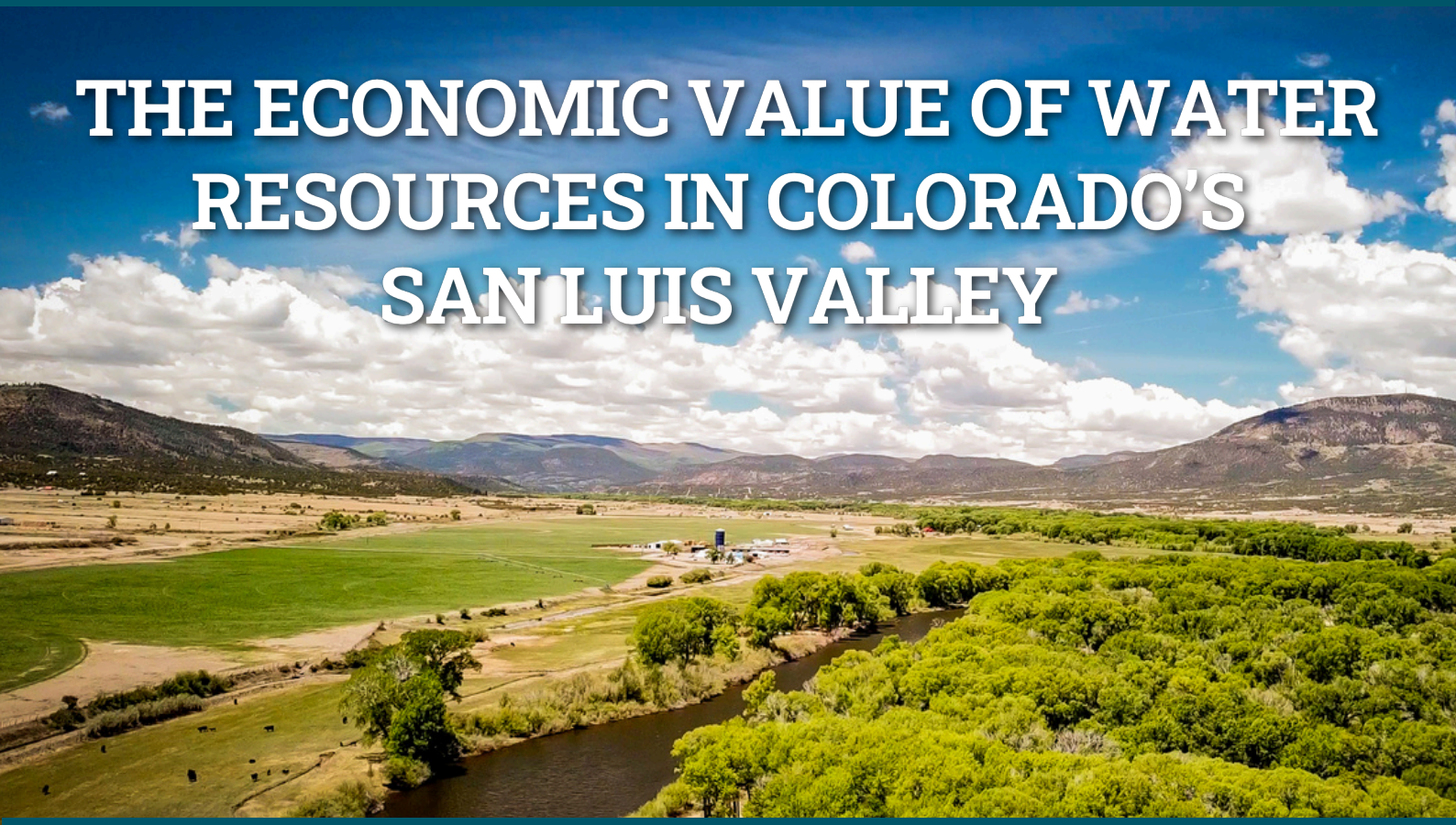
THE ECONOMIC VALUE OF WATER RESOURCES IN COLORADO'S SAN LUIS VALLEY



Final Report
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AMERICAN RIVERS
Life Depends on Rivers℠

ONEWATER ECON

Contents

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Cover photo: Rio Grande | Sinjin Eberle

Executive Summary

In south central Colorado, the Rio Grande ties together generations of people and communities across the San Luis Valley (SLV or Valley). Braided together by shared ethics of caring for land and water, everyone in the San Luis Valley depends deeply on the Rio Grande – for their livelihoods, the rich diversity of wildlife, activities they enjoy, as well as their connection to the rich history of people who have come before them. Water resources, including the Rio Grande, its tributaries and the interconnected groundwater aquifers, contribute significantly to economic activity in the six counties that make up the Valley community while also supporting local ecosystems.

To illustrate the importance of water in the San Luis Valley in sustaining agriculture, industry, recreation and environmental benefits, the following economic analysis assesses the value water holds and creates in the SLV. This report presents the economic benefits of key sectors and services that depend on water, including agricultural irrigation, municipal and industrial uses, tourism and recreation, as well as environmental values like habitat for wildlife. The intention of this analysis is not to compare the value of water used in different sectors, but rather to illustrate the critical value water plays across all sectors in the Valley. Key findings are discussed in greater detail in the report and summarized in Table E1.

Table E1. Water's Benefit and Value Across Sectors in the San Luis Valley

Economic Impacts	Direct Output	Total Output (Direct, Indirect & Induced)
Irrigated Agriculture	$310.3M	$484.8M
Water Dependent Industry	$951.1M	$1,359.3M
Recreation	$365.9M	$697.7M
Habitat & Wildlife	$4.0M	--
Economic Benefits	**Total Benefit**	
Drinking Water	$1,314.3M	
Recreation	$213.7M	
Habitat & Wildlife	$49.8M	
Cultural Heritage	$0.42M	

The concepts of economic benefits and impacts overlap. Economic benefits measure the broader values individuals have for ecosystem services provided by water, while impacts track the contribution of spending to local economic activity. The economic impact of an industry's total output is considered the benefit to that industry.

Water resources in the San Luis Valley support a wide range of social, financial, and environmental benefits. This report quantifies the value of water in this region across a multitude of its uses. The values, summarized above, highlight the diversity of uses and the benefits accrued to individuals, communities and across the local economy. This report aims to underscore the value of water across all sectors to promote and foster continued collaboration in the protection of water resources. In doing so, the Valley can invest in a future where all water-dependent sectors and beings can thrive.

Introduction

Whether flowing through the watershed, drawn from the Rio Grande and its many local tributaries, or pumped from the aquifers that underlie the Valley floor, water resources in the San Luis Valley (SLV or Valley) of Colorado contribute significantly to economic activity in the six counties that make up the Valley community. They also play a pivotal role in supporting local ecosystems. Capturing the value of water as it is used in homes, businesses, and for environmental purposes can add important information to conversations about the future of the Valley and its water resources.

This report presents an assessment of select ecosystem service benefits (Figure 1) associated with water resources in the SLV. It focuses on key economic sectors and services that depend on water, including agricultural irrigation, municipal and industrial uses, tourism and recreation, and instream flows that support and make up critical habitat.

Figure 1. Ecosystem Services

When benefits stem from natural resources, such as water, they are referred to as ecosystem services. Ecosystem services reflect the benefits people receive from nature that are essential to human survival and economic prosperity. Ecosystem services can be difficult to monetize because they are not bought and sold in a market and therefore do not have a directly observable market price. Economists have developed several methods for valuing these and other "non-market" goods and services (see Figure 3 for more details on methodology).

This assessment summarizes the current value water holds and creates in the SLV. It does not attempt to weigh competing uses of water or provide analysis about suggested future water developments. Instead, it focuses on the economic values associated with an intersecting range of uses of water, including the value of riparian waters that support recreation and habitat, and the value of diverted surface water and groundwater withdrawals as they are put to use by residents, agriculture, and other water dependent industries. The report relies on well-established economic methods and publicly available data to quantify the value of water resources in the Valley. The report is organized as follows:

- The remainder of this section provides essential context about the SLV, including its physical and hydrologic setting, and the local economy
- Section 1 describes the economic valuation methods and research approaches used in creating this report
- Section 2 assesses the economic value of water to the region's agricultural economy
- Section 3 analyzes the contributions to the Valley's economy made by industries that rely on water to some extent for their activity or outputs
- Section 4 examines domestic water use and highlights the economic importance of supporting local households through access to safe, clean, and reliable water supplies
- Section 5 assesses the value of water-related recreation
- Section 6 offers insights into the value of the ecological and habitat services provided by the creeks, rivers, and other waterbodies in the Valley.

Study area overview

The San Luis Valley spans nearly 8,000 square miles in south central Colorado. It is bordered by the Sangre de Cristo Mountains to the east, the Saguache Mountains to the north, the San Juan Mountains to the west, and the Rio Grande Valley of northern New Mexico to the south (Figure 2). The Valley encompasses portions of six largely rural Colorado counties that make up the study area: Alamosa, Conejos, Costilla, Mineral, Rio Grande, and Saguache. Together, these counties are home to a population of approximately 46,600, ranging from just under 800 full time residents in Mineral County to 16,460 in Alamosa County. The City of Alamosa is the largest city in the region, home to approximately 9,900 people.[1]

With an average altitude of 7,664 feet and an average annual rainfall below ten inches, the Valley's environment is characterized as high desert. The Rio Grande flows through the center of the Valley, running from the San Juan Mountains through Creede and South Fork before bending southeast through Alamosa, and then south toward the New Mexico border. There are heavy demands on both surface and groundwater in the Valley from agricultural and municipal users. Agriculture is responsible for the greatest use of water in the Valley overall; approximately 50% of agricultural consumptive water use in the region is provided by groundwater.[2]

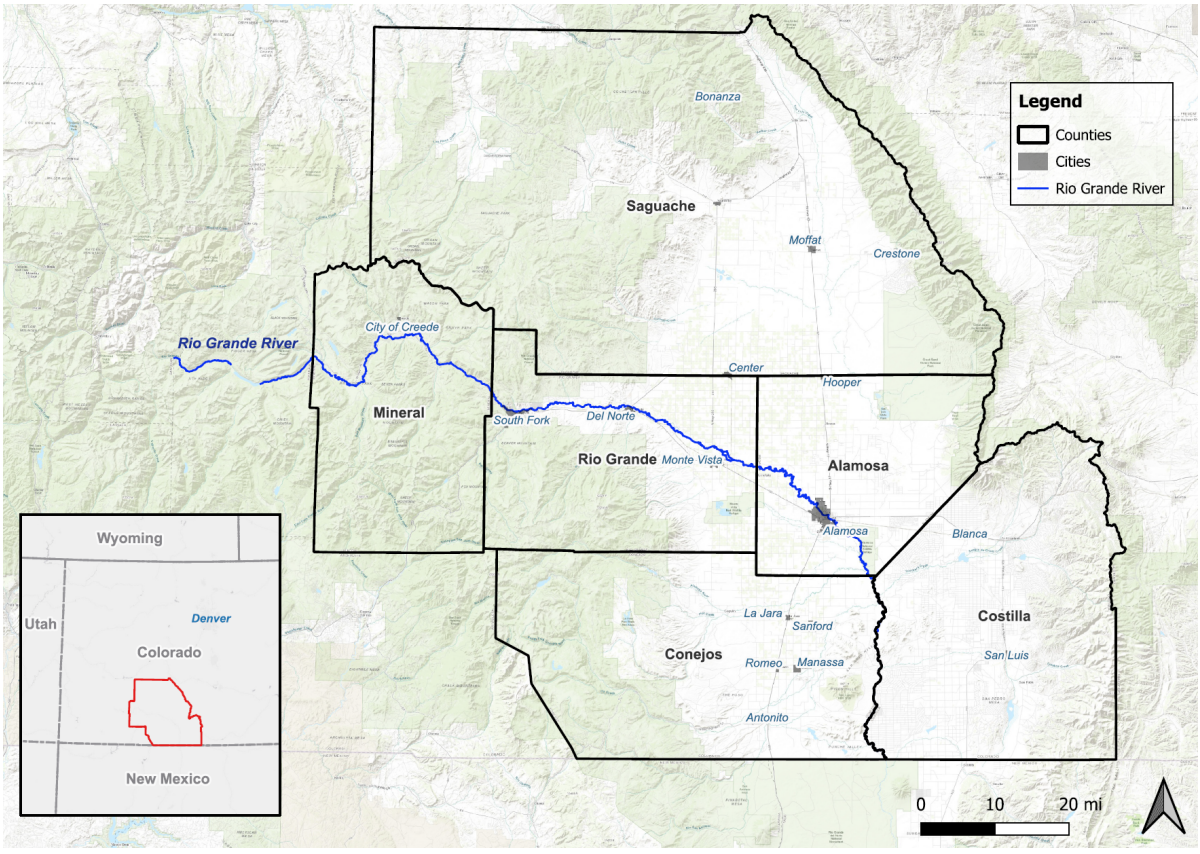

Figure 2. San Luis Valley study area

Hydrologic setting

The hydrology of the San Luis Valley is made up of a complex combination of surface water originating from surrounding mountain ranges, precipitation, and groundwater interactions at varying depths. The water flows (hydrograph) in the SLV have two peaks, with the first peak occurring in the spring due to snow melt and a secondary peak because of monsoons in late summer. The water flows are supplemented by interactions with the unconfined and confined aquifers (described below). The northern part of the Valley is characterized as a closed basin, meaning surface flows do not naturally go back into the Rio Grande, instead entering creeks and rivers flowing towards San Luis Lakes and Blanca Wetlands on the northeast side of the Valley.[3] The Rio Grande and tributaries flow from the continental divide east through the SLV and then south towards New Mexico and the Taos Plateau.

The SLV has a complex groundwater system that is defined by two aquifers; the unconfined and confined. The unconfined aquifer sits above the confined aquifer, supporting agricultural, municipal and residential wells along with wetlands, lakes, and streams within the Valley. The unconfined aquifer links directly to surface water through snowmelt, precipitation, streams, wetlands, flood irrigation, and return flows. Interactions between surface water and the aquifer is integral to the sustainability of residents, habitats, and local economies. The confined aquifer lies below the unconfined aquifer, separated by significant layers of clay and basalt.

The Rio Grande and its tributaries, like other western rivers, were adjudicated to water users during the expansion of the railroad and settlers moving west. By 1900, the surface water in the SLV was over-appropriated and water users began pumping the region's aquifers to supplement reduced flows during drought years and began building high elevation reservoirs to help manage surface flows. By 1938, use of water resources in the SLV was negatively impacting downstream state water users prompting the 1938 Rio Grande Compact between Colorado, New Mexico and Texas. The Compact requires a proportion of the annual flow of the river to be delivered downstream to New Mexico and Texas, an amount that differs based on a complex set of factors and total available water in the system.[4] Water users in Colorado must abide by and follow Compact obligations. The Colorado Division of Water Resources manages allocations and may reduce or curtail the amount of surface water available to meet Compact obligations. Reductions in available surface water can increase the demand for groundwater to maintain crops.

In 1972 the Colorado State Engineer's office imposed strict regulations on groundwater withdrawals, including a moratorium on new withdrawals from both the confined and unconfined aquifers, and in 1981 imposed a moratorium on issuance of well permits for new appropriations from the unconfined aquifer in the closed basin portion of the Valley[5]. Applications to expand withdrawals through new or deeper wells must be supported by a judicial confirmation that these expansions will not cause material injury to other well users.[6] Communities in the SLV are working together maintain surface water flows and sustain aquifers through the development of Groundwater Management Subdistricts, that were formed through the Rio Grande Water Conservation District as a result of state Groundwater Rules and Regulations. There are now six sub-districts in the Valley that have adopted Plans of Water Management detailing measures landowners will take to maintain surficial flows/surface water rights and permanently reduce consumptive use of aquifers. These measures are financially supported by pumping fees paid by subdistrict members.[7]

Changing climate conditions include decades of drought, increased variability in precipitation patterns, and higher temperatures are also impacting surface and groundwater conditions in the Rio Grande Basin. These conditions are reducing snowpack and thus river flows, increasing river temperatures, impacting water quality, reducing water tables, and contributing to more frequent and intense wildfires, among other challenges. Groundwater resources are also impacted as the natural and managed processes that replenish groundwater, including snowmelt and rain percolation and recharge through wetlands, ditches and canals, are impacted by uncertain precipitation variability and the demand for water. Reduced and variable runoff flows have made administering surface water flows difficult, are negatively impacting native aquatic and terrestrial habitats, and increasing wildfire risk. These risks continue to exacerbate the challenging supply limitations of both surface and groundwater for all water users.

The unique and challenging hydrology of the SLV has required significant cooperation amongst different water users as the link between surface and groundwater is integral to the sustainability of water rights and water resources throughout the Rio Grande watershed. Water users have begun developing collaborative and novel methods for conserving and sharing water across the Valley to meet multiple needs. The Rio Grande Basin Roundtable has been an integral component in creating a community that respects the needs of all users and seeks to find innovative projects that meet multiple benefits across the basin.

Economy of the SLV

The San Luis Valley economy generates $4.5 billion in total annual economic output, largely driven by hospitals, electric power companies, insurance, crop farming and cattle ranching. Alamosa and Rio Grande Counties account for 60% of the population and 67% of total economic output in the region. Approximately 15% of residents in the Valley earn less than the federal poverty level (FPL) income, compared with 9.3% for Colorado overall, and median household incomes in the SLV counties consistently rank among the lowest in the state. **Agriculture, including cattle ranching, generates 10% of all output in the region (although this varies significantly by county) and makes up 39% of Colorado's total agricultural output.** Table 1 highlights key demographics and economic indicators by county and for the study region overall.

Table 1. Economic and demographic county profiles

	Alamosa	Conejos	Costilla	Mineral	Rio Grande	Saguache	San Luis Valley	Colorado
Total Economic Output ($M)	$1,914	$558	$282	$142	$1,139	$499	**$4,534**	**$746,907**
Agricultural Output ($M) (as a % of total)	$96.4 (5.0%)	$104.1 (18.6%)	$31.3 (11.1%)	$0.4 (0.3%)	$116.3 (10.2%)	$132.6 (26.6%)	**$481.0 (10.6%)**	**$1,527 (39% from SLV)**
Total Population	16,700	7,500	3,600	900	11,200	6,700	**46,600**	**5,877,600 (0.01% in SLV)**
Poverty Rate	15.5%	15.7%	22.5%	11.2%	10.3%	17.5%	**15.0%**	**9.3%**
Median Household Income	$75,000	$60,500	$51,200	$72,400	$78,300	$75,100	**$71,600**	**$92,900**

Source: IMPLAN 2022, ACS 2022

To categorize industries at a high level in the SLV, IMPLAN data was grouped according to the North American Industrial Classification System (NAICS). In the SLV, this sector is dominated by grain and feed crop farming, vegetable and melon farming, beef and cattle ranching, and industries that support agriculture, which account for 97% of the jobs in the NAICS industry category of Agriculture, Forestry, Fishing and Hunting. The agriculture, forestry, fishing, and hunting sector is the largest private employer in the SLV, generating over 4,000 jobs each year. This sector also leads in economic output, generating $566 million annually. Health care, government and educational services are significant employers in the region. The SLV hosts Adams State University in Alamosa and several Colorado State University Extension offices. Finance and insurance businesses also generate significant economic output, some of which may be connected to agricultural activity. Figure 3 shows the leading economic sectors in the SLV, including employment totals and annual economic output.

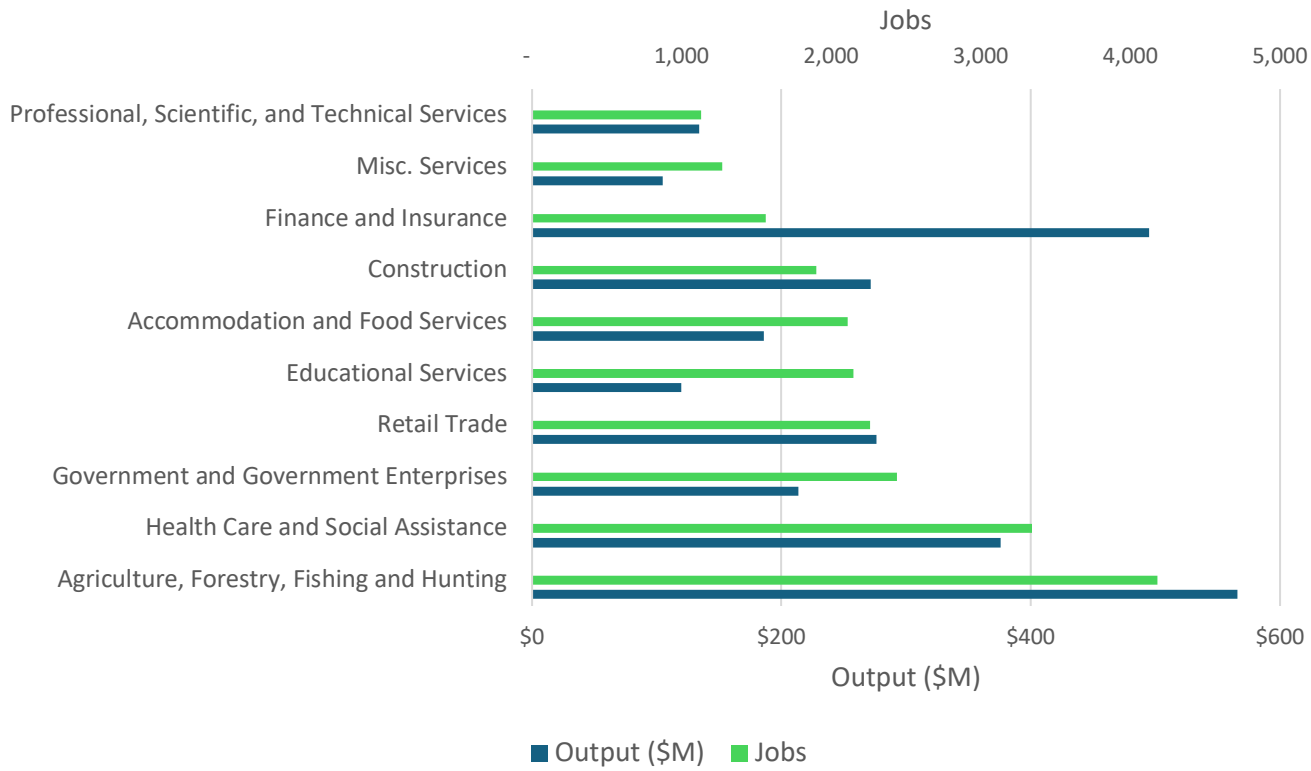

Figure 3. Top 10 Sectors by Output and Jobs in the San Luis Valley (Source: IMPLAN 2022)

The San Luis Valley's Comprehensive Economic Development Plan (2021) reports potential economic opportunity in local food and value-added farming, as well as hemp production and processing, and growing the outdoor recreation economy.[8] All of these identified opportunities rely to some degree on the water in the Rio Grande and underlying aquifers, underscoring the importance of water to the region.

1. Approach and Methods

This section describes the approaches used to perform the economic assessment, including key inputs and data sources and the methods used to quantify and monetize the ecosystem service benefits provided by water resources in the region. Throughout this report, dollar values are reported in 2024 United States dollar (USD) values, unless otherwise noted.

1.1 Economic analysis methods

This report evaluates ecosystem service benefits associated with water resources in the San Luis Valley. Several of these uses and benefits can be monetized based on the economic value of the goods and services they support. For example, the economic output and jobs supported by irrigated agriculture underscore the importance of water resources for this sector. Some benefits, such as those related to recreation and habitat or biodiversity, can be more difficult to monetize because they are not bought and sold in a market and therefore do not have a directly observable market price. Economists have developed several methods for valuing these and other "non-market" goods and services (Figure 4).

Figure 4. Primary Non-market Valuation Approaches

Research approaches to estimate the value of non-market benefits, such as recreation and habitat improvements, include:

Stated Preference methods rely on survey questions that ask individuals to make a choice, describe a behavior, or state directly what they would be willing to pay for a non-market good or service. They are based on the notion that there is some amount of market goods and services that people would be willing to trade off so they can benefit from a non-market good. Stated preference studies typically yield average per-person or per-household willingness to pay (WTP) estimates for survey respondents. These estimates can be extrapolated to the wider study population to provide an indication of the total value of non-market benefits.

Revealed Preference methods estimate WTP using data gathered from observed choices that reveal the preferences (i.e., WTP) of individuals for nonmarket goods and services. The most common revealed preference methods are the hedonic pricing (statistical analysis to estimate the influence of different factors on observed market prices), travel cost (economic demand functions for recreation based on the choices people make to travel to a specific location), and averting behavior (infers values from defensive or averting expenditures) methods.

For this analysis, the project team valued non-market benefits using a secondary research approach called benefits transfer. Benefits transfer relies on values reported in the literature from primary or original valuation studies (e.g., a stated or revealed preference study) to estimate the non-market benefits for a specific study site. Benefits transfer is commonly used in economics, and there is a well-developed literature on how to correctly apply this method.[9] When implemented correctly, with the recognition that the estimates are not intended to be precise, benefits transfer is accepted as a suitable method for estimating non-market benefits in various contexts.[10]

In addition to non-market benefits, the project team examined the direct economic contribution and economic impacts associated with water used in agriculture and other water-dependent industries. In the context of this analysis, an economic impact assessment estimates the contribution in local economic activity attributable to a given industry. The economic activity associated with different sectors is quantified in

terms of economic output (i.e., total sales), employment, value added (i.e., gross domestic product), and labor income.

The concepts of economic benefits and impacts overlap. Economic benefits measure the broader values that individuals have for ecosystem services provided by water. Economic impacts track the contribution of spending to local economic activity. One way to value economic benefits of water for a given industry is to measure that industry's direct economic impact, further explained below.

Economists use Input-Output (IO) models to conduct economic impact assessments. An IO model captures inter-industry relationships within an economy, showing how outputs from one economic sector are used as inputs by other sectors. These models can also capture how income from jobs earned in one industry is spent across other industries in the local economy. Economic impacts are categorized as follows:

- Direct effects are production changes associated with the immediate effects of economic activity (e.g., loss in revenue, spending on public projects).
- Indirect effects are production changes resulting from various rounds of re-spending by industries that experience direct impacts.
- Induced effects are the changes in economic activity resulting from household spending of income earned directly or indirectly as a result of additional spending.

For this analysis, the project team used the IMPLAN model to assess economic impacts associated with agriculture and other water-dependent industries. IMPLAN is an economic impact/IO model that uses actual dollar amounts of all business transactions occurring in a local economy, as reported each year by businesses and government agencies for 546 industry sectors. The project team performed industry contribution analyses in IMPLAN to identify the economic activity (i.e. output, employment, labor income, and value added) that is supported by water-dependent industries, including direct, indirect, and induced impacts.

One limitation of IMPLAN is that it only captures backwards linkages in the supply chain of a local economy. For example, the total impacts of agriculture include the indirect impacts of purchasing fertilizer and equipment needed to grow hay, and the induced impacts of workers who harvest the hay spending the money they earn in the local economy. It does not capture the value of hay as an input to other industries in the region. If cattle ranchers buy hay from local suppliers, this would not be captured in the total impact of agriculture. Given this limitation in the modeling and the interconnected industries of rural Colorado, the economic impacts could potentially exceed the values presented in this report.

1.2 Key data sources

To assess the full range of benefits provided by water in this region, the project team relied on both public and proprietary data. The following data sources apply generally. Moreover, specific data or research for a given benefit (i.e. recreation or habitat) will be referenced in the corresponding section. Note that this analysis relies on existing data, recognizing that new data or surveys specific to the SLV could improve the fidelity of this analysis.

- **IMPLAN** (2022): In addition to the Input/Output modeling results, IMPLAN reports output by sector for each county in the SLV. This enables an analysis of county-level economic characteristics, as well as industry-specific breakdowns (e.g., contributions of different sectors within agriculture).

- **American Community Survey** (2022 1-year estimates): U.S. Census data describes households, poverty levels, incomes, and other sociodemographic characteristics. These data are useful in contextualizing the background for water supply benefits.
- **Colorado Division of Water Resources** (DWR, 2021): A wealth of water use data, including irrigated agricultural acres by crop type, water flows, and groundwater levels, are available from the Division of Water Resources. This analysis utilizes data from Division 3 – Rio Grande Basin.
- **US Department of Agriculture National Agricultural Statistics** (NASS, 2023): County-level data on cropland, harvests, crop types, irrigated lands, value of agricultural products, and farm characteristics reported through NASS provide significant context for the agricultural analysis.
- **US Environmental Protection Agency Safe Drinking Water Information System** (SDWIS, 2024 Q2): SDWIS database contains basic information on public water systems, including area served, population served, type of system, and characteristics of the systems' sources of water. SDWIS data was used to categorize the drinking water resources for residents of the Valley in Section 4.

2. Irrigated Agriculture

Along the length of the Rio Grande, farmers use about 75% of the Rio Grande's flow for irrigating agriculture.[11] Across the SLV's six counties, there are approximately 400,000 acres of irrigated cropland, including a small amount of irrigated pastureland.[a] Over 80% of all cropped acreage in this region is irrigated. This adds up to approximately 800,000 acre feet of consumptive water use each year.[12] Alfalfa, grass hay, and pastureland account for nearly 75% of irrigated acres in the Valley (Figure 5). Irrigated crops are primarily grown on the Valley floor for practical access to the Rio Grande aquifer, as groundwater is the source for half of all irrigation (Figure 7).

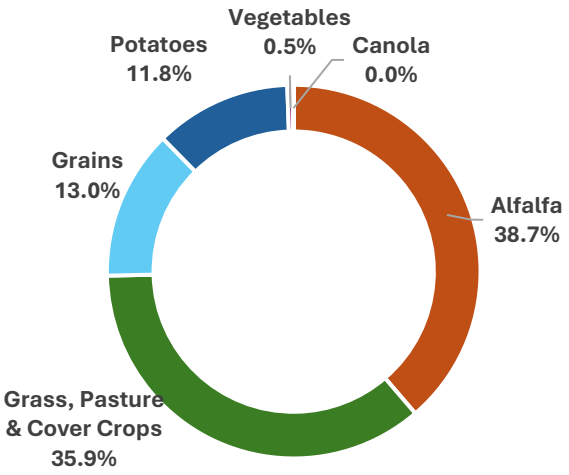

Figure 5. Irrigated acreage by crop type, San Luis Valley (Source: DWR 2021)

The project team conducted an industry contribution analysis in IMPLAN to estimate the overall economic contribution of irrigated agriculture to the SLV economy. Irrigated crops account for approximately 97% of all economic output associated with total cropped acreage.[b] The IMPLAN data for agricultural crops does not include values associated with pasture irrigation for cattle ranching operations (Figure 6).

Figure 6. Irrigation in pasture for beef cattle ranching

Data on irrigated and non-irrigated pastureland and grassland used for grazing cattle is difficult to validate. While NASS reports total non-irrigated and irrigated pasture acres, DWR data suggests that irrigated pastureland is much higher than NASS reports based on surveys done by water commissioners across the state. Even accounting for higher acreage of irrigated pasture, only an estimated 5% of all pasture in the SLV is irrigated. Beef cattle ranching generates $136 million in economic output (3% of the region's total output), but the low acres of irrigated pasture led to the exclusion of this sector from the analysis of agricultural irrigation.

In IMPLAN, pastureland is included in the *Beef cattle ranching* industry sector. The IMPLAN data reported in this section on employment, labor income, value added, and economic output do not account for irrigated pastureland that is used as an input in ranching.

[a] Total irrigated acres range annually, reaching highs of 500,000 when surface flows are high and dropping to below 400,000 in dry years. This report relies on DWR values, which differ from values reported in the USDA National Agricultural Statistical Survey (NASS). DWR uses parcel data and Landsat data to report irrigated acres, checked initially against NASS classification, and then cross checked with ground-truth data from DWR's water commissioners. DWR also does a secondary cross-check against water diversion records to ensure water sources for the irrigated lands is actually diverted. DWR was consulted in the development of this report.

[b] Economic output associated with irrigated crops is estimated based on the ratio of cash rents for irrigated and non-irrigated land (NASS 2022) and the amount of cropped acreage in each crop category. The ratio was applied to value added estimates for cropped agriculture from IMPLAN to determine total value added of irrigated agriculture. The ratio of value added to economic output for each crop sector was then applied to determine total economic output by sector.

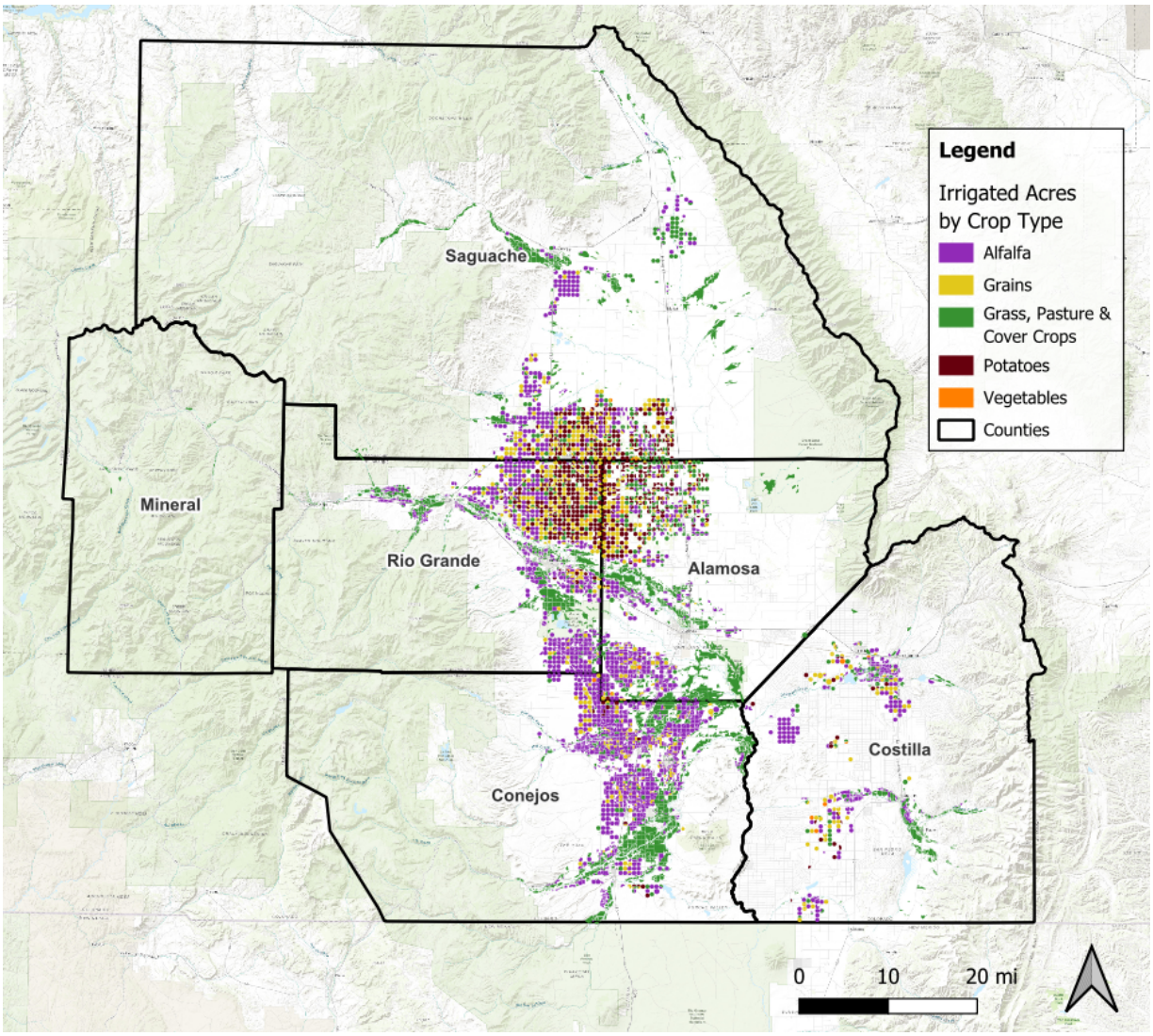

Figure 7. Irrigated acres by crop category in the San Luis Valley (Source: DWR, 2021)

Agriculture in the San Luis Valley makes up 39% of Colorado's total agricultural output

The largest economic generators for farmers in the SLV are potatoes and vegetables (captured in the vegetable and melon farming category) illustrated in Table 2 on the next page. Close to 12% of cropland (just over 50,000 acres) is irrigated for potato and vegetable farming. Together, these crops generate more than 52% of economic output for irrigated farming in the region. The category of "all other crop farming" includes alfalfa, which employs the greatest number of people across irrigated agriculture. This sector also generates over $100 million in economic output each year. As described previously, **agriculture in the San Luis Valley, including cattle ranching, generates 10% of all output in the region (although this varies significantly by county) and makes up 39% of Colorado's total agricultural output.**

Table 2. Economic Indicators for Irrigated Crops in the SLV (Source: IMPLAN 2022)

Crop Categories*	Employment	Labor Income ($M)	Value Added ($M)	Economic Output ($M)
All other crop farming	1,476	$42.8	$38.6	$101.0
Grain farming	52	$4.7	$(0.4)	$23.5
Oilseed farming	1	$0.3	$0.1	$1.4
Vegetable and melon farming	793	$56.9	$50.3	$184.4
Total	**2,322**	**$104.7**	**$88.5**	**$310.3**

*This table does not include values associated with irrigated pasture for cattle ranching.

The role of irrigated agriculture in supporting employment for rural residents in the region cannot be understated. Agriculture is the largest private employer in the SLV, and irrigated agriculture employs 8% of the total workforce (an estimated 2,322 jobs per year). Approximately 64% of these jobs are in the category of all other crop farming (which represents alfalfa and grass hay) and 34% are in vegetable farming (mostly potatoes). The unemployment rate in the SLV is 4.6%, higher than the rate of 2.3% for Colorado overall.[13] The jobs supported through irrigated agriculture provide consistent incomes in a regional economy with higher unemployment.

For every $1 spent in agriculture, an additional $1.56 is generated in the regional economy.

Irrigated agriculture generates an estimated $182 million in GDP every year in the SLV (Table 3). Nearly half of the GDP generated by irrigated agriculture is from indirect and induced impacts. This means that the local agricultural sector relies heavily on local inputs for production. **For every $1 spent in agriculture, an additional $1.56 is generated in the regional economy.** The 2,300 jobs generated directly by irrigated agriculture support and induce another 1,500 jobs in the region. Because IMPLAN only captures backwards linkages, the contribution of irrigated agriculture is likely much greater than shown here. For example, irrigated alfalfa is likely sold to local farmers for their cattle ranching, which in turn supports meat processing plants in the region (see Section 4 for more on meat processing facilities).

Table 3. Annual contribution of irrigated agriculture to the San Luis Valley (Source: IMPLAN 2022)

Impact Type	Employment	Labor Income ($M)	Value Added ($M)	Output ($M)
Direct	2,322	$104.7	$88.5	$310.3
Indirect	1,078	$41.9	$55.8	$105.6
Induced	430	$15.0	$37.9	$68.8
Total	3,831	$161.6	$182.2	$484.8
Direct Impacts as % of all SLV	*8.4%*	*8.1%*	*4.2%*	*6.8%*

Figure 8. The Nexus between Conservation and Agriculture

Conservation projects play an important role in the Valley. Many projects focus on upgrading agricultural infrastructure to restore instream health, fortify riverbanks and diversion ditches, and restore downstream movement of water across the floodplain, which irrigates agricultural lands while creating and supporting wet meadows that provide critical habitat for wildlife. Upstream, beaver mimicry and log structures enhance drought and fire resilience and improve ground-to-surface water connections. The Valley has a strong history of conserving private lands to protect wildlife habitat, working lands, water rights, and the pastoral landscape that makes up the Valley, through conservation easements.

The community is also exploring novel ways to conserve water for habitat and aquifer sustainability. In 2022, Colorado Open Lands completed the nation's first groundwater conservation easement in the northern San Luis Valley on a roughly 1,900-acre farm. The landowner voluntarily agreed to cease pumping a large percentage of the farm's groundwater in perpetuity, which will keep the community's groundwater subdistrict in compliance with State sustainability requirements and preserve water resources for ecological purposes. This novel approach combined with traditional conservation measures ensures water resources are available for the fragile high desert ecology in the SLV.

Rio Grande in the San Luis Valley | Sinjin Eberle

3. Water-Dependent Industries

Water is an essential input for many industries and commercial businesses. Beyond requiring water to meet the basic needs of employees, customers and visitors, many industries and businesses rely on water as a key input into their processes and/or products. These so-called "water-dependent" industries (WDIs) generally rely on the services of water utilities to support and grow their business.[14] Having a clean, reliable water supply can be a key factor for these businesses when deciding where to locate or whether to expand.

Figure 9. Water dependent industries

- Manufacturing
- Hospitals and other health care facilities
- Junior colleges, colleges, universities, and professional schools
- Hotels and motels
- Restaurants
- Car washes
- Dry-cleaning and laundry services
- Greenhouse, nursery, and floriculture production
- Breweries and wineries
- Waste remediation

Several studies have identified water dependent industries by comparing water use to industry output or sales.[15] Based on these studies, Figure 9 identifies industries that are relevant to the SLV and widely recognized as being highly dependent on water. Industries such as hospitals and other health care facilities, universities, restaurants, and hotels, rely on water to support large numbers of users and for sanitation services. Other industries use water as part of the manufacturing process (e.g., for cleaning equipment) or as a direct input into products or processes (e.g., car washes, laundromats, breweries, and wineries).[c] For the WDI economic impact assessment, the project team included those industries identified in Figure 9.

Based on data from the IMPLAN model, water dependent industries account for approximately 21% of total direct economic output and 23% of employment in the SLV. These businesses generate additional economic activity across the six-county region in the form of indirect and induced spending. Table 4 (below) shows the total contribution of water dependent industries across the Valley – together, these industries support nearly $1.3 billion in economic output and $367 million in total value added within the six-county region, as well as supporting over 8,260 jobs.

Table 4. Annual contribution of water dependent industries to the SLV (Source: IMPLAN 2022)

Impact Type	Employment	Labor Income ($M)	Value Added ($M)	Output ($M)
Direct	6,340	$279	$364	$951
Indirect	1,290	$67	$95	$280
Induced	630	$24	$72	$128
Total	**8,260**	**$370**	**$531**	**$1,359**
Direct Impacts as % of all SLV	*23%*	*22%*	*18%*	*21%*

[c] Irrigated agriculture is not included in this analysis, as it is highlighted in the previous section.

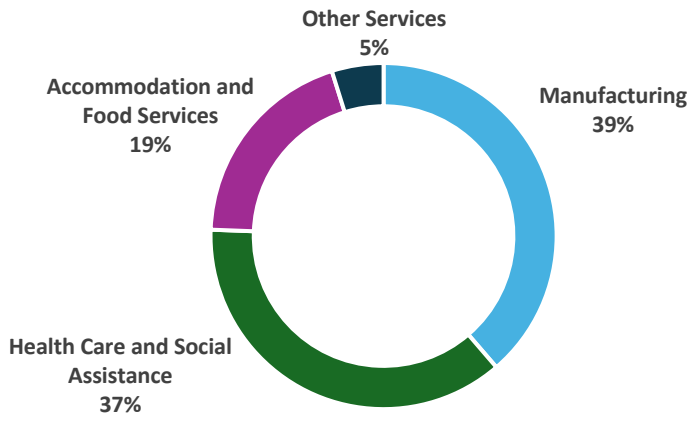

Figure 10. Contribution to economic output of water dependent industries by industry type (Source: IMPLAN 2022)

Figure 10 shows the direct contribution of water dependent industries by industry category for the SLV. Manufacturing, healthcare, and hospitality (accommodation and food services) account for 95% of economic output for water dependent industries in the San Luis valley. The manufacturing sector contributes $368 million annually, accounting for 39% of WDI output and 8.1% of output for all sectors. Water-intensive manufacturing in this region includes petroleum refineries, meat processing facilities and sawmills. Health care facilities, including hospitals, doctors' offices, and outpatient clinics, annually contribute $350 million in economic output. Hospitals alone account for $212 million in output, just under 5% of total output. Accommodation and food service industries, such a hotels and restaurants, play a large role in economic output for WDIs, making up 19% of the WDI output (about $186 million) and 4% of total regional economic output.

Local breweries and distilleries are worth noting due to their efforts to source all inputs from regional producers. Barley, rye, hops, juniper berries, and other products grown in the Valley are harvested and utilized in beer and spirit production. Combined, breweries and distilleries in the Valley contribute $12.8 million in annual total output to the region.

WDIs contribute between 14% and 27% of annual economic output in each county, amounting to more than $950 million. These industries make up 21% of the total economic output in the SLV. Just as importantly, the businesses and industries that depend on water employ nearly a quarter of the workforce in the SLV. Jobs are particularly concentrated in the health care industry, with hospitals being the largest employer. Restaurants and hotels also rank among the higher WDI employers. Table 5 presents economic output and employment for WDIs in the SLV.

There are important distinctions between the SLV counties with regards to the types of water dependent businesses and their contribution to the local economy. For Alamosa, Conejos, and Rio Grande counties, hospitals are the top economic contributors in the WDI sectors. Conejos and Rio Grande also have prominent meat processing facilities. In Mineral and Saguache Counties, petroleum refineries have the highest economic output of the WDI industries. Saguache County also has a thriving pottery and ceramics manufacturing sector: the town of Villa Grove is known for its unique style of handmade pottery. Finally, Costilla County's largest WDI by output is the sawmill industry, where water is used to maintain the moisture content of logs and to cool sawblades.

Water-dependent industries in the SLV support nearly $1.3 billion in total economic output.

Table 5. WDI economic sectors and jobs in the San Luis Valley (Source: IMPLAN 2022)

WDI Economic Sectors	ECONOMIC OUTPUT			EMPLOYMENT		
	Annual Output	% of WDI	% of SLV	Total Jobs	% of WDI	% of SLV
Manufacturing	$367.9	38.7%	8.1%	757	11.9%	2.7%
Health Care and Social Assistance	$350.8	36.9%	7.7%	2,980	47.0%	10.7%
Accommodation and Food Services	$186.1	19.6%	4.1%	2,106	33.2%	7.6%
Administrative and Support and Waste Management and Remediation Services	$16.6	1.7%	0.4%	115	1.8%	0.4%
Other Services	$14.6	1.5%	0.3%	196	3.1%	0.7%
Educational Services	$10.2	1.1%	0.2%	165	2.6%	0.6%
Agriculture, Forestry, Fishing and Hunting	$4.5	0.5%	0.1%	23	0.4%	0.1%
WDI Total	**$950.7**	**100.0%**	**21.0%**	**6,342**	**100.0%**	**22.8%**

4. Domestic Water Use

According to the U.S. EPA's Safe Drinking Water Information System (SDWIS), there are 33 community water systems (CWS) that provide water services within the six-county SLV region, including three CWSs serving Tribal communities. Together, these CWSs serve approximately 34,400 people, or 74% of the total population in the region. The SDWIS database reports groundwater as the primary source of water for all CWSs in the region.

There are an additional 100 non-community water systems in the SLV, classified as both transient (86) and non-transient (14) systems. EPA defines transient non-community water systems as public water systems that provide water in a place where people do not remain for long periods of time (e.g., gas stations or campgrounds). Non-transient non-community water systems are public water systems that regularly supply water to at least 25 of the same people for at least six months of the year (e.g., schools, factories, office buildings, or hospitals that have their own water systems). These systems all report groundwater as their primary source of drinking water. They serve populations ranging from 12 to just over 2,000.

The value of clean drinking water in the San Luis Valley is estimated to be over $3,600,000 per day.

The U.S. Federal Emergency Management Agency (FEMA) publishes standard economic values in its Benefit-Cost Analysis Toolkit that can be used to estimate the value to households of having access to clean and reliable water services.[16] FEMA calculates the value of water services to residential customers based on households' willingness-to-pay (WTP) to avoid water supply disruptions and the cost of replacing potable water for basic needs. The agency relies in part on studies that have developed a demand curve for potable water and measured the welfare loss associated with a loss of supply. This is done by obtaining WTP to avoid water supply interruptions: in essence, asking respondents how much they will pay to avoid a loss of water service of a given duration.

Based on a meta-analysis of empirical studies, the average price of water nationally, and average quantity of water consumed per person, FEMA defines an average welfare loss as $67.88 per person per day of a water service disruption. To replace water lost, FEMA multiplies the price of replacement water by the basic water requirement per person per day, for a total of $9.35. Adding these costs together, the total economic benefit associated with having access to clean and reliable water services is $77.23 per person per day. Multiplied by the total population of the SLV (46,624 residents), the **total benefit of drinking water supplies in the region is estimated to be $3,600,800 per day**.

Figure 11. Drinking water conservation efficiency in Alamosa

The City of Alamosa is getting help to jumpstart sustainable drinking water projects from WaterNow Alliance's Project Accelerator program. In recognition of the importance of water conservation stemming from a Growing Water Smart workshop in 2022, the city has adopted and is in the process of implementing a Water Efficiency Plan. Alamosa aims to develop water efficiency incentive programs for their customers, ensuring equitable benefits for all residents, particularly those in lower income brackets. Water conservation in residential homes results in more water available to support the multitude of other uses and beneficiaries described in this report.

5. Water-Based Recreation and Tourism

The San Luis Valley is home to a wide range of outdoor recreation opportunities that draw residents and visitors. The Great Sand Dunes National Park attracts national and international travelers to the Valley, as do the world-class birding and wildlife viewing opportunities at the nine state and national wildlife refuges and areas that dot the Valley floor. Often containing wetland, riparian and open water ecosystems, these areas support numerous species of resident and migratory birds, including Sandhill Cranes, which inspire the popular annual Monte Vista Crane Festival (See figure 17 for more information). The Rio Grande draws whitewater boaters, particularly during the spring/early summer snowmelt season. The river is also home to one of Colorado's longest designated Gold Medal trout habitats, an attraction for fishing enthusiasts.

Many recreational opportunities in the SLV are either directly dependent on water or enhanced by the proximity to rivers, lakes, and reservoirs. River boating, fishing, and migratory birding in the wildlife refuges and riparian areas are dependent upon the presence of surface waters and instream flows. Other activities, such as biking, camping, hiking, picnicking, or trail use are less dependent on the presence of water but recreators may prefer locations with water. River amenities in the SLV also attract significant numbers of RV campers, but data do not currently exist to quantify the impact of these recreators.

A few studies have demonstrated the magnitude of water-related recreational activity in the SLV. In 2019, the Business for Water Stewardship surveyed residents and visitors about water-related outdoor recreation in the Rio Grande Basin.[17] Results from this study indicate that **the SLV hosts an estimated 2.5 million water-related recreational user days each year.** Figure 12 shows the percentage of "user days" by water-related recreation activity for the Basin overall. A "user day" is defined as a single person recreating per day.

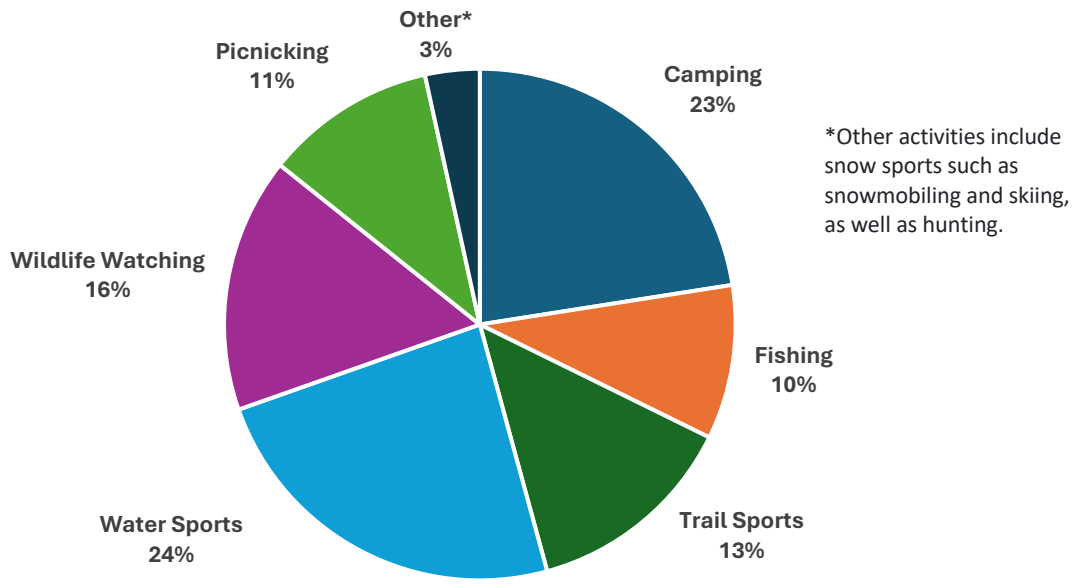

Figure 12. Proportion of water-based recreational user days in the Rio Grande Basin (Source: Business for Water Stewardship, 2020)

The San Luis Valley Great Outdoors (SVL GO) is a local nonprofit organization dedicated to enhancing recreational experiences and opportunities in the Valley. In 2013, SLV GO surveyed local residents to solicit input on recreational planning efforts. SLV residents are the most frequent beneficiaries of the outdoor recreation opportunities in the area. Results of the survey indicate that over 40% of residents participate in outdoor recreation at least once per week, with an additional 22% going outdoors two to three times per month. Residents' top five recreational activities include camping, hiking/climbing mountains, walking, picnicking, and hunting.[18] Results from this survey shaped the SLV GO Master Plan and identified recreational investment needs.

National Park Service | Patrick Myers

Figure 13. Great Sand Dunes National Park
The Great Sand Dunes saw more than 500,000 visitors in 2023, many when Medano Creek flows at the base of the dunes in spring during peak snowmelt. During this time, the dunes turn into "Colorado's only natural beach." Visitors skim board or tube down the seasonal creek, enhancing their recreational experience while visiting the National Park. While not typically considered a water-based attraction, Medano Creek highlights how even seasonal flows can have important economic benefits in the San Luis Valley.

The inherent value that individuals place on outdoor recreational activities can be difficult to measure. However, economists have developed non-market valuation techniques to estimate the value of recreational experiences across a range of activities. These studies yield what economists refer to as *direct use values,* which reflect the maximum amount that individuals would be willing to pay for a recreational user day. This estimate of willingness to pay (WTP) attempts to monetize the value that individuals have for their recreational experiences.

WTP varies depending on the recreational activity and the quality of the recreational experience. As discussed in Section 2 (Figure 4), surveys of users can help establish WTP values for a specific type of recreation or activity. This report relied on the following WTP studies to establish valuation estimates for user days in the SLV.

- *Economic Value of Whitewater Sports in the Cache La Poudre Canyon, Colorado* (McTernan 2011): This survey estimates the benefits to non-commercial users enjoying whitewater sports in the Poudre Canyon, estimating the mean net willingness to pay per user is approximately $103 per day.[19] Based on input for local stakeholders, the project team assumed 80% of non-motorized boating days would be captured under this activity type.

- *Opportunity Cost of Water in the South Platte River, Colorado* (Stein 2019): Two surveys distributed at three access points along the South Platte River identified WTP for improved recreational fishing quality at $95.80 per individual.[20] The project team assumed 100% of recreational fishing in the SLV region is of the "improved quality" described in this opportunity cost report.

- *Value of Migratory Bird Recreation at the Bosque del Apache National Wildlife Refuge in New Mexico* (Huber and Section 2019): Survey of visitors to a wildlife refuge that hosts 50% of the migratory

sandhill cranes along the Rio Grande, including sampling of visitors during the local Festival of the Cranes (different from the festival discussed in Figure 17). The survey found WTP ranging from $73-$87 per user day.[21] Based on input for local stakeholders, the project team assumed that 40% of wildlife viewing in the SLV involves Sandhill Cranes.

- *Recreation Economic Values for Estimating Outdoor Recreation Economic Benefits from the National Forest System* (Rosenberger et al. 2017): This study publishes estimates of recreation economic values for 14 activities by US Forest Service region, based on a meta-analysis of multiple decades worth of willingness to pay studies. Values range from $42.67 per day for backpacking to $141.23 per day for non-motorized boating.[22] To apply these values, the project team assumed 20% of all water sports are motorized boating, while the remaining water sports were non-motorized boating activities. Camping is assumed to include 20% backpacking and 80% car camping or developed camping (RV camping is not included in these estimates). "Other" activities include snowmobiling, cross country skiing, and hunting, among others.

Figure 14. Del Norte Riverfront Project

Del Norte Riverfront Park | Sinjin Eberle

The Del Norte Riverfront Project improved recreation opportunities and access on the Rio Grande near North Park in Del Norte, creating much needed connectivity between the communities and visitors of the San Luis Valley and the river that sustains it. The Project also improved the ecological condition of the riparian areas and instream habitat for fish and other wildlife. The Town of Del Norte hosts a music festival on the waterfront called Rhythm on the Rio, bringing many visitors to the community of Del Norte and river. Projects like this enhance the user day value of recreational use of the Rio Grande and offer value-added development opportunities to improve and diversify local economies.

Figure 15 represents the results from the project team's analysis of the economic benefits associated with water-related recreation.[d] **In total, water-related recreation provides $213.7 million in benefits annually in the San Luis Valley.** The greatest number of user days and highest annual value are represented by the category water sports which includes boating, kayaking, rafting, tubing, and swimming in the Valley's rivers, lakes, and reservoirs. The high willingness to pay for whitewater activities, combined with the high volume of users, leads to 30% of the recreational value stemming from these activities. Another half million user days are spent camping in the vast public lands that surround the SLV. Sandhill Crane migration draws a large number of visitors

Water-related recreation provides $213.7 million in benefits annually in the San Luis Valley

[d] These recreation values do not include RV camping. Existing data used in this study did not distinguish RV camping from other campground users. If this data existed, the value of recreation could be substantially higher.

that come from out of town with a high willingness to pay per user day, generating another 15% of total recreational benefit valued at $31.3 million per year.

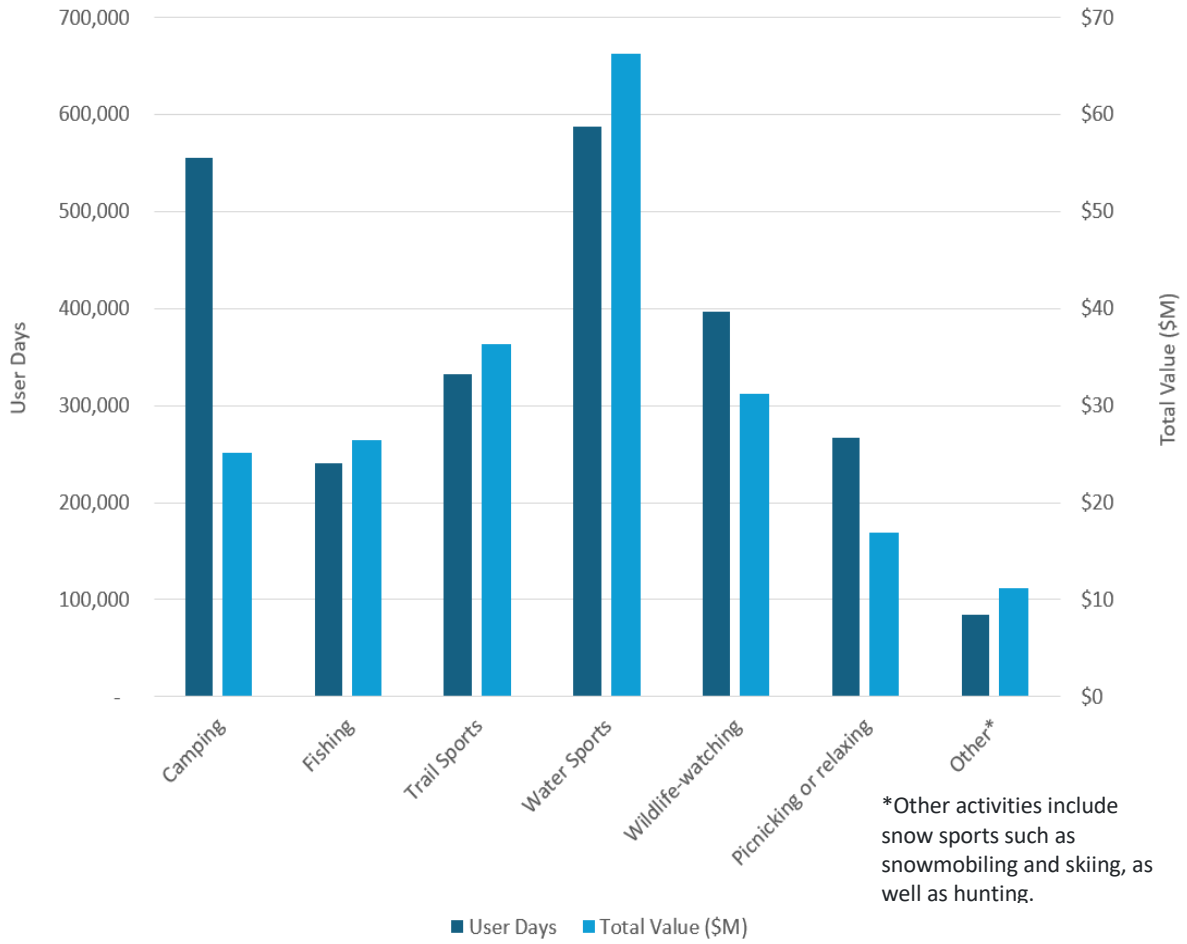

Figure 15. Annual estimates of user days and economic benefits of water-related recreational activities in the San Luis Valley

$365.9 million in direct sales associated with water-related outdoor recreation generates an economic impact of $679.7 million in the SLV

Dollars spent on recreational activities generate economic activity in rural communities, as residents and visitors spend money on gear, hotels, local guides, rentals, restaurants, and other trip-related activities. The Rio Grande and its tributaries, as well as the lakes and reservoirs in the SLV, underpin economic activity associated with many outdoor recreational activities. Based on the Business for Water Stewardship survey from 2019, **an estimated $365.9 million in direct sales associated with water-related outdoor recreation in the SLV generated a total economic impact of $679.7 million.**

This means **that for every $1 spent on recreation, $1.91 is generated through ripple effects within the local economy**.[e] In addition, water-related recreation in the SLV directly creates over 2,000 jobs paying $102.7 million annually. Once again, job creation associated with recreation cannot be undervalued. Opportunities for growth in this economic sector abound in this region but rely on careful consideration of limited water resources to sustain growth.

Figure 16. Wolf Creek Ski Area

Wolf Creek Ski Area in Mineral County draws about 10 acre feet per year from the Rio Grande to make snow that supports skiing and snowboarding at the resort every winter. Snowmaking during early season holidays helps the resort stay open during peak tourism to the surrounding communities. Even the small volume of water used in snow making makes a significant impact on the local recreation economy.

Wolf Creek Ski Area

[e] Data gathered for the 2023 Statewide Contributions of Outdoor Recreation in Colorado report indicates that $3.19 is generated per every dollar spent on all recreation in the state, and $2.60 is generated per every dollar spent in the Western Slope (an area that includes the SLV). Although this report is not specific to water-related recreation, the more recent data suggests an increase in the economic impact of the recreation industry in local economies.

6. Habitat & Cultural Values

The SLV provides critical habitat for many species of wildlife including the iconic Sandhill Cranes, as well as 13 state and federal threatened and endangered species and species of concern.[23] The riparian areas, wetlands and wet meadows across the Valley support over 75% of the area's wildlife, including over 160 species of birds. There is an important connection between irrigated agriculture and wildlife habitat as many farms and ranches within the Valley are situated along riparian corridors and have ditches that utilize surface irrigation. These areas provide critical seasonal wildlife habitat by flooding wet meadows and hay fields.[24]

Sandhill Cranes perform a courtship dance in the wetlands of the SLV. Monte Vista Crane Festival |Arron Myers

A recent study surveyed stakeholders, residents and visitors across the Rio Grande Basin in Colorado, New Mexico, and Texas to identify willingness to pay for ecosystem services provided by the river.[25] Most respondents identified water availability as the most urgent issue in the basin region, followed by ecosystem conservation to preserve habitat for wildlife. The survey measured willingness to pay for different ecosystem services, including habitat for wildlife, freshwater supplies, recreational activities, and cultural heritage, in the form of an annual donation. The project team evaluated freshwater supplies and recreational activities in Sections 5 and 6 of this report. This survey on the Rio Grande Basin facilitates the valuation of cultural values and wildlife habitat.

Annual habitat and wildlife benefits in the Valley are valued at $49,787,100

The category habitat for wildlife received the highest mean WTP at $34.28 per resident per year.[f] (Note that residents were willing to pay $0.92 more per year than non-residents for this benefit.) For residents of the Valley, this results in a total annual habitat benefit of $1,598,400.

The willingness to pay to support habitat and wildlife biodiversity extends beyond the immediate residents of the Valley. As an example of the potential population outside of the SLV that might be willing to pay for habitat conservation, the project team relied on the number of Keep Colorado Wild Passes sold in 2022.[26] This is the Colorado State Parks pass that is optionally included in vehicle registration and indicates that a resident values conservation of habitat and public lands. Of the 1.49 million passes sold, the 46,600 SLV residents were subtracted out to avoid double counting. The mean WTP from the survey is estimated to be $33.36 per person. Multiplying this value by the total number of non-residents that

[f] The count of residents only includes permanent year-round residents of the Valley. Stakeholders have noted the high proportion of vacation homes in the region, but currently data do not exist to count those additional part time residents.

hold State Parks passes results in a value of $48,188,700 annually. **Collectively, the benefit of habitat and wildlife is valued at $49,787,100 annually.**

Monte Vista Crane Festival | Dave C. Jones

Figure 17. Economic Impact of Monte Vista Crane Festival

In early March each year, thousands of Sandhill Cranes, ducks, and geese flying south draw in wildlife enthusiasts to celebrate the Crane Festival in Monte Vista. Preserving Sandhill Crane habitat draws in an estimated 16,700 visitors each year to the Valley during a time where tourism is typically very slow. A recent study estimated that the Sandhill Cranes generate $4.0 million in direct revenues from visitor spending.[27] This demonstrates how conservation has real economic implications for communities in the region.

The category for cultural heritage refers to the intangible benefits people derive from water, including spiritual enrichment, cognitive development or enrichment, sense of place, identity, aesthetic appreciation gained through interactions with landscapes, and historical context. Cultural heritage is difficult to detect and measure, but many survey respondents reported this service to be of the most importance. Individual WTP was estimated to be just over $9 per year. Applying this value estimate to the approximately 46,600 residents of the 6-county SLV region yields a total annual cultural heritage value of $421,500.

Conclusion

Water resources in the San Luis Valley support a wide range of social, financial, and environmental benefits. From drinking water in residential homes, to irrigating barley fields, to providing riparian habitat for trout that attract so many recreational anglers, water supports life in the valley in so many fundamental ways. This report aimed to quantify the value of water in this region across a multitude of uses. These values, summarized in Table 6, highlight the diversity of uses and the benefits accrued to individuals and across the local economy. The values in different benefit categories are not intended for comparing across sectors, but rather to demonstrate the diversity of benefits that water provides. In the case of industries, the direct impacts can also be considered as benefits.

Table 6. Summary of the value of water in the San Luis Valley

Economic Impacts	Direct	Total	Multiplier
Irrigated Agriculture	$310.3M	$484.8M	$1.56
Water Dependent Industry	$951.1M	$1,359.3M	$1.43
Recreation	$365.9M	$697.7M	$1.91
Habitat & Wildlife - Crane Festival	$4.0M	--	--
Economic Benefits		**Total**	
Drinking Water		$1,314.3M	
Recreation		$213.7M	
Habitat & Wildlife		$49.8M	
Cultural Heritage		$0.42M	

The diversity of water uses do not have to be competing. The intention of this report is to underscore the value of water across all sectors to promote and foster continued collaboration in the protection of water resources. In doing so, the Valley can invest in a future where all water-dependent sectors can thrive.

End Notes

[1] U.S. Census American Community Survey (ACS) 2022 1-year estimates.
[2] Dubinsky, Jonathan & Karunanithi, Arunprakash. 2016. Consumptive Water Use Analysis of Upper Rio Grande Basin in Southern Colorado. Environmental Science & Technology. 51. DOI: 10.1021/acs.est.6b01711.
[3] Dunn, Darrel. *San Luis Valley Groundwater*. Posted 4/1/2021. Revised 6/3/2023. Available: https://www.dunnhydrogeo.com/home/san-luis-valley-groundwater (Accessed 9/16/24).
[4] Colorado Water Conservation Board and Rio Grande Basin Roundtable. 2015. Rio Grande Basin Implementation Plan. Executive Summary, page 7.
[5] Colorado Water Conservation Board and Rio Grande Basin Roundtable. 2022. Rio Grande Basin Implementation Plan – Volume 2. History of Water Development, page 31
[6] King, Naomi, et al. 2020. Water Exports and the San Luis Valley in Colorado: Understanding the History and Current Regulatory Framework. Getches-Wilkinson Center for National Resources, Energy, and the Environment, University of Colorado Law School.
[7] Rio Grande Water Conservation District website. Available: https://www.rgwcd.org/subdistricts (Accessed 9/19/24).
[8] San Luis Valley Development Resources Group & Council of Governments. 2021. *Comprehensive Economic Development Strategy.* Available: https://www.slvdrg.org/comprehensive-economic-development-strategy/ (Accessed 9/16/24).
[9] Rosenberger, R.S., and J.B. Loomis. 2003. *Benefit Transfer. In: Champ, P.A., Boyle, K.J., Brown, T.C. (eds) A Primer on Nonmarket Valuation.* The Economics of Non-Market Goods and Resources, Vol 3. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0826-6_12.
[10] U.S. Environmental Protection Agency National Center for Environmental Economics, Office of Policy. 2010. Guidelines for preparing economic analyses. Washington, DC: U.S. EPA. Available: https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analysis-2010-revised-2014 (Access 9/16/2024).
[11] J. Robbins. 2022. *The Vanishing Rio Grande: Warming Takes a Toll on a Legendary River*. Available: https://e360.yale.edu/features/warming-and-drought-take-a-toll-on-the-once-mighty-rio-grande (Accessed 10/7/2024).
[12] Obmascik, Mark. *The water supply of the San Luis Valley faces pressure as never before.* The Colorado Sun, published August 29, 2021. Available: https://coloradosun.com/2021/08/29/san-luis-valley-water-diversion-drought-climate-change/ (Accessed 10/7/2024).
[13] Bureau of Labor Statistics Local Area Unemployment Statistics. Labor force data by county, June 2023.
[14] Value of Water Campaign (VOWC). 2016. "The Economic Benefits of Investing in Water Infrastructure." Available: https://uswateralliance.org/wp-content/uploads/2023/09/Economic-Impact-of-Investing-in-Water-Infrastructure_VOW_FINAL_pages_0.pdf (Accessed 9/16/24).
[15] Raucher, R, J Hendreson, J Clements, T Meernik, M Duckworth, J Oxenford, J Kiefer, and B Dziegielewski. 2015. "The Value of Water Supply Reliability in the CII Sector." Alexandria, VA: WateReuse Research Foundation.
[16] U.S. FEMA. May 2023. *Benefit-Cost Analysis Sustainment and Enhancements: Standard Economic Value Methodology Report Version 12.0.* Available: https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_2023.pdf (Accessed 9/16/24).
[17] Business for Water Stewardship. 2020. *The Economic Contributions of Water-related Outdoor Recreation in Colorado*. Available: https://waterforcolorado.org/wp-content/uploads/2020/03/Southwick-Technical-report-2020.pdf (Accessed 11/27/2024).
[18] San Luis Valley Great Outdoor Coalition. 2014. *San Luis Valley Trails and Recreation Plan*. Available: http://slvgo.com/wp-content/uploads/2015/08/SLVGO_FinalPlan-No-Chapter-5.pdf (Accessed 11/27/2024).
[19] J. McTernan. 2011. *Economic Value of Whitewater Sports in the Cache La Poudre Canyon, Colorado.* These for Master of Science, Department of Agricultural and Resource Economics, Colorado State University. Advisor: John Loomis.

[20] S. Stein. 2019. *Opportunity Cost of Water in the South Platte River: Comparing economic value derived from stated and revealed preferences.* Master of Science, Department of Agricultural and Resource Economics, Colorado State University. Advisor: Jude Bayham.

[21] C. Huber and N. Sexton. 2019. *Value of Migratory Bird Recreation at the Bosque del Apache National Wildlife Refuge in New Mexico.* Western Economics Forum: Vol. 17 Issue 2. A Journal of the Western Agricultural Economics Association.

[22] Rosenberger, R. S., E. M. White, J. D. Kline and C. Cvitanovich. 2017. *Recreation Economic Values for Estimating Outdoor Recreation Economic Benefits from the National Forest System.* Gen. Tech. Rep. PNWGTR-957. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

[23] Colorado Water Conservation Board and Rio Grande Basin Roundtable. 2015. Rio Grande Basin Implementation Plan. Executive Summary, page 10.

[24] Ibid.

[25] Wang,W., J.E. Mu, J.R. Ziolkowska. 2021. Perceived Economic Value of Ecosystem Services in the US Rio Grande Basin. Sustainability 2021,13, 13798. https://doi.org/10.3390/su132413798

[26] Colorado Parks and Wildlife Financial Update. January 2023. Available: https://cpw.state.co.us/committees/colorado-parks-and-wildlife-commission/meetings/parks-and-wildlife-commission-meeting-1 (Accessed 10/3/2024).

[27] Ciaglo, Max. Kyle Balint, and Jenny Nehring. 2021. *The Economic Impact of the Spring Crane Migration on the San Luis Valley of Colorado*. Colorado Open Lands. Available: https://coloradoopenlands.org/wp-content/uploads/Cranes-Economic-Impact-1.pdf (Accessed 9/16/24).