Four-Forest Restoration Initiative
Draft Socioeconomic Resource Report

Prepared by:

Delilah Jaworski

Social Scientist

TEAMS Enterprise Unit

for:

Four Forest Restoration Initiative

Coconino National Forest and Kaibab National Forest

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Introduction

The Four Forest Restoration Initiative (4FRI) includes lands on four National Forests in northern Arizona – the Apache-Sitgreaves, Coconino, Kaibab, and Tonto National Forests. This report provides social and economic analysis in support of the first Environmental Impact Statement (EIS) for the 4FRI.

The 4FRI planning area includes lands in Apache, Coconino, Gila, Graham, Navajo, and Yavapai counties. The first stage of 4FRI considers portions of the Kaibab and Coconino National Forests. Coconino and Yavapai counties form the relevant study area for the first stage. Maricopa County is also included in the analysis due to the social and economic linkages between Maricopa County and the assessment area.

Communities in the vicinity of proposed treatments include Flagstaff, Munds Park, Mormon Lake, Tusayan and Williams, Arizona.

Affected Environment

Existing social and economic conditions are necessary to establish the baseline from which to estimate potential consequences of the Four Forest Restoration Initiative. The proceeding section analyzes the current conditions and trends related to the social and economic environment of the planning area, including: population and demographic changes, potential environmental justice populations, and employment and income conditions.

Population and Demographics

This section highlights population and demographic trends in the study area. Population is an important consideration in managing natural resources. In particular, population structure (size, composition, density, etc.) and population dynamics (how the structure changes over time) are essential to describing the consequences of forest management on the social environment (Seesholtz et al. 2004).

Population Growth

The study area is home to 4,162,571 people (U.S. Census Bureau 2010). **Error! Reference source not found.** displays population data for the counties, state, and nation in 1990, 2000, and 2010.

Maricopa County is by far the largest county in the study area. Maricopa County alone accounts for approximately 60 percent of Arizona's population. As a result, the study area totals are dominated by Maricopa County. These data highlight the importance of presenting socioeconomic information at a county-level; otherwise, the inclusion of Maricopa County could mask substantial changes in other counties.

The study area population growth rate mirrored Arizona's population growth rate during the two periods. However, the growth rates varied between study area counties. The population in Maricopa and Yavapai counties grew at approximately double the rate of Coconino County. Regardless, all study area counties surpassed the national population growth rate in both periods.

Rapid population growth may signal expanding economic opportunities and/or desirable amenities. Much of Coconino, Maricopa, and Yavapai counties are occupied by protected federal lands. National Forest System (NFS), Bureau of Land Management (BLM), and National Park Service (NPS) lands provide natural amenities for area residents.

Table 1. Population Change, 1990-2000 and 2000-2010

	1990	2000	Percent Growth 1990-2000	2010	Percent Growth 2000-2010
Coconino County	96,591	116,320	20.4	134,421	15.6
Maricopa County	2,122,101	3,072,149	44.8	3,817,117	24.2
Yavapai County	107,714	167,517	55.5	211,033	26.0
Study Area Total	2,326,406	3,355,986	44.3	4,162,571	24.0
Arizona	3,665,228	5,130,632	40.0	6,392,017	24.6
United States	248,709,873	281,421,906	13.2%	308,745,538	9.7%

Source: U.S. Census Bureau, 1990, 2000, and 2010

Population Density

Population density can serve as an indicator of a number of socioeconomic factors of interest – urbanization, availability of open space, socioeconomic diversity, and civic infrastructure (Horne and Haynes 1999). More densely populated areas are generally more urban, diverse, and offer better access to infrastructure. In contrast, less densely populated areas provide more open space, which may offer natural amenity values to residents and visitors. Table 2 displays the number of people per square mile for each of the counties of interest.

Table 2. Population Density

	People/Square Mile
Coconino County	7.2
Maricopa County	414.8
Yavapai County	26.0
Arizona	56.3
United States	86.6

Source: U.S. Census Bureau 2010, Table DP-1

Despite substantial gains in population since 1990, both Coconino and Yavapai counties continue to have relatively low population density. Both counties are less dense than the state and nation. In contrast, Maricopa County is much denser than the state and nation, with more than 400 people per square mile in the county.

These findings suggest that the study area, outside of the Phoenix metropolitan area, is quite rural. Low population density also points to high levels of public ownership. In all of the Arizona counties included in the analysis, a minority of the land is privately owned. Maricopa County has the highest private ownership rate, at 29 percent, but the majority of land is publicly owned (Forest Service, BLM, and State Lands) or Indian reservation land (Arizona Department of Commerce 2008).

Age and Gender

Table 3 lists the median age by county for the study area. As with other population characteristics, the median age varies substantially between counties. Coconino and Maricopa counties are relatively young with median ages below the state and national medians. In contrast, Yavapai County exceeds the state and national median ages by more than a decade. A high median age generally indicates that a relatively large number of retirees reside in the area. An area with a large percentage of retirees will earn income primarily from investments and transfer payments (e.g., dividends and Social Security), rather than salaries and wages.[1]

Table 3. Median Age

	Median Age
Coconino County	31.0
Maricopa County	34.6
Yavapai County	49.2
Arizona	35.9
United States	37.2

Source: U.S. Census Bureau 2010, Table DP-1

Age data may be relevant for Forest management decisions. A population's age may affect community values and uses associated with Forest lands. For example, older populations are more likely to desire easily accessible recreation opportunities.

Gender disparities in counties (i.e., deviations from a 50/50 split) may have numerous explanations, including: (1) the significant presence of an industry that is often dominated by one gender – e.g., forestry or mining; (2) a large number of single-parent households; (3) a large retiree population, which due to differences in life expectancy, often leads to a higher concentration of women; and (4) a combination of the above and other unnamed factors.

Table 4 displays the gender breakdown for the study area counties, the states, and the nation. None of the counties markedly deviate from state and national conditions in terms of gender distribution.

Table 4: Gender Distribution

	Females (Percent Total Population)	Males (Percent Total Population)
Coconino County	50.4	49.6
Maricopa County	49.5	50.5
Yavapai County	51.0	49.0
Arizona	50.3	49.7
United States	50.8	49.2

Source: U.S. Census Bureau 2010, Table DP-1

[1] This prediction is borne out in the non-labor income data presented in **Error! Reference source not found.**. More than 50 percent of the income in Yavapai County comes from non-labor sources.

Educational Attainment

Educational attainment, the measure of people with at least a high school diploma or bachelor's degree, is an important indicator of an area's social and economic opportunities and its ability to adapt to change. Table 5 lists the percentage of the adult population with at least a high school diploma and a bachelor's degree.

Table 5. Educational Attainment, Percent of Persons Age 25+

	High School Graduate (Percent)	Bachelor's Degree or Higher (Percent)
Coconino County	85.7	31.3
Maricopa County	86.3	28.3
Yavapai County	89.0	21.6
Arizona	85.6	25.9
United States	85.6	28.2

Source: U.S. Census Bureau 2010, Table DP02

The vast majority of adult residents in the study area are high school graduates. Approximately a quarter of study area residents have a bachelor's degree or higher. The study area, state, and nation all have similar percentages of residents with a bachelor's degree or higher. These findings suggest that the study area is relatively well-educated. Opportunities likely exist for working-age adults with high levels of education. The presence of highly educated adults may be self-reinforcing: a highly educated population is a signal that an area provides economic and cultural opportunities, which attracts additional college educated adults to the area. This process leads to further economic development and job creation. In contrast, areas with low levels of educational attainment have lower levels of human capital, which reduces an area's ability to capitalize on economic change (Florida 2002).

There are a number of institutions of higher education in the study area, including Arizona State University and Northern Arizona University. Post-secondary institutions improve a county's ability to retain and attract young residents. In areas without higher educational opportunities, young people who wish to continue their education migrate out of the area – a process known as the "brain drain."

Employment and Income

The previous section assessed demographic trends in the study area relative to the state and national averages. This section will focus on economic conditions and trends in the study area. This discussion provides additional information on the social and economic environment in the study area. The baseline analysis is the foundation of subsequent impact analyses.

Per Capita Income

Per capita income is a key indicator of the economic well-being of a county. High per capita income may signal greater job opportunities, highly skilled residents, greater economic resiliency, and well-developed infrastructure. Table 6 provides data on per capita income in 2010 for the counties, state, and nation.

Table 6. Per Capita Income, 2010 US Dollars

	Per Capita Income
Coconino County	$19,703
Maricopa County	$25,350
Yavapai County	$22,619
Arizona	$23,618
United States	$26,059

Source: U.S. Census Bureau 2010, Table DP03

Per capita income in the study area is similar to per capita income in the state and nation. Coconino County has the lowest per capita income among the study area counties, which is consistent with the finding in the Environmental Justice section that Coconino County has a high poverty rate relative to the study area, the state, and the nation.

Median Earnings

Per capita income offers an incomplete picture of the economic well-being of an area. Table 7 presents data on median earnings for workers. Whereas per capita income considers all sources of income (including wage and salary payments, transfer payments, investment earnings, dividends, and rents), median earnings considers only wage and salary earnings.

Table 7. Median Earnings for Workers, 2010 US Dollars

	Median Earnings (Dollars)
Coconino County	19,921
Maricopa County	30,583
Yavapai County	22,222
Arizona	27,813
United States	28,899

Source: U.S. Census Bureau 2010, Table DP03

Median earnings in Coconino and Yavapai counties are below state and national medians. Maricopa County has slightly higher median earnings than either the state or nation, indicating that Maricopa County offers relatively high-paying employment.

Median earnings are higher than per capita income in Coconino and Maricopa counties, which suggests that employed residents of these counties have slightly higher incomes than individuals who do not derive income from employment (e.g., retirees). In contrast, median earnings are approximately equivalent to per capita income in Yavapai County, which suggests that retirees and workers have similar incomes in the county.

Forestry-Related Employment and Income

Table 8 shows the economic contribution of forestry-related sectors to the local economy. In terms of employment, forestry-related sectors account for approximately one-third of one percent of study area employment. This is less than the statewide contribution, where forestry-related jobs account for approximately 0.63 percent of total employment. The same trend is observed in employee compensation and output – the forestry sector in the study area is relatively smaller

than in other parts of the state. These findings indicate that the study area is currently less specialized in forestry than the rest of the state.

Table 8. Economic Contribution of Forestry-Related Sectors in the Study Area

	Employment		Employee Compensation (in USD Millions)		Output (in USD Millions)	
	Value	Percent of Total	Value	Percent of Total	Value	Percent of Total
Coconino County	182	0.25	4	0.13	15	0.19
Maricopa County	6,784	0.31	192	0.20	801	0.26
Yavapai County	154	0.22	5	0.22	12	0.16
Study Area Total	7,120	0.30	201	0.20	828	0.25
Arizona	20,169	0.63	575	0.42	1,713	1.26

Source: MIG 2009

Economic Diversity

Economic diversity generally promotes stability and offers greater employment opportunities. Highly specialized economies (i.e., those that depend on very few industries for the bulk of employment and income) are prone to cyclical fluctuations and offer more limited job opportunities. Determining the degree of specialization in an economy is important for decision-makers, particularly when the dominant industry can be affected by changes in policy. For Forest Service decision-makers, this is likely to be the case where the forest products industry or the tourism and recreation industries, for instance, are reliant on the local National Forest(s).

Figure 1 provides a breakdown of employment by industry in the study area. The study area economy is quite diverse, with no single sector dominating the local economy. This economic diversity is largely attributable to Maricopa County, which is the geographic and commercial center of the state. Government, retail trade, and the health and social services sectors are the largest employment sectors in the local economy. These industries are consistent with findings discussed in the demographic section – namely a substantial government presence due to public land management, a large retiree population that consumes health and social services, and amenities that attract tourists who contribute to the retail trade sector.

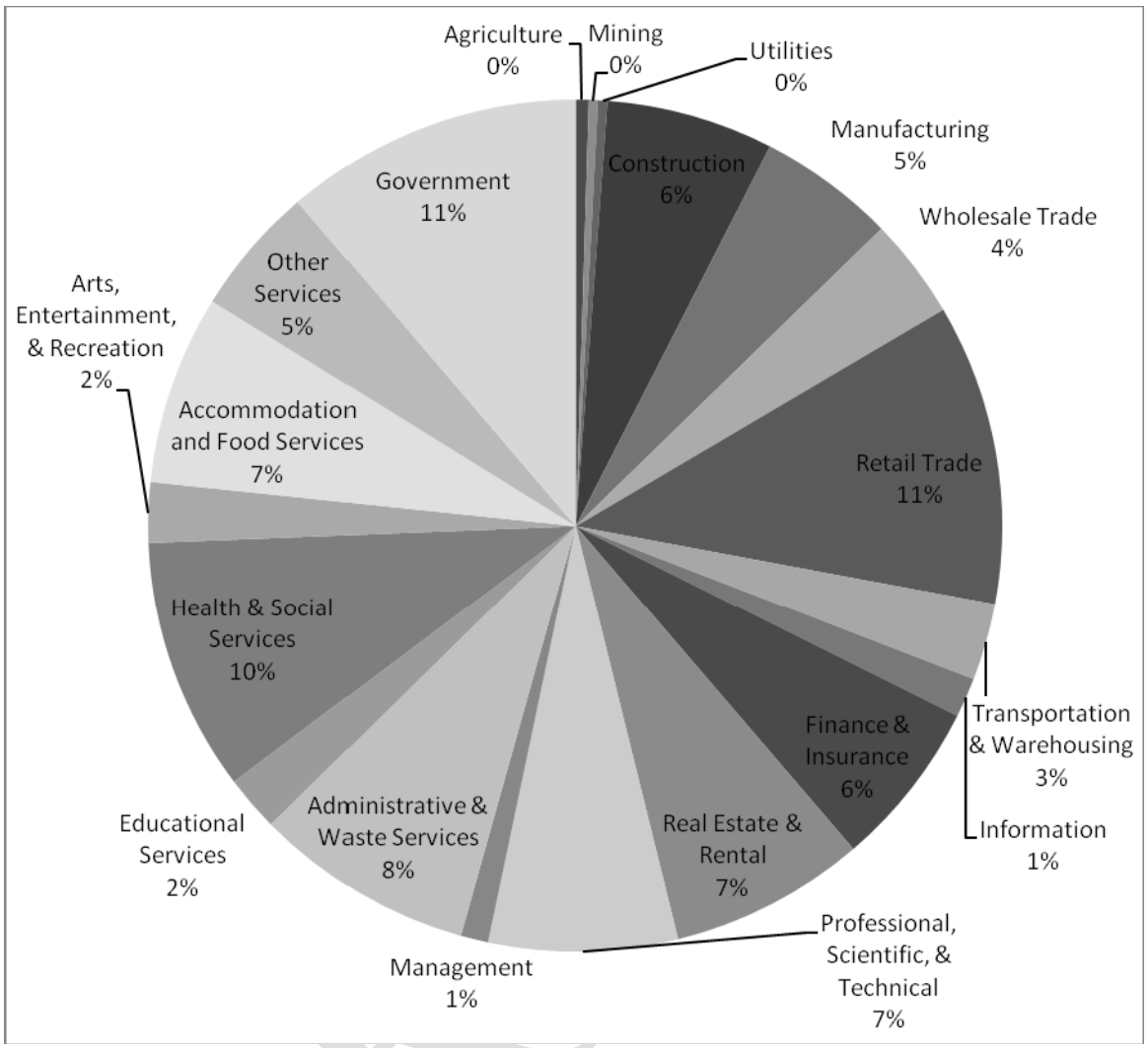


Figure 1. Employment by Industry in the Study Area

Source: MIG 2009

The Interior Columbia Basin Ecosystem Management Project identified communities that were specialized with respect to employment. This method is applied here using the ratio of the percent employment in each industry in the region of interest (study area) to an average percent of employment in that industry for a larger reference area (Arizona). For a given industry, when the percent employment in the analysis region is greater than in the reference area, local employment specialization exists in that industry (USFS 1998). Using this criterion applied with 2009 data, the study area can be characterized as specialized with respect to several industries, particularly management, real estate and rental, wholesale trade, educational services, finance and insurance, and arts, entertainment and recreation (MIG 2009). Figure 2 provides the employment specialization index for all industries in study area.

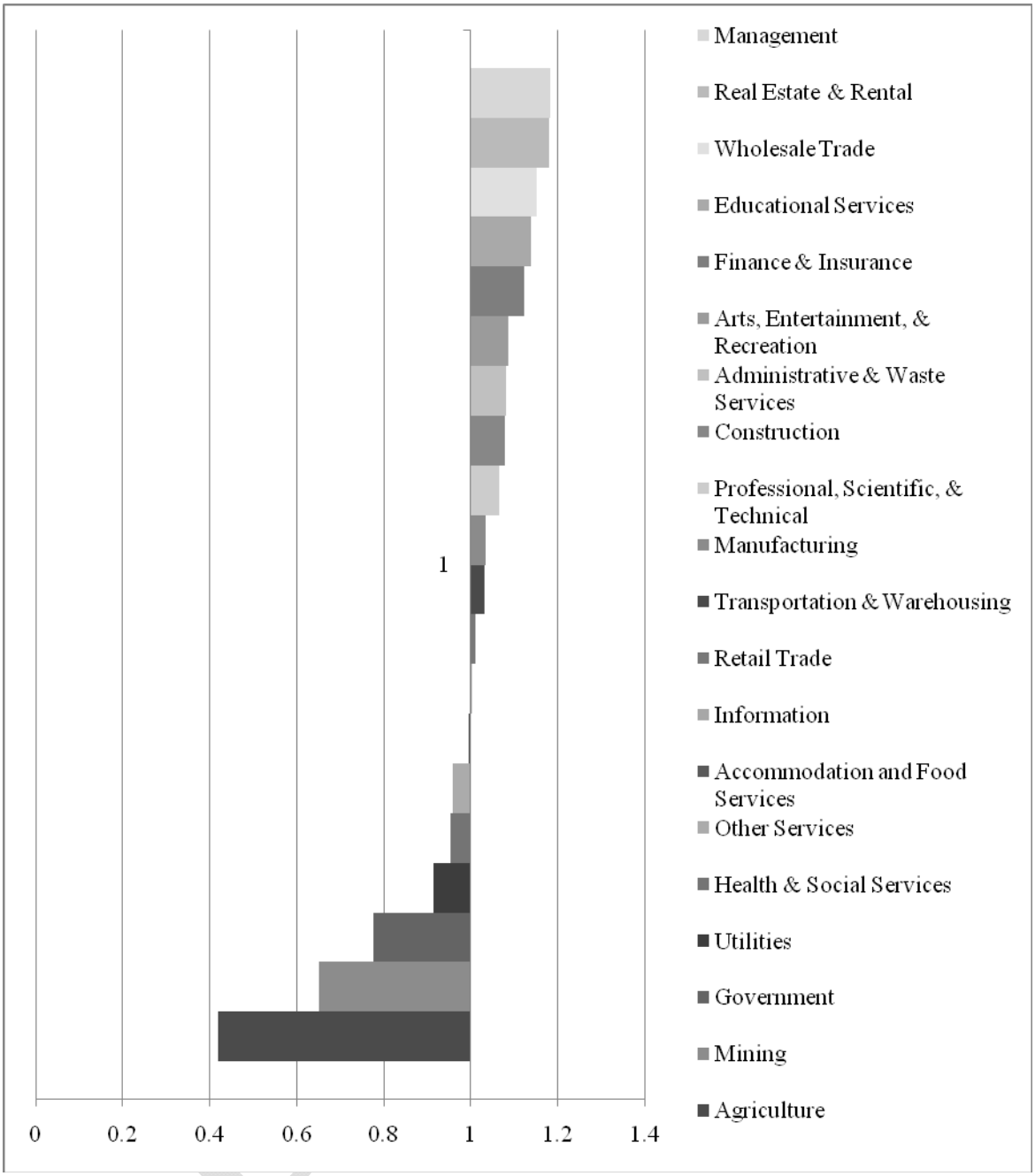


Figure 2. Employment Specialization in the Study Area

Source: MIG 2009

Whereas **Error! Reference source not found.** considers the study area in isolation, Figure 2 compares industry concentration in study area to the state as a whole. The numbers on the x-axis of Figure 2 show the degree of specialization in the local economy. A score of one indicates that the study area and the state are equally specialized in the sector. A score above one indicates that the study area is more specialized in the sector than the state. A score below one indicates that the study area is less specialized in the sector than the state. As the two figures demonstrate, these two methods of data analysis can suggest quite different results. Management accounts for just one percent of employment in the study area – a relatively modest figure until it is put in the context of the state. A resident of study area is more likely to be employed in the management sector compared to residents of Arizona as a whole. Similarly, although government employment

accounts for a relatively large percentage of total employment in Figure 1, the study area is less specialized in government employment compared to the state. Public lands (National Forests, National Parks, BLM-managed public lands, and state-owned lands), military installations, and tribal lands are common across the state. Furthermore, Arizona has a large number of state and local government employees2 (U.S. Bureau of Economic Analysis 2011b). All of these features contribute to a relatively large government presence in Arizona.

Non-Labor Income

Table 9 displays the role of labor and non-labor income in total personal income for 2000 and 2009. Non-labor income is any income derived from investments, dividends, rents, or transfer payments. In contrast, labor income is salary and wage disbursements from employment. During the past decade, the percentage of total income derived from non-labor sources increased in all considered areas.

Non-labor income is not directly tied to employment; therefore, it can be more resistant to economic downturns. However, as the most recent recession demonstrated, asset markets can be quite volatile, and non-labor income that depends on investment returns may be unstable.

An increase in non-labor income may reflect changing demographic characteristics. Older populations rely largely on non-labor income, including rents, dividends, and transfer payments (e.g., Social Security). High percentages of non-labor income likely indicate higher concentrations of retirees.

Table 9. Contribution of Labor and Non-Labor Income to Total Personal Income, 2000 and 2009

	2000		2009	
	Labor Percent	Non-Labor Percent	Labor Percent	Non-Labor Percent
Coconino County	64	36	62	38
Maricopa County	72	28	66	34
Yavapai County	50	50	43	57
Arizona	68	32	62	38
United States	69	31	64	36

Source: U.S. Bureau of Economic Analysis 2011a

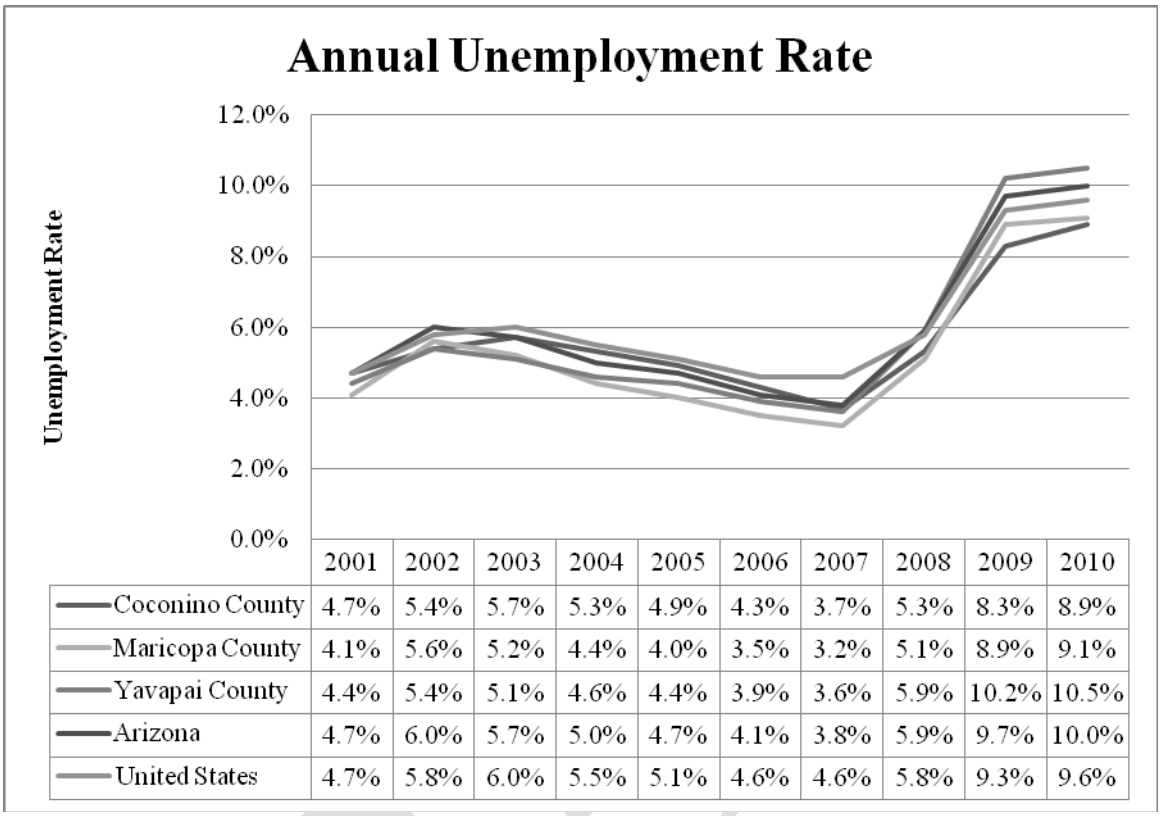
Non-labor income dominates total personal income in Yavapai County, where it accounts for more than half of income. This finding is consistent with the median age data presented in Table 3, which showed that the median age in Yavapai County is approximately a decade older than the state and national medians. The distribution of labor and non-labor income in Coconino and Maricopa counties mimics the state and national distributions.

Unemployment

The unemployment rate provides insight into the correspondence between residents' skills and employment opportunities. The "natural" rate of unemployment is said to be around 5 percent. This is the so-called "natural" rate because this is a level that allows for movement between jobs

[22] Similar to the United States, approximately 80 percent of government employees in Arizona and the study area work for state or local government.

and industries, but does not signal broad economic distress. Recently, the national unemployment rate has hovered between 8 and 10 percent. Figure 3provides the annual unemployment rates for the counties, state, and nation from 2001 to 2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Coconino County	4.7%	5.4%	5.7%	5.3%	4.9%	4.3%	3.7%	5.3%	8.3%	8.9%
Maricopa County	4.1%	5.6%	5.2%	4.4%	4.0%	3.5%	3.2%	5.1%	8.9%	9.1%
Yavapai County	4.4%	5.4%	5.1%	4.6%	4.4%	3.9%	3.6%	5.9%	10.2%	10.5%
Arizona	4.7%	6.0%	5.7%	5.0%	4.7%	4.1%	3.8%	5.9%	9.7%	10.0%
United States	4.7%	5.8%	6.0%	5.5%	5.1%	4.6%	4.6%	5.8%	9.3%	9.6%

Figure 3. Annual Unemployment Rate, 2001-2010

Source: U.S. Bureau of Labor Statistics 2011

Unemployment trends in the study area counties have mirrored state and national rates. This suggests that employment conditions in the study area are similar to broader state and national trends.

Economics of Wildfire

Wildfire Costs

Annually, millions of dollars are spent suppression wildfires in the United States. In 2007, there were 27 large fires in the U.S. that cost $547 million to suppress (WFLC 2010). Between 2000 and 2008, the percentage of the Forest Service budget spent on extinguishing wildfires expanded from 25 to 44 percent (WFLC 2010). Furthermore, suppression costs account for only a fraction of the total cost of wildfires. The Western Forestry Leadership Coalition (WFLC) estimates that total wildfire-related expenses range from two to thirty times the reported suppression costs (2010).

Wildland-Urban Interface

As explained above, the cost of fighting wildfires increased over the past decade. A principal reason for the increasing cost is the growing number of homes located in the wildland-urban interface (WUI). Suppression activities are frequently undertaken when wildfire threatens private

property. A century of fire suppression has led to increased frequency of high-intensity wildfire. The spread of the WUI has increased the probability that wildfires will occur near private residences. These two factors – the growth of the WUI and the use of suppression tactics – increase the cost of wildfire. Table 10 presents the extent of the wildland-urban interface (WUI) in the study area counties and the western United States.

Table 10. Wildland-Urban Interface, Planning Area and West-Wide

	WUI Area with Homes (2000)	WUI Homes as Percent of Total Homes (2000)	West-Wide Rank by Existing Wildfire Risk (2000)
Coconino County	21.5	25.6	55 of 413
Maricopa County	16.9	0.3	161 of 413
Yavapai County	23.5	9.7	71 of 413
Western U.S.	13.9	3.9	N/A

Source: Gude et al 2008

In Coconino County one-quarter of homes are in the WUI and approximately 10 percent of Yavapai County homes are located within the WUI. Both of these counties are also in the top quintile for existing fire risk. These factors make it more likely the Coconino and Yavapai counties will experience large, expensive wildfires.

Non-Market Values

The economic value of Forest Service management is not entirely captured in market transactions. Much of the value of National Forests is "non-market" in nature – meaning that many of the benefits that forests provide to humans do not have a price. The lack of a price, however, should not be conflated with an absence of value. Indeed, non-market values from forests provide economic benefits to adjacent communities and forest visitors.

Ecosystem services are "components of nature, directly enjoyed, consumed, or used to yield human well-being" (Boyd and Banzhaf 2007). Healthy forests provide numerous ecosystem services, including clean water and air, biodiversity, forest products, and many other goods and services. Consistent with direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15 (7/06/04) and 22.35 (01/14/05), the subsequent analysis of environmental consequences will consider non-market goods and services primarily in qualitative terms. Where appropriate, discussion of how the alternatives may affect non-market values will be presented. However, due to the qualitative nature of these discussions, direct comparisons between changes in market and non-market values are generally not possible.

Environmental Justice

In 1994, President Clinton issued Executive Order 12898. This order directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Environmental justice (EJ) is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision-makers to identify impacts that are disproportionately high and adverse with

respect to minority and low-income populations and identify alternatives that will avoid or mitigate those impacts. According to USDA DR5600-002 (USDA 1997), EJ, minority, minority population, low-income, and human health and environmental effects, are defined as follows:

Environmental Justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by, government programs and activities affecting human health or the environment.

Minority means a person who is a member of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

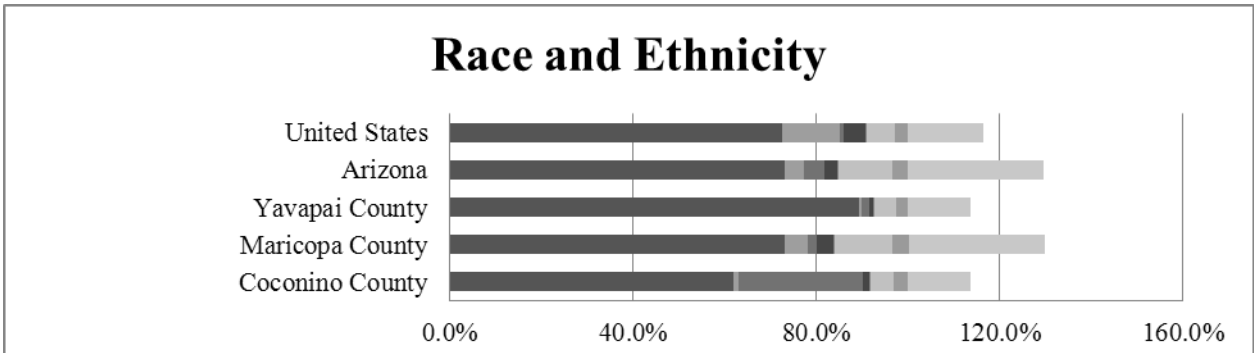
Minority Population means any readily identifiable group of minority persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities.

Low-Income Population means any readily identifiable group of low-income persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities. Low-income populations may be identified using data collected, maintained and analyzed by an agency or from analytical tools such as the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty.

Human Health and/or Environmental Effects as used in this Departmental Regulation includes interrelated social and economic effects.

The emphasis of environmental justice is on health effects and/or the benefits of a healthy environment. The CEQ has interpreted health effects with a broad definition: “Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities or Indian Tribes …when those impacts are interrelated to impacts on the natural or physical environment” (CEQ 1997).

According to the U.S. Census Bureau (2010) data reported in Figure 4, study area counties differ substantially in their racial and ethnic composition.



	Coconino County	Maricopa County	Yavapai County	Arizona	United States
White	61.7%	73.0%	89.3%	73.0%	72.4%
Black or African American	1.2%	5.0%	0.6%	4.1%	12.6%
American Indian and Alaska Native	27.3%	2.1%	1.7%	4.6%	0.9%
Asian	1.4%	3.5%	0.8%	2.8%	4.8%
Native Hawaiian and Other Pacific Islander	0.1%	0.2%	0.1%	0.2%	0.2%
Some Other Race	5.2%	12.8%	4.9%	11.9%	6.2%
Two or More Races	3.1%	3.5%	2.5%	3.4%	2.9%
Hispanic or Latino (of any race)	13.5%	29.6%	13.6%	29.6%	16.3%

Figure 4. Race and Ethnicity

Source: U.S. Census Bureau 2010, Table DP-1

Coconino County has a high concentration of American Indian residents, due to the presence of five reservations in the county. Maricopa and Yavapai counties also contain Indian reservations; however, their concentrations of American Indian residents are small relative to both Coconino County and Arizona.[3] Maricopa County has the highest proportion of Hispanic/Latino residents in the study area, although it is equivalent to Arizona's proportion (29.6 percent). In contrast, Yavapai County is less diverse than both the state and nation. Approximately 90 percent of Yavapai County residents self-identify as white. As a result, environmental justice issues are more likely to occur in Coconino and Maricopa counties than Yavapai County. However, a finding of low racial/ethnic diversity does not eliminate the need to consider potential disproportionate impacts of Forest Service management actions. A county may have a low overall concentration of minority residents, but still have areas with a high concentration of minority residents who could be adversely affected by management actions.

Table 11 reports the percentage of residents living in poverty. Maricopa and Yavapai counties have poverty rates similar to the state. Coconino County has the highest poverty rate in the study area, with more than one-quarter of individuals in the county living in poverty.

[3] Coconino County contains all or part of the Navajo Indian Reservation, Hualapai Indian Reservation, Hopi Indian Reservation, Havasupai Indian Reservation, and Kaibab Indian Reservation.

Maricopa County contains all or part of the Fort McDowell Yavapai Nation, the Gila River Indian Community, and the Salt River-Pima Indian Community.

Yavapai County contains all or part of the Yavapai-Prescott Indian Reservation, the Yavapai-Apache Nation Indian Reservation, the Hualapai Indian Reservation, and the Camp Verde Indian Reservation.

Table 11: Percent of Persons Living in Poverty

	Poverty Rate Percent
Coconino County	25.9
Maricopa County	16.5
Yavapai County	19.2
Arizona	17.4
United States	15.3

Source: U.S. Census Bureau 2010, Table DP03

The incidence of poverty in Coconino County is not evenly distributed among racial and ethnic groups. Approximately 50 percent of American Indian residents in Coconino County live in poverty (U.S. Census Bureau 2000). The high proportion of American Indian residents in the county, therefore, increases the poverty rate relative to other study area counties and the state.

Based on the minority status and poverty data presented above, Coconino County appears most at risk for environmental justice issues. The largest minority group in the county – American Indians – also experience a very high poverty rate. Furthermore, Coconino County contains the most acreage that could be affected by the first stage of 4FRI, which suggests that the consequences of management actions will be felt most acutely by Coconino County residents. These conditions underscore the importance of evaluating environmental justice consequences. The potential for disporportionate adverse impacts on minority and low-income individuals will be evaluated in all study area counties.

In response to a comment from the June 2012 NEPA update public meeting, the possibility of smoke-related environmental justice consequences in Snowflake, Arizona were evaluated. The community does not have a meaningfully greater percentage of minority residents than the state and Snowflake has a smaller proportion of individuals living in poverty than either the state or nation (U.S. Census Bureau 2010). In addition, the community is geographically distant from the project area, and therefore unlikely to experience acute smoke effects. As a result, Snowflake is not considered an environmental justice community in this analysis.

Environmental Consequences

The previous sections assessed past and current social and economic conditions. The following section will consider the potential consequences of alternative management scenarios on the social and economic environment. The Tools and Data Sources section below describes the economic and social analysis procedures employed in this document.

Methodology and Assumptions

Tools and Data Sources

Economic impacts were modeled using IMPLAN Professional Version 3.0 with 2010 data. IMPLAN is an input-output model, which estimates the economic impacts of projects, programs, policies, and economic changes on a region. IMPLAN analyzes the direct, indirect, and induced economic impacts. Direct economic impacts are generated by the activity itself, such as the value of cattle grazed on the Forest. Indirect employment and labor income contributions occur when a sector purchases supplies and services from other industries in order to produce their product. Induced contributions are the employment and labor income generated as a result of spending new household income generated by direct and indirect employment. The employment estimated is defined as any part-time, seasonal, or full-time job. In the economic impact tables, direct,

indirect and induced contributions are included in the estimated impacts. The IMPLAN database describes the economy in 440 sectors using federal data from 2010.

Data on use levels under each alternative were collected from the Forest's resource specialists. In most instances, the precise change is unknown. Therefore, the changes are based on the professional expertise of the Forest's resource specialists. Regional economic impacts are estimated based on the assumption of full implementation of each alternative. The actual changes in the economy would depend on individuals taking advantage of the resource-related opportunities that would be supported by each alternative. If market conditions or trends in resource use were not conducive to developing some opportunities, the economic impact would be different than estimated here.

The regional economic impact analysis also borrows from the 2012 report, "Workforce Needs of the Four Forest Restoration Initiative Project: An Analysis," conducted by researchers at Northern Arizona University's Ecological Restoration Institute (Combrink et al 2012).

Economic efficiency analysis was conducted with QuickSilver Version 6. A 4-percent discount rate is commonly used for evaluations of long-term investments and operations in land and resource management by the Forest Service (FSM 1971.21). This discount rate is used in the calculation of Present Net Value (PNV). Inflation can affect PNV; however, due to the uncertainty of future inflation, OMB Circular A-94 recommends the avoiding assumptions about the inflation rate whenever possible. Thus, for the purposes of this analysis, inflation is left at zero. Data on program revenues and program expenditures were provided by the Coconino and Kaibab National Forests' resource specialists and budget staff.

Social impacts use the baseline social conditions presented in the Affected Environment section, National Visitor Use Monitoring (NVUM) profiles (USFS 2011a and USFS 2011b), and information from the Coconino and Kaibab Economic and Social Sustainability Assessments (USFS 2008a, USFS 2008b) to discern the primary values that the Forests provide to area residents and visitors. Social effects are based on the interaction of the identified values with estimated changes to resource availability and uses. Additionally, key determinants of quality of life that may be affected by 4FRI treatments were identified through scoping and on-going public involvement.

Assumptions

1. The IMPLAN software assumes a static economy – in other words, the industry composition and trade linkages in 2010 will be the same in 2020. Where appropriate and feasible, adjustments to industry composition are made to reflect the belief that 4FRI will attract new timber harvesting and processing facilities to the region. In general, the employment and income estimates here should be viewed as a lower-bound.

2. The economic impact analysis for grazing assumes a 10 percent reduction in authorized AUMs throughout the 10-year treatment period.

3. The economic impact analysis for recreation assumes that 10 percent of the project area would be unsuitable for recreational use at any given time during the 10-year treatment period. Ten percent of the project area translates to 2 percent of the total acreage of the Kaibab and Coconino National Forests. [4] The recreation analysis is conducted at the forest level, for consistency with recreation use reporting methods.

[44] The proposed 4FRI project area is 988,764 acres. Restoration activities would occur on approximately

4. Trees less than five inches in diameter are classified as woody biomass for the purposes of the economic impact and economic efficiency analyses. Trees greater than five inches in diameter are classified as timber.

Summary of Effects

Economic Consequences

The economic analysis of the Four Forest Restoration Initiative (4FRI) uses two types of analysis: (1) regional economic impact analysis and (2) economic efficiency analysis.

Regional Economic Impact

Economic impact analysis measures how activities under the 4FRI would affect employment, income, and economic activity in the regional economy.

Tourism and Visitor Spending

According to the National Visitor Use Monitoring (NVUM) reports, there are approximately 2,868,000 visits to the Coconino NF and 456,000 visits to the Kaibab NF each year. It is unknown what portion of these visits occurs in the 4FRI project area. At any given time during the 10-year treatment period, approximately 2 percent of the Coconino and Kaibab NFs would not be suitable for recreational use.

Visitors to the Coconino and Kaibab National Forests support approximately 3,000 jobs and $110 million in labor income in the study area economy, annually. None of the alternatives are expected to change the economic contribution from recreation. Although the 4FRI treatments would make portions of the forests temporarily unsuitable for recreational use, most visitors would engage in substitute behavior that would also contribute to the local economy (e.g., visiting an alternate site on National Forest, visiting nearby National Parks, State Parks, or other public lands). Annually, the 4FRI treatments would affect fewer than 60,000 acres of the more than 3 million acres of the Coconino and Kaibab National Forests (two percent of the total acreage). Therefore, the probability that visitor use would be substantially disturbed is low within the Coconino and Kaibab National Forests.

Grazing

In the 4FRI project area, 49 allotments provide forage for 110,173 cattle animal unit months (AUMs) and 13,616 sheep AUMs.

The 4FRI treatments would entail one major pasture burn per year, per allotment. Over the 10-year treatment period, a 10 percent reduction in AUMs is expected. At the end of the 10 years, a return to pre-treatment AUM levels would occur. Therefore, during the 10-year treatment period, cattle AUMs would decrease to approximately 100,000 and sheep AUMs would decrease to approximately 12,250.

595,716 acres on the Coconino NF and Kaibab NF. Of this total, approximately 361,550 acres would be treated on the Coconino NF and 234,166 acres would be treated on the Kaibab NF. The Coconino NF is composed of approximately1.8 million acres and the Kaibab NF is composed of approximately 1.5 million acres (approximately 890,000 acres in the southern portion).

At current levels, grazing supports approximately 130 jobs and $2.15 million in labor income in the local economy, annually. The brief duration and advance notice of disturbances due to 4FRI treatments will make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor and temporary reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, over the long-run, improved forest health would improve forage quality and ranching viability.

Treatment and Forest Products

4FRI treatments would produce commercially-valuable forest products. Table 12 shows the expected forest product volumes from 4FRI treatment for all action alternatives.

Table 12. Forest Product Volumes by Alternative

	Alternative B	Alternative C	Alternative D
Timber (ccf)	138,959	212,930	138,959
Biomass (dry tons)	2,862	4,043	2,862

The NAU workforce analysis estimates 422 full-time equivalent (FTE) private sector employees will be required to support full implementation of the 4FRI. This estimate is not based on any alternative considered in this analysis, but is based on treatment of all four forests – approximately one-half of this employment is expected under the first stage implementation (Coconino and Kaibab NFs). The employment estimate includes only direct employment – it does not capture employment in forest product utilization, effects to suppliers, or the consequences of employee spending. The workforce analysis is based on an extrapolation of the employment impacts of the White Mountain Stewardship Project on the Apache-Sitgreaves National Forest (Combrink et al 2012). An additional 300 FTE jobs are expected as a result of forest product utilization and other indirect effects. Again, approximately half of this employment can be attributed to the first stage implementation (Combrink et al 2012). The total workforce estimate, therefore, is 361 FTE employees. These estimates do not include induced effects (the effects from households spending income associated with the 4FRI).

An internal analysis was conducted using an input-output method. The employment estimates obtained are broadly similar to the NAU workforce analysis estimates. Approximately 294 direct jobs (full and part-time jobs) would be supported by 4FRI harvesting and restoration activities. An additional 352 indirect and induced jobs would be supported in forest product utilization, supplying firms, and as a result household spending. Thus, the first stage of 4FRI is expected to support 646 private sector jobs on an average annual basis. While this estimate is higher than the NAU workforce analysis estimate, there are two key factors that explain the discrepancy: (1) the NAU estimate uses full-time equivalents (FTE). The internal estimate includes both full and part-time jobs. (2) The NAU estimate does not account for induced employment effects, which are the consequences of increased household spending attributable to 4FRI-related employment. For example, the individuals employed by firms contracted to implement 4FRI harvesting and restoration activities will spend their money on housing, gas, groceries, and other goods and services in the local economy. The firms that these individuals buy from will benefit from these expenditures.

U.S. Forest Service Employment

The Forest Service does not anticipate that additional employees will be required to administer 4FRI implementation. Approximately 35 Forest Service personnel will be required to administer and monitor the first stage (Coconino and Kaibab NFs) implementation of 4FRI. Existing personnel are expected to meet this need (Combrink et al 2012). The indirect and induced impacts of Forest Service 4FRI implementation and monitoring are expected to support approximately 8 jobs in the local economy. In total, Forest Service implementation and monitoring of 4FRI is expected to support 42 jobs. This represents no change from existing conditions.

Economic Efficiency

Economic efficiency analysis measures the ratio of economic benefits to economic costs resulting from activities under the 4FRI.

Central to the economic efficiency analysis of forest treatment is the relationship between treatment (prescribed burning and thinning, in the case of the 4FRI) and wildfire risk (incidence) and hazard (severity) reduction. Mercer (2000) notes that treatment is associated with a decrease in wildfire suppression costs and a decrease in net resource damage; however, the precise relationship between treatment and wildfire cost reduction is not identified. Therefore, the following discussion of economic efficiency is primarily descriptive in its analysis of tradeoffs.

Direct Costs

Direct costs include only expenses associated with personnel and supplies used to administer a prescribed burn or extinguish a wildfire. Federal and state budgets are finite – and increasingly limited in recent years. The direct cost of extinguishing a wildfire can be devastating for state and federal agencies. From 2000 to 2008, wildfire suppression funding increased from 25 percent to 44 percent of the U.S. Forest Service budget (WFLC 2010). The more money spent suppressing wildfires, the less funding remains for activities that promote forest health and improve the quality of recreation opportunities for visitors. Table 13 displays historic wildfire expenditures5 of the Coconino and Kaibab National Forests.

Table 13. Historic Wildfire Suppression Costs by Forest

	Coconino National Forest	Kaibab National Forest
2006	$11,554,537	$6,821,329
2007	$5,473,007	$1,969,503
2008	$1,181,338	$1,442,289
2009	$6,081,460	$5,718,035
2010	$13,500,703	$6,332,694
2011	$5,137,758	*N/A*
Average Annual Expenditure	**$7,154,801**	**$4,456,770**

Source: Forest Service Fire Ecology and Budget Staff, Coconino and Kaibab National Forests

[5] Wildfire suppression and wildfire use expenditures are reported together. However, according to the budget and fire staff, suppression accounts for the vast majority of the reported expenditures.

Treatment Costs

Treatment is associated with a decrease in wildfire suppression costs and a decrease in net resource damage (Mercer et al 2000). Prescribed burning is often preferred to mechanical thinning due to the lower cost of prescribed burning. However, depending on proximity to urban centers, a full accounting of the costs of prescribed burning may reveal that mechanical thinning is more economically efficient in some circumstances. The cost of smoke exposure, for instance, is higher when prescribed burning occurs near population centers. Mechanical treatment also has costs that are not accounted for in the cost of implementation, such as soil erosion. However, the indirect consequences of prescribed burning are more easily observable, which generally make it a less publicly popular treatment option.

Fuel reduction projects can significantly reduce the risk of catastrophic wildfire (WFLC 2010). Assessing the cost-benefit ratio of fuel reduction projects is questionable without information on the degree to which treatment reduces the risk of wildfire. Furthermore, the scale and cost of prevented wildfires is uncertain and hugely variable.

The cost of prescribed burning ranges from $50 to $300 per acre on the Coconino and Kaibab National Forests. The cost of thinning generally ranges from $100 to $400 per acre on the forests, but some projects may be as costly as $1500 per acre.[6]

Wildfire Costs

Wildfire costs are very difficult to predict because wildfires range enormously in size, terrain, and proximity to local communities. All of these factors will affect the direct cost of dealing with a wildfire. The Wallow Fire of summer 2011, for instance, cost more than $79 million to extinguish (WMI 2011). However, not all wildfires need to be extinguished. Fire is a natural part of the landscape and unnecessary wildfire suppression leads to fuel buildup and increased fire risk and hazard.

Suppression costs are generally only a small component of the total cost of a wildfire. The Western Forestry Leadership Coalition finds that the total cost of wildfire ranges from 2 to 30 times greater than the suppression cost (WFLC 2010). For context, historic wildfire suppression costs data are presented in Table 13.

Health Impacts

Smoke is inevitable in the airsheds of northern Arizona, whether from wildfire or prescribed fire. Smoke can travel great distances and affect communities far away from the burn unit, sometimes persisting after the burn has been completed. Fires burning under historic conditions (wildfire or prescribed fire) produce behavior and effects that are low to moderate. Fires that burn under more extreme conditions (most/all fires in this category are wildfires) produce behavior and effects that are moderate to severe.

Ambient particulate matter (PM) concentrations increase substantially during a wildfire (Kochi et al 2010b). A dose-response function is an equation that estimates the health consequences of exposure to pollution. Compared to conventional PM studies (based on urban air pollution), wildfire studies are “less likely to find a significant positive mortality effect in spite of the substantial increases in PM levels during the wildfire period” (Kochi et al 2010a). There are

[6] The cost difference between prescribed burning and thinning is larger than indicated in these data, as the per acre prescribed burning costs include the cost of NEPA, planning, and a fire management organization. In contrast, the per acre thinning estimates include only crew and equipment costs.

several probable reasons for this finding, including: (1) urban air pollution and wildfire smoke are chemically different (wildfire smoke is generally less toxic), (2) wildfire events are more likely to promote averting behavior, such as evacuation (Kochi et al 2010a). However, the wildfire studies did find increased hospital admissions linked to asthma and respiratory problems during wildfire events (Kochi et al 2010a). PM studies find that the dose-response function is not linear. In other words, a doubling of PM concentration more than doubles the health consequences. Furthermore, at low-levels an increase in PM may result in no measureable health consequences (Kochi et al 2010b).

Five key health outcomes are considered in the literature: (1) mortality, (2) restricted activity days, (3) hospital admissions, (4) respiratory symptoms, and (5) self-treatment. Kochi et al (2010b) estimate that the cost of health effects due to smoke from wildfire events range from $0.26 million to $1.2 billion depending on the scale of the fire and the health outcomes considered.

The timing of prescribed fires is predictable, the volume of smoke produced is far less than in a wildfire, and there is time to notify the public when burns will be implemented. As a result, adverse health consequences are less likely to result from prescribed fires.

Tourism

During wildfire events, tourism decreases due to evacuations, road closures, and negative publicity (Mercer et al 2000). Depending on the size and intensity of the wildfire, impacts to tourism may be long-lasting. For instance, the 2002 Rodeo-Chediski fire burned 106 miles of trails on the Apache-Sitgreaves National Forest (Morton et al 2003). Recreation and tourism displacement can reduce contributions to the local economy (discussed above in the Regional Economic Impact section). In addition to the costs to local businesses, individuals may have lower consumer surplus[7] values if they must recreate at a substitute site due to the presence of fire or smoke.

Knotek et al (2008) find that local visitors are more accepting of prescribed fire than non-local visitors. This finding may be due to (1) better communication between federal agencies and local residents, (2) more local familiarity with the role of fire in the landscape, or (3) more opportunities to engage in substitute behavior.

Ecosystem Services

Wildfire has the potential to reduce ecosystem service values through: (1) destruction of wildlife habitat, (2) water quality and watershed impacts, (3) damage to cultural and archaeological sites, and (4) soil erosion and impacts to water quality (Morton et al 2003). In contrast, forest restoration has the potential to improve ecosystem services. Expected ecosystem service benefits from 4FRI treatment include:

- Reduction of unnaturally large wildfires
- Protection of watersheds, leading to increases in surface water and decreases in soil loss
- Diversification of understory composition and protection of rare habitat from fire

[7] Consumer surplus is the value that individuals receive above what is paid to consume the good or service. For instance, if an individual pays $10 to recreate at a site, but would be willing to pay $25, his/her consumer surplus is $15.

- Better management of wildlife habitat
- Enhanced recreation that is aesthetically pleasing
- Sequestering carbon in large trees and soils (Combrink et al 2012).

Timber Market

Prescribed burning allows for the measured and controlled use of fire to manage forest density and health. Wildfire events, however, are unplanned and have the potential to cause extreme destruction. Wildfires can be a substantial shock to timber markets. Following a wildfire, some of the killed timber is salvaged and brought to market. This can flood markets, temporarily decreasing the price of timber. In the American Southwest, processing capacity is generally too low to lead to this a substantial price shock. However, in the longer-term, the price of timber increases due to reduced timber inventories (Mercer et al 2000). The Rodeo-Chediski fire burned approximately 1 billion board feet of timber, valued at more than $300 million (Morton et al 2003).

Social Consequences

In addition to effects on the local economy, activities under the 4FRI have the potential to affect quality of life. The social consequences are measured both quantitatively and qualitatively, with a particular focus on traffic, smoke emissions, recreation displacement, scenery management, and environmental justice.

Road Traffic

Truck volume would increase throughout the 4FRI treatment period. Approximately 120,000 additional truck trips per year are expected to result from activities under 4FRI. Individuals who commute along the roads to be used for 4FRI activities will experience longer drive times. Longer commutes reduce quality of life due to increased stress and reduced leisure time.

Smoke Emissions and Quality of Life

Smoke emissions are inevitable under all alternatives – whether from prescribed burns or wildfire. The degree (intensity and duration) of emissions, however, are variable. With prescribed burns, burn plans are developed, which helps to minimize adverse effects to quality of life in nearby communities. The Forest Service is required to work with the Arizona Department of Environmental Quality (ADEQ) to ensure that smoke impacts to human health are avoided or minimized. In contrast, wildfires are by definition unplanned. The community smoke effects from wildfire can range from negligible to severe. The advance notice associated with prescribed burns allows individuals with acute sensitivity to smoke (e.g., asthmatics) to engage in averting behavior, which reduce the negative quality of life impacts.

Recreation Displacement

Both wildfire and prescribed burns may prevent individuals from recreating at their favorite sites. When individuals engage in substitute behavior within the local area, there is unlikely to be a decrease in visitor spending. However, individuals may get less pleasure from their alternate pursuit. As a result, consumer surplus and quality of life are reduced. The recreation analysis addresses this issue in detail.

Scenery Management

Wildfire, prescribed burns, and other treatments may adversely affect scenic areas. The 4FRI treatments would affect scenery; however, all anticipated effects are short-term. Forest visitors and nearby residents may have interrupted views during portions of the 10-year treatment period. The ability to experience scenic views is central to many individuals' visit to the forests. A change in scenery may affect both quality of life and consumer surplus. The scenery and recreation analyses address the consequences in detail.

Environmental Justice

The goal of environmental justice is for agency decision-makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that will avoid or mitigate those impacts. None of the alternatives would reduce employment and income relative to current conditions, therefore, no disproportionate adverse economic effects would occur.

Nuisance smoke resulting from wildfires and prescribed burns can have health and quality of life consequences. Nuisance smoke is most likely to affect vulnerable populations – children, the elderly, and individuals in poor health. Limited communications technology, language barriers, and cultural differences may also limit the effectiveness informing nearby residents of upcoming prescribed burns. These conditions are true under all alternatives – including the no action alternative. No alternative eliminates fire on the forests - smoke from wildfire and prescribed fires would occur regardless of chosen alternative.

Traditional and sacred forest uses would continue under all alternatives. The heritage report addresses these uses and potential effects in detail.

Alternative A: No Action

As required by 40 CFR 1502.14(c)) the no action alternative (alternative A) has been analyzed to contrast the impacts of the action alternatives with the current condition and expected future condition if the proposed action were not implemented. This alternative proposes no restoration treatments in the project area.

Direct and Indirect Effects

Recreation: No changes to visitor spending or recreational activities are anticipated under alternative A. As stated above, visitors to the Kaibab and Coconino National Forests support approximately 3,000 jobs and $110 million in labor income to the study area economy on an average annual basis.

Forest restoration activities would continue to occur on both the Kaibab and Coconino National Forests, with possible minor interruption of recreational opportunities. Over the long-term, fewer treated forest acres would increase the probability of uncharacteristic wildfire under alternative A. Large wildfires destroy trails, campsites, and other forest infrastructure. Major and destructive fires decrease tourism to the local area, which would reduce recreation-related employment and income in the regional economy.

Grazing: The forests would continue to provide forage for 110,173 cattle animal unit months (AUMs) and 13,616 sheep AUMs. These activities support approximately 130 jobs and $2.15 million in labor income to the study area economy on an average annual basis.

The increased probability of uncharacteristic wildfire on untreated land could lead to the destruction of pasture, reduce forage availability, and lead to soil erosion. These conditions could reduce available AUMs. Therefore, over the long-term, untreated land could lead to a reduction in grazing-related employment and income.

Forest Products: Under alternative A, both forests would continue to provide forest products and support restoration activities. However, the scale of these activities would be substantially smaller than activities under the 4FRI. The provision of forest products unrelated to 4FRI treatments would be the same under all alternatives, and therefore, are not described in detail in this report.

Wildfire Expenditures and Economic Efficiency: Historically, the Coconino NF and Kaibab NF have annually spent an average of $7,154,801 and $4,456,770 on wildfire, respectively. Under alternative A, wildfire suppression costs would, on average, increase due to fuel buildup and the expanding wildland-urban interface.

The per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be highest under alternative A . The 4FRI benefits from economies of scale – a single environmental compliance document addresses nearly 600,000 acres of restoration activities. Furthermore, the large treatment area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests. In contrast, restoration activities under alternative A would occur piecemeal – requiring numerous environmental compliance documents and increased administrative costs.

The cost to government to treat an area equivalent to the 4FRI project area would be approximately $12 million annually. Discounted at 4 percent over a 10-year period, this is equivalent to a cost of more than $100 million. In contrast, the certainty of a sustained supply under 4FRI would encourage private sector restoration, significantly reducing cost to government.

Social Consequences: Alternative A would not produce measurable social consequences relative to the existing condition. Quality of life and social values would not be affected. As with current conditions, wildfire could displace recreational activities, compromise forest scenery, and degrade air quality. Uncharacteristic wildfire conditions would reduce the quality of life of area residents and forest visitors.

Environmental Justice: The communities that surround the 4FRI project area, particularly in Coconino County, have large minority populations, a relatively high population, and individuals vulnerable to smoke. None of the alternatives eliminate smoke – either from wildfire or prescribed burns. Alternative A would treat the fewest acres with prescribed fire; however, it would also due the least to restore fire-adapted forests. As a result, smoke from uncharacteristic wildfire is most likely under alternative A.

Cumulative Effects

Treatment and Restoration: Forest restoration activities are emphasized in the existing and proposed forest plans in the region. Restoration activities would continue to occur in the region regardless of the 4FRI decision. Between 2000 and 2010, approximately 140,000 (138,736) acres have been treated on the Coconino and Kaibab NFs. On-going projects treat an additional 100,000 acres (96,125). Since 2000, approximately 80,000 acres (78,734) have been treated on private, state, and other federally-managed lands in the project area. Reasonably foreseeable activities will treat 142,869 acres in the project area. These actions will occur regardless of the selected 4FRI alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of 4FRI.

Alternative B: Proposed Alternative

The Coconino and Kaibab National Forest propose to conduct approximately 587,923 acres of restoration activities (within the 988,764 acre project area) over approximately 10 years or until objectives are met. Approximately 20,000 to 30,000 acres of vegetation would be treated annually and up to 40,000 acres would be prescribed burned annually across the two forests.

Direct and Indirect Effects

Recreation: Under alternative B, approximately 2 percent of the Coconino and Kaibab NFs would be unsuitable for recreational uses at any given time. As section 4.6 of the National Visitor Use Monitoring (NVUM) surveys for the forests demonstrate, when individuals are unable to visit their preferred site, most will engage in substitute behavior that will continue to have an effect in the local economy (USFS 2011a, USFS 2011b). As a result, 4FRI treatments are not expected to measurably reduce the economic impact of recreation in the study area. However, if recreational activities reduced one-to-one with the reduction in suitable recreation areas (i.e., by 2 percent), approximately 2,940 jobs and $108 million in labor income would be supported on an average annual basis for the duration of the project. This is a decrease of approximately 60 jobs and $2 million in labor income relative to alternative A.

Grazing: The 4FRI treatments would entail one major pasture burn per year, per allotment. Over the 10-year treatment period, a 10 percent reduction in AUMs is expected. At the end of the 10 years, a return to pre-treatment AUM levels would occur. Therefore, during the 10-year treatment period, cattle AUMs would decrease to approximately 100,000 and sheep AUMs would decrease to approximately 12,250.

At current levels, grazing supports approximately 130 jobs and $2.15 million in labor income in the local economy, annually. The brief duration and advance notice of disturbances due to 4FRI treatments will make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, post-treatment soil and forage quality is expected to increase. Therefore, over the long-term, ranchers would benefit from 4FRI activities.

Forest Products: Alternative B would provide approximately 138,959 ccf of timber and 2,862 dry tons of biomass on an average annual basis throughout the 10-year treatment period. As described above in the Summary of Effects section, harvesting and utilization activities related to 4FRI would support approximately 646 jobs and $29.9 million in labor income in the study area economy on an average annual basis throughout the 10-year project period. Forest Service project administration will require 35 employees who are currently on staff.

Wildfire Expenditures and Economic Efficiency: Under alternative B, wildfire suppression costs would, on average, decrease due to the restoration of fire-adapted forests. The decrease in wildfire suppression costs would allow more Forest Service expenditures to be directed toward forest health (e.g., fire management for resource benefit) and visitor services activities.

The per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be lower than alternative A and approximately equivalent to alternatives C and D. The 4FRI benefits from economies of scale

– a single environmental compliance document addresses nearly 600,000 acres of restoration activities. Furthermore, the large treatment area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests. As discussed under alternative A, 4FRI has the potential to provide a $100 million net benefit to government over the 10-year project period.

Social Consequences: Alternative B would increase truck traffic volume on Forest Service and nearby roads. Approximately 120,000 truck trips per year are expected to result from 4FRI activities under alternative B. The increased truck volume would increase commute times. Individuals who use those roads would have their quality of life adversely affected.

As with all action alternatives (B, C, D), some individuals may not be able to recreate at their preferred sites during the treatment period. If these individuals engage in substitute behavior (e.g., recreating at a different site in the local area), there would be no impact to visitor spending. However, there are social and non-market consequences to recreation displacement. Individuals may get less fulfillment or enjoyment from recreating at an alternate site, which would adversely affect quality of life. Due to the short duration and relatively few sites that are expected to be affected, the quality of life implications of recreation displacement would be small.

Environmental Justice: Alternative B would not reduce employment and income relative to current conditions and the community smoke effects are not expected to disproportionately adversely affect low income or minority populations. As a result, no environmental justice consequences would occur due to 4FRI treatments.

Cumulative Effects

Treatment and Restoration: Forest restoration activities are emphasized in the existing and proposed forest plans in the region. Restoration activities would continue to occur in the region regardless of the 4FRI decision. Between 2000 and 2010, approximately 140,000 (138,736) acres have been treated on the Coconino and Kaibab NFs. On-going projects treat an additional 100,000 acres (96,125). Since 2000, approximately 80,000 acres (78,734) have been treated on private, state, and other federally-managed lands in the project area. Reasonably foreseeable activities will treat 142,869 acres in the project area. These actions will occur regardless of the selected 4FRI alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of 4FRI. Under alternative B, due to the expected increase in the size of the timber harvesting and processing industry in the region, the local economic impact of current and future restoration activities would increase. The estimated employment and income consequences of non-4FRI treatment activities, therefore, are likely underestimated in the related environmental compliance documents.

Recreation: Other on-going and reasonably foreseeable vegetation treatments in the project area will reduce the opportunities for substitute behavior when the preferred recreation site is unavailable. As a result, individuals may choose to stay home, which would decrease visitor spending and consumer surplus to a greater extent than estimated in the direct and indirect effects analysis.

Planned expansions and improvements to recreation opportunities within the project area, however, may counterbalance the visitor use consequences of treatment. Increased recreation opportunities will increase both the number and appeal of substitute recreation activities in the study area.

The extent to which these two forces (vegetation treatment and recreation opportunity improvement) will balance each other is unknown. Therefore, the cumulative effects to the social and economic impacts from recreation cannot be precisely described. Based on the available information, the net effect to visitor spending and consumer surplus from on-going and reasonably foreseeable actions is not expected to change.

Alternative C

The Coconino and Kaibab National Forest would mechanically treat 434,038 and prescribe fire on approximately 593,211 acres over a period of 10 years or until objectives are met. Approximately 20,000 to 30,000 acres of vegetation would be treated annually and up to 40,000 acres would be prescribed burned annually across the two forests.

Direct and Indirect Effects

Recreation: Under alternative C, approximately 2 percent of the Coconino and Kaibab NFs would be unsuitable for recreational uses at any given time. As section 4.6 of the National Visitor Use Monitoring (NVUM) surveys for the forests demonstrate, when individuals are unable to visit their preferred site, most will engage in substitute behavior that will continue to have an effect in the local economy (USFS 2011a, USFS 2011b). As a result, 4FRI treatments are not expected to measurably reduce the economic impact of recreation in the study area. However, if recreational activities reduced one-to-one with the reduction in suitable recreation areas (i.e., by 2 percent), approximately 2,940 jobs and $108 million in labor income would be supported on an average annual basis for the duration of the project. This is a decrease of approximately 60 jobs and $2 million in labor income relative to alternative A.

Grazing: The 4FRI treatments would entail one major pasture burn per year, per allotment. Over the 10-year treatment period, a 10 percent reduction in AUMs is expected. At the end of the 10 years, a return to pre-treatment AUM levels would occur. Therefore, during the 10-year treatment period, cattle AUMs would decrease to approximately 100,000 and sheep AUMs would decrease to approximately 12,250.

At current levels, grazing supports approximately 130 jobs and $2.15 million in labor income in the local economy, annually. The brief duration and advance notice of disturbances due to 4FRI treatments will make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, post-treatment soil and forage quality is expected to increase. Therefore, over the long-term, ranchers would benefit from 4FRI activities.

Forest Products: Alternative C would increase timber and biomass availability by approximately 50 percent relative to alternatives B and D. Alternative C, therefore, would support approximately 969 jobs and $45.0 million in labor income in the study area economy on an average annual basis throughout the 10-year project period. Forest Service staffing is expected to remain the same under alternatives B, C, and D.

Wildfire Expenditures and Economic Efficiency: Under alternative C, wildfire suppression costs would, on average, decrease due to the restoration of fire-adapted forests.

The per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be lower than alternative A and approximately equivalent to alternatives B and D. The 4FRI benefits from economies of scale – a single environmental compliance document addresses nearly 600,000 acres of restoration

activities. Furthermore, the large treatment area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests.

As discussed under alternative A, 4FRI has the potential to provide a $100 million benefit to government over the 10-year project period.

Social Consequences: Increased forest product availability under alternative C would increase the volume of truck traffic on forest and nearby roads. Individuals who commute along those roads or live in their proximity would be more likely to be disturbed by traffic increases relative to alternatives B and D.

As with all action alternatives (B, C, D), some individuals may not be able to recreate at their preferred sites during the treatment period. If these individuals engage in substitute behavior (e.g., recreating at a different site in the local area), there would be no impact to visitor spending. However, there are social and non-market economic consequences to recreation displacement. Individuals may get less fulfillment or enjoyment from recreating at an alternate site, which would adversely affect quality of life. Due to the short duration and relatively few sites that are expected to be affected, the quality of life implications of recreation displacement would be small.

Environmental Justice: Alternative C would not reduce employment and income relative to current conditions and the community smoke effects are not expected to disproportionately adversely affect low income or minority populations. As a result, no environmental justice consequences would occur due to 4FRI treatments.

Cumulative Effects

Treatment and Restoration: Forest restoration activities are emphasized in the existing and proposed forest plans in the region. Restoration activities would continue to occur in the region regardless of the 4FRI decision. Between 2000 and 2010, approximately 140,000 (138,736) acres have been treated on the Coconino and Kaibab NFs. On-going projects treat an additional 100,000 acres (96,125). Since 2000, approximately 80,000 acres (78,734) have been treated on private, state, and other federally-managed lands in the project area. Reasonably foreseeable activities will treat 142,869 acres in the project area. These actions will occur regardless of the selected 4FRI alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of 4FRI. Under alternative C, due to the expected increase in the size of the timber harvesting and processing industry in the region, the local economic impact of current and future restoration activities would increase. The estimated employment and income consequences of non-4FRI treatment activities, therefore, are likely underestimated in the related environmental compliance documents.

Recreation: Other on-going and reasonably foreseeable vegetation treatments in the project area will reduce the opportunities for substitute behavior when the preferred recreation site is unavailable. As a result, individuals may choose to stay home, which would decrease visitor spending and consumer surplus to a greater extent than estimated in the direct and indirect effects analysis.

Planned expansions and improvements to recreation opportunities within the project area, however, may counterbalance the visitor use consequences of treatment. Increased recreation

opportunities will increase both the number and appeal of substitute recreation activities in the study area.

The extent to which these two forces (vegetation treatment and recreation opportunity improvement) will balance each other is unknown. Therefore, the cumulative effects to the social and economic impacts from recreation cannot be precisely described. Based on the available information, the net effect to visitor spending and consumer surplus from on-going and reasonably foreseeable actions is not expected to change.

Alternative D

The Coconino and Kaibab National Forests would mechanically treat 567,279 acres and prescribe burn 178,852 acres over a period of 10 years or until objectives are met. Approximately 20,000 to 30,000 acres of vegetation would be treated annually. Under alternative D, the acres to be prescribed burn decrease by more than 50 percent relative to alternative B.

Direct and Indirect Effects

Recreation: Under alternative D, approximately 2 percent of the Coconino and Kaibab NFs would be unsuitable for recreational uses at any given time. As section 4.6 of the National Visitor Use Monitoring (NVUM) surveys for the forests demonstrate, when individuals are unable to visit their preferred site, most will engage in substitute behavior that will continue to have an effect in the local economy (USFS 2011a, USFS 2011b). As a result, 4FRI treatments are not expected to measurably reduce the economic impact of recreation in the study area. However, if recreational activities reduced one-to-one with the reduction in suitable recreation areas (i.e., by 2 percent), approximately 2,940 jobs and $108 million in labor income would be supported on an average annual basis for the duration of the project. This is a decrease of approximately 60 jobs and $2 million in labor income relative to alternative A.

Grazing: The 4FRI treatments would entail one major pasture burn per year, per allotment. Although fewer acres would be prescribe burned under alternative D, the same number of pastures would be affected under all action alternatives. Therefore, over the 10-year treatment period, a 10 percent reduction in AUMs is expected. At the end of the 10 years, a return to pre-treatment AUM levels would occur. Therefore, during the 10-year treatment period, cattle AUMs would decrease to approximately 100,000 and sheep AUMs would decrease to approximately 12,250.

At current levels, grazing supports approximately 130 jobs and $2.15 million in labor income in the local economy, annually. The brief duration and advance notice of disturbances due to 4FRI treatments will make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, post-treatment soil and forage quality is expected to increase. Therefore, over the long-term, ranchers would benefit from 4FRI activities.

Forest Products: Alternative D would provide approximately 138,959 ccf of timber and 2,862 dry tons of biomass on an average annual basis throughout the 10-year treatment period. As described above in the Summary of Effects section, harvesting and utilization activities related to 4FRI would support approximately 646 jobs and $29.9 million in labor income in the study area economy on an average annual basis throughout the 10-year project period. Forest Service project administration will require 35 employees who are currently on staff.

Wildfire Expenditures and Economic Efficiency: Alternative D significantly reduces (by 50 percent) the acres to be treated by prescribed burning. As described in the fire ecology report, prescribed burning is the most effective and least costly treatment option. Per acre, thinning is approximately twice as costly as prescribed burning. Alternative D would lead to fewer restored acres than alternative B and alternative C. The net ecological and economic benefits of alternative D, therefore, are the lowest among the action alternatives. However, Forest Service expenditures related to 4FRI implementation and monitoring activities are expected to be the same under all action alternatives. As a result, alternative D would be less economically efficient than alternatives B and C.

The per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be lower than alternative A and approximately equivalent to alternatives B and C. The 4FRI benefits from economies of scale – a single environmental compliance document addresses nearly 600,000 acres of restoration activities. Furthermore, the large treatment area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests.

As discussed under alternative A, 4FRI has the potential to provide a $100 million benefit to government over the 10-year project period.

Social Consequences: The key difference between alternative D and alternatives B and C is the reduction in the use of prescribing burning as a forest restoration method. Individuals in nearby communities who oppose the use of prescribed burning due to smoke would experience the highest quality of life under alternative D. However, alternative D is expected to be less effective at restoring fire-adapted forests. Therefore, the probability of uncharacteristic wildfire would be higher under alternative D (relative to alternatives B and C). Unlike prescribed burns, which require burn plans and are implemented under favorable conditions, the smoke consequences of wildfire on nearby communities are likely to be more severe.

As with all action alternatives (B, C, D), some individuals may not be able to recreate at their preferred sites during the treatment period. If these individuals engage in substitute behavior (e.g., recreating at a different site in the local area), there would be no impact to visitor spending. However, there are social and non-market economic consequences to recreation displacement. Individuals may get less fulfillment or enjoyment from recreating at an alternate site, which would adversely affect quality of life and consumer surplus. Due to the short duration and relatively few sites that are expected to be affected, the quality of life implications of recreation displacement would be small.

Environmental Justice: Alternative D would not reduce employment and income relative to current conditions and the community smoke effects are not expected to disproportionately adversely affect low income or minority populations. Alternative D would treat the fewest acres with prescribed burns, which would reduce nuisance smoke. However, alternative D would also be less effective than alternatives B and C in terms of reducing the risk and hazard of uncharacteristic wildfire. Therefore, wildfire smoke is more likely under alternative D (and alternative A). As a result, no environmental justice consequences would occur due to 4FRI treatments.

Cumulative Effects

Treatment and Restoration: Forest restoration activities are emphasized in the existing and proposed forest plans in the region. Restoration activities would continue to occur in the region regardless of the 4FRI decision. Between 2000 and 2010, approximately 140,000 (138,736) acres have been treated on the Coconino and Kaibab NFs. On-going projects treat an additional

100,000 acres (96,125). Since 2000, approximately 80,000 acres (78,734) have been treated on private, state, and other federally-managed lands in the project area. Reasonably foreseeable activities will treat 142,869 acres in the project area. These actions will occur regardless of the selected 4FRI alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of 4FRI. Under alternative D, due to the expected increase in the size of the timber harvesting and processing industry in the region, the local economic impact of current and future restoration activities would increase. The estimated employment and income consequences of non-4FRI treatment activities, therefore, are likely underestimated in the related environmental compliance documents.

Recreation: Other on-going and reasonably foreseeable vegetation treatments in the project area will reduce the opportunities for substitute behavior when the preferred recreation site is unavailable. As a result, individuals may choose to stay home, which would decrease visitor spending and consumer surplus to a greater extent than estimated in the direct and indirect effects analysis.

Planned expansions and improvements to recreation opportunities within the project area, however, may counterbalance the visitor use consequences of treatment. Increased recreation opportunities will increase both the number and appeal of substitute recreation activities in the study area.

The extent to which these two forces (vegetation treatment and recreation opportunity improvement) will balance each other is unknown. Therefore, the cumulative effects to the social and economic impacts from recreation cannot be precisely described. Based on the available information, the net effect to visitor spending and consumer surplus from on-going and reasonably foreseeable actions is not expected to change.

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