

Recreation, Grazing, Minerals and Timber Demand

Analysis of the Management Situation

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for:

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Recreation

Introduction

This document provides estimates of existing recreation use and capacity on the Apache-Sitgreaves National Forests (ASNF). Current recreation use and anticipated changes in demand during the next planning period are provided in order to aid in planning for future management of the Forests' resources. Outdoor recreation is of growing popularity across the western states, and National Forests in Arizona provide unique recreational experiences. Demand for these recreational opportunities is directly tied to population levels; therefore population growth provides a proxy for changes in demand. A variety of data sources are utilized throughout this report, including national and state demographic and recreation studies. Visitor use data for the ASNF is provided from the National Visitor Use Monitoring Survey (NVUM). NVUM provides current use estimates by activity. Although factors such as population growth, available services and amenities, and substitute activities may be controlled for when projecting demand for forest recreation, there are several issues that are beyond the control of natural resource planners. Weather, future regional economic conditions, state wildlife regulations and other unknown factors can impact the rate at which public stakeholders recreate on Federal lands. Accounting for such factors is outside the scope of this report. Forest recreation is a dynamic concept in that it changes across time. This report utilizes quantitative data, when available, to predict changes in demand for recreation. However, the quantitative analysis must be paired with a qualitative assessment of socioeconomic factors affecting recreation use for which no data exists.

The goal of this report is to provide a comprehensive analysis of outdoor recreation as it relates to the ASNF, and provide projections of demand so that managers may make more informed decisions during the next planning cycle. Part of forest management is to decide the level of recreation supply to introduce to the market. In a balanced recreation economy supply equals demand. However, the equilibrium state is impossible to predict without dynamic supply and demand functions. Such functions do not exist for recreation on the ASNF. When possible, quantitative data is used to report recreation supplied and demanded; which is then paired with a qualitative assessment of the market for outdoor recreation. NVUM data is also assumed to report the current quantity of recreation supplied. Since the public good qualities of National Forests prohibit the exclusion of recreators, and the only mechanism of limiting supply is the productivity and sustainability of forest resources. Current use levels are assumed to be the equilibrium state for recreation supply and demand. Exogenous factors provide the basis for the assessment of directional change from that equilibrium.

The ASNF receives visitors from all over the western United States. The study area for this analysis is the State of Arizona. State trends in population and outdoor recreation use are relied upon to serve as a proxy to recreation demand. When necessary, the report will discuss regional findings at a smaller scale, however, quantitative data at this level is limited.

Recreation Summary

At the national level, outdoor recreation participation has been steadily increasing for decades. Cordell (2004) explains that "outdoor recreation is not only a deeply entrenched part of Americans' lifestyles but also is a growing part of those lifestyles. National Forests serve as a primary destination for outdoor recreators across the nation. They provide opportunities for many different activities in both developed and primitive environments. Recreational activities on forests are often an issue of disagreement and contention across user groups. For example,

motorized and non-motorized interests groups are often at odds with each other regarding their ideas of the best use of public lands. One of the critical components of forest planning is to develop a mechanism for providing a sustainably diverse set of recreational opportunities meeting the demands of the public. Those demands are constantly evolving and likely to vary across different regions of the US.

Arizona offers a wide range of outdoor recreation opportunities. The supply and demand of recreation on public lands is complex. Arizona consists of approximately 72.6 million acres of land, 33 percent of which is public land and 13 percent state trust land (AZGFD, 2009). The public-private interface complicates the availability and demand for outdoor recreation. More than 6 percent the State's land base is considered landlocked public ground, meaning there is no legal access through public means (AZGFD, 2009). To address this, the Arizona Game and Fish Department (AZGFD) developed the Landowner Relations Program, which includes an access program with the objective of maintaining public access by cooperatively working with private land owners. This improves accessibility to public land across the state.

Overall, tourism in Arizona is on the rise. A total of 35.2 million overnight travelers visited the state in 2007; this represents a 4.4 percent increase from the previous year. This visitation resulted in \$19.3 billion dollars of direct expenditures, and generated 171,500 direct jobs (AOT, 2008). The economic activity specific to outdoor recreation is not reported, however, it is assumed to be a substantial contributor. Arizona's rich natural amenity base, including the Grand Canyon, is a popular draw for many tourists. This includes activities on National Forests. In 2008, the Arizona Office of Tourism (AOT) launched an outdoor adventure campaign in partnership with Arizona State Parks and Arizona Trail Association to showcase the state's outdoor offerings (AOT, 2008). These campaigns should increase Arizona's visibility as an outdoor recreation destination among residents and non-residents, and consequently increase demand.

Outdoor recreation on public lands is concentrated due to the limited acreage available. Managing over two million acres, the ASNF is a popular recreation destination for many residents in the southwest. The majority of visitors surveyed during round 2 of NVUM resided in Arizona, Southern California and Western New Mexico. Overall it was estimated that the ASNF received 1,886,700 visits in 2007. Only 18 percent of those visitors were considered local residents. Locals were considered those traveling less than 50 miles to site visited. Non-locals accounted for 80 percent of total visits and non-primary accounted for 2 percent. Non-primary visitors are those whose primary purpose of trip was something other than recreation on the Forests. The ASNF is located in a remote part of eastern Arizona, away from the large population center of Phoenix. This accounts for the high proportion non-local visitation. Much of the demand for outdoor recreation in Arizona is supplied by the ASNF.

Demand

The 1987 Forest Plan highlighted several areas where demand for developed recreation sites exceeds the availability of improvements. It is noted that most areas where demand is expected to outpace supply is around lakes and streams. Water is a scarce resource in the southwestern deserts, and many outdoor recreation experiences are enhanced by the presence of lakes and streams. Outdoor recreators tend to flock to easily accessible, high amenity, areas which could stress the Forests' natural resources. Therefore, consolidated use around the ASNF's water resources is expected to reach the maximum output sustainable. The 1987 plan estimates that projected future use will meet the potential supply for developed recreation. Demand for

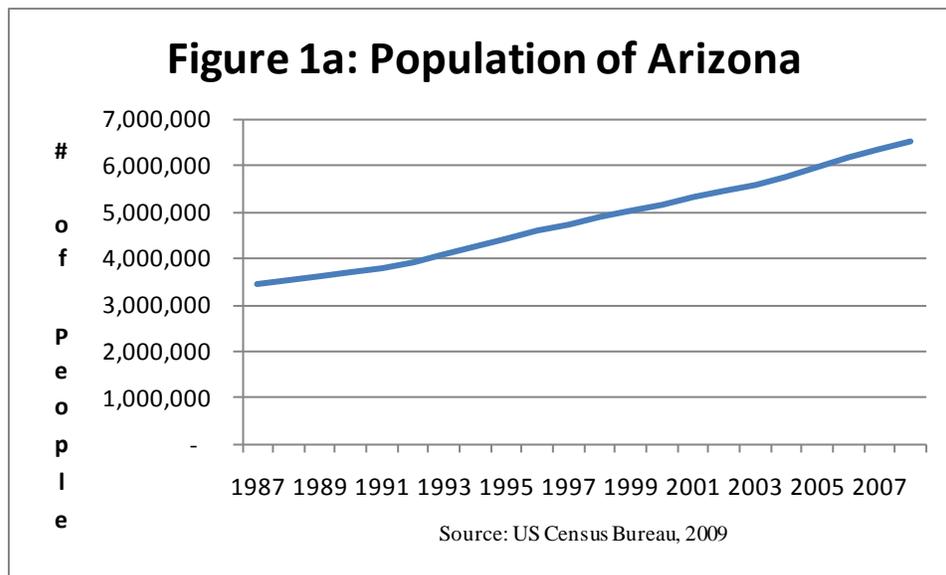
wilderness and dispersed recreation, on the other hand, is not expected to outpace the Forests' ability to supply.

Table 1a: Comparison of Recreation Outputs with Projected Future Use and Supply

		Average Annual					
		Proposed Plan		Potential Supply		Projected Future Use	
Resource Output	Unit of Measure ¹	Period 1	Period 5	Period 1	Period 5	Period 1	Period 5
Wilderness Recreation (excluding wildlife)	MRVD	19	32	35	75	35	75
Developed Recreation (including skiing)	MRVD	1,035	2,293	1,035	2,293	1,035	2,293
Dispersed Recreation (Excluding Highway Use)	MRVD	714	1,553	900	2,700	891	1,850

Source: 1987 ASNF Plan

¹: MRVD = Thousands of Recreation Visitor Days



Demand for recreation is closely tied to population levels. Figure 1a reports Arizona's population from 1987 to 2008. Since 1987, the state's population has increased at an average annual growth rate

of 3.1 percent. It is therefore expected that the demand for outdoor recreation among residents should have increased at a similar rate. Population growth serves as a proxy for change in recreation demand; actual change in demand could vary according to changes in other socioeconomic variables. A person's tastes and preferences, household income, mental and physical health, proximity to National Forests, as well as a variety of other variables affect their demand for outdoor recreation. A well researched demand function should control for those variables significantly influencing the population of the study area. However, such functions for recreation on the ASNF do not exist, and development of one is beyond the scope of this analysis. Therefore, population growth serves as the best proxy for change in demand.

Table 2a reports the estimated distribution of activities participated in during recreational visits. NVUM measures visitation as National Forest Visits which are different than MRVD's. Thus the methods of reporting recreation use are not directly comparable between the 1987 Forest Plan and current revision efforts. A National Forest Visit is defined as the entry of one person onto a National Forest for the primary purpose of recreation for an unspecified period of time. It is assumed that this data represents current recreation use based on the existing population. The

main activity represents the primary purpose for the trip, and participation represents all activities participated in no matter what the main activity was. Therefore, one visitor could participate in multiple activities during one trip. It is important to consider total activity participation because that identifies the demand for recreational goods and services supplied by the Forests. The most common activities include viewing natural features and wildlife, relaxing, and hiking/walking. There should be continual growth in demand for most forest activities during the next planning cycle.

Table 2a: ASNF Activity Participation

Activity	% Participation	% Main Activity
Camping in developed sites	24%	9%
Primitive camping	4%	0%
Backpacking	7%	0%
Resort Use	2%	0%
Picnicking	17%	3%
Viewing wildlife	70%	1%
Viewing natural features	68%	3%
Visiting historic sites	7%	1%
Visiting a nature center	4%	0%
Nature Study	17%	0%
Relaxing	81%	20%
Fishing	35%	23%
Hunting	1%	1%
OHV use	9%	0%
Driving for pleasure	47%	4%
Motorized water travel	8%	1%
Hiking or walking	63%	26%
Horseback riding	2%	1%
Bicycling	6%	1%
Non-motorized water travel	4%	1%
Other non-motor activity	3%	0%
Gathering forest products	11%	1%
Motorized trail Activity	8%	6%

Based on a 3.1 percent average annual growth rate, the demand for recreation on the ASNF in the year 2025 will be 3,268,578 visits. Table 3a reports the demand for recreation at 5 year intervals during the next planning cycle. These estimates are based on 2007 data reported during round 2 of NVUM and Arizona’s average annual population growth rate from 1987 to 2008. The distribution of activity participation is also based off of NVUM round 2 results. The sum of participants is greater than the total National Forest visits because individuals can participate in more than one activity during their visit.

Table 3a: Demand for Recreation on the ASNF during the Next Planning Cycle

	2007¹	2010²	2015³	2020³	2025⁵
National Forest Visits	1,886,700	2,067,659	2,408,642	2,805,857	3,268,578
	Number of Participants				
Camping in developed sites	460,355	504,509	587,709	684,629	797,533
Primitive camping	75,468	82,706	96,346	112,234	130,743
Backpacking	132,069	144,736	168,605	196,410	228,800

Resort Use	41,507	45,488	52,990	61,729	71,909
Picnicking	315,079	345,299	402,243	468,578	545,852
Viewing wildlife	1,322,577	1,449,429	1,688,458	1,966,906	2,291,273
Viewing natural features	1,279,183	1,401,873	1,633,059	1,902,371	2,216,096
Visiting historic sites	124,522	136,465	158,970	185,187	215,726
Visiting a nature center	69,808	76,503	89,120	103,817	120,937
Nature Study	324,512	355,637	414,286	482,607	562,195
Relaxing	1,535,774	1,683,074	1,960,634	2,283,967	2,660,622
Fishing	667,892	731,951	852,659	993,273	1,157,077
Hunting	24,527	26,880	31,312	36,476	42,492
OHV use	177,350	194,360	226,412	263,751	307,246
Driving for pleasure	890,522	975,935	1,136,879	1,324,364	1,542,769
Motorized water travel	143,389	157,142	183,057	213,245	248,412
Hiking or walking	1,196,168	1,310,896	1,527,079	1,778,913	2,072,278
Horseback riding	28,301	31,015	36,130	42,088	49,029
Bicycling	109,429	119,924	139,701	162,740	189,578
Non-motorized water travel	79,241	86,842	101,163	117,846	137,280
Other non-motor activity	50,941	55,827	65,033	75,758	88,252
Gathering forest products	203,764	223,307	260,133	303,033	353,006
Motorized trail Activity	143,389	157,142	183,057	213,245	248,412

¹Estimate from NVUM Round 2

^{2,3,4} and ⁵Projection based on an average annual growth rate of 3.1 percent

It is projected that the ASNF will receive steady growth in the demand for all recreation activities during the next planning cycle. Infrastructure must be developed to meet this increase in demand, or regulations must be invoked to limit use. The most growth should occur to the more common activities reported in Table 2a; therefore planning efforts should focus around these user groups. Public collaboration is an important element of gauging demand for recreation throughout the planning cycle. Changes in tastes and preferences could affect participation rates of outdoor activities. Other factors such as aging populations, decreasing leisure times, geographically uneven population growth, immigration, family values and education levels could impact total forest visits and the distribution of activity participation (Cordell et al., 1999). Such evolutions in recreation use should emerge through public comments and in various political arenas. Therefore, the data reported in Table 3a should be considered in conjunction with any information received during scoping periods and incorporate future advancements in the science.

Recreation Trends

Many variables affect trends in participation of outdoor recreation. Geographic location, socioeconomic status, age, and education all influence recreational behavior. However, outdoor recreation has remained largely popular across American communities and groups within society. And although recreational activities evolve overtime, the basic motivation is still having the opportunity to visit, view and live with nature (Cordell et al., 1999). Past trends indicate that casual activities are most in demand. These activities include hiking/walking, family gatherings and viewing sites of interest. Long term and short terms trends also indicate continued growth in outdoor recreation among all segments of the population (Cordell et al., 1999).

As reported above, population growth has been, and is expected to continue to be the primary driver of outdoor recreation participation growth. Projections for winter, water-based, wildlife related, dispersed land activities, and developed land activities were developed based on data published in *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends*, by H. Ken Cordell, et al. (1999). Projections were developed by region and

indexed using 1995 as the base year (Cordell et al., 1999). For example, in Table 4a, the value of 1.06 for canoeing means that in the year 2000 total participation in canoeing should be 6 percent greater than it was in 1995; in 2010 it should be 21 percent greater than it was in 1995. For the purposes of this report the pacific region is used as a proxy for recreation trends. Given Arizona’s close proximity to the west coast, and similarities in the socioeconomic environments of large population centers in Arizona and Southern California, it is assumed that average recreators have more in common with those in the pacific region than the mountain states. The projected participation trends in this region are reported in Table 4a; winter recreation is not included because it was not a popular activity on the ASNF.

Table 4a: Projected Trends in Outdoor Recreation, Indexed to 1995

Variable	2000	2010	2020	2030	2040	2050
Water-Based Activities:						
Canoeing	1.06	1.21	1.30	1.51	1.69	1.89
Motor-boating	1.07	1.22	1.32	1.52	1.69	1.88
Non-pool Swimming	1.06	1.19	1.29	1.43	1.57	1.72
Rafting/Floating	1.05	1.20	1.30	1.52	1.73	1.97
Wildlife-Related Activities:						
Fishing	1.05	1.12	1.20	1.23	1.30	1.38
Hunting	0.94	0.93	0.91	0.89	0.88	0.89
Non-consumptive Wildlife Activities	1.08	1.23	1.37	1.52	1.65	1.77
Dispersed Land Activities:						
Backpacking	1.05	1.12	1.23	1.24	1.34	1.46
Hiking	1.08	1.23	1.34	1.53	1.69	1.85
Horseback Riding	1.05	1.18	1.29	1.46	1.61	1.77
Off-Highway Driving	1.04	1.10	1.20	1.20	1.26	1.33
Primitive Camping	1.05	1.13	1.23	1.27	1.35	1.44
Rock Climbing	1.03	1.06	1.16	1.12	1.21	1.34
Developed Land Activities:						
Biking	1.06	1.19	1.29	1.41	1.53	1.65
Developed Camping	1.06	1.19	1.32	1.45	1.59	1.73
Picnicking	1.07	1.20	1.31	1.44	1.54	1.63
Family Gathering	1.07	1.20	1.30	1.42	1.54	1.65
Sightseeing	1.09	1.26	1.42	1.58	1.74	1.87
Visiting Historical Places	1.08	1.22	1.33	1.46	1.58	1.68
Walking	1.08	1.23	1.34	1.49	1.62	1.73

Source: Cordell et al., 1999

Activities projected to experience the greatest growth are most water based activities, hiking and walking, sightseeing and non-consumptive wildlife activities. The only activity in the pacific region projected to experience a decline in participation is hunting. Hunting and fishing are considered consumptive forms of wildlife activities. Fishing is expected to experience growth, but at rates much slower than other non-consumptive activities. For the most part, it is the more casual activities that are expected to experience the greatest growth. Individuals and families are likely to continue to participate in outdoor activities during their leisure time for recreational and bonding purposes. Based on these trends, it is safe to say the ASNF will experience an increase in demand for most recreational activities during the next planning cycle.

Forest Capacity

Forest capacity refers to the ability of the resources to supply recreation. The ASNF has a limited resource base; therefore supply may not grow infinitely. Available forest resources may be considered as a fixed input to production. Other factors such as the development of new technology and investments in infrastructure may increase the supply of recreation to a certain degree, but at some point the available resources will be exhausted and recreation supply will reach a ceiling or possibly experience a decrease. Forest resources must support recreational opportunities well into the future. This section explores the ASNF's ability to supply sustainable levels of recreation.

Recreation at developed sites is more subject to capacity restrictions than dispersed recreation. A developed site, such as a campground, typically supports a limited number of recreators. Infrastructure at the site limits the number of people who may recreate at one time. Parking spots, campsites and picnic tables are all examples of infrastructure that limit the total capacity at developed sites. Table 5a reports the volume and capacity of recreation sites by type. Campgrounds have the largest capacity of developed sites supporting up to 9,393 recreators at one time. Each site may have a different season of use, which would affect annual capacity. Demand for these sites does not occur evenly throughout the year. For much of the year, during moderate or low demand periods such as mid-week or off-season periods, a significant quantity of developed capacity is unused. Public perceptions of crowding tend to occur during periods of high (i.e. weekends) and peak use (i.e. holidays). Based on recreation trends and projected population growth, it is expected that total demand for outdoor recreation at developed sites will surpass the Forest's ability to supply during high use periods given the current volume and capacity of developed sites. Investment in infrastructure, or adopting regulations to control use, will be needed to align capacity with demand in future years.

Table 5a: Volume and Capacity of Recreation Sites by Type

Site Type	Number of Sites	Total Capacity
Boating	22	2,367
Campground	51	9,393
Camping Area	8	1,730
Day Use Area	7	140
Dump Station	3	21
Fishing Site	5	268
Group Campground	7	710
Group Picnic Site	1	575
Horse Camp	1	25
Info Site/ Fee Station	3	73
Interpretive Site (Major)	2	230
Interpretive Site (Minor)	12	329
Lookout/ Cabin	1	6
Observation Site	8	303
Other Recreation Concession Site	1	35
Picnic Site	12	650
Trailhead	141	3,545

Source: USDA Forest Service, 2009

Capacity estimates are subject to a certain amount of subjectivity. While the capacity of a campground can be estimated based on the parking available and the number of sites provided;

estimates of the capacity of general forest areas are subject to interpretation based on personal or social preferences. Social capacity is the number of other persons or activities that a visitor can tolerate without feeling that their experience has been compromised. If social capacity is exceeded, a visitor will try to find another location to pursue their chosen activity or abandon that activity in favor of another. Social capacity can vary from one person to another. What one individual is willing to accept, may be unacceptable to another.

Since use is concentrated around developed sites and water resources, it is likely that capacity of general forest areas will be sufficient to meet demand during the next planning cycle. Those looking for a primitive experience may travel to part of the Forests' nearly 200,000 acres of wilderness. However, wilderness designation does not appear to be a hot topic for ASNF managers. According to Russell and Adams-Russell (2006) existing wilderness is valued but there is skepticism about the need for future designations. These areas are perceived by some as desolate and unproductive because they have greater restrictions compared to general forest areas. However, there are other stakeholders that value the primitive experiences offered by wilderness, and travel to the ASNF specifically to recreate in those areas. Maintaining adequate wilderness capacity is essential to meeting multiple-use and sustained-yield goals. There are no definitive estimates of wilderness capacity. But given the social views defined by Russell and Adams-Russell (2006) there should not be unmet demand during the next planning cycle. Collaborating with the public is an important method for addressing forest capacity and identifying areas where demand may outpace supply.

Grazing

Introduction

While shrublands and grasslands are most commonly associated with grazing, forest lands also support an understory of grasses, shrubs and forbs valuable as a source of forage for domestic livestock grazing. Most of the ASNF grazing allotments are seasonal rather than year round use however, the seasons of use are spread throughout the year. The high elevation allotments are “summer seasonal,” with grazing starting in May, June or July and most ending in October. Mid and low elevation allotments have variable seasons spread throughout the year. There are a few “winter seasonal” allotments, typically starting in November and ending in February or March.

This assessment of demand considers use of head months on the forest service and does not address the demand for non-economic values tied to ranching as a way of life. These non-economic values can include having a working relationship with the land, owning livestock, commitment to community, land stewardship, continuing a family tradition, and the ability to pass on the operation to future generations (Raish and McSweeney, 2003, Conley et al, 2007).

Demand

The demand for grazing is ultimately dependent on the demand for livestock products. The USDA Economic Research Service provides projections of domestic per capita meat consumption and some explanation of expected trends. They anticipate the production decreases that occurred in 2007 and 2008 in response to high grain and soybean meal prices to continue to ripple through the livestock sector in the first several years of the projections. In addition, they expect that with current demand weakened due to the domestic recession and global economic slowdown that these production changes combine with strengthening meat exports to reduce domestic per capita consumption through 2012 (Figure 1b). Finally they conclude “The result is lower production at higher prices, with improving net returns providing economic incentives for moderate expansion in the sector toward the end of the projection period” (USDA 2009a). Thus, while demand may decrease in the next few years, they anticipate opportunities for producers with returning demand at the end of their project period.

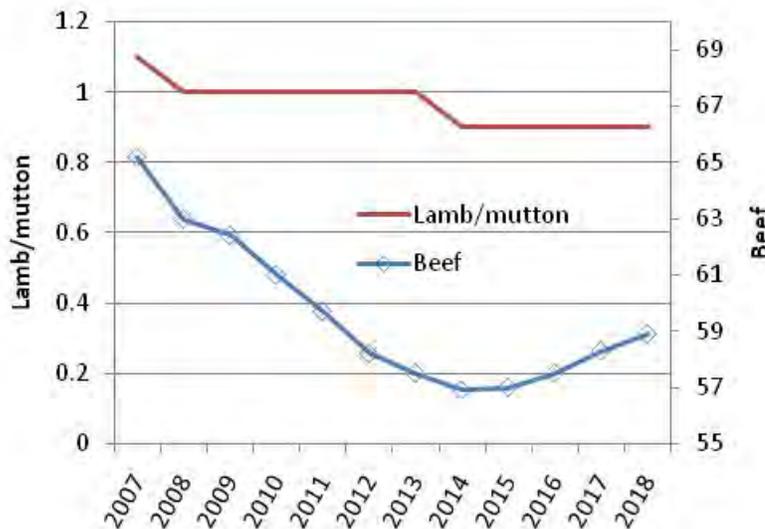


Figure 1b: Per capita meat consumption, retail weight

Examining demand for forage presents some difficulties because only a portion of forage consumed by livestock is leased or sold in an observable market. The vast majority of forage consumed by livestock in the U.S. is produced from pasture owned by the operator and is therefore is not priced in a forage market (USDA 2000). Price information specific to Arizona and New Mexico provide some indication that demand may be increasing. Data shows that grazing fees, adjusted for inflation, have increased from \$8.12 in 2003 to \$8.50 in 2008 per Animal unit month (AUM) in Arizona and increased from \$9.32 to \$11 per AUM in New Mexico (USDA 2009c). If we assume supply has remained constant, the increase in price suggests demand for forage may be increasing in these states. The price for forage on National Forest System and other public lands is set by federal laws and was \$1.35 per AUM in 2008. Forage on public land may not be of the same quality as competitively priced forage and there are often additional costs of operation associated with use of forest service forage.

The best indicator for demand for forage is the number of livestock. Between 1975 and 2009 the numbers of cattle decreased by 13 percent in Arizona (approximately 150,000 animals) and by 10 percent in New Mexico (approximately 180,000 animals) (USDA 2009c) (Figure 2b).

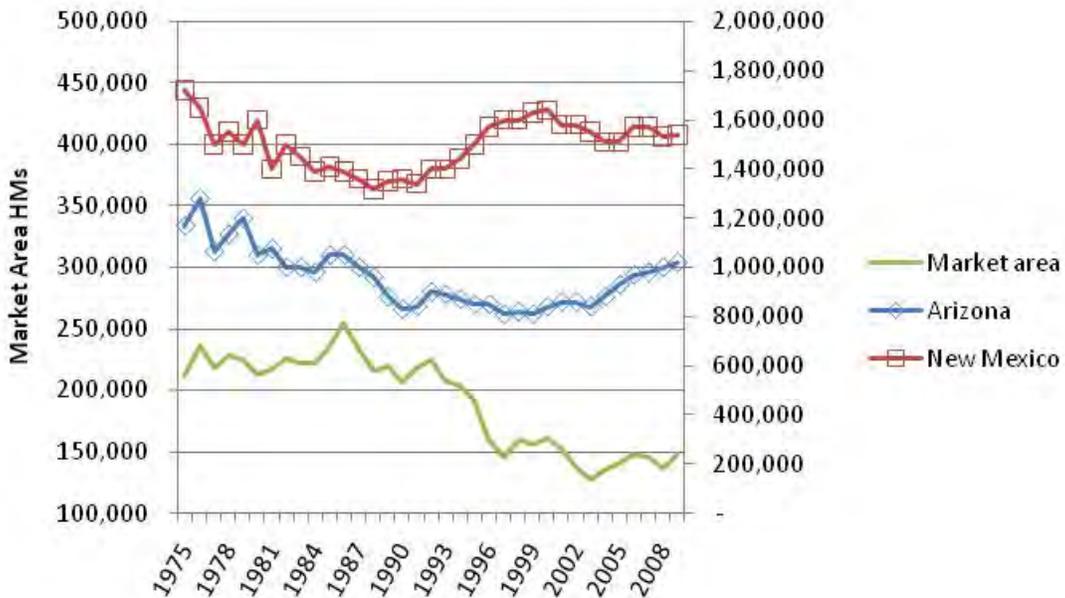


Figure 2b: Cattle inventory in counties dependent on ASNF forage and within the states of Arizona and New Mexico (Source: USDA 2009c)

According to the 2009 Social and Economic Assessment for the ASNF, counties dependent on forage from the ASNF are Apache, Coconino, Greenlee and Navajo counties. In addition, Grant County is included because it is adjacent to the ASNF and some grazing permittees operate on both the ASNFs and the Gila National Forest (USDA 2009b). Within this market area cattle inventory has declined by 30 percent over the period from 1975 to 2009 (Figure 2b) and has not seen the recovery starting in the late 90s in Arizona and late 80s in New Mexico.

Between 1997 and 2008 (Figure 3b) actual cattle and horse Head Months (HMs) on the ASNF has decreased by 35 and 89 percent, respectively. Sheep grazing has not occurred on the forest since 2004. Actual use of HMs on the forest has supported a high of approximately 5.2 percent of the market area cattle inventory in 2003 and a low of 1.2 percent in 2008. While the share of total

demand provided by the ASNF is small, it may be more important for smaller areas within the market area. In addition, the recently observed decreases in the number of actual HMs and share of inventory support by actual use suggests demand for forage from the forest may be decreasing within the market area. However, this trend is uncertain given the wide degree of variation in actual use over the relatively short period examined.

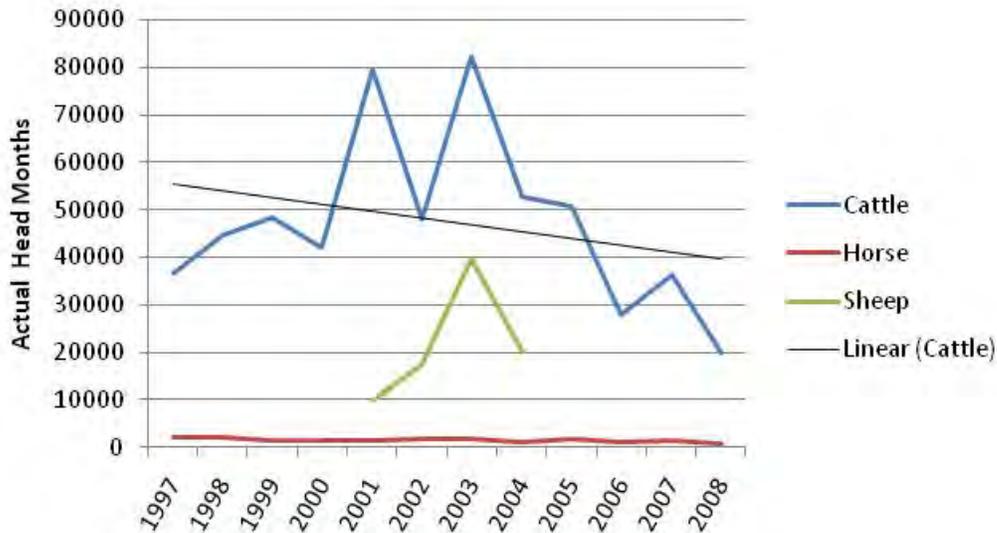


Figure 3b: Actual Head Months on the Apache and Sitgreaves National Forests Supply

While livestock grazing is an important and valued use, it is not the only use on the ASNF and is limited by other resource considerations. Consequently, these other uses and resource values impact the supply of forage available for livestock grazing. The forest service establishes permitted limit for HMs on allotments. This is the maximum number of HMs that could be offered under ideal forage conditions. Permitted livestock grazing on the ASNFs has declined since the late 1980s (USDA 2009b). These changes have occurred with implementation of grazing practices to protect forage conditions. For example, many allotments on the ASNF involve some sort of rest-rotation regime and some have seasonal exclusions to protect habitat, mostly due to willow flycatcher and fish habitat. The ASNF also practices "range readiness" on some seasonal allotments, where livestock are not allowed until plant phenology and soil moisture levels are met in order to prevent resource damage. In addition, a continued drought and large fires have also affected the numbers of permitted livestock (USDA 2009b). Between 1997 and 2008 (Figure 4b) permitted cattle, horse and sheep grazing has, respectively decreased (5 percent), decreased (60 percent) and increased (12 percent). Given large changes in year to year variation it is difficult to say whether these data are indicative of long term trends however they provide a baseline comparison with trends in actual use on the ASNF.

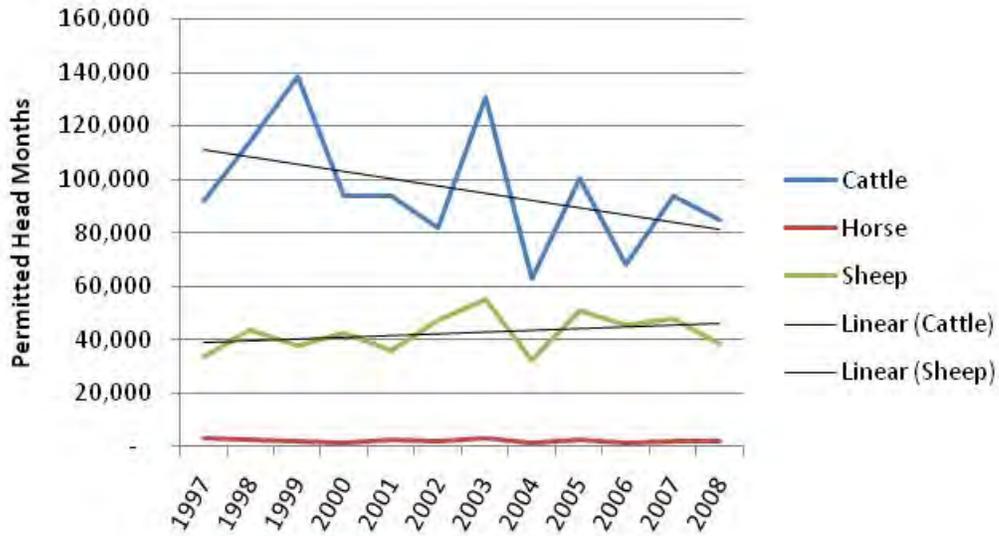


Figure 4b. Permitted Head Months on the Apache and Sitgreaves National Forests

The share of actual grazing use from permitted use on the ASNF has ranged from a high of 85 percent in 2001 to a low of 23 percent in 2008, due to factors such as drought, financial limitations on operators and market conditions.

Minerals

Introduction

This document assesses the current state and future development of mining activity on the Apache-Sitgreaves National Forests (ASNF). Minerals of all types are an important resource on National Forests in the southwest. Types of extractable minerals include energy minerals (i.e. oil and gas), metallic minerals (i.e. copper and gold) and construction related materials (i.e. sand and gemstones). The ASNF is located in eastern Arizona. Demand for minerals on the Forest is influenced by state trends regarding capacity and extraction. Therefore Arizona serves as the study area for this analysis. Current and projected extraction levels are used to assess demand, however there is less information regarding the supply of available minerals on the ASNF. Locatable and extractable minerals depend heavily on the technology available which is influenced by pricing in a global marketplace. This report assesses the supply and demand conditions of minerals using the limited data available as well as a qualitative assessment of indicators lacking reliable data.

Regional Mineral Activity

In 2007 Arizona ranked as the Nation's top producer of non-fuel minerals with a production value of \$7.58 billion. "Arizona leads the Nation in copper and ranks in the top five in molybdenum, sand and gravel, gemstones, perlite, silver, zeolites, and pumice" (ADMMR, 2008). Other extractable minerals include: zinc, lead, beryllium, vanadium, uranium, tungsten, rare earths, manganese, coal, and at least 18 varieties of industrial minerals. Arizona's copper industry alone accounted for 62 percent of National production and had a total impact of \$4.7 billion to the state's economy in 2006 (ADMMR, 2008).

The total value of Arizona's mineral production has increased substantially in recent years (Table 1c). Copper is the most valuable mineral resource under production in the state. Copper deposits are scattered throughout Arizona, are more likely to be discovered in the future. Strong demand and high prices have driven exploration and development activity to their highest levels in many years (ADMMR, 2008). As with most minerals, exploration activity is driven by the market price for the resource. Market prices are determined by supply and demand, however available supply changes with technology. In many cases new technology has allowed for the production of materials previously considered un-extractable. Therefore if copper prices continue to rise, it is likely that new technology and exploration endeavors will lead to the discovery of additional deposits.

Table 6c: Value of Arizona's Mineral Production (\$)

Commodity	2005 Value	2006 Value	2007 Value
Bentonite	-	1,710,000	1,730,000
Copper	2,640,000,000	4,950,000,000	5,540,000,000
Gemstones	1,370,000	1,560,000	1,580,000
Sand and Gravel	516,000,000	662,000,000	597,000,000
Crushed Stone	69,300,000	102,900,000	116,000,000
Coal	1,120,000,000	1,040,000,000	1,120,000,000
Other	290,000,000	190,000,000	200,000,000
Total	4,640,000,000	6,940,000,000	7,580,000,000

Source: ADMMR, 2008

Uranium is the only fuels mineral in Arizona monitored by the USGS; exploration for which continues at a high rate. Mining activity is concentrated in three regions: Colorado Plateau, central Arizona and Date Creek Basin (USGS, 2009). Much of the activity surrounding uranium is prospective; however many companies are well positioned to expand production capabilities if the marketplace permits. The current and expected future interest for uranium mining on the ASNF is minimal, and not expected to be a hot topic during the next planning cycle.

Demand

Minerals are a main resource on National Forests, many of which have national and global importance. Minerals of most importance on Arizona forests are of the metallic variety. In general, there has been a decline in the demand for metallic minerals due to the development of cheaper, non-metal, substitutes. Demand for individual minerals, however, is more volatile; and high demand growth is expected for scarce and costly metals (USDA, 1989). Statutory and regulatory direction separate mineral resources in federal lands into three categories: leasable, locatable, and salable. Forest level data exists for salable minerals because a contract is developed to administer the sale. Demand for leasable and locatable minerals is much more subjective because there is no standardized system of reporting extraction levels.

The most valuable metallic mineral removed from National Forests in Arizona is copper. Exploration for copper is highly influenced by market conditions. As price increases, mining companies increase exploration and hence increase demand for the commodity on public lands. There is currently no measurable extraction of copper on the ASNF. Productive copper mines are located on nearby BLM and private land, and there is a lot of interest to expand on to Forest Service land. Global Geoscience currently has submitted a plan of operations to ANSF managers, that plan is under review and a decision has not yet been made. This topic is controversial amongst public interest groups and industry stakeholders. Such proposals will continue to be controversial in the future and managers will have to address the full spectrum of concerns on a case by case basis. However, it is apparent that substantial demand exists for copper on the Forest, and it is likely that demand will increase in the future. As deposits on nearby property become depleted, and market conditions remain favorable, companies will invest more resources into exploring other sites.

Demand for energy minerals is very low in Arizona. There is some potential for geothermal activity, but currently no development has occurred on the ASNF. As markets for energy minerals become more volatile, demand for geothermal will increase. There is no method for predicting future demand on the ASNF, but as prices for energy minerals rise, so will demand for geothermal. ASNF managers should be prepared to deal with this demand during the next planning cycle.

Construction related materials are the most productive on the ASNF. Table 2c reports sale contracts for cinders, crushed stone, dimension stone, landscape rock and sand/gravel for 2007 thru 2009. Demand has varied considerably in recent years. The total value of minerals sold in 2009 was \$4,625, which is down from \$19,454 in 2008. Overall this is a small level of demand relative to the rest of the state. It is likely that demand will continue to fluctuate in the future because it is highly speculative and dependent on private and commercial construction activities in the local area. ASNF managers will be forced to adapt to varying demand conditions for construction related materials. Demand may be predicted by monitoring future construction activities and investments in public infrastructure in the local area. These activities are usually

followed by an increase in population, which would consequently contribute to an increase in demand for construction related materials.

Table 7c: Construction Related Materials Sale Contracts

Commodity	2007		2008		2009	
	Sale Contracts (Short tons)	Value (\$)	Sale Contracts (Short tons)	Value (\$)	Sale Contracts (Short tons)	Value (\$)
Cinders	713	361	692	350	1,028	530
Crushed Stone	5,456	2,728	34,708	17,354	4,817	2,410
Dimension Stone	68	68	90	90	90	90
Landscape Rock	394	1,646	455	1,659	382	1,560
Sand & Gravel	14	45	-	-	14	45
Forest Total	6,645	4,849	35,944	19,454	6,330	4,625

USDA Forest Service, 2009d.

Trends in Mineral Development

Consumption of minerals has varied considerably by resource in recent years. Demand for energy minerals has increased moderately since the early 1980's and the trend is expected to continue in the future. Among the various types of energy minerals, oil consumption is expected to decrease while coal consumption is expected to increase (USDA, 1989). The ASNF currently does not produce any energy minerals. The only potential for energy development is geothermal, and future demand is highly speculative and influenced by global energy markets.

Demand trends for metallic minerals are hard to pinpoint because use patterns are sporadic. In general, demand for these minerals is volatile and effected by substitutes introduced to the marketplace, however it is expected to increase at a modest rate through 2040 (USDA, 1989). High demand growth is expected for copper in the United States. This is likely to increase the interest of mining on the ASNF. Currently there is no measurable removal of copper from the Forests, however there is a development proposal under review, and more are likely to appear during the next planning cycle. Demand for copper will continue to be highly dependent on market price. As prices increase, private industry will invest more in research and development making new areas open for exploration. The supply and demand for copper on National Forests is influenced by available technology. The level of demand stimulates investment in new technology, which in turn increases available supply by locating new deposits and bringing some deposits previous considered un-extractable into development.

Demand for construction related materials has also varied considerably in the past. This trend is expected to continue in the future. Table 2c reports the sale of contracts for construction related materials extractable on the ASNF. Mining activity for these minerals is highly sporadic, and is more influenced by local demand than energy and metallic minerals. Those minerals are more influenced by the global market place, whereas construction related materials are typically consumed within the local area due transportation costs.

Forest Capacity

Forest capacity refers to the ability of the Forests to supply minerals for both commercial and private consumption well into the future. The ASNF has a limited resource base; therefore supply may not grow infinitely. Non-renewable resources should be considered as fixed; however certain factors, such as the development of new technology and investments in infrastructure, may increase available supply to a certain degree. Technology may increase the volume of minerals considered extractable, but at some point the available resources will be exhausted. Forest resources must be managed to ensure that mining activities are sustainable well into the future. This section explores the ASNF's ability to supply sustainable levels of extractable minerals.

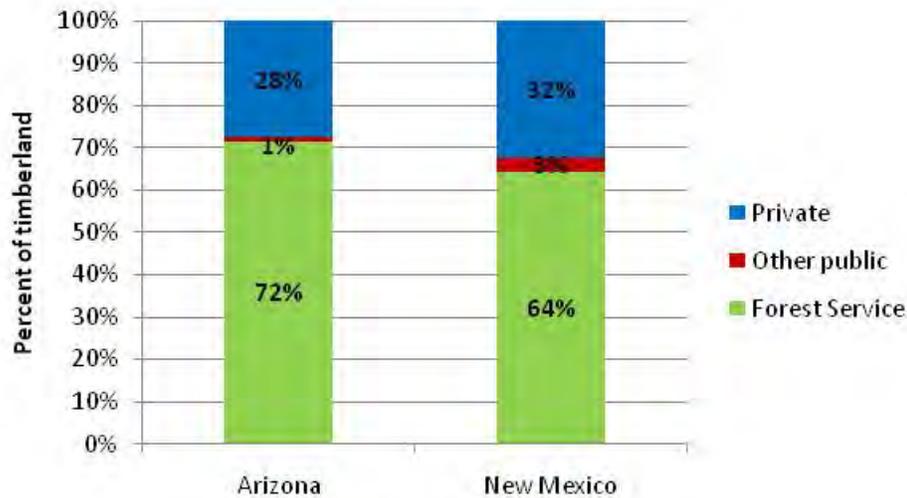
The US Bureau of Mines has conducted several Mineral Land Assessments (MLAs) across Arizona's National Forests. However, no such assessment was conducted for the ASNF. Therefore data regarding the supply of minerals currently does not exist. It is assumed, however, that the ASNF has the capacity to satisfy demand for minerals well into the future. This Forest has not received substantial demand for its mineral resources, and therefore has not experienced depletion of supply. The only mineral that is expected to experience substantial demand growth is copper. As managers make decisions regarding development proposals, it will become important to conduct surveys of the available resource to ensure mining activities are sustainable.

Timber

Timber resources within the states of Arizona and New Mexico

In many discussions of sustainability, it is customary to compare harvest and growth as a gauge of “resource sufficiency” (Adams et al. 2006). Description of timber resources within Arizona and New Mexico provides a comparison between timber inventory on national forest lands and demand from those lands. Timber demand and inventory are assessed by examining timber cut and sold reports and timber inventory at the state level given available data. At a smaller scale, specific to the ASNF, total timber demanded from all primary wood processing facilities is unavailable given a lack of information on current consumption from these facilities. Similarly standing volume inventory on all national forests within the Arizona and New Mexico are considered since data is unavailable by forest¹. Regardless of data deficiencies, timber resources and demand from the ASNF are discussed qualitatively and when data are available below.

The states of Arizona and New Mexico cover approximately 72.8 and 77.7 million acres, respectively of which 5 and 6 percent (3.4 and 4.4 million acres) are timberland on all ownerships. Under FIA definitions, timberland is any forested land capable of growing at least 20 cubic feet (cf) of industrial wood per acre per year. The remaining land area is in nonforest land, water, reserved timberland, or other forest land. Figure 1d shows the distribution of timberland by ownership for Arizona and New Mexico. Within Arizona 72 percent of timberland (2.4 million acres) is managed by the USFS, one percent is managed by other public agencies (27,643 acres) and 28 percent is private forest ownership (939,985) which includes individuals, farmers, and corporations. Within New Mexico 64 percent of timberland (2.8 million acres) is managed by the USFS, three percent is managed by other public agencies (146,511 acres) and 32 percent is private forest ownership (1.4 million acres) (USDA 2009e).



¹ Data on timber inventory was obtained from the most recent Forest Inventory Analysis (FIA) inventories for forest service land. This inventory data was aggregated to summarize major timber resource attributes (timberland area, ownership, stocking, volume, average annual growth, mortality, and removals).

Figure 1d: Percent total timberland managed by Forest Service, private and other public agencies

Estimates of total volume of live trees in Arizona and New Mexico are approximately 6.89 and 7.47 billion cf; 70 and 68 percent of this (4.82 and 5.11 billion cf) are managed by the forest service. Growing-stock volume is defined as the cubic-foot volume of sound wood from a 1-foot stump to a 4-inch top for commercial species of trees 5 inches or larger in diameter at breast height (dbh) that are capable of producing sawlogs. Total net annual growth of growing stock (net of mortality) on national forest lands is about 23.7 and 25.2 million cf in Arizona and New Mexico, respectively (USDA 2009e).

Timber harvest from Arizona, New Mexico and the Apache and Sitgreaves National Forests

In this analysis, total annual consumption of timber from Arizona and New Mexico National Forests is used as a proxy for current timber demand from National Forest land. No attempt was made to measure the demand for fuelwood or specific forest products. Annual consumption of timber from the ASNf was obtained from cut and sold reports for region 3. This data represents the most accurate data on timber removal from national forest system lands in these states.

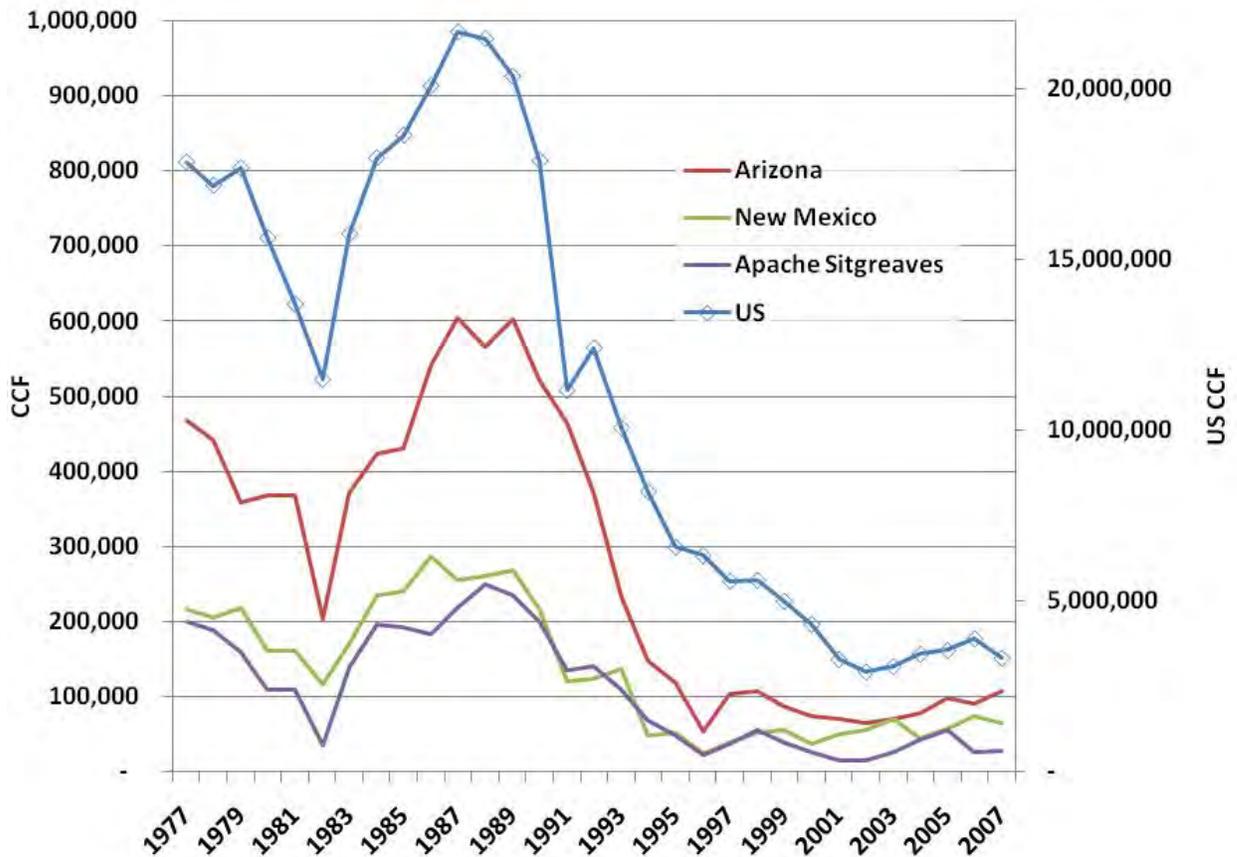


Figure 2d: Annual timber removed from National Forest land in Arizona, New Mexico and the ASNf

Timber removal in Arizona, New Mexico and on the ASNF has varied over time with changing market and policy conditions (Figure 2d). Timber harvests on national forests have increased by approximately 30 percent between 1905 and 2005 in the entire nation (USDA 2009e). However, timber harvests have decreased since the late 80's on national forests throughout the nation including the ASNF (Figure 2d). Litigation against public agencies in the 1980's and 90's suggested the role of public forest land was changing.

Lawsuits in the Pacific Northwest challenged the adequacy of protection of old growth species and fish in federal forest plans. Timber sales on federal land within the Northwest Forest plan region came to a complete halt in April 1989 with a federal court injunction made by Judge Dwyer (Caldwell et al. 1994). The influence of this decision was widespread for national forest lands throughout the nation (Figure 2d).

In May of 1991 Judge Dwyer ruled that the Forest Service had violated the EIS requirement of NEPA and a second timber harvest injunction was enacted (Caldwell et al. 1994). In May of 1992 Dwyer ruled that the Forest Service EIS violated NEPA by "failing to consider new information on the environmental effects of logging on Spotted owl habitat and ... not prescribing measures to protect critical habitat or assess the viability of other species associated with old-growth forests and Northern spotted owl habitat" (Marcot and Thomas, 1997). The Forest Service formed the Scientific Analysis Team (SAT) in response to Judge Dwyer's ruling. SAT's 1993 report recommended management changes to accommodate 667 species associated with old-growth forests and "was a significant step toward a broader ecological basis for evaluating ecosystems" (Marcot and Thomas, 1997). In 1993 President Clinton assigned the Forest Management Assessment Team with development of the Northwest Forest Plan (NWFP). On December 21st Judge Dwyer ruled that the NWFP was consistent with the viability regulation of the National Forest Management Act. Thus, by 1995 the outcome of national forest policy situation was known and timber harvest on national forests land had decreased by 62 percent throughout the nation from 1987 to 1994 (Figure 1d).

Policy has established a new status quo of timber inventory available for harvest. In order to account for such changes, timber consumption has been from the ASNF has been examined as a minimum, midpoint, and maximum from a range of values over the post 1994 period, following the convention of LeDoux et al. 2003. This range is a reasonable benchmark for current timber demand from national forests in the area.

For Arizona and New Mexico national forests the maximum consumption was 14.7 and 7.4 million cf, respectively while the minimum was 5.4 and 2.5 million cf and the median was 8.9 and 5.1 million cf, over the period from 1994 to 2007 (Table 1d). This material is used for the production of chips, pulp and paper, and sawtimber products, including lumber, veneer, plywood, and other industrial products (posts, rail and fence material, biomass and related products).

Annual removal of sawtimber on the ASNF was 2.7 million cf in 2007. Between 1994 and 2007 the maximum, midpoint and minimum consumption were 6.9, 3.2 and 1.5 million cf, respectively. Given the lack of availability information on net annual growth for the ASNF, a baseline comparison of inventory and demand cannot be made. Similarly, as stated above, a lack of information on total timber demanded from primary wood processing facilities is unavailable given a lack of information on current consumption from these facilities. Regardless recent estimates of capacity suggest that area facilities have the capacity to accommodate existing removal. These facilities specialize in roundwood, moulding, pallets and pellets.

Baseline timber inventory and demand comparison

A baseline estimate of timber inventory and demand is established by comparing consumption from all national forest in the state and timber from the ASNF with estimates of current timber inventories (standing inventory and net annual growth) (Table 1d).

Table 8d: Statewide national forest timber demand as a percentage of national forest timber inventories

	Timber consumption range ²		Demand/total inventory ³		Demand/net annual growth ⁴
	Arizona	New Mexico	Arizona	New Mexico	Arizona
Minimum	2.52	5.37	0.05%	0.11%	11%
Midpoint	5.18	8.86	0.11%	0.17%	22%
Maximum	7.43	14.76	0.15%	0.29%	31%

Following the convention of LeDoux et al., This comparison assumes that all supplies of timber on Arizona and New Mexico national forests are available for commercial timber harvest and ignores such factors as harvest economics, steep terrain, and resource quality. Consequently this baseline assessment of inventory ignores the effects of physical and market constraints. Under this baseline estimate, current annual demand represents only 0.05 to 0.15 percent of the total inventory in Arizona and 0.11 to 0.29 percent of inventory in New Mexico (Table 1d). On the basis of these numbers, there appears to be sufficient timber inventory within these states to sustain current consumption rates indefinitely (Table 1d). These figures are consistent with FIA estimates of growth and removal for the most recent inventory periods, that is, the calculated net annual growth exceeded removals within the states of Arizona and New Mexico.

Given available data, these estimates of inventory and demand are limited to growing stock defined by FIA as cubic-foot volume of sound wood from a 1-foot stump to a 4-inch top for commercial species of trees 5 inches or larger in dbh. Thus timber often classified as nontraditional materials are not considered in the estimates above of growing stock and growth. Volume estimates for removals or stocking levels are not available however, the share of live trees less than 5 inches dbh from all live trees on timberland is 57 percent in Arizona and 70 percent in New Mexico (USDA 2009e). Stocking levels of these size classes are well above desired levels as defined by forest desired conditions and as forests manage for desired conditions non-traditional materials will be increasingly available (personal communication with James Youtz on October 29, 2009). Current management within Region 3 focuses on attaining conditions similar to historic ranges of variability by creating open uneven aged forests complimentary of frequent fire regimes. Management within these guidelines could produce regular timber yields (personal communication with James Youtz on October 29, 2009).

The availability of this timber and the change in management focus on removal of these smaller size classes does not mean demand for these materials will follow. These materials may increase in demand with favorable market conditions, changes in energy markets and programs that incentivize industry development. Industry development has found a foothold in area projects such as that occurring on White Mountain. As a result increasing demand may be occurring for facilities specializing in pellets in ShowLow, Snowflake, and Springerville.

² In million cf per year

³ 4,818 and 5,109 million cf (includes growing stock and all other live trees)

⁴ 23.77 million cf (based on growing-stock volume). Information unavailable for New Mexico from FIA.

Conclusions

The comparison of inventory and demand presented here assumes that all supplies of timber in Arizona and New Mexico national forests are available for commercial timber harvest and ignores such factors as harvest economics, steep terrain, and resource quality. Under this baseline estimate, current annual demand represents only 0.05 to 0.15 percent of inventory in Arizona and 0.11 to 0.29 percent of inventory in New Mexico. Consequently, there appears to be sufficient timber inventory to sustain current consumption rates indefinitely assuming moderate rates of growth. Given the lack of availability information on net annual growth for the ASNF, a baseline comparison of inventory and demand cannot be made. Similarly, a lack of information on total timber demanded from primary wood processing facilities is unavailable given a lack of information on current consumption from these facilities. However, recent estimates of capacity suggest that area facilities have the capacity to accommodate existing removal. The change in forest service management focusing on removal of smaller size classes does not mean demand for these materials will follow. These materials may increase in demand with favorable market conditions, changes in energy markets and continued programs that incentivize industry development.

Summary

Demand for outdoor recreation is expected to grow indefinitely. As long as populations are increasing, so will the demand for recreation on the ASNF. Non-consumptive wildlife and developed recreation will grow the most, exceeding the Forests' ability to supply. Capacity of general forest areas and designated wilderness is expected to meet the increased demand for more primitive forms of recreation during the next planning cycle. The greatest growth will occur for more popular activities requiring easy access and public services.

The share of total demand for grazing within the market area (as measured by cattle inventory) that could be supported by actual use on the ASNF has ranged from a high of approximately 5.2 percent of the market area cattle inventory in 2003 and a low of 1.2 percent in 2008. While the share of total demand provided by the ASNF is small, it may be more important for smaller areas within the market area. However, the actual HM use numbers must be used with caution as the supply of grazing is limited, and factors other than demand may limit grazing use on the forest. In addition, this trend is uncertain given the wide degree of variation in actual use over the relatively short period examined. Despite these limitations, actual use trends on the Forest indicate a possible trend of decreasing demand for ASNF forage relative to cattle inventory within the market area. There has been no recorded sheep use since 2004 thus there is no current demand from the ASNF.

The ASNF is not a major producer of minerals. The only measurable extraction is for construction related materials which have varied substantially in recent years. The Forest's capacity is expected to allow for sustainable removal of these minerals. There is currently no mining for metallic or energy minerals. However, there is renewed interest in the Forest's copper deposits. There is a development proposal currently under review, but no decision has been made. Additional proposals are likely to appear during the next planning cycle; therefore surveys of copper deposits may be required to provide better data. There are also interests in geothermal resources; however no formal proposals have been developed.

The comparison of timber inventory and demand presented here assumes that all supplies of timber in Arizona and New Mexico national forests are available for commercial timber harvest and ignores such factors as harvest economics, steep terrain, and resource quality. Under this baseline estimate, current annual demand represents only 0.05 to 0.15 percent of inventory in Arizona and 0.11 to 0.29 percent of inventory in New Mexico. Consequently, there appears to be sufficient timber inventory to sustain current consumption rates indefinitely assuming moderate rates of growth. Given the lack of availability information on net annual growth for the ASNF, a baseline comparison of inventory and demand cannot be made. Similarly, a lack of information on total timber demanded from primary wood processing facilities is unavailable given a lack of information on current consumption from these facilities. However, recent estimates of capacity suggest that area facilities have the capacity to accommodate existing removal. The change in forest service management focusing on removal of smaller size classes does not mean demand for these materials will follow. These materials may increase in demand with favorable market conditions, changes in energy markets and continued programs that incentivize industry development.

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