



United States Department of Agriculture  
Forest Service

# Grand Mesa, Uncompahgre, and Gunnison National Forests

**DRAFT Forest Assessments:  
Benefits to People: Multiple Uses, Ecosystem  
Services, and Socioeconomic Sustainability**

November 2017



Recreation is only one of the many ways that the GMUG National Forests benefit people.

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# Contents

<b>Contents</b> .....	<b>i</b>
<b>Chapter 1. Introduction</b> .....	<b>1</b>
<i>Summary Public Input</i> .....	1
<i>Use of Best Available Science</i> .....	2
<i>Area of Influence</i> .....	2
<b>Chapter 2. Conditions and Trends of the Economic Environment</b> .....	<b>4</b>
<i>Economic Sustainability</i> .....	4
<i>Evaluating Economic Sustainability in the GMUG Area of Influence</i> .....	4
Market Access and Connectivity.....	5
Creative Class Employment .....	6
Measures of Productivity .....	6
Economic Diversity .....	6
<i>Employment by Industry</i> .....	7
<b>Chapter 3. Conditions and Trends of the Social Environment</b> .....	<b>12</b>
<i>Social Sustainability</i> .....	12
<i>Evaluating Social Sustainability in the GMUG Area of Influence</i> .....	13
Population and Age .....	13
Values, Beliefs, and Attitudes .....	14
Environmental Justice.....	15
Protection of Children .....	17
<b>Chapter 4. Conditions and Trends of GMUG Contributions to Social and Economic Sustainability</b> .....	<b>18</b>
<i>Multiple Uses and Ecosystem Services</i> .....	18
Forage for Grazing.....	19
Outdoor Recreation and Human Enjoyment of Fish and Wildlife Species .....	20
Cultural, Historical, and Sacred Sites .....	23
Solitude, Spirituality, and Sense of Escape.....	23
Timber.....	24
Water Resources .....	26
<i>Contributions from Infrastructure and Agency Operations</i> .....	27
Infrastructure.....	27
Agency Operations and Presence in the Community.....	28
Federal Payments to State and Counties .....	28
<i>Summary</i> .....	29
<i>Current Forest Plan and its Context within the Broader Landscape</i> .....	30
Forest Plan Consistency with External Plans in the Broader Landscape.....	30
Potential Need for Changes.....	30
<b>References</b> .....	<b>30</b>

## List of Tables

Table 1. Factors of economic sustainability in the GMUG analysis area.....	5
Table 2. County level employment counts (2015), by industry for Delta, Fremont, Garfield, Gunnison, and Hinsdale Counties.....	8
Table 3. County level employments counts (2015), by industry for Mesa, Montrose, Ouray, Saguache, San Miguel Counties and the State of Colorado.....	9
Table 4. Share of employments (2015), by industry for Delta, Fremont, Garfield, Gunnison, and Hinsdale Counties .	10
Table 5. Share of employments (2015), by industry for Mesa, Montrose, Ouray, Saguache, San Miguel Counties and the State of Colorado.....	11
Table 6. Population characteristics in the GMUG analysis area.....	13
Table 7. Share of minority population and share of people in poverty, 2015 estimates.....	17
Table 8. Infrastructure supporting the provision of forage for grazing, by district.....	19
Table 9. Active facilities in the timber processing area of the Forest.....	24
Table 10. Annual capacity and capability to process trees by size class in the GMUG timber processing area, 2016 25	
Table 11. Federal payments to states and counties.....	29

## List of Figures

Figure 1. Socioeconomic analysis area.....	3
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## **Chapter 1. Introduction**

The GMUG National Forests provide a wide range of resources, experiences, and benefits to people and communities, contributing to social and economic sustainability in the broader landscape. Since management of the Forests contributes to social and economic sustainability primarily through the provisions of (1) multiple uses, (2) ecosystem services, (3) infrastructure, and (4) having a presence in the community (FSH 1909.12, ch. 10, sec. 13).

This section describes the conditions and trends of the social and economic environments within the GMUG socioeconomic area of influence that are most affected by the management of the plan area. Some social, cultural, and economic conditions in the area of influence are sensitive to changes in the management of the plan area while others are not. Conditions in the area of influence that are neither sensitive to, nor affect, the management of the plan area are not assessed and analyzed in detailed, because the assessment should identify the social, cultural, and economic conditions that are sensitive to the management of the plan area (FSH 1909.12, ch. 10, sec. 13.23). Since forest plans under the 2012 Planning Rule will guide management of NFS lands so that they are ecologically sustainable and contribute to social and economic sustainability (36 CFR 219.1), this assessment chapter places special emphases on indicators of sustainability.

### **Summary Public Input**

During the summer of 2017, the planning team received public input with respect to the social and economic environment of the GMUG plan area, including emails, electronic and hand-written comments, and conversations at the public open houses, summarized here.

- There is a desire to specifically support cross-country Nordic skiing in Delta County.
- County level employment counts, particularly agricultural employment, should be presented as accurately as possible.
- Canada thistle should be maintained in some capacity, rather than wiped out completely, due to their many beneficial social and economic values such as papermaking, aid in cattle and horse health, food for humans.
- To effectively evaluate the potential need and opportunity for additional designated areas, it was recommended that the assessment identify the socioeconomic factors relevant to protecting national forest lands through conservation designations; specifically, the assessment should consider recent trends in recreation, public opinion and values, and the economic contributions associated with wilderness and other conservation designations.
- Consider the social, cultural, and economic impacts of any proposed action.
- Explore options of Payment for Ecosystem Services via improving soil health, carbon credits.
- Identify the economic contributions of OHV recreation.
- CPW is interested in highlighting the economic contributions of hunting and fishing.

## Use of Best Available Science

This Assessment Chapter primarily relies on the following information and data sources:

- Colorado Department of Local Affairs (DOLA) Division of Local Governments, State Demography Office
- Headwaters Economics Economic Profile System
- Bureau of Business and Economic Research, University of Montana's data on Timber Use, Processing Capacity and Capability of Mills in the GMUG area
- U.S. Census Bureau population data
- IMPLAN, LLC. software and data system
- USDA Forest Service Visitor Use Report for the GMUG National Forests

## Area of Influence

Managements of GMUG lands affect local residents and communities adjacent to the National Forest boundaries, and also the broader regional economy and people living further away from the National Forest. Individuals who share a connection with the GMUG can include those who actively use the lands and resources, as well as those interested in the non-use values and protection of the Forest – either locals or residents from across the Nation. Since local communities that are close to National Forest lands tend to be some of the greatest beneficiaries of the ecosystem services the land provides, the socioeconomic area of influence is made up of counties that are most tied – economically or socially – to the resources and management of the Forest. They include Delta, Fremont, Garfield, Gunnison, Mesa, Montrose, Ouray, Saguache, Hinsdale and San Miguel counties in Colorado (see Figure 1).

The area of influence is determined by a variety of indicators, including timber, grazing, and recreation, as well as local knowledge from the public and Forest Service staffs. A county is included if supported under one or more of these criteria. For instance, under the timber criteria, counties are included based on the flow of timber sales, processors, and location of timber-related employment; under the range criteria, counties are included based on the location (home or business) of permittees and the amount of animal unit months authorized; and counties are included under the recreation criteria in order to capture the economic contribution of visitor spending, according to the 50 percent recreation market area as defined by the National Visitor Use Monitoring program for the Forest. The *50 percent recreation market area* is based on distance zones (travel distances as reported by NVUM survey respondents) from which about half of the recreation visits to the forest originated.

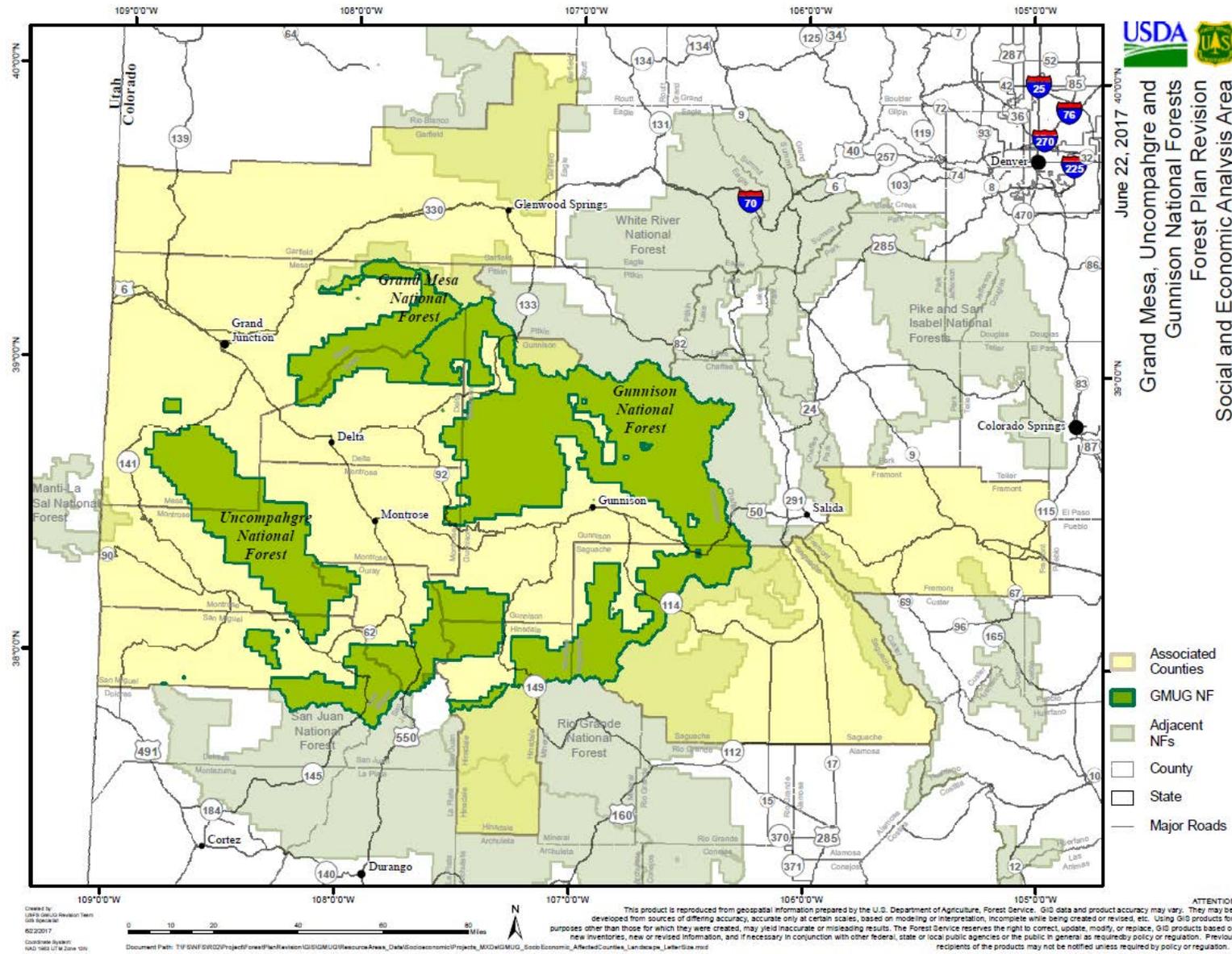


Figure 1. Socioeconomic analysis area

While San Juan County, CO is chiefly connected (socially and economically) with the managements of other units of public lands, it does contain a small portion of the Gunnison National Forest. Therefore, in subsequent sections, San Juan County, CO is included only when land ownership and Federal county payments information are presented.

Additionally, the Multiple-Use discussion will integrate information for other counties peripherally connected with livestock permittees living further away (i.e. Dolores, Mineral, Montezuma, Pitkin, Rio Grande, and San Juan counties in Colorado; and Grand and San Juan counties Utah).

## **Chapter 2. Conditions and Trends of the Economic Environment**

### **Economic Sustainability**

It is not how big you grow, but how you grow big that matters when it comes to economic sustainability – which requires reaching a balance between efficiency and resilience. An economy that lacks efficiency risks being stagnant, while a lack of diversity reduces resilience (Goerner et al. 2009). Consequently, putting the concept of economic sustainability into practice, or, at least being able to earnestly measure progress toward sustainability, requires clear distinction differentiating healthy, long-term economic development from the sheer numeric growth in outputs (Saisana and Philippas 2012; Ng 2014; Ng 2015). Traditional metrics on economic growth such as total output overlook the network structure needed to process resources and circulate energy to all parts of the whole, so by relying on these measures alone, it is not possible to differentiate between a bubble or unstable economy from a resilient one (Daly 1997; Goerner et al. 2009). As the 2012 Planning Rule (36 CFR §219.19) defines sustainability as the capability to meet the needs of the present generation without compromising the ability of future generations to meet their needs, the concepts of economic diversity and efficiency are germane and should be considered in order to describe the forest's contribution to economic sustainability.

### **Evaluating Economic Sustainability in the GMUG Area of Influence**

Resilience is related to the concept of diversification in modern portfolio theory. For example, an economy or labor force that over relies on the specialization in a single industry (i.e. putting all of one's eggs in a single basket) lacks diversity and resilience, thus diminishing its ability to recover from periodic disturbances such as economic downturns.

In a similar way, efficiency is related to the ideas of productivity, connectivity, as well as specialization. When economies specialize, total output increases, potentially allowing for greater level of enjoyment and consumption, increasing standards of living. An economy that lacks efficiency and productivity risks being stagnant. The United States has been experiencing weak growth in productivity in recent decades (BLS 2017b). This is especially worrisome because productivity growth is a crucial determinant of the living standard for future generations.

With the concepts of resilience and efficiency in mind, this section focuses on indicators that can provide important insights on economic sustainability in the Forest’s area of influence. Measures include indices on economic diversity (Shannon-Weaver Index, Creative Employment), Base Industries Analysis and productivity. Each of these factors, for each county, is listed in Table 1.

**Table 1. Factors of economic sustainability in the GMUG analysis area**

[Individual metrics are explained in the following text. Source: USDA ERS, Headwater Economics and IMPLAN (2015).]

County	Market Access Classification	Creative Class Employment	GDP per Worker (Thousands of 2016 \$)	GDP per Worker National Ranking (out of 3,110 counties)	Shannon-Weaver Diversity Index
Delta	Connected	17.68%	\$76.10	2,484	0.70
Fremont	Isolated	19.39%	\$83.20	2,128	0.68
Garfield	Connected	22.02%	\$99.20	1,298	0.70
Gunnison	Connected	28.35%	\$72.60	2,644	0.68
Hinsdale	Isolated	30.14%	\$52.40	3,105	0.57
Mesa	Metro	22.84%	\$90.60	1,764	0.73
Montrose	Connected	18.85%	\$80.30	2,284	0.72
Ouray	Connected	28.68%	\$63.40	2,940	0.67
Saguache	Isolated	14.96%	\$78.20	2,381	0.57
San Miguel	Connected	36.87%	\$52.90	3,098	0.65

### Market Access and Connectivity

While recreation opportunities and natural amenities bring visitors, retirees and tourism-related businesses to rural areas, the remoteness of an area often presents challenges to economic development due to limited availability of transportation infrastructure and access to market. Research shows there are three different types of counties in the West, defined by their access to major markets and population centers: (1) “Metro”: counties classified by the Office of Management and Budget as metropolitan statistical areas, (2) “Connected”: non-metro counties with population centers that are within a one-hour drive of the nearest major airport with daily passenger service, and (3) “Isolated”: non-metro counties further than a one-hour drive from the nearest major airport with daily passenger service (Headwaters Economics, 2015).

Most counties in the area of influence fall within the ‘connected’ category. Fremont, Hinsdale and Saguache Counties are ‘isolated’ while Mesa is considered to be a ‘metro’ county.

Communities within an isolated county are not necessarily destined to slow growth or economic woes; nevertheless they are less likely to share the same magnitudes and pace of growth, compared with other more connected cities and towns.

## **Creative Class Employment**

The creative class notion – that towns need to attract engineers, architects, artists, and people in other creative occupations to compete in today's economy—may be particularly relevant to rural communities, which tend to lose much of their talent when young adults leave. The USDA ERS creative class codes indicate a county's share of population employed in occupations that require "thinking creatively." Variables used to construct the ERS creative class measure include number and percent employed in creative class occupations. Occupation titles belonging to the creative class represent skill element defined as: developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions. These job titles range from advertising, marketing, promotions, public relations, and sales managers; architects, surveyors, cartographers; to artist, entertainers and performers, sports, and media related workers (USDA-ERS, 2017).

About 24 percent of all employments within the GMUG area of influence belong in the creative class, with San Miguel County (37 percent) in the lead. The national and state (Colorado) averages are about 18 percent and 23 percent, respectively.

## **Measures of Productivity**

While Gross Domestic Product (GDP) measures economic output at a point in time, GDP per worker is a measure of productivity. Using data from the U.S. Bureau of Economic Analysis (BEA) and IBRC GDP-county-complete estimates, GDP per worker and rankings (out of 3,110 counties) are presented for counties within the area of influence (IBRC, 2016). With \$99,200 per worker, Garfield County has the highest GDP per worker value, which is above the national average (\$94,400). But overall, counties in the GMUG area of influence (with the exception of Garfield) are all below national average.

Low productivity ranking across the GMUG analysis area is a source of concern because productivity growth is a crucial determinant of the living standard for future generations.

## **Economic Diversity**

An economic diversity index based on the Shannon-Weaver entropy function (Shannon and Weaver, 1949) are calculated for counties within the GMUG analysis area using 2015 IMPLAN data (Table 1). The entropy method, such as the Shannon-Weaver Diversity Index, measures diversity of a region against a uniform distribution of employment, which measures how a region's employment is distributed among its industries. It ranges from 0 (perfect inequality or no diversity) to 1 (perfect equality or diversity). The Shannon-Weaver Diversity Index for the GMUG analysis area and the State of Colorado are 0.67 and 0.76, respectively. Delta, Garfield, Mesa and Montrose counties are relatively diverse (all above 0.70) while Hinsdale and Saguache counties are less diverse (0.57).

In other words, since the Shannon-Weaver Diversity Index accounts for both numbers of industries and the spread of employment across them (Attaran 1986), it is a valuable indicator that can provide insights into the economic sustainability of an area.

These indices should be viewed in context with the other indicators presented in this analysis, such as the labor base industries analysis and county typology codes. This index does not account for the fact that many of the industries in a region may be closely related and would therefore provide little protection were one of the other closely related industries to suffer a

major decline. The city of Detroit is a well-known example, where, the surrounding area has a relatively high Shannon-Weaver index – indicating economic diversity. But due to the high interdependence of the majority of the industries with just one economic behemoth (the automobile industry). Indeed, employment may be shared across a variety of industries, but they are all closely tied to just one struggling industry. The lesson to be learned from this example is that the Shannon-Weaver index is of great value and utility, but it should be viewed along with other information such as base industries analysis.

## **Employment by Industry**

Understanding which industries are responsible for most jobs and which sectors are growing or declining is key to grasping the type of economy that exists, and evolving competitive strengths. Most new jobs created in the U.S. economy in the last thirty years have been in services-related sectors, a category that includes a wide variety of high and low-wage occupations ranging from jobs in hotels and amusement parks to legal, health, business, and educational services. In many small rural communities, government employment represents an important component of the economy. In others there have been important changes in employment in mining (which includes fossil fuel energy development), manufacturing (which includes lumber and wood products), and construction.

Since economic diversity generally promotes stability and offers greater employment opportunities, assessing employment by sector helps identify industries which are important to the local economy surrounding the GMUG. Overall, more than half of all employments in the GMUG analysis area belong in the following five industry groups: government, retail, health services, accommodation/food and construction. This is comparable to the state of Colorado's top five industries, with the exception that the State of Colorado has a higher share of employments in the Professional, scientific and technical services industry. County level employment counts by industry (Table 2 and Table 3), as well as the share of employment by industry (Table 4 and Table 5) are displayed below.

**Table 2. County level employment counts (2015), by industry for Delta, Fremont, Garfield, Gunnison, and Hinsdale Counties**

[Source: Colorado Department of local Affairs (2015).]

County	Delta	Fremont	Garfield	Gunnison	Hinsdale
<b>Agriculture</b>	1,380	502	741	314	17
<b>Mining</b>	402	104	1,715	396	*
<b>Utilities</b>	42	59	301	55	*
<b>Construction</b>	775	1,032	4,415	1,002	70
<b>Manufacturing</b>	553	610	464	*	*
<b>Wholesale trade</b>	184	167	822	79	*
<b>Retail Trade</b>	1,471	1,961	3,486	1,087	37
<b>Transportation and warehousing</b>	139	437	906	108	*
<b>Information</b>	169	105	198	97	*
<b>Finance activities</b>	322	288	650	182	*
<b>Real estate</b>	396	438	1,605	614	18
<b>Professional, scientific and technical services</b>	468	528	1,898	666	*
<b>Management of companies and enterprises</b>	30	5	153	5	*
<b>Administrative waste management services</b>	357	458	1,733	406	*
<b>Education</b>	9	65	520	140	*
<b>Health Services</b>	1,383	2,314	2,918	375	15
<b>Arts, entertainment and recreation</b>	136	437	716	977	7
<b>Accommodation and food services</b>	795	1,150	3,094	1,547	55
<b>Other services, except public administration</b>	832	1,078	2,012	797	31
<b>Government</b>	2,443	5,282	5,524	2,106	92
<b>Total Jobs</b>	<b>12,375</b>	<b>17,017</b>	<b>33,870</b>	<b>11,090</b>	<b>417</b>

\* Data suppressed by DOLA for nondisclosure issue and not released to the public. This occurs, for example, when there are very few establishments in a single industry for an individual county, data are withheld in order to protect the confidentiality of company-specific employment information.

**Table 3. County level employments counts (2015), by industry for Mesa, Montrose, Ouray, Saguache, San Miguel Counties and the State of Colorado**

[Source: Colorado Department of local Affairs (2015).]

County	Mesa	Montrose	Ouray	Saguache	San Miguel	Colorado
<b>Agriculture</b>	2,393	1,145	134	992	118	46,768
<b>Mining</b>	2,755	80	125	*	*	34,470
<b>Utilities</b>	220	213	*	*	7	8,576
<b>Construction</b>	5,477	1,691	297	152	706	206,722
<b>Manufacturing</b>	3,017	1,345	98	58	155	147,896
<b>Wholesale trade</b>	2,819	470	11	133	43	111,249
<b>Retail Trade</b>	9,124	2,409	215	164	496	302,217
<b>Transportation and warehousing</b>	2,914	589	*	47	59	89,885
<b>Information</b>	806	190	11	*	78	76,882
<b>Finance activities</b>	2,410	413	58	16	114	127,886
<b>Real estate</b>	2,793	761	150	58	654	107,826
<b>Professional, scientific and technical services</b>	3,756	816	237	63	566	289,138
<b>Management of companies and enterprises</b>	155	108	*	*	7	36,721
<b>Administrative waste management services</b>	3,956	719	86	*	343	191,144
<b>Education</b>	712	109	34	49	152	62,407
<b>Health Services</b>	10,358	2,088	94	113	269	311,408
<b>Arts, entertainment and recreation</b>	1,418	290	111	61	757	79,075
<b>Accommodation and food services</b>	6,615	1,256	464	98	1,277	269,511
<b>Other services, except public administration</b>	4,653	1,359	167	148	512	185,588
<b>Government</b>	0,218	3,182	399	554	799	479,750
<b>Total Jobs</b>	<b>76,570</b>	<b>19,235</b>	<b>2,706</b>	<b>2,749</b>	<b>7,146</b>	<b>3,164,256</b>

\*Data suppressed for nondisclosure.

**Table 4. Share of employments (2015), by industry for Delta, Fremont, Garfield, Gunnison, and Hinsdale Counties**

[Source: Colorado Department of local Affairs (2015).]

<b>County</b>	<b>Delta</b>	<b>Fremont</b>	<b>Garfield</b>	<b>Gunnison</b>	<b>Hinsdale</b>
<b>Agriculture</b>	11.2%	2.9%	2.2%	2.8%	4.1%
<b>Mining</b>	3.2%	0.6%	5.1%	3.6%	
<b>Utilities</b>	0.3%	0.3%	0.9%	0.5%	
<b>Construction</b>	6.3%	6.1%	13.0%	9.0%	16.8%
<b>Manufacturing</b>	4.5%	3.6%	1.4%		
<b>Wholesale trade</b>	1.5%	1.0%	2.4%	0.7%	
<b>Retail Trade</b>	11.9%	11.5%	10.3%	9.8%	8.9%
<b>Transportation and warehousing</b>	1.1%	2.6%	2.7%	1.0%	
<b>Information</b>	1.4%	0.6%	0.6%	0.9%	
<b>Finance activities</b>	2.6%	1.7%	1.9%	1.6%	
<b>Real estate</b>	3.2%	2.6%	4.7%	5.5%	4.3%
<b>Professional, scientific and technical services</b>	3.8%	3.1%	5.6%	6.0%	
<b>Management of companies and enterprises</b>	0.2%	0.0%	0.5%	0.0%	
<b>Administrative waste management services</b>	2.9%	2.7%	5.1%	3.7%	
<b>Education</b>	0.8%	0.4%	1.5%	1.3%	
<b>Health Services</b>	11.2%	13.6%	8.6%	3.4%	3.6%
<b>Arts, entertainment and recreation</b>	1.1%	2.6%	2.1%	8.8%	1.7%
<b>Accommodation and food services</b>	6.4%	6.8%	9.1%	13.9%	13.2%
<b>Other services, except public administration</b>	6.7%	6.3%	5.9%	7.2%	7.4%
<b>Government</b>	19.7%	31.0%	16.3%	19.0%	22.1%

\*Data suppressed for nondisclosure.

**Table 5. Share of employments (2015), by industry for Mesa, Montrose, Ouray, Saguache, San Miguel Counties and the State of Colorado**

[Source: Colorado Department of local Affairs (2015).]

County	Mesa	Montrose	Ouray	Saguache	San Miguel	Colorado
<b>Agriculture</b>	3.1%	6.0%	5.0%	36.1%	1.7%	1.5%
<b>Mining</b>	3.6%	0.4%	4.6%			1.1%
<b>Utilities</b>	0.3%	1.1%			0.1%	0.3%
<b>Construction</b>	7.2%	8.8%	11.0%	5.5%	9.9%	6.5%
<b>Manufacturing</b>	3.9%	7.0%	3.6%	2.1%	2.2%	4.7%
<b>Wholesale trade</b>	3.7%	2.4%	0.4%	4.8%	0.6%	3.5%
<b>Retail Trade</b>	11.9%	12.5%	7.9%	6.0%	6.9%	9.6%
<b>Transportation and warehousing</b>	3.8%	3.1%		1.7%	0.8%	2.8%
<b>Information</b>	1.1%	1.0%	0.4%		1.1%	2.4%
<b>Finance activities</b>	3.1%	2.1%	2.1%	0.6%	1.6%	4.0%
<b>Real estate</b>	3.6%	4.0%	5.5%	2.1%	9.2%	3.4%
<b>Professional, scientific and technical services</b>	4.9%	4.2%	8.8%	2.3%	7.9%	9.1%
<b>Management of companies and enterprises</b>	0.2%	0.6%			0.1%	1.2%
<b>Administrative waste management services</b>	5.2%	3.7%	3.2%		4.8%	6.0%
<b>Education</b>	0.9%	0.6%	1.3%	1.8%	2.1%	2.0%
<b>Health Services</b>	13.5%	10.9%	3.5%	4.1%	3.8%	9.8%
<b>Arts, entertainment and recreation</b>	1.9%	1.5%	4.1%	2.2%	10.6%	2.5%
<b>Accommodation and food services</b>	8.6%	6.5%	17.1%	3.6%	17.9%	8.5%
<b>Other services, except public administration</b>	6.1%	7.1%	6.2%	5.4%	7.2%	5.9%
<b>Government</b>	13.3%	16.5%	14.7%	20.2%	11.2%	15.2%

\*Data suppressed for nondisclosure.

In addition to describing the share of employment by industries, results from an economic base analysis is also presented here to further inform which industries are the driving force, and which industries survive because the base industry exists. Base industries are important because they bring outside dollars to an economy, much like an export, and serve as an anchor for other industries, which would otherwise not exist. County-level economic base analyses for the GMUG analysis area are compiled using results from Colorado’s demographer office within the Department of Local Affairs (DOLA 2017). Summary findings on the most important economic drivers for each counties are highlighted here:

- Delta County: retirees are important drivers because they spend their savings, pensions, and other non-labor income locally. Agriculture and regional services (like construction and health care) are also important drivers. Commuters and mining are also important drivers, but their impact is less now due to layoffs at coal mines. A large commuter base indicates that many residents travel outside of the county in order to obtain employment.
- Fremont County: retirees and governments are important drivers for the county.
- Garfield County: Regional Services are important. Regional Services are industries that may provide Direct Basic services/goods to outside consumers, and services and employment to local residents, i.e., telephone services. Outside dollars may be used to maintain telephone services to nonlocal residents, employment for local residents, and would also be used to support Direct Basic industries. Government, tourism, and retirees are also important drivers for the county.
- For Gunnison County, tourism is important as visitors bring in outside dollars to the local economy. Regional services, government and retirees are also important drivers for the county.
- For Hinsdale County, tourism and retirees are important drivers.
- For Mesa County, regional service is relatively important. Retirees, tourism, and government are also important drivers, however, their relative importance are similar to other industries in Mesa County (mining, agriculture, etc.).
- Montrose County: regional service is relatively important. Retirees and agriculture are also important drivers.
- For Ouray County, tourism and retirees are important drivers, because visitors bring in outside dollars to the local economy, while retirees spend their pensions and other non-labor income in the area.
- For Saguache County, production agriculture as well as the agricultural services industry are the most important drivers. Retirees are also important for the county.
- For San Miguel County, tourism is the most important driver. This includes resort-based tourism, other tourism-related service industries, as well as second home residents. Retirees are also important for the county because they spend their pensions and other non-labor income in the area.

## Chapter 3. Conditions and Trends of the Social Environment

### Social Sustainability

Sustainability is a complex idea focused around intergenerational equity. The 2012 Planning Rule defines social sustainability as *the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another and support vibrant communities* (36 CFR §219.19). Social sustainability can be broad and complex and can often not be easily measured and addressed. This is in large part due to the differing sustainability desires and values people hold, how they connect to the landscape and how they would like to see the Forest contribute to their definition of vibrant communities.

The factors of social sustainability can differ amongst individuals, however generally many factors relate to interactions and relationships, culture, leisure, amenities, income, employment and job satisfaction, affordable housing, and health. One way of examining social sustainability is to understand the views and values held by individuals or groups and how they would like the Forest to contribute to social sustainability. What people value and how they prioritize their values helps to determine what they would like to see the Forest contribute to social sustainability and if the values they prioritize exist in the surrounding area.

## Evaluating Social Sustainability in the GMUG Area of Influence

### Population and Age

Population growth in the GMUG analysis area kept pace with the statewide population growth rate between 1990 and 2016. Colorado was the fourth fastest growing state in the nation over this period (U.S. Census Bureau 1990 and U.S. Census Bureau 2017). Population growth was not evenly distributed across the planning area. Garfield, Ouray, and San Miguel counties more than doubled in population between 1990 and 2016. In contrast, Delta, Fremont, and Saguache counties experienced relatively slow population growth. The Colorado State Demography Office forecasts that the GMUG analysis area will continue to grow through 2050 (DOLA 2016). Population growth can contribute to community vibrancy, as new residents bring different customs and cultures to a local area. However, these same characteristics can also strain existing social networks and lead to conflict due to competing norms and values.

**Table 6. Population characteristics in the GMUG analysis area**

[Source: U.S. Census Bureau (1990) and U.S. Census Bureau (2017).]

County	Population (1990)	Population (2016)	Population Growth, 1990-2016	Median Age (2016)	Share of Population 65 Years and Over	Share of Population 18 Years and Under
Delta	20,980	30,442	45%	47.7	25%	20%
Fremont	32,273	47,446	47%	44.8	21%	16%
Garfield	29,274	58,887	101%	36.6	12%	25%
Gunnison	10,273	16,408	60%	34.6	12%	17%
Hinsdale	467	788	69%	51.5	26%	20%
Mesa	93,145	150,083	61%	39	18%	22%
Montrose	24,423	41,471	70%	44.8	22%	22%
Ouray	2,295	4,857	112%	53.5	26%	16%
Saguache	4,619	6,389	38%	48.3	21 %	22%
San Miguel	3,653	8,017	119%	41.8	12%	19%
Colorado	3,294,394	5,540,545	68%	36.6	13%	23%

Overall, the population of the GMUG analysis area accounts for only 7 percent of Colorado's population, but 20 percent of its land base (U.S. Census Bureau 2017). This indicates that the GMUG analysis area has low population density. Indeed, every county in the analysis area is less densely populated than the state overall. Mesa County has the highest population density, with 45 people per square mile. Hinsdale County has the lowest population density, with less than one person per square mile. Colorado has 53 people per square mile (U.S. Census Bureau 2017). This suggests that the GMUG analysis areas offers rural character, including abundant open space. The GMUG National Forests contribute to the availability of natural amenities in the analysis area. Areas with low population density, however, are also more likely to have relatively poor access to urban amenities, such as transportation and communication infrastructure, hospitals, and retail businesses.

Natural amenities often attract residents who are not tied to urban labor markets. In the GMUG analysis area, Hinsdale, Ouray, and Saguache counties have particularly high shares of retirees. Approximately 25 percent of residents in these counties are 65 years or older and their median ages are near 50 years (U.S. Census Bureau 2017). A population's age structure can influence the relationship between people and national forests. For example, some older residents may face mobility constraints that affect their outdoor recreation preferences.

The 2012 planning rule directs national forests to engage youth to better connect young people to public lands. In general, the GMUG analysis area's population skews older and only Garfield County has a higher share of young people than the state overall. The National Visitor Use Monitoring survey for the GMUG shows that approximately 15 percent of visitors to the Forest are 19 years or younger (USDA Forest Service 2016). In all GMUG analysis area counties, youth make up a greater share of the total population than the share of youth visits to the Forest. This suggests that youth are less likely to engage with the Forest than people in other age groups.

### **Values, Beliefs, and Attitudes**

Several cities and counties in the GMUG analysis area have conducted citizen surveys to measure residents' satisfaction with their communities. Resident surveys indicate overall high levels of satisfaction (ETC Institute 2013, ETC Institute 2016, NRC 2017). Satisfaction with recreational opportunities was particularly high in some of the GMUG analysis area communities (ETC Institute 2013, NTC 2017). However, concern about economic opportunities was common in the communities (ETC Institute 2016, NRC 2017). Seventy percent of Mesa County residents surveyed in 2013 rated job opportunities in the community as "fair" or "poor" (ETC Institute 2013).

The City of Montrose resident satisfaction survey results show that city residents are largely satisfied with quality of life and community parks, but few respondents are satisfied with available job opportunities. However, residents rated improvement in natural amenities – trails and parks – as more important than improvements in tourism-related businesses (ETC Institute 2016). Forest management actions have the potential to affect quality of life, particularly as it relates to outdoor recreation opportunities and the availability of open space, as well as local employment opportunities.

Gunnison County residents identified connection to nature as one of their core community values (Gunnison County 2015). Healthy and active lifestyles – another community value – are also influenced by recreational opportunities on the Forest. Gunnison County public input reveals

concern about economic opportunities, but with the caveat that other values such as sense of place and quality of life should be considered when evaluating opportunities for economic growth (Gunnison County 2015).

County master plans also emphasize the importance of sustainable economic growth that provides diverse job opportunities, reduces unemployment and poverty, while protecting the rural character and natural amenities that characterize many communities in the GMUG analysis area (Fremont County 2015, Saguache County 2015).

Public surveys and county planning documents reveal considerable similarity in public attitudes across the GMUG analysis area. Residents seem to agree that their communities are special because of abundant natural amenities and outdoor recreation opportunities, which contribute to sense of place and quality of life. However, residents across the GMUG analysis appear concerned with economic opportunities in their communities. Residents report relatively low levels of satisfaction with employment opportunities and resources for job-seekers. The core concern present in many of these surveys and plans is expressed clearly in the Delta County public involvement plan for their master plan: “How do we create opportunities for everyone to thrive while protecting the things that make Delta County unique?” (Delta County 2017).

Across the GMUG analysis area, approximately 70 percent of the land is federally managed (Headwaters Economics 2017). As a major land manager in the GMUG analysis area, Forest Service management actions have the potential to affect the future of the counties – both in terms of quality of life and economic opportunities. Timber harvesting, mining, livestock grazing, and outdoor recreation on the Forest contribute to economic opportunities in the GMUG analysis area. These multiple uses and ecosystem services are discussed in the final section of this chapter.

## **Environmental Justice**

U.S. Census Bureau data is used to determine whether the populations residing in the study area constitute an “environmental justice population” through meeting any of the following criteria:

- At least one-half of the population is of minority or low-income status; or
- The percentage of population that is of minority or low-income status that are “meaningfully greater” is at least five (5) percentage points higher than for a comparable geographic area.

Additionally, it is important to note that Forest Service management actions may affect minority populations, low-income populations, or Tribes even if they do not reside in the immediate planning area. This may be especially true for Tribes that may not reside in the planning area but have a cultural connection to the area.

Two approaches were taken to identify whether minority populations or low-income populations in the GMUG analysis area met the criteria for environmental justice populations. The first approach evaluated minority populations and low-income populations at the county level and compared county level data to state level data. Given the geographic scale and the lack of site specificity of management actions at the Forest Plan level, focusing the examination at the county level is appropriate. The results from this county level approach are discussed below. However, since county level data may not reflect specific areas where minority populations or low-income populations may exist, a second approach comparing block group data within the GMUG boundaries to the associated county-level data was also conducted. Given the amount of

data for the numerous block groups across the ten counties, detail results are provided in the planning record. While the focus of the below discussion is on the county level information, the two approaches together provide a broad scale and finer scale examination for identifying if any low-income populations or minority populations constitute environmental justice populations. Again, given the broad nature of forest planning and the use of the GMUG by residents countywide, the emphasis is on the county-level approach and results.

The area analyzed in the first approach includes the ten counties that make up the GMUG analysis area: Delta, Fremont, Garfield, Gunnison, Hinsdale, Mesa, Montrose, Ouray, Saguache, and San Miguel counties. Minority populations were identified using 2015 data from the U.S. Census Population Estimates program which provides estimates for the resident population by age, sex, race, and Hispanic origin at the national, state and county scales. Data for the identification of low-income populations are from the U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) 2015 estimates, which are the latest available at the time of writing. The U.S. Census Population Estimates program has released data for 2016 for minorities, however, for consistency with the SAIPE data, the 2015 Population Estimates are used. The SAIPE program annually produces single year poverty estimates for states, counties, and school districts. The U.S. Census Bureau suggests using SAIPE data for poverty estimates for counties or school districts, especially for areas with populations of 65,000 or less (U.S. Census Bureau 2016a). Estimates from SAIPE and the Population Estimates program are used in federal funding allocations.

Table 7 provides population estimates and the percent of population by minority categories and the percent in poverty for the ten counties of the GMUG analysis area and the State of Colorado for 2015. Also identified in the table is the five percentage points greater than the State of Colorado criteria that is being used as the “meaningfully greater” threshold. Based upon the 2015 data, several counties have minority populations and low-income populations that meet the criteria to be identified as environmental justice populations. Fremont and Montrose counties both have low-income populations that have been identified as environmental justice populations. The Hispanic or Latino populations in Garfield and Saguache counties meet the criteria to be identified as environmental justice populations. Additionally, the total minority population and the low-income population in Saguache County have also been identified as environmental justice populations based upon the criteria discussed above. In addition to these identified environmental justice populations, there are several Tribes affiliated with the GMUG planning area due to the historical and traditional cultural connections to the resources and landscape of this area. Tribes that may have concerns about potential Forest Service management practices and decisions and their effects on resources, uses, or areas of cultural importance would be considered as environmental justice populations as well. See the *Cultural and Historic Resources and Uses* and the *Area of Tribal Importance* assessments for more information.

**Table 7. Share of minority population and share of people in poverty, 2015 estimates**

[Source: U.S. Census Bureau (2016b) and U.S. Census Bureau (2016c).]

County	% White Alone	% Black or African American Alone	% American Indian and Alaska Native Alone	% Asian Alone	% Native Hawaiian and Other Pacific Island Alone	% Two or More Races	% Hispanic	% Total Minority Population	% Poverty, All Ages
Colorado	87.5%	4.5%	1.6%	3.2%	0.2%	2.9%	21.3%	31.3%	11.5%
5% Points Greater	9.5%	6.6%	8.2%	5.2%	7.9%	26.3%	36.3%	16.5%	9.5%
Delta	94.9%	0.8%	1.4%	0.9%	0.1%	1.9%	15.3%	18.6%	15.8%
Fremont	91.4%	4.0%	1.9%	1.0%	0.1%	1.7%	13.2%	20.9%	17.2%
Garfield	94.2%	1.2%	1.8%	0.9%	0.2%	1.8%	28.1%	31.2%	10.3%
Gunnison	94.2%	0.5%	2.6%	0.9%	0.0%	1.8%	9.4%	12.8%	12.5%
Hinsdale	95.2%	0.5%	1.2%	0.6%	0.0%	2.5%	3.9%	8.1%	10.9%
Mesa	94.1%	1.0%	1.5%	1.0%	0.1%	2.3%	14.4%	18.4%	14.1%
Montrose	94.1%	0.8%	1.9%	0.9%	0.3%	2.0%	20.5%	24.0%	17.7%
Ouray	96.5%	0.2%	0.6%	0.6%	0.1%	1.9%	5.9%	8.8%	9.4%
Saguache	92.1%	1.0%	3.2%	0.9%	0.0%	2.7%	37.8%	42.6%	29.6%
San Miguel	95.3%	0.8%	1.3%	0.9%	0.1%	1.7%	10.2%	13.5%	11.0%

### Protection of Children

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks (April 21, 1997), recognizes a growing body of scientific knowledge which demonstrates children may suffer disproportionately from environmental health risks and safety risks. These risks arise because (1) children’s bodily systems are not fully developed, (2) children eat, drink, and breathe more in proportion to their body weight, (3) their size and weight may diminish protection from standard safety features, and (4) their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. As noted above, the GMUG analysis area has relatively small youth populations compared to Colorado overall. Nevertheless, youth may still be uniquely affected by Forest Service management actions that affect environmental quality.

## **Chapter 4. Conditions and Trends of GMUG Contributions to Social and Economic Sustainability**

The GMUG provides a number of contributions that affect social, cultural, and economic conditions. These contributions include ecosystem services and multiple uses from the Forest that provide benefits to people either directly or indirectly. Forest infrastructure – such as roads and transmission lines - also benefit people and communities. Management of the GMUG, in terms of its operations, employees, and connection to institutions and people outside the National Forest boundary are also an important contribution to the area socially and economically. This section describes the conditions and trends of the major contributions the GMUG provides that affect the socioeconomic sustainability in the area of influence: multiple uses and ecosystem services, infrastructure, and agency operation (having a presence in the community).

### **Multiple Uses and Ecosystem Services**

The provision of multiple uses and ecosystem services are two of the major contributions to social and economic sustainability of the Forest in the broader landscape. While ecosystem services are components of nature that contribute to human well-being, and multiple uses include outdoor recreation, range, timber, watershed, wildlife and fish, these contributions are closely intertwined and best described in an integrated manner.

The concept of ecosystem services makes explicit the various ways humans benefit from and depend on the natural world. This dependency extends from essential support for life (oxygen, water and food) to security (e.g., natural regulation of insects, disease, and fire regime) and quality of life (scenic beauty and other cultural services such as outdoor recreation and spiritual values). Understandably, all biotic resources in existence are important and contribute to human well-being directly or indirectly. In order to have a more operationally focused way of defining, classifying, and measuring ecosystem services, the concept of Final Ecosystem Goods and Services (FEGS) was developed. Final Ecosystem Goods and Services are the components of nature, directly enjoyed, consumed or used to yield human well-being (Boyd and Banzhaf 2007). This analysis draws partly on this concept as it facilitates a more explicit discussion on the relationship between landscape, resources and beneficiaries – people who obtain benefits from nature (Ng and Miller 2014).

When considering ecosystem services in forest plans, it is Forest Service policy to identify and consider a set of key ecosystem services provided by the plan area, rather than trying to identify and evaluate information about all ecosystem services that may be present in the plan area (FSH 1909.12, ch. 10, sec. 13.12). In the effort to better focus and highlight contributions of National Forest management, key ecosystem services are defined as those services that are important in the area(s) of influence or the broader landscape and, are likely to be influenced by the land management plan.

These services – along with components of multiple uses – are described here with special emphasis on the various ways they contribute to people, communities, and ultimately social and economic sustainability. More detailed information on various ecosystem services are provided within other assessments including recreation, range, timber, soil and water, infrastructure, and more.

## Forage for Grazing

Forage for livestock grazing is a key ecosystem service provided by the GMUG since it is important in the area of influence or the broader landscape, while also likely to be influenced by the land management plan.

Range encompasses permanent forage-producing rangelands and temporary or transitory forage-producing conditions (such as after timber harvest or fire) that may sustain ungulate species of wildlife or to graze domestic livestock. Since domestic livestock grazing occurs in the plan area, available information are identified on how the GMUG currently provides grazing forage for domestic livestock and ungulate species. These include information regarding the availability of forage, such as allotment maps, and information collected from transect data and inspection reports (see rangeland resource section). Various investments, including infrastructures, are necessary in order to support the Forest’s livestock grazing program.

**Table 8. Infrastructure supporting the provision of forage for grazing, by district**

District	Fences (miles)	Water Systems	Handling Facilities	Buildings	Cattle Guards	Total
Grand Valley	396	822	103	21	49	1,391
Gunnison	1,045	700	21	6	139	1,911
Norwood	205	538	10	6	8	767
Ouray	281	396	17	11	51	756
Paonia	363	1,139	23	7	33	1,565
<b>Total</b>	<b>2,290</b>	<b>3,595</b>	<b>174</b>	<b>51</b>	<b>280</b>	<b>6,390</b>

Compared with range conditions in 2005, the Forest now has more acres in good condition, and fewer acres in fair and poor conditions: 11,901 acres poor (1%); 375,986 fair (28%); 915,653 good (67%); 53,656 excellent (4%). Conditions are trending mostly upward or stable: 359,952 acres upward trend (27%); 968,418 stable (72%); 18,266 downward (1%). Note that the trend is very similar to 2005’s trend (26% upward, 72% stable, and 1% downward). There exist various factors, drivers or risks affecting this provisioning service, including, but not limited to drought, climate change, invasive species, and conflict between domestic sheep grazing in bighorn sheep habitat. With warmer and drier winters in the foreseeable future, there will be less runoff to fill earthen tanks or to recharge springs, for example. If the monsoon season is disrupted, there would not be additional summer moisture that helps recharge the systems for the regrowth on forage plants. If the grazing season is disrupted, it may move forage resource condition similar to those found in Arizona (Prescott, Tonto, and Coronado, for example), where yearlong grazing is prevalent, but with far fewer numbers.

In terms of usage, there are currently 225 grazing permittees, 150 active allotments, with a total of 253,411 permitted AUMs. Usage had been downward trending since 2006 (2006 Comprehensive Evaluation Report), when the Forest had 246 grazing permittees, 174 active allotments, and 290,000 permitted AUMs. This decrease from 2005 to 2016 is primarily due to sheep allotments being closed. Domestic cattle and sheep grazing on the Forest supports approximately 770 full- and part-time jobs, and \$21 million in labor income on an annual average basis for the area of influence. There exist various factors, drivers or risks affecting

grazing on public lands, such as domestic sheep/bighorn sheep conflicts, livestock prices and the cost to purchase base property.

In addition to its contribution to economic activity in the GMUG analysis area, livestock grazing on the Forest contributes to social sustainability. Ranch ownership can strengthen ties to the community, fellow ranchers, and families. Research has found that many ranchers identify the value of ranching as being closer to the earth, providing a desirable place to raise a family, and providing a satisfying way of life (Smith and Martin 1972). Interaction with other ranchers builds networks and social capital (Ooi et al. 2015). Such interpersonal relationships contribute to a sense of belonging and quality of life.

### **Outdoor Recreation and Human Enjoyment of Fish and Wildlife Species**

Settings and opportunities supporting outdoor recreation activities, including fishing and hunting, are key ecosystem services (cultural service) on the GMUG since they are important in the area of influence or the broader landscape, and also likely to be influenced by the land management plan. The Forest has diverse recreational opportunities ranging from nonmotorized activities such as hiking, fishing, snowshoeing, and skiing to motorized activities such as dirt biking, four-wheeling, and snowmobiling. Forest lands include a variety of developed recreation sites, many areas for dispersed recreation, recreation rentals, and several other unique recreation areas. Outdoor recreation opportunities on the GMUG also contribute to visitors' quality of life. The Forest provides an area for friends and family to gather, to pass on traditions, and to strengthen relationships. Outdoor recreation opportunities on the Forest also contribute to physical and mental health and well-being (Godbey 2009).

Non-local visitors bring new money into the area economy with their tourism spending; while local recreationists also spend money in their communities. Accounting for all recreation activities on the GMUG, spending by local visitors support about 290 full- and part-time jobs, and tourism spending by nonlocal visitors support an additional 900 total full- and part-time jobs on an annual average basis. The labor income associated with these jobs is estimated at about \$8.2 million for local recreation activity, and about \$24 million for nonlocal visitors on an annual average basis. These contributions are primarily in the private sectors, and include both direct and indirect jobs and income in the area economy.

For a complete description of recreation resources, tourism, and scenery on the Forest, see the *Recreation Assessment* and *Scenic Character Assessment*. The following highlights just a few of the major aspects of recreation opportunities (including the human use of fish and wildlife species), with an emphasis on human enjoyment and economic contributions.

#### **Motorized Recreation**

While Downhill Skiing, Viewing Natural Features, Hiking/Walking, Viewing Wildlife and 'Relaxing' are the top five activities in terms of participation on the GMUG, many visitors also participate in motorized recreation activities (USDA Forest Service, 2016). 'Driving for Pleasure' had the highest percentage of participation (13.6 %) among all motorized recreation. In terms of main activities (visitors were asked which activity was the primary reason for coming to the Forest), 7.6% of all visits were for 'Driving for Pleasure'. Other motorized recreation include Snowmobiling (4.9 %), Motorized Trail Activity (2.9%) and OHV Use (1 %). Note that while only 1% of all visitors stated that OHV Use was their primary activity, 3.2 % of all visitors participated in this form of recreation. Although OHV use is not one of the top activities on the

Forest, motorized recreation plays an important role for Colorado's economy as a whole. According to one recent study, motorized recreation contributed \$914 million in direct sales in Colorado during the 2014–2015 season, including \$70 million in state and local business taxes (Colorado Off-Highway Vehicle Coalition, 2016).

### ***Hunting***

There are 17 Game Management Units that overlap the GMUG, in addition to 5 more in the broader landscape influenced by the plan area. Deer and elk hunting occurs extensively across the entire plan area and in the broader landscape. In total, the 23 Game Management Units in the broader landscape support approximately 49,000 elk (17.5% of the statewide Colorado population estimate) and 99,000 deer based on 2016 post-hunt population estimates. The population of the hunted species are stable. Based on CPW hunter harvest statistics, numbers of hunters in the plan area and broader landscape also appear to be stable. However, there is a concern of long-term declining license sales statewide. 42,514 elk hunters were issued hunting licenses in the 17 Game Management Units overlapping the plan area in 2016, resulting in 7,965 elk harvested and a total of 234,856 recreation days. 8,997 deer hunters were issued hunting licenses in the 17 Game Management Units overlapping the plan area in 2016, resulting in 5,165 deer harvested and a total of 45,450 recreation days.

Other hunted species include moose (primarily on the Grand Mesa), Rocky Mountain bighorn sheep, Merriam's wild turkey (particularly in the Uncompahgre Plateau and North Fork Valley Geographic Areas), dusky grouse (Forest-wide) and other small game species (such as white-tailed ptarmigan, squirrels, rabbits, etc.).

### ***Fishing***

Colorado Parks and Wildlife sold over 1 million fishing licenses to residents and nonresidents in 2016; and recreational fishing related activities contributed \$1.9 billion in total economic impact to Colorado (CPW 2017). On the Forest, common species pursued by anglers include Brook, Brown, Rainbow, and Cutthroat trout. Using survey data collected at various stocked reservoirs in Colorado (several of the sampled reservoirs were on the Grand Mesa), Loomis and Ng (2012) found that anglers fishing for trout received approximately \$195 per angler per day in non-market economic benefits. Since the study employed non-market valuation techniques, the estimated economic benefits represent the enjoyment anglers obtain from, or willingness to pay for, the recreational fishing experience above and beyond those monetary expenditures incurred on the trip.

### ***Non-consumptive Uses and Enjoyments of Wildlife Species***

Species supported by habitats on the GMUG are enjoyed—both consumptively and non-consumptively—by local and nonlocal residents alike. There exist diverse types of uses and benefits that people derive from wildlife resources that are considered non-consumptive or passive in nature. These include wildlife viewing, photography, nature study, etc. For instance, **existence values** are benefits people derive from the very existence of species, even when the individual has not ever seen, or planned on ever seeing, the species on the Forest. For example, some local residents and nonlocal visitors are willing to pay for the preservation of wildlife through donations and/or taxes, even if they know that they may never actually encounter a particular species. **Vicarious use value** is closely related to existence values. Vicarious use value

occurs when people gain pleasure from pictures, broadcasts, or written accounts of nature, including plants and wildlife species on the GMUG. Another form of existence value is **intrinsic value**, where, wildlife has a right to exist, and therefore, has value independent of any human involvement. Intrinsic value is the human perception of that value. **Option values** exist when people are conscious that they might want to enjoy (either consumptively or non-consumptively) some species of fish, plant, or wildlife on the Forest in the future, but are unsure that it will be available at that time, and they may be willing to pay a premium to ensure its future availability. **Quasi-option value**, on the other hand, is the potential benefits of new—or yet-to-be discovered—species and uses of plants and wildlife for a variety of benefits, including medicinal, agricultural, and other uses. This is based on the fear that any further destruction of habitats and species on the Forest may obliterate future opportunities for beneficial discoveries. Lastly, there are **bequest values**, where individuals attach value from the fact that plant, fish, and wildlife species on the Forest will be available for the enjoyment of future generations.

### ***Drivers and Risks Affecting the Provisioning and Human Enjoyment of Outdoor Recreation***

Access is one of the most important aspects of providing opportunities to the public to engage in hunting and fishing activities across the plan area. Road access is a complex driver due to the need to balance reasonable access with the need to lesson motorized disturbance. Less motorized disturbance equates to higher hunter success rates. There are management challenges with providing opportunities for quiet use/access for backcountry hunters and anglers, with those users that rely more heavily on motorized routes for hunting opportunities.

Drought, climate change, and invasive/noxious species affecting habitat quality and species distributions can also affect the provision of outdoor recreation as an important cultural service. Conflict between domestic sheep grazing in bighorn sheep habitat may also affect different aspects of human enjoyment of wildlife species.

Infrastructure, such as roads, trails, and fences are other examples of drivers. There are over 19,000 miles of roads in the plan area and broader landscape combined (this includes all open, decommissioned, administrative, and roads outside the plan area boundaries but within the broader landscape) and 2,290 miles of fences in the plan area. These factors are likely more influential on the broader landscape. Roads and fences affect habitat connectivity, movement patterns, and distributions of big game species. Roads affect hydrology and water quality which influences aquatic habitat quality for fisheries (there is no single watershed in the plan area and broader landscape where hydrology is not influenced by roads or trails).

Other examples of risks include disturbances other than hunting, particularly motorized and non-motorized modes of travel that displace animals and affect distribution. On the broader landscape, development (primarily residential housing) on private lands adjacent or near the plan area boundaries affects big game movement corridors, migration routes and affects animal distribution patterns. Roads, particularly highways, are a significant cause of mortality for big game species. The GMUG National Forests are within Regions 3 and 5 of the Colorado Department of Transportation (CDOT). The majority of the plan area is in CDOT Region 3. In 2016, 2,086 and 2,065 animals were reported killed in wildlife-vehicle collisions in CDOT Regions 3 and 5, respectively. The majority of those animals are deer, with elk being the second highest hit. A large percentage of those wildlife-vehicle collisions occur on highways within and especially in the broader landscape of the plan area.

There are numerous ecological processes and functions that provide a foundation for the provision of this important cultural service. For example soil, water quality, hydrologic function, aquatic habitat conditions, range conditions, wildlife habitat cover and forage, and habitat connectivity are important ecosystem processes and functions for resiliency and sustainability of fish and wildlife species. Factors that cause soil loss and loss of water retention and water quality, reductions in forage and cover, loss of terrestrial and aquatic habitat connectivity, and introductions or increases in non-native species (particularly noxious or invasive plants and aquatic nuisance species) are detrimental to these ecosystem services. Areas in the plan area and broader landscape that function as big game migration corridors or that are important for animal migratory patterns are essential. Maintaining habitat connectivity and ecosystems within their natural range of variability, through the use of prescribed fire and other vegetation management activities consistent with species needs, and in consideration of climate change influences, will continue to support the foundation for hunting and fishing.

### **Cultural, Historical, and Sacred Sites**

Cultural, historical and sacred sites have been identified as one of the key ecosystem services provided by the Forest since it is important in the area of influence or the broader landscape, while also likely to be influenced by the land management plan.

The lands of the present day GMUG have been supporting cultural traditions for many generations and its landscapes serve as a reminder of traditions shared across time. The historic features and landscape features that hold these memories help people form attachments to places by providing an understanding of their place in the natural, spiritual, and cultural environment.

The Ute people once inhabited much of present day Utah, Colorado, and northern New Mexico. The lands in the GMUG analysis area were home to Ute Indian people from approximately 1300 until 1881, when they were forcibly removed to reservation lands in Utah. However, evidence of the Utes' ties to Forest lands is still visible today. The soft inner bark of ponderosa pines provided food and medicine to the Utes. These culturally scarred trees can be found across the Uncompahgre Plateau on the GMUG. These trees capture the history of the Ute Indian people in Colorado. Today, visitors to the GMUG also seek out these trees for historical and cultural connection.

The GMUG is also home to many sites that chronicle American westward expansion. Historical rail lines, mines, cabins, and other sites dot the Forest. By preserving and facilitating the interpretation of these resources, GMUG management helps to pass on the cultural legacy and heritage values of the Forest lands to present and future generations.

For more details on the cultural and historic resources in the plan area and their importance to local and tribal communities, see the *Cultural and Historic Resources* assessment.

### **Solitude, Spirituality, and Sense of Escape**

Solitude, spirituality, and sense of escape has been identified as one of the key ecosystem services provided by the Forest since it is important in the area of influence or the broader landscape, while also likely to be influenced by the land management plan.

These inspirational benefits enhance the quality of life of those who hold these values. Both local community members and visitors enjoy these benefits. People can be inspired by, and connect with nature, in all recreation opportunity spectrum classes (see the Recreation assessment for a

description of recreation opportunity spectrum). For some user groups, such as backpackers and backcountry skiers, primitive and semiprimitive nonmotorized settings provide the most inspirational opportunities associated with solitude. For motorized and mechanized recreation users, roaded natural and rural settings provide the most inspiration or opportunities to connect with nature through various activities such as UTVing and camping in developed campgrounds. For others, simply knowing that wild lands (such as wilderness), wildlife (such as black bear and lynx) and wild, scenic, and recreational rivers exist in the Forest is a benefit, even if they never plan to visit.

For more details on specific areas where visitors may experience inspiration through solitude or spiritual connection to nature on the Forest, please see the *Recreation* and *Designated Areas* assessments.

## Timber

Timber and biomass have been identified as one of the key ecosystem services provided by the Forest since it is important in the area of influence or the broader landscape, while also likely to be influenced by the land management plan. Timber harvests, including salvage and restoration activities such as thinning provide forest products and contribute to the local economy, in addition to being an important tool in shaping the structure and composition of the forest. See the *Timber and Vegetation Management* assessment for data on harvest volume and other information on forest health.

Timber harvest directly supports employment and income in logging and wood manufacturing firms and also indirectly contributes to a number of other industries, from transportation, local government to other support sectors in the local economy. Based on cut volumes in 2014, commercial timber harvests on the GMUG support a total of 630 full and part-time jobs, and approximately \$24 million in labor income on an annual average basis.

### **Market and Timber Processing Capacity**

Counties containing mills receiving GMUG timber were identified in order to determine the timber-processing area for the Forest. This area includes 9 counties: Delta, Fremont, Garfield, Gunnison, Mesa, Montrose, Ouray, Saguache and San Miguel counties in Colorado. Within the Forest timber-processing area there were 15 facilities operating as of 2016: 9 sawmills, 1 post and small pole facility and 5 log home manufacturers; in addition, there was 1 sawmill and 1 co-located sawmill and post and pole plant that were idle during that year (Table 9) (McIver et al. 2017).

**Table 9. Active facilities in the timber processing area of the Forest**

[Source: McIver et al. (2017).]

Type	2003	2007	2012	2016
Sawmills	16	10	11	9
Log Home	15	6	5	5
Log Furniture	3	1	0	0
Post and Pole	1	1	2	1
Total	35	18	18	15

### **Timber Processing Capacity and Use by Size Class**

Factors influencing the trend and sustainability of the Forest’s contribution include varying budget level for timber management and sales administration, as well as the housing market, which also fluctuates in cycles. One major risk and driver affecting the continued provision of Forest’s commercial timber supply is the large amount of spruce mortality from beetle. While efforts have been underway to increase harvest of these volumes in recent years, it is only sustainable in the near short- to medium-term because the larger – and financially viable – dead trees cannot retain their value as saw or house logs indefinitely. Furthermore, in areas of extremely high mortality, it may be 100-200 years before spruce regrowth may be harvested again. But trends in these changing forest condition indicates that it has been increasingly critical for markets to expand, in order to accommodate small diameter material and salvaged timber.

Due to mill closures since 2003, capacity to process timber in the GMUG TPA has decreased from 15.8 MCF (77.5 MMBF) to 12.2 MCF (55.1 MMBF), despite technological upgrades at existing mills that expanded capacity and increased efficiency. Mills utilized approximately 55 percent of capacity in 2016 (Table 10) (McIver et al. 2017).

**Table 10. Annual capacity and capability to process trees by size class in the GMUG timber processing area, 2016**

[Source: McIver et al. (2017).]

<b>Tree DBH</b>	<b>Capability</b>	<b>Use</b>	<b>Capacity Utilized</b>
	<b>MCF</b>		<b>%</b>
Less than 10 inches	1,701	1,252	74
10 inches and over	10,534	5,516	52
<b>Total Capacity</b>	<b>12,235</b>	<b>6,768</b>	<b>55</b>

As discussed above, due to changing forest condition and the need to accommodate small diameter and salvaged material, understanding processing capacity by size class provides meaningful insights regarding the area’s industry sustainability. McIver et al. (2017) estimated that mills in the GMUG area had an existing capacity of approximately 1,700 MCF for processing smaller diameter trees (less than 10 inches dbh), out of which approximately 1,250 MCF was utilized. Therefore, mills in the area utilized approximately 74 percent of capacity to process smaller diameter trees. Note that mills have rarely operated at more than 90 percent of capacity, even during favorable market conditions (Spoelma et al. 2008; Brandt et al. 2012).

The loss of milling infrastructure throughout the West and in Colorado raises questions about the industry’s capability to process trees of various sizes (Keegan et al. 2005, 2006). Other than the challenge of adapting to a changed forest landscape (resulting to the shift away from traditional logging and toward service-type projects, such as those resulting in smaller diameter timber), there exists various issues facing forestry firms in Colorado. A recent survey indicated that a diminished forestry workforce and contractor capacity means that Colorado will face substantial challenge to mitigate various restoration needs to address forest health and prevent catastrophic wildlife (Vaughan and Mackes 2014). Challenges facing contractors include a shrunken workforce, fewer federal timber sales, competition with local fire districts, landowners’

understanding about the expense of mitigation work, and competition with illegitimate contractors (Vaughan and Mackes 2014).

## **Water Resources**

Water resources within the plan area contribute to the use and enjoyment by the public, both consumptive use including water withdrawals and diversions for agricultural, municipal, and commercial uses and non-consumptive use including water storage for flood control, hydropower, and recreation.

The provisioning of water resources have been identified as one of the key ecosystem services provided by the Forest since it is important in the area of influence and in the broader landscape, while also likely to be influenced by the land management plan. A well-functioning ecosystem helps maintain the integrity of the watersheds so that upland forests, riparian areas, and wetlands are able to filter out pollutants to help keep base loads within reasonable levels which reduce municipal and well-water treatment costs and alleviates demand for costly infrastructure. The continued provision of water resources depend upon various built infrastructure, not to mention snowpack and vegetation within the plan area that allow for storage and gradual release of precipitation. Wetlands in the plan area also provide water storage, regulation, and filtration services. Built infrastructures include over 800 authorizations for water-related infrastructure such as dams, reservoirs, ditches and pipelines on the Forest (more than any other unit in the National Forest System). For a breakdown of numbers and types of water-related uses see Assessment 11 – Infrastructure. See Assessment 2 (Air, Soil and Water) for detail regarding the existing condition of watersheds.

### ***Condition and Trends of Water Resources Provided by the Forest and in the Broader Landscape***

Water quality on the Forest is generally excellent based on the support of classified uses and attainment of numerical and narrative water standards established by CDPHE. However, 11 stream segments totaling approximately 43 miles within the plan area do not meet water quality standards due to metal concentration related to historic mining activities (USDA Forest Service, 2006). See Chapter 5 of the GMUG NF Comprehensive Assessment of Watershed Aquatic Resources (USDA Forest Service, 2005). In terms of trends in the broader landscape, among the most significant water quality challenges in the Colorado River Basin are salinity and selenium levels. The Colorado River System is naturally very saline. From 2005 to present, an annual average of approximately 7.7 million tons of salt are being measured in the river, including years of floods and drought (BOR, 2013). Historically at the USGS gauge below Hoover Dam, between 1940 and 1980, an annual average of approximately 9.3 million tons of salt was carried down the river, so the trend is toward lower salinity (BOR, 2013).

There exist various factors, drivers or risks affecting this ecosystem service, including, but not limited to vegetation management and road construction, natural disturbances (flood, drought, fire, etc.) exacerbated by climate change, and mineral exploration and development. In the broader landscape, other factors include salinity in the Colorado River Basin that comes from natural sources, irrigation, reservoir evaporation, and municipal and industrial sources, in that order (BOR, 2013).

### **Condition and Trends of the Enjoyment and Use of Water Resources**

2.8 million acre-feet (MAF) of runoff is generated annually from the GMUG (USDA Forest Service, 2006). Approximately 3,600 miles of perennial streams supply about 11,650 surface acres of lakes and reservoirs in the plan area. Two of the most prominent values sustained by water originating in the plan area include drinking and agricultural water supplies. There are 18 surface water and 42 private ground-water providers serving a combined population of about 175,000 from the GMUG (USDA Forest Service, 2006). There are approximately 1,600 surface water rights (diversionary and storage rights) within the plan area (USDA Forest Service, 2006). The plan area is the principal drinking water source (principal means 70 percent or more of the source area lies within the plan area) for 16 providers (21 separate source areas totaling 1,038,000 acres) (USDA Forest Service, 2006). The current Forest Plan includes Management Prescription 10E emphasizing municipal watersheds for the Fruita division of the Grand Mesa NF, a total of approximately 7,850 acres. All other source areas emphasize multiple use prescriptions. (USDA Forest Service, 2006).

In the broader landscape, the unregulated inflow to Lake Powell, which is a good measure of hydrologic conditions in the Colorado River Basin, has averaged a water year volume of 10.22 MAF (94% of average (period 1981-2010)) during the period from 2005 through 2012 (BOR, 2013). The Colorado River and its tributaries provide water to about 36 million people and irrigation water to nearly 5.5 million acres of land in the United States. Usage is increasing in Colorado and in the Colorado River System. In 2050, Colorado is projected to face a municipal water supply gap of 500,000 AF (CO River Dist. Annual Report, 2014). The larger Colorado River System faces a median projected imbalance between supply and demand of 3.2 MAF in 2060 (BOR, 2015).

There are many factors, drivers or risks affecting this ecosystem service, including, but not limited to, climate change/drought and other natural disturbances (flood, fire), population growth on the Western Slope of Colorado as well as all areas that rely on the Colorado River for municipal and irrigation water. Looking ahead, several potential changes to the planning and management of GMUG water resources may include:

- Fens or springs of special conservation or botanical interest could be identified and protected as Special Interest Areas (possibly Jensen, Star and McCullough).
- Desired conditions for aquatic habitat and other surface or groundwater flow dependent resources on the GMUG could be evaluated with new water development proposals or when reissuing special use authorizations
- Specific guidance for maintaining reliable drinking water supplies and perhaps protecting municipal water infrastructure from fire should be developed.
- Update location of municipal watersheds in plan (i.e., update 10E designation)

## **Contributions from Infrastructure and Agency Operations**

### **Infrastructure**

Infrastructure within the Forest can have substantial contributions to social and economic sustainability. These can include facilities for energy generation or transport, communications, water delivery, transportation (including airstrips and other aviation testing sites), or recreation.

These facilities directly affect conditions and uses within the plan area and may support delivery of goods and services in the broader landscape. Infrastructure within the GMUG can contribute to the social, economic, and cultural conditions within both the Forest boundaries and the broader social and economic area of influence. Infrastructure can directly support the delivery of goods and services, as such, their conditions can be a vital piece of the local economy.

For instance, the provision of forage for domestic livestock grazing is supported by various investments necessary in order to support the Forest's livestock grazing program, which include fences, water systems, livestock handling facilities and other buildings, cattle guards, etc. Watershed resources supported by built infrastructure is another example: over 800 authorizations for water-related infrastructure such as dams, reservoirs, ditches and pipelines on the Forest (more than any other unit in the National Forest System) are relied upon to deliver benefits to people and communities.

The *Infrastructure Assessment* provides additional detail regarding the role of infrastructure in the plan area, and doesn't make evaluations about specific facilities. Nonetheless, due to budgetary limitations, numerous infrastructure resources have had their necessary maintenance deferred. The deferred maintenance backlog is not sustainable. If not funded, numerous locations will have to be closed, which has the potential to limit access, reduce water quality, and increase demand on other infrastructure and recreation facilities.

### **Agency Operations and Presence in the Community**

Agency operations are developed to implement the Forest plan and contribute directly and indirectly to the Forest Service presence in the community. Management of the GMUG directly contributes to the local economy by employing individuals living within the area and by spending federally appropriated dollars on goods and services to carry out management programs. In 2014, expenditures on forest programs, management activities, including salary for personnel on the GMUG have support about 460 full- and part-time jobs (direct, indirect and induced) and approximately \$18 million in labor income on an annual average basis. These values are the result of Forest Service spending on restoration activities, local lodging for FS personnel, filling Forest Service vehicles at local gas stations, hiring local contractors for building maintenance, etc.

Forest Service staffs, partnerships, contracts, or agreements with the Forest Service, and other operations directly and indirectly influence the social, cultural, and economic conditions of the affected communities through demand for local goods and services, contributions to the tax base, and participation in community institutions and activities. While forest plans do not include staffing and procurement strategies, the presence and impact of Agency resources in the area of influence are considered in this analysis. In recent years, GMUG employs an average of 160 permanent employees and 150 temporary employees annually.

### **Federal Payments to State and Counties**

The GMUG makes payments to states and local governments through several programs. The Payments-in-lieu-of-taxes (PILT) program compensates local governments for the lack of property taxes on federal lands. Local governments provide a variety of services that support the use and enjoyment of the GMUG, including road maintenance and emergency services. Between 2000 and 2016, the Forest Service also made payments to counties through the Secure Rural Schools (SRS) program to offset declines in revenue-sharing payments due to lower timber

harvest volumes. The SRS program supported schools, roads, and ecosystem restoration in the GMUG analysis area. Without reauthorization for the SRS program, counties instead receive 25% payments based on a 7-year rolling average of receipts from national forests. Twenty-five percent payments are typically substantially lower than those under the SRS program.

Table 11 displays federal payments to states and counties in the GMUG analysis area. This PILT column captures payments from all federal lands in the county and the SRS and 25-percent payment columns capture payments from all national forests in the county. Including all federal payment sources in the county provides context for the relative importance of federal payments to county budgets and also enables a more clear comparison of the change in payments due to the lapse of the SRS program.

**Table 11. Federal payments to states and counties**

[Source: USDOJ (2017) and USDA Forest Service (2017).]

County	PILT (2014)	SRS (2014)	Estimated 25-percent payment (2014)
Delta	\$164,966	\$196,035	\$36,413
Fremont	\$1,097,117	\$131,579	\$10,268
Garfield	\$3,026,294	\$411,966	\$488,957
Gunnison	\$587,617	\$1,033,879	\$207,827
Hinsdale	\$140,616	\$264,508	\$62,279
Mesa	\$3,354,896	\$471,087	\$196,119
Montrose	\$2,266,958	\$340,380	\$62,663
Ouray	\$385,448	\$73,904	\$27,056
Saguache	\$976,053	\$1,134,278	\$93,370
San Miguel	\$928,867	\$87,252	\$35,986

Many of the GMUG analysis area counties saw large declines in federal payments when the SRS program was not reauthorized. Fremont and Saguache counties both receive approximately 90 percent less under the 25-percent payments program than the SRS program. Only Garfield County receives more under the 25-percent payments program compared to their SRS payments.

Payments to states and local government support public services in communities near the GMUG and contribute to employment and labor income in the counties that surround the Forest. Forest Service payments to local governments in sparsely populated and low-income areas are likely to be particularly meaningful, since these areas typically get less revenue from property, sales, and income taxes to fund local government operations.

## Summary

In the GMUG area of influence, the Unit will continue to contribute to social and economic sustainability by providing for multiple uses, ecosystem services, infrastructure and having a presence in the community. While timber harvest, ranching, recreation, and other resources

including ecosystem services will continue to play an important economic and social role in the area, individual counties may experience different levels of contributions, as well as varying degrees of progress toward the path of sustainable economic development. This is because some counties are more dependent upon retirees (sources of non-labor income); while other counties rely more on tourism, regional services, or agriculture. For this reason, different counties will experience different extents of contributions deriving from GMUG National Forest's resources and managements.

## **Current Forest Plan and its Context within the Broader Landscape**

### **Forest Plan Consistency with External Plans in the Broader Landscape**

GMUG forest plan revision effort does not conflict with county level master plans reviewed (see Values, Beliefs, and Attitudes section) regarding socioeconomic contributions. Note that Delta County's Master Plan is currently in development.

### **Potential Need for Changes**

In order to comply with the 2012 Planning Rule, the new plan will explicitly consider the Forest's roles and contributions to social and economic sustainability as well as ecosystem services. See also related assessments (Range, Timber, Recreation, etc) for additional potential needs for change.

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