\$3,673,714	\$13,667
Management of companies and enterprises	30,849	\$3,673,714	\$119,087
Administrative and waste services	200,328	\$5,458,891	\$27,250
Educational services	54,642	\$1,329,885	\$24,338
Health care and social assistance	261,716	\$10,764,630	\$41,131
Arts, entertainment, and recreation	83,914	\$1,766,755	\$21,054
Accommodation and food services	241,193	\$4,763,281	\$19,749
Other services, except public administration	170,570	\$4,005,580	\$23,483
Government and government enterprises	423,713	\$24,676,519	\$58,239
Federal, civilian	52,215	\$5,190,482	\$99,406
Military	43,392	\$3,408,491	\$78,551
State and local	328,106	\$16,077,546	\$49,001
State government	89,504	\$4,607,080	\$51,473
Local government	238,602	\$11,470,466	\$48,074

Source: Regional Economic Information System, Bureau of Economic Analysis, US Department of Commerce

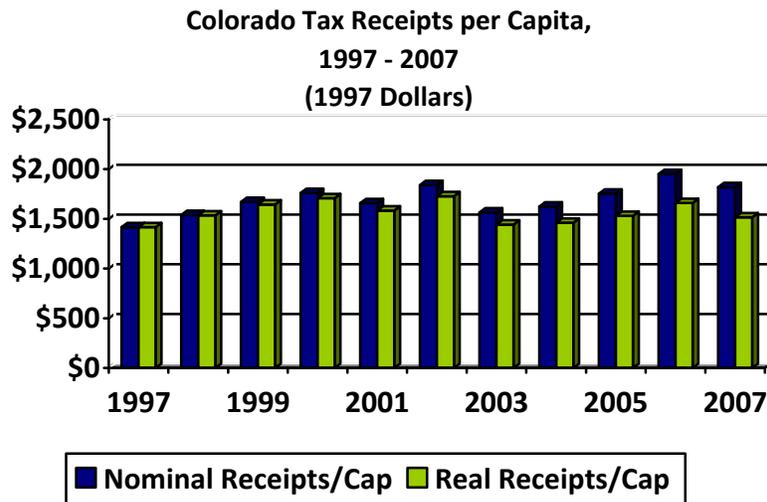
State Fiscal Structure

The state government relies heavily on individual income taxes and sales and use taxes to fund government services. Overall, the budget was 3.8% of Colorado's total output of goods and services (State GDP) in 2008.

Colorado 2008 Budgeted Source of Revenues		
	2008	%
Sales and Use Tax	\$3,281,568,707	35.1%
Individual Income Tax	\$5,014,366,103	53.7%
Corporate and Fiduciary Income Tax	\$561,601,721	6.0%
Estate Tax	\$426,790	0.0%
Severance Tax	\$151,473,654	1.6%
Motor Vehicle Tax	\$259,051,901	2.8%
Regulatory and Business Tax	\$65,579,500	0.7%
Other Receipts	\$12,235,812	0.1%
Total	\$9,346,304,188	100%

Source: 2008 Colorado Department of Revenue Annual Report

State government revenues on a total and per capita basis rise and fall with the economy -- both in nominal and real (inflation adjusted) terms. In real terms, state revenues have remained constant at about \$1,500 in real 1997 dollars.

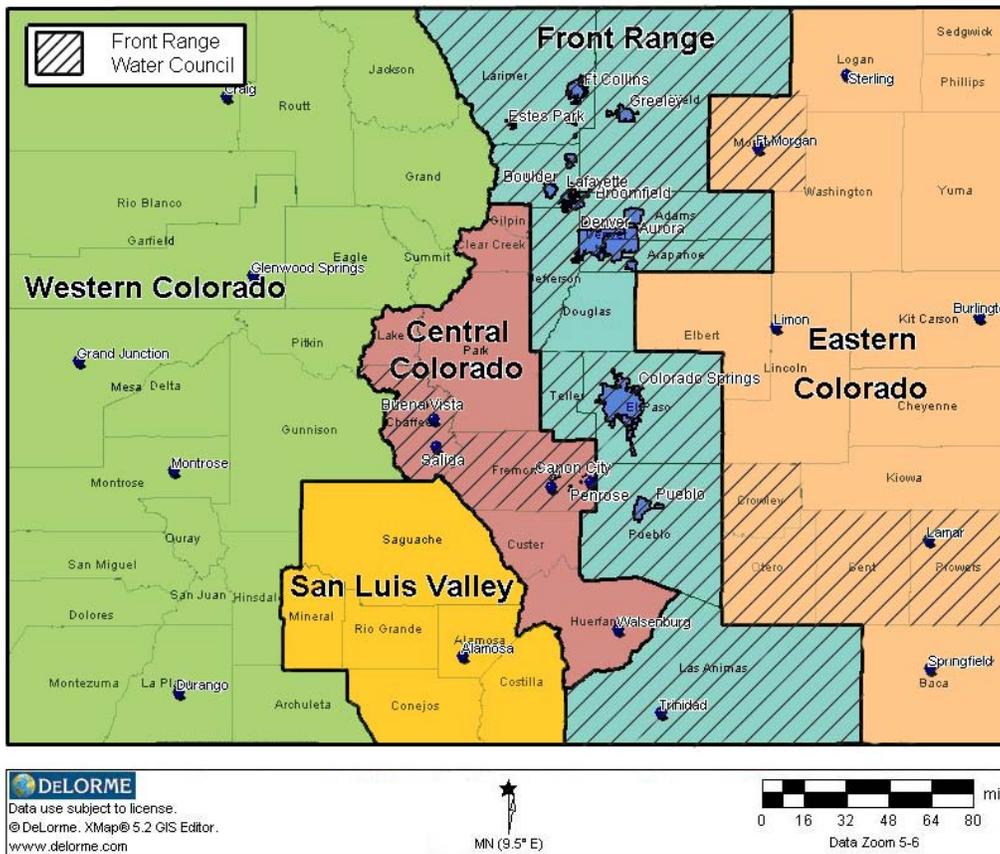


Regional Contributions to the Colorado Economy

For the purposes of this study, Colorado has been broken down into regions based on relatively homogenous economies and geographies. Due to the availability of most economic data on a county basis, regions are defined as containing a group of whole counties as opposed to dividing counties up to place them in multiple regions.

The Western Region is generally defined as west of the Continental Divide while the Front Range is east of the Rockies, from the foothills to the agricultural Eastern Plains Region, which runs all the way to the Kansas and Nebraska borders. The Front Range runs the full length of the State from north to south – from Trinidad to Fort Collins. The San Luis Valley is a well defined region known for potato farming. This leaves the remaining mountain counties, east of the Continental Divide, which is referred to as the Central Region.

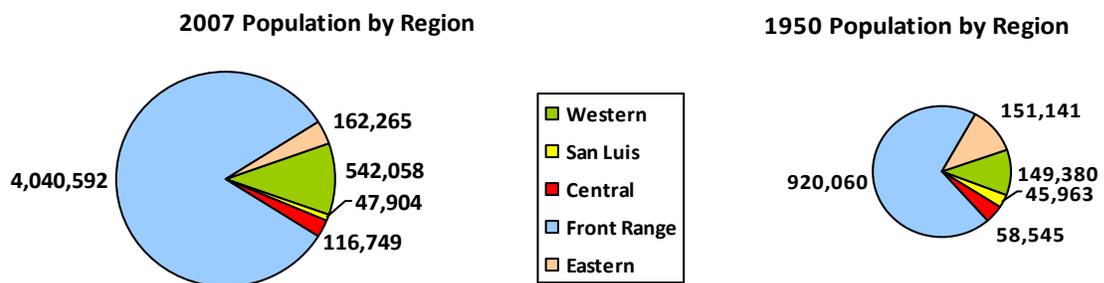
Colorado Regions



The hatched area on the map shows the counties covered by the Front Range Water Council (FRWC). While data were collected for the FRWC area, they are not included in this report as the Front Range is the more relevant level of analysis as discussed above. The Front Range Water Council area includes all of the Front Range except Douglas County; and also includes the counties of Morgan, Fremont, Chaffee, Crowley, Bent, Otero, and Prowers. In terms of actual

land acreage in the Front Range, it should be noted that much of Larimer, Weld, Adams, El Paso, Pueblo and other counties have extensive non-urban use, including ranching and farming.

Colorado, like many states in the Western half of the United States, has been undergoing significant demographic change since the end of WWII, with population shifts from rural to urban areas, accompanied by rapid growth rates. In 1950, the Front Range of Colorado had 920,000 people, or about 70% of Colorado’s population. Since then, it has captured 87% of the total growth in the State, and now contains about 82% of the total population in the state. Western Colorado represents 11% (11.3% in 1950) and the three remaining areas contain the balance of 7% of the State’s population. The Eastern Plains and San Luis Valley have not experienced much population growth at all since 1950 (having actually experienced population declines from 1950 through 2000) and have lost a significant share to the Front Range since 1950.



Source: Colorado State Demographer

While the Front Range has 82% of the State’s population, it has 86% of the State’s personal income. All other regions have slightly lower contributions to the State’s personal income relative to their shares of population. In contrast, the Front Range has a slightly lower share of civilian employment (total employment less the military) while Western Colorado has a higher share. These differences can be explained by the higher urban wages as reflected in the significantly higher per capita income in the Front Range.

In terms of taxes, the Front Range contributes a relatively greater share to income taxes and a lower share to retail sales tax as a result of proportionately more tourism existing outside the Front Range.

Given the relative magnitude of the Front Range, its indicators are going to mathematically be closest to the State’s total indicators. So for instance, the Front Range per capita income was \$42,667 in 2007 while that State was only slightly lower at \$41,192.

Economic Overview of Regions
(2006 – 2008 Snapshot)

Summary of Key Economic Statistics for Colorado Regions

Region	Western	San Luis	Central	Front Range	Eastern	State Total
2007 Sales of Goods & Services (\$,000,000)	\$44,504	\$2,777	\$5,186	\$386,791	\$10,978	\$450,235
% of State	9.9%	0.6%	1.2%	85.9%	2.4%	100%
2007 Total Personal Income (\$,000)	\$19,998,539	\$1,154,457	\$3,298,497	\$170,515,000	\$4,516,882	\$199,483,375
% of State	10.0%	0.6%	1.7%	85.5%	2.3%	100%
2007 Per Capita Income	\$37,828	\$25,080	\$28,760	\$42,667	\$28,777	\$41,192
2008 Civilian Employment	314,727	21,883	53,783	2,126,598	79,320	2,596,311
% of State	12.2%	0.8%	2.1%	81.9%	3.1%	100%
2007 Population	542,058	47,904	116,749	4,040,592	162,265	4,909,568
% of State	11.0%	1.0%	2.4%	82.3%	3.3%	100%
2007 Net State Sales Tax Revenue	\$285,927	\$10,535	\$45,493	\$1,586,338	\$32,372	\$1,960,665
% of State	14.4%	0.5%	2.3%	79.7%	1.6%	98%
2004 State Income Net Tax (\$,000)	\$298,859	\$11,986	\$60,754	\$2,776,805	\$59,571	\$3,224,737
% of State	9.3%	0.4%	1.9%	86.1%	1.8%	100%

Sources: Minnesota Implan Group, Summit/Adams, Bureau of Economic Analysis, Colorado Department of Labor & Employment, LMI Gateway, Colorado State Demographer, Colorado Department of Revenue, .

Employment by Region

As was shown in the previous table, county level employment from the Colorado Division of Employment and Training, in 2008, the Front Range had almost 82% of the total statewide civilian employment. The second largest employment region of the state was Western Colorado, with 12% of the total. The Eastern Region had approximately 3% of the total, Central had 2% and the San Luis Valley had just less than 1% of the civilian employment.

While total employment (wage and salary jobs and proprietors) has grown consistently since 1970, the distribution of employment by region has slowly changed. In 1970, Eastern Colorado accounted for 5.8% of employment, and has since dropped to about 2.7%. Over the same period, the employment share of the Western region has grown from 7.9% to 12.5%. The Front Range share has decreased from 83% to 82.1%.

Regional Share of Total Colorado Employment					
	Annl Avg - 2007	Annl Avg – 2000	Annl Avg – 1990	Annl Avg- 1980	Annl Avg – 1970
Western	12.5%	11.4%	10.7%	10.2%	7.9%
San Luis	0.8%	0.8%	0.9%	1.1%	1.3%
Central	1.9%	1.9%	1.5%	1.9%	1.9%
Front Range	82.1%	83.0%	83.5%	82.6%	83.0%
Eastern	2.7%	2.9%	3.4%	4.2%	5.8%
Total	100%	100%	100%	100%	100%

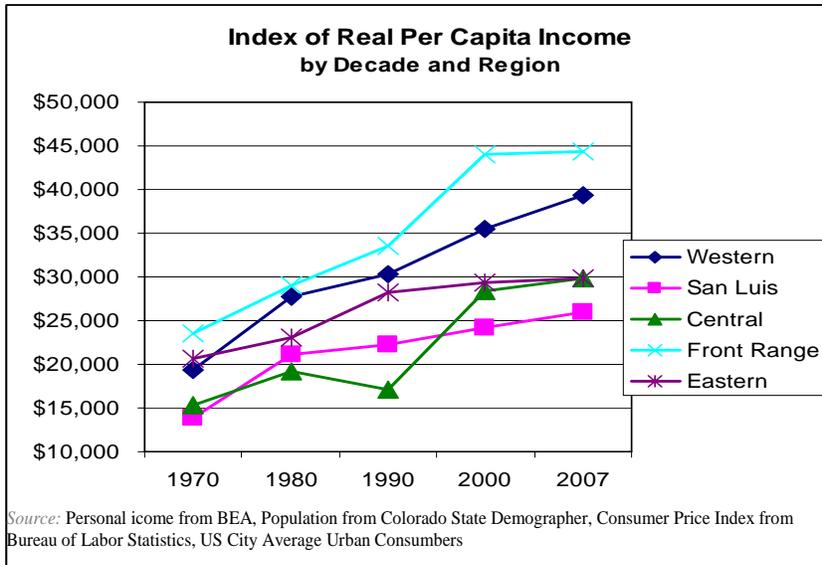
Sources: 1970 – 2007: BEA Regional Economic Accounts, Table CA30 Regional Economic Profiles.
Total Full Time & Part Time Employment.

Personal Income

Consistent with most income differentials between relatively more urban and rural areas, the Front Range and Western Colorado record the higher per capita personal incomes. The Eastern Plains have fallen from the second highest per capita income region in 1970 to the lowest income region in 2007

Real Total Per Capita Income, By Region by Decade (2008 Dollars)					
	1970	1980	1990	2000	2007
Western	\$19,325	\$27,693	\$30,324	\$35,415	\$39,288
San Luis	\$13,795	\$21,179	\$22,255	\$24,134	\$26,048
Central	\$15,298	\$19,123	\$17,050	\$28,409	\$29,870
Front Range	\$23,520	\$29,112	\$33,543	\$44,053	\$44,314
Eastern	\$20,568	\$23,019	\$28,200	\$29,287	\$29,888
Total	\$22,608	\$28,264	\$32,376	\$41,972	\$42,782

Source: Personal income from BEA, Population from Colorado State Demographer, Consumer Price Index from Bureau of Labor Statistics, US City Average Urban Consumers



Colorado per capita income statewide is essentially the same as Front Range per capita income due to the relative size of the Front Range in the weighted average. The sustained and strong national economic growth of the 1990s favorably impacted the Front Range and the Central Mountains from 1990 to 2000. Faster growth rates than the Front Range are noted in the San Luis Valley and Western Slope in the

1970s and since 2000. All areas, except the Eastern Plains and San Luis Valley, have seen real incomes almost double since 1970.

While the Front Range and Western regions have led the State in population growth, all regions, except the Eastern Plains, appear to have benefitted in terms of real income growth.

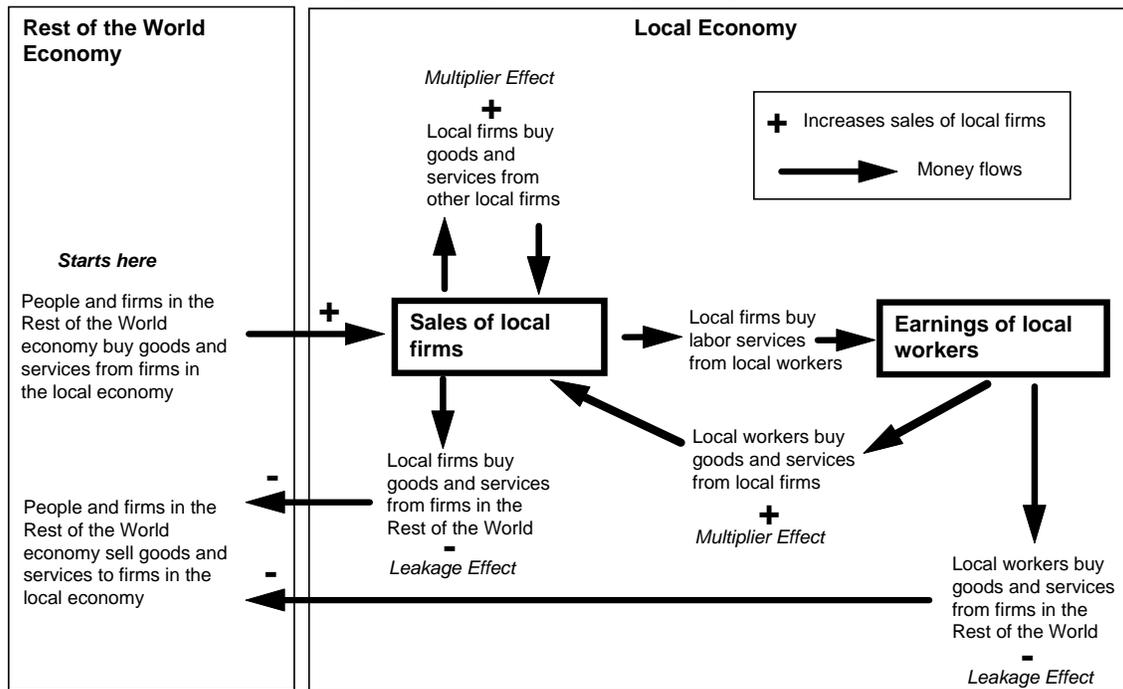
Note that real income growth must be compared to regional variations and changes in the cost of living to ascertain changes in the general well-being of the region. Thus even though there may be real gains in income (relative to national consumer inflation) in high cost areas like mountain resorts, there may be a reduction in the resident populations' well-being in those areas if costs are growing faster than incomes.

The Economic Base

Area economies, whether at the state, regional, county, or municipal level depend on their basic or primary industries. Without the primary industries there would be no basis for employment, income, consumption, or tax payments.

Basic industries generate income to an area by exporting goods and services to the rest of the world from their region. Basic industry employs area residents (basic employment), who then receive income, and in turn consume, invest, and pay taxes. In spending their income, the basic employees create more jobs where they shop and in the government sector. Retirees who receive their pension from sources out of their home area and commuters who work in other areas are also basic in nature in that they bring income into the area from the rest of the world and then spend it locally. The creation of additional jobs and incomes from the basic jobs and incomes has a multiplier effect on local area incomes and employment, creating non-basic or secondary employment and income.

Regional Impact Multiplier System



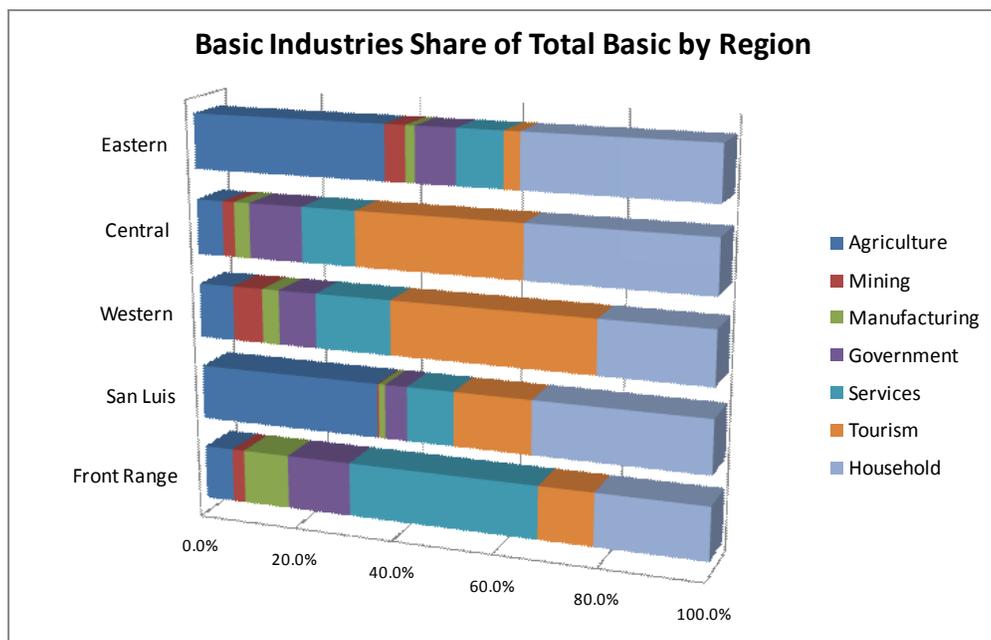
The size of the area multiplier is a function of the tendency to buy and pay taxes locally. When area companies, residents, and governments purchase goods and services or pay taxes outside of their local area (rest of the world), the multiplier is diminished. They create a leakage to the rest of the world.

Colorado Forecasted Household & Industrial Direct Basic Employment By Sector		
Sector	Number of Jobs	% of Total
Agriculture	105,232	7%
Mining	43,312	3%
Manufacturing	111,190	8%
Government	164,489	12%
Services	451,325	32%
Tourism	219,433	16%
Household	318,751	23%
Total Direct Basic	1,413,732	100%
Non Basic Jobs	1,685,090	
Total Jobs	3,098,822	
State Multiplier	2.19	
Source: Colorado State Demographer		

From this perspective, it is important to know the economic base of an area. For the entire State the multiplier is 2.19, meaning that one basic job creates 1.19 additional jobs (or a total of 2.19 jobs) in the economy. Statewide, the largest basic employment sector is services, creating almost a third of all jobs in Colorado. The household sector creates 23% of jobs. This sector is comprised of retirees, transfer payments, and income from dividends, interest, and rent not related to retirees. The government and tourism sectors represent 12% and 16% of the economic base respectively and agriculture, mining, and manufacturing make up the balance of the economic base, contributing less than 10% each to the total. Historically agriculture, mining, and manufacturing represented a much larger share of Colorado’s basic economy.

There are four sectors that stand out across the five regions as basic industries. These include:

- Agriculture – present in all regions, but especially in the Eastern Plains and the San Luis Valley.
- Services – significant in all regions, but especially in the Urban Front Range.
- Tourism – significant in all regions except the Eastern Plains, and dominant in the Western and Central regions.
- Households – is the largest or second largest sector in all regions.



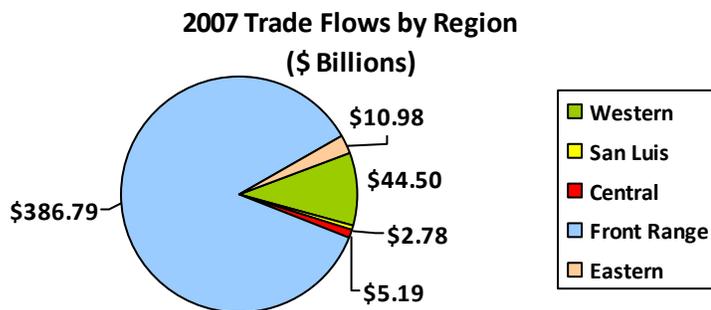
Source: Colorado State Demographer

REGIONAL TRADE FLOWS

Methodology

Given an understanding of the structure of the regional economies within Colorado, the next important question focuses on how dependent are the various regions on one another. In other words, is each region in Colorado largely self-sufficient, supporting its basic economy with sales to other states and nations, or do the regions of Colorado depend heavily on sales with one another to support their own basic economies?

Data are readily available on the county level, which describe the make-up of a county economy in terms of industry sectors, employment, number of firms, unemployment, and population characteristics. Other than migration and commuting pattern data from the decennial census, there are no data that describe the movement of goods and services between areas. That type of data would require knowing business sales broken out by the geographic area from which the sale originated. Conducting survey work to acquire accurate data is cost prohibitive for this study.



Source: MIG, Summit/Adams

Regions interact economically with one another based upon their relative size, distance from one another, transportation costs, and other barriers between them. Studies show that trade flows (business sales) between regions typically decrease with distance and increase with size of the regions. Hence economic interdependence operates like gravity – the larger the mass and closer the distance, the more “connected” regions are.

To estimate the magnitude of trade flows requires an econometric model based on demonstrable theory. Greg Alward with the Minnesota Implan Group (MIG) provides such a model – the IMPLAN RPC. The model is based on the Gravity Theory of Trade and was developed in conjunction with the USDA Forest Service using national databases, regional purchase coefficients (RPC), and impedances that restrict the flow of transportation from the Oak Ridge National Laboratory’s transportation model.⁴

⁴ For a complete description of the Implan RPC, see Appendix C.

Regional Economic Interdependencies

According to the IMPLAN RPC model run for this report, in 2007 Colorado’s total sales or trade flows originating from Colorado were \$450 billion, of which \$387 billion (86%) originated from the Front Range. The total \$450 billion in sales appears consistent to the total State GDP of \$236 billion in 2007 as sales or trade flows count every transaction while GDP only counts a subset of transactions. The model is also consistent with calculations made using a United Nations methodology for calculating value added based on employee compensation by industry and with anecdotal evidence from ski areas, universities, newspapers, and the Colorado State Patrol.

Trade with Rest of US (\$ in Millions)				
By Colorado Region				
	Total Sales to Other States	% of State Total	Net Exporter/ (Importer) to Other States	% of State Total
Western	\$12,503	11.2%	\$711	4.2%
San Luis	\$927	0.8%	\$50	0.3%
Central	\$1,221	1.1%	-\$364	-2.2%
Front Range	\$92,583	82.8%	\$15,856	94.6%
Eastern	\$4,562	4.1%	\$501	3.0%
Total Colorado	\$111,795	100.0%	\$16,754	100.0%

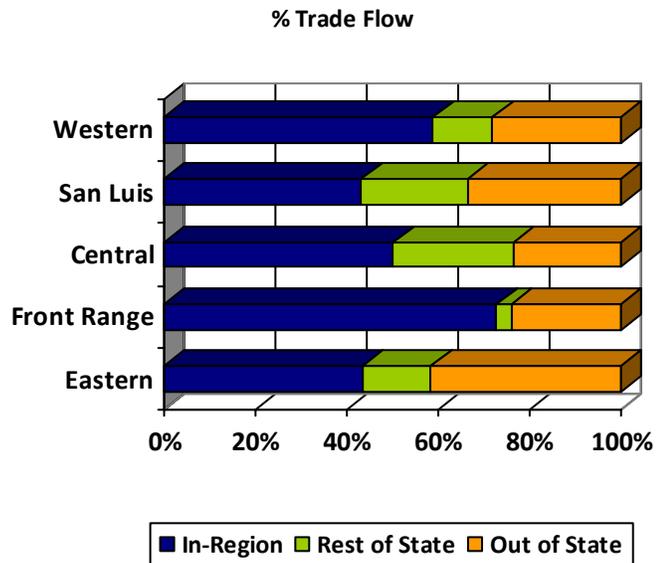
Sources: MIG, Summit/Adams

Based on IMPLAN RPC, Colorado sells or exports \$111 billion of goods and services to other states in the U.S. Eighty-three percent of the total exports are from the Front Range. Comparing exports to imports, if Colorado were a nation, it would have a trade surplus equal to approximately \$16.8 billion or 7% of State GDP. All regions in the State, except the Central Mountains, are net exporters to the rest of the country. The Front Range accounts for 95% of the

State’s net exports (exports less imports).

Net exporter regions generally show greater tendencies towards economic growth in terms of income per capita. As noted earlier, this is the case when Colorado is compared to the nation. Furthermore, international evidence suggests that being close to richer regions makes it very unlikely that neighboring regions will be poor – a concept known as spatial contagion. This concept implies that all regions benefit from the net export status of Colorado and the strong economic performance of the Front Range.

Considering total trade flows, the model indicates 70% of all sales in Colorado stay within the state, while 30% are exported to other states.



Source: MIG, Summit/Adams

Overall, 55% of all sales stay within the same region. In smaller regions, less than 50% of total sales originating from the region stay within the same region. In contrast, 70% of the sales from the Front Range stay within the Front Range.

Western Colorado is between the two extremes at 55%. All regions, except the Central Mountains, export a larger percent of their sales out-of- state than they export in-state to other regions. With the exception of the Front Range, all regions export between 13% and 26% of their goods and services to other regions in-state. The Front Range only sells 3% to the rest of the state, outside their own region.

Looking just at goods and services exported from the respective regions, the non-Front Range regions rely on the Front Range for 15.6% to 45.4% of the export demand for their products and services. In all cases sales to the rest of the United States exceed sales to the Front Range.

On a total sales basis:

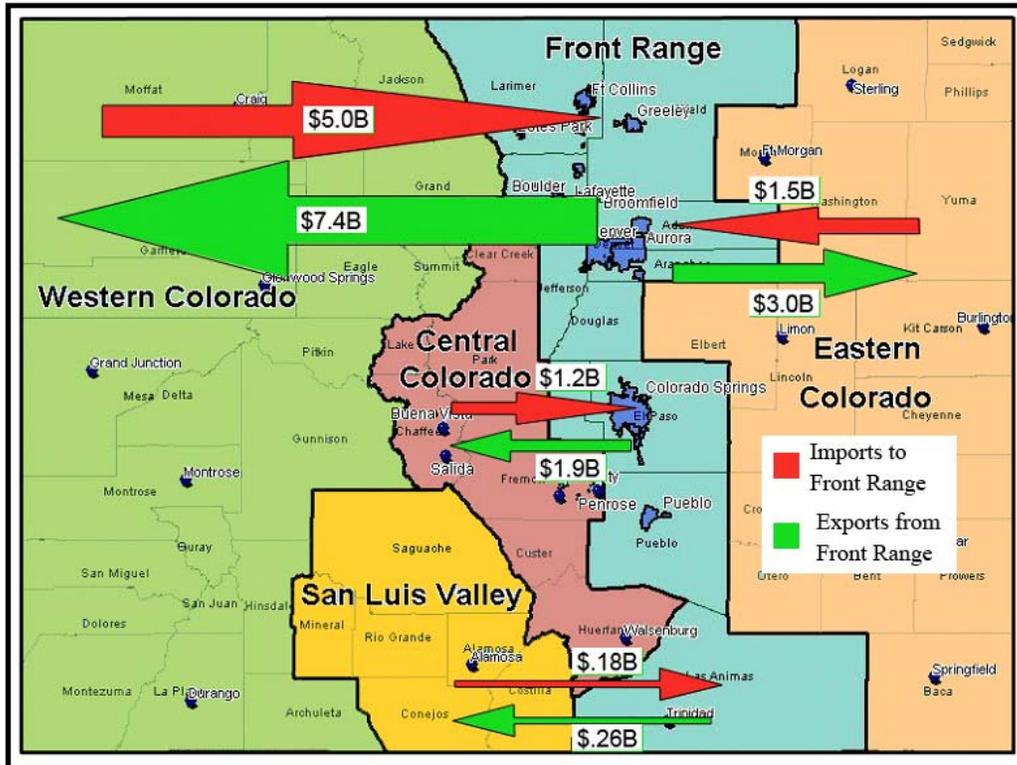
- San Luis sells \$180 million (7%) of its products and services to the Front Range
- Western sells \$5 billion (11%) of its output to the front Range
- Eastern sells \$1.5 billion (14%) of its output to the front Range
- Central sells \$1.2 billion (23%) of its output to the front Range

Non-International Exports by Colorado Region			
	<i>Percent Exports Sold To:</i>		
Sold From:	Front Range	Other Colorado Regions	Other States
Western	27.6%	3.9%	68.5%
San Luis	15.6%	40.6%	43.8%
Central	45.4%	7.5%	47.1%
Front Range	N/A	12.0%	88.0%
Eastern	24.5%	1.9%	73.6%

Source: MIG, Summit/Adams

The IMPLAN RPC model shows all regions outside the Front Range being net importers from the Front Range. They import more than they export. Not included in the trade flow equation is the effect of commuting on the economic integration of the different regions.

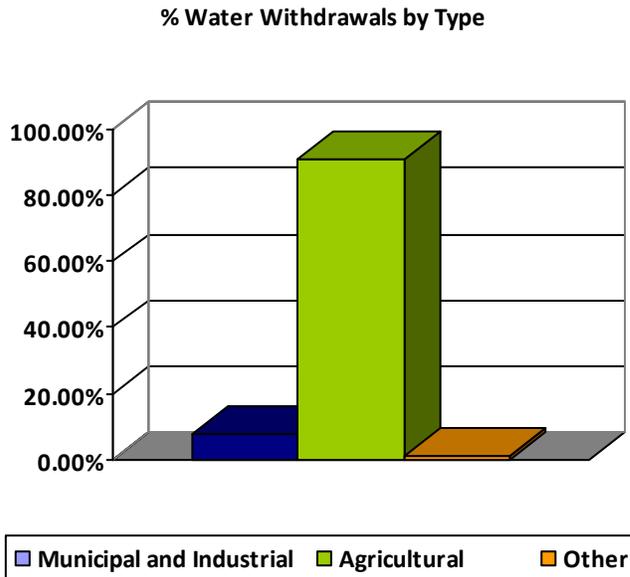
Front Range Trade Flows



Source: MIG, Summit/Adams

WATER IN THE COLORADO ECONOMY

Water Withdrawals



Source: USGS and Summit/Adams

may be withdrawn multiple times, with only a portion of it actually being “consumed” and the balance being returned to river systems for additional use downstream. This analysis is based on withdrawals as it is a simple, readily available measure that does not require technical consumption calculations.

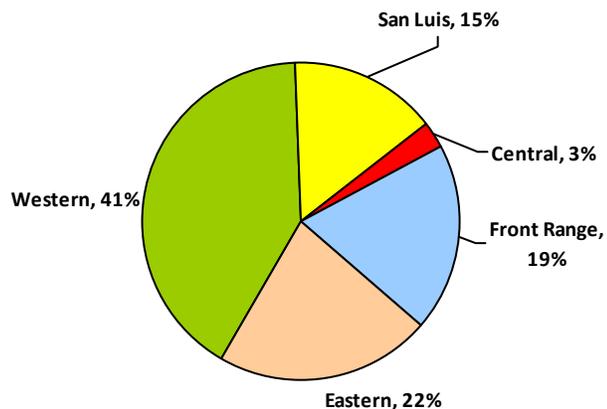
When viewed on a regional basis, no relationship is observable between the relative economic size of a region and the region’s percent of water withdrawals relative to the state total. Western Colorado, which is the second largest economic region in the state with 11% of the state’s population and 10% of total value of sales, withdrew 41% of the total water in 2005. Western is by far the largest water user as measured by withdrawals. The Eastern Plains and San Luis regions

Water is a vital resource to the Colorado economy. Water is withdrawn to support:

- the residential, commercial, and industrial sectors under the label “Municipal and Industrial” (M&I);
- the agricultural sector;
- “other” sectors, especially mining.

According to the United States Geological Survey (USGS), 91.3% of all water withdrawn in Colorado is used for agriculture, 7.5% for municipal and industrial, and 1.2% for other. It is worth noting that water withdrawals does not necessarily equate to water use or consumption, in that the same water

% of State Water Withdrawals by Region

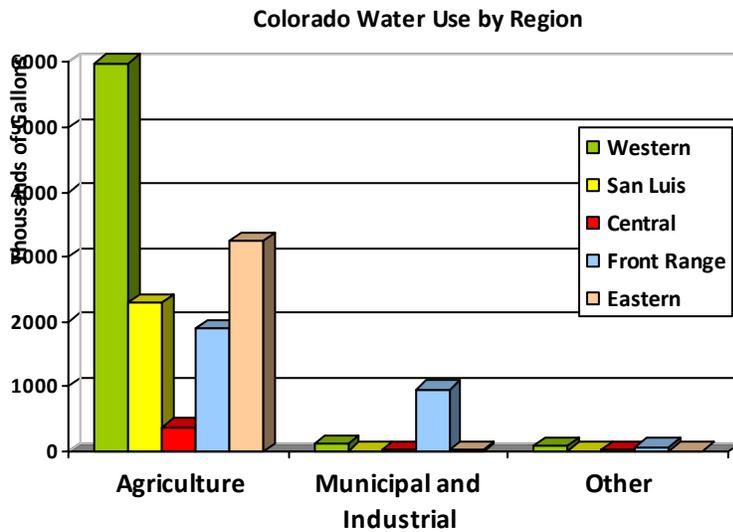


Source: USGS and Summit Economics

withdraw 22% and 15% respectively. The Front Range, representing 80% to 85% of Colorado's economy, only withdrew 19% of the State's water, with only a third of the withdrawal going towards municipal and industrial activity.

When data are observed by region and by use, usage patterns become very clear. Agriculture is the largest user of water in all regions -- even along the Front Range. Some Front Range counties have large agricultural sectors. Agriculture in the Front Range encompasses one-third of all the State's agricultural production. In fact, Weld County (part of the Front Range) has the

8th highest agricultural sales output in the nation according to the 2007 Census of Agriculture. Western Colorado's agricultural sector withdraws approximately 6 million acre feet of water annually -- almost double the water used by the Eastern Plains and triple the amount used by the San Luis Valley.



The Front Range withdraws 85% of the municipal and industrial water in Colorado. This is consistent with the region's share of the State's non-farm economy.

Source: Summit/Adams

Economic Productivity

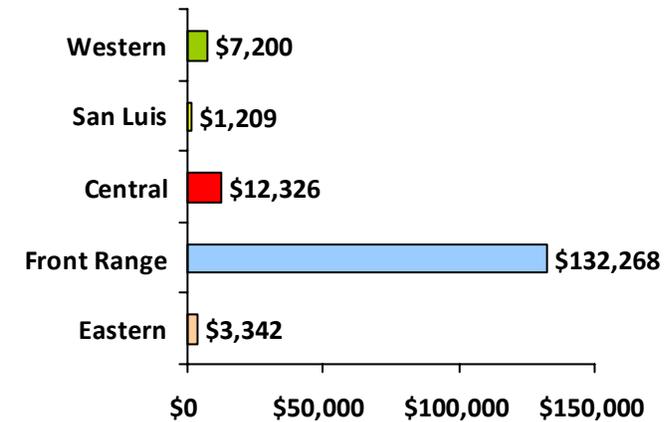
One of the most important economic measures is the productivity of resource use. A major source of wealth creation in societies is labor productivity or output per worker - the greater the output per worker, the higher the per capita income of the society. With water, economic activity per acre foot of water withdrawn is an appropriate productivity measure. Water productivity becomes more critical as the demand for water approaches supply capacity, which is the case in Colorado.

$$\frac{\text{Total Regional Sales of Goods and Services (\$)}}{\text{Total Regional Water Withdrawals (AF)}} = \text{Sales per Acre Foot of Water}$$

Given data availability, relating regional sales to regional water withdrawals provides a good measure of productivity. The Front Range’s sales per acre foot of water withdrawn exceeds the next closest region, the Central Mountains, by a factor of almost 11 times (\$132,268 in the Front Range to \$12,326 in the Central Mountains).

When considering water withdrawals, it is worthwhile to revisit the two largest sectors of the economy related to total economic activity and water withdrawals. Agriculture and recreation/tourism account for \$7.2 and \$21.5 billion in Colorado sales out of a total of \$450 billion. The Front Range represents 32.5% of the State’s total agricultural sales and 73.2% of the State’s recreational/tourism sales. Western Colorado has proportionately more agriculture and recreation/tourism sales relative to their share of the total state-wide sales at 15.7% and 20.8% respectively.

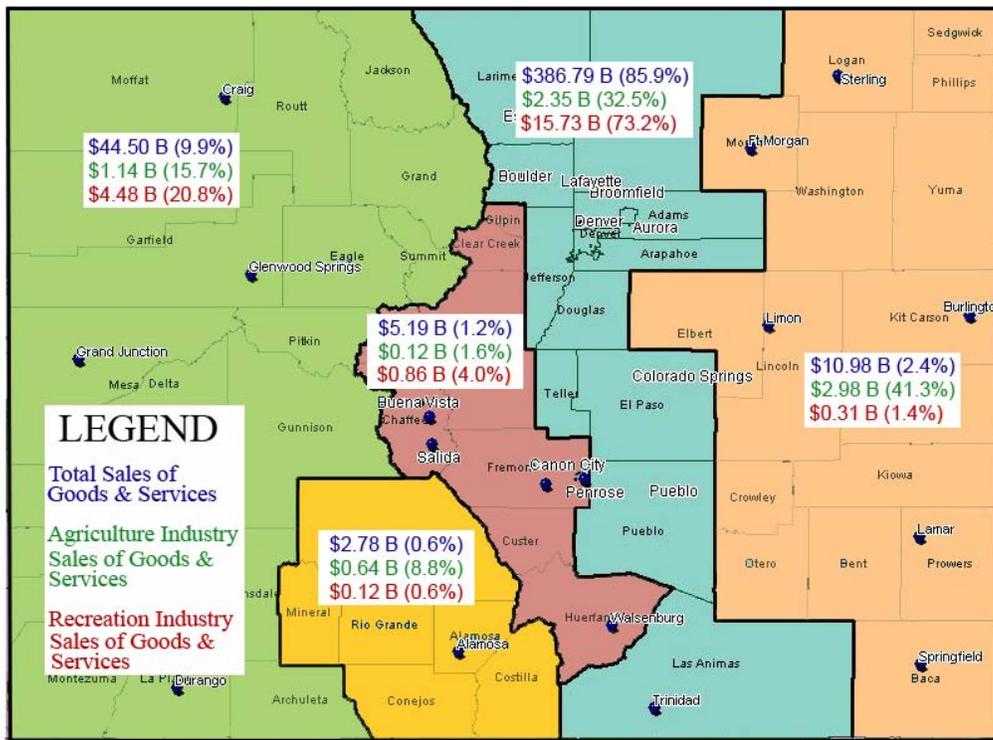
2007 Sales of Goods and Services per Acre Foot of Total Water Withdrawn, by Region



Source: USGS, Summit/Adams

As noted previously, tourism and recreation account for approximately 16% of Colorado’s economic base. In contrast, Implan RPC trade data for recreation/tourism total about \$21.5 billion, or about 4.8% of all trade. According to the Longwoods annual tourism study for the State, total tourism spending was about \$9.8 billion in 2007 by overnight visitors. This included visits for skiing, gaming, city trips, special events and combined business/pleasure trips. According to Longwoods, about 80% of the overnight trips are to Front Range destinations.

Relative Sector Size, 2007



Source: MIG, Summit/Adams, DeLorme

Measuring water productivity or value independently for tourism would require extensive survey work. Most water use for tourism is incorporated into the M&I water withdrawal numbers. Water is withdrawn by the ski industry for snow making, but it is unclear whether such use limits water use for other purposes during the spring runoff. The same can be said for the rafting and fishing segments of the tourism industry. These segments would only compete with other industry sectors to the degree required water levels in rivers restrict agricultural or M&I use of the water. There may be a strong compatibility between economic river use and other water uses both on the rivers and through the creation of water storage facilities, which also create tourism and recreational venues. For instance, the Arkansas River, which provides water for portions of the Front Range and Eastern Plains, captures approximately 50% of the rafting market in Colorado according to the Colorado River Outfitters Association.

It is clear that there exists a substantial difference between relative productivities when one compares municipal and industrial water versus agricultural withdrawal of water. However, the economic discrepancy does not take into account the social values associated with agricultural production, such as the importance of a reliable domestic food supply and the continuation of open space amenities.

Activity Measure	Western	San Luis	Central	Front Range	Eastern
Total Sales of Goods and Services per Acre Foot of Total Water Withdrawn	\$7,200	\$1,209	\$12,326	\$132,268	\$3,342
Agricultural Industry Sales of Goods and Services per Acre Foot of Agricultural Water Withdrawn	\$190	\$278	\$302	\$1,240	\$919
Ratio Total Productivity to Agricultural Productivity	37.98	4.35	40.80	106.66	3.64
Source: Colorado State Demographer, Colorado Department of Labor and Employment, Colorado Department of Revenue, Implan Group, U.S.					

The relationship of total water productivity in each region to agricultural water productivity indicates the relative reliance of each region on agriculture. Larger and more developed regional economies will have greater water productivity ratios as a result of several factors. First, multiple levels of trade or value added occur within their boundaries as a result of greater self sufficiency for goods and services; and secondly, much of their output is based on services which use relatively little water per dollar of output. In contrast, agriculture based economies sell a product with high water content without the benefit of multiple levels of value added as the products make their way to market via transportation, wholesale, and retail channels.

Also notable in the above table are the relative productivity levels of water in each region's agricultural sectors. The differences are probably related to crop mix, relative water scarcity that can force more efficient water use, and the presence of agricultural support services as opposed to only farming and ranching in the agricultural calculation.

It is important to note that the vast majority of Front Range Water Council's water withdrawals are from Colorado River Basin sources. The only river basins native to the Front Range are the South Platte and Arkansas Rivers. These rivers supply 28% of the water. The remaining 72% comes from the Colorado River basin on the west side of the Continental Divide through a complex systems of diversions, storage, piping and tunnels.⁵

⁵ For a map showing the 1998 diversions by source and acre feet diverted, see Appendix D.

Water and Colorado's Future Economy

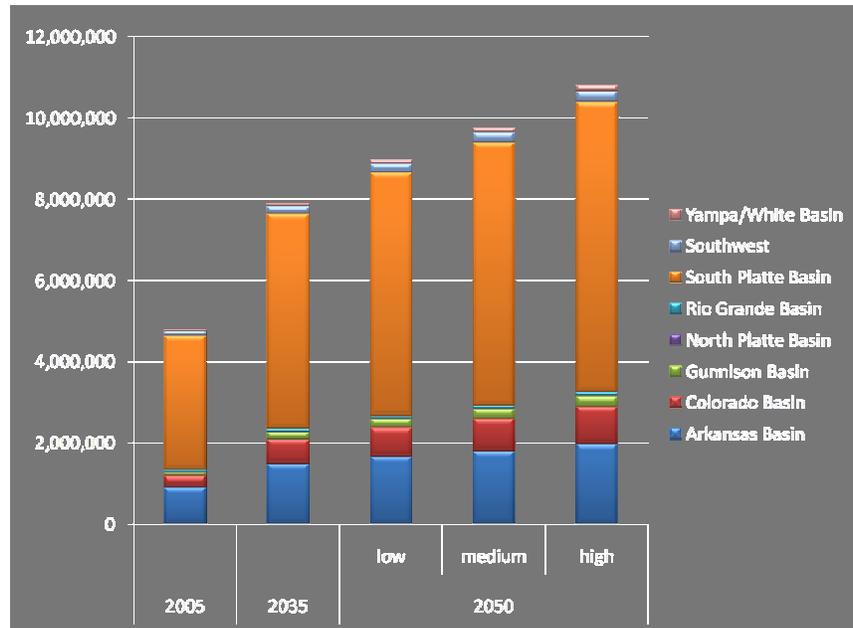
The introductory section of this report discussed the emerging water gap Colorado is facing. When viewed by river basin, the Colorado Department of Natural Resources forecasts that the greatest population growth will occur in the South Platte, Arkansas, and Colorado basins through 2050.

Using population estimates and forecasts from the Colorado State Demographer on the county level, regional forecasts show Western Colorado gaining population share from 11% today to 13.4% and 14.8% in 2035 and 2050 respectively.

This results from the region growing by 174%, almost tripling in size, while the rest of the State is forecasted to almost double in size. The total figures show Western Colorado growing by 942,000 people, while the Front Range and State are forecasted to grow by 3.84 million and 5.15 million respectively.

Hence, while the highest growth rate will be in the Western region, the greatest magnitude will continue to occur along the Front Range. Most of the Statewide growth is anticipated to come from municipal and industrial demand and not agricultural growth. Western Colorado, at least the area within the Colorado River basin, apparently has sufficient water supplies to meet growth demands. This assumes that most Western Region growth comes from municipal and industrial water as well, and not agricultural growth or wide scale, water intensive oil shale development. The state study currently underway should provide valuable insights into water availability for other uses.

Forecasted Population Growth by River Basin



Source: Department of Natural Resources Water Study

Population Estimates and Forecasts: 2007, 2035, and 2050						
	2007		2035		2050	
	Population	% of State	Forecast	% of State	Forecast	% of State
Western	542,058	11.0%	1,044,209	13.4%	1,483,592	14.8%
San Luis	47,904	1.0%	67,431	0.9%	80,990	0.8%
Central	116,749	2.4%	214,817	2.7%	292,707	2.9%
Front Range	4,040,592	82.3%	6,240,840	79.8%	7,877,785	78.3%
Eastern	162,265	3.3%	254,478	3.2%	319,928	3.2%
Total	4,909,568	100%	7,819,775	100%	10,055,003	100%

Source: Colorado State Demographer and Summit Economics/ The Adams Group

In the coming 40 years the growth of the Colorado economy will continue to be shaped by:

- The increasingly global economy;
- Colorado's ability to attract and retain highly skilled labor;
- Growth prospects that attract capital.
- National economic and demographic trends

Growth and development will continue to be concentrated along the Front Range; however, Western Colorado will grow in its relative share of the State total. Growth in the regions outside the Front Range will be most heavily influenced by economic growth in the Front Range, especially for the adjacent regions like the Eastern Plains and Central Mountains. Unique attributes or comparative advantages such as minerals, agricultural productivity, tourism, and retirement opportunities will also influence growth in non-Front Range regions. Along with growth from the Front Range, relatively high growth rates in other metropolitan areas of the southern Intermountain West, especially Albuquerque/Santa Fe for the San Luis Valley and southwestern Colorado and Salt Lake City for western and northwestern Colorado, will impact Colorado growth patterns in the coming 40 years.

The degree of economic integration among Colorado regions is likely to increase in the coming decades as the household sector grows with Baby Boomer retirement and with growth in virtual workplaces, which will tend to be a decentralizing force enabling service workers to telecommute.

Colorado's economic future will definitely be impacted by the water gap. If the market mechanism is the driver to resolve water allocation issues, the high value associated with municipal and industrial water will shift water resources in that direction. The future total

developed price of water will certainly be higher than historical prices. This may hinder certain historic industries that are intensive water users. In addition to agriculture, mining and some manufacturing industries could find water costs prohibitive from a competitive perspective, and seek water sales and transfer to higher value uses. However, water shortages and quality are becoming a national and global issue as opposed to just a Colorado and western U.S. issue. This could drive up costs in other areas as well. A greater emphasis will be placed on water conservation and productivity similar to what society is currently facing with energy conservation and productivity.

This complex and controversial water situation will affect the economy and economic opportunity in the years to come. Therefore it is essential for economic considerations are balanced with technical, legal, social, and cultural considerations as policy is developed and decisions made in an effort to close the State's water supply gap.