

4. Access and Travel Patterns

This section examines the historic and current factors affecting access patterns and transportation infrastructure within the five counties surrounding the Kaibab National Forest (KNF). The information gathered is intended to assess current and future trends in forest access as well as potential barriers to access encountered by various user groups. Primary sources of data on access and travel patterns for the state's national forests include the Arizona Department of Transportation (ADOT), the Arizona Department of Commerce, and the circulation elements of individual county comprehensive plans. Indicators used to assess access and travel patterns include existing road networks and planned improvements, trends in vehicle miles traveled (VMT) on major roadways, seasonal traffic flows, and county transportation planning priorities. Additional input on internal access issues has been sought directly from forest planning staff.

Various sources of information for the area surrounding KNF cite the difficulty of transportation planning in the region given its vast geographic scale, population growth and pace of development, and constrained transportation funding. In an effort to respond effectively to such challenges, local and regional planning authorities stress the importance of linking transportation planning with preferred land uses. Data show that Yavapai, Coconino, and Mohave Counties saw relatively large increases in VMT between 1990 and 2000, mirroring the region's relatively strong population growth over the same period. Research shows that there are relatively few significant improvements currently scheduled for the region's transportation network and that seasonal traffic flows coincide with weather conditions which influence patterns of visitors from outside the region.

4.1 Historical context and current access issues

Transportation infrastructure throughout the state of Arizona was initially developed to serve the needs of a predominantly rural population while supporting expansion of the state's largely agricultural economy. State, county, and city comprehensive plans reviewed for this assessment specifically mention economic influences such as logging, ranching, mining, and tourism as having played a role in developing the region's circulation system (Coconino County 2003, Mohave County 1995, ADOT 2004a).

Today, many regions of the state, including the area surrounding Kaibab National Forest, are struggling to provide much needed improvements to transportation networks in order to accommodate growing populations and changing local economies. Circulation planning throughout the area of assessment is challenging given the geographic scale of the area, the presence of private lands and development within the national forest boundaries, and the competing needs of rural and urban county residents. Each of the comprehensive plans further admit that current transportation networks have been developed as needs have arisen and are therefore inadequate for handling projected long-term growth (Coconino County 2003, Yavapai County 2003, Mohave County 1995).

Despite a diverse array of transportation planning issues at the county and municipal level, planning agencies throughout the state express a common concern for the linkages between transportation and land use planning. In its current long range plan, ADOT includes an appendix which analyzes broad transportation trends and issues as well as potentially significant implications for future transportation planning. In summary, ADOT identifies five large-scale issues that are most likely to influence transportation planning in the coming years: 1) Population growth and demographic change, 2) Economic growth and change, 3) Security concerns, 4) Energy supply and efficiency, and 5) Technological change and opportunities (ADOT 2004b). While the latter three issues are discussed in largely hypothetical terms

and are at best indirectly linked to forest management, the first two identified issues are immediately relevant and pertain directly to other factors presented in this assessment.

Stressing the importance of demographic change for the future of transportation planning in the state, ADOT notes that Arizona's population is projected to double over the next forty years, growing from 5 to 10 million residents. In the agency's estimation, such changes will require "major expansions of roadway capacity and the development of transportation options and alternatives to provide acceptable levels of service on Arizona's roadways and maintain circulation" (ADOT 2004b). Specific concerns regarding the impact of population growth on state transportation planning include the cost of infrastructure surrounding sprawling metropolitan areas, traffic congestion and greater commuting distances within developed areas, and access to the state highway system for areas outside of major metropolitan centers.

In order to adequately prepare for future transportation needs, ADOT calls for greater coordination between state, regional, and local agencies in transportation and land use planning statewide. Strategies for doing so include the provision of education and technical assistance to local partners, enforcement of legal land use requirements, and the exercise of direct land use controls through state agencies such as the Arizona State Land Department. Through such efforts, ADOT hopes to play an important role in shaping the location of future development to ensure maintenance of existing infrastructure while meeting the transportation needs of millions of new residents (ADOT 2004b).

Citing Arizona's transition from an agricultural- and extraction-based economy toward one where sales and services are increasingly important, ADOT addresses the consequent changes to transportation needs throughout the state. As a case in point, small parcel shipments and an increase in commuting that result from the growing information- and service-based industries lead to different travel patterns and different types of vehicles on the road. ADOT suggests that increases in highway and freight rail capacity, development of intelligent traffic systems (ITS), expansion of intermodal facilities, and other related investments could help sustain Arizona's current industries and provide opportunities for new industries (ADOT 2004b).

4.2 Predominant transportation modes and seasonal flow patterns

A map of the roadway network within the area of assessment is presented in Figure 14. Interstates, U.S. and State highways, and Indian Routes within the area of assessment are presented in Table 23. The information shows that the area clearly has a considerable transportation network with a predominant number of State highways. Figure 14 shows that the area clearly has a substantial amount of roads with a particularly dense road network adjacent to more urban areas. Additionally, most of the major roadways follow a north-south orientation, the lone exception being Interstate 40 which is oriented east to west.

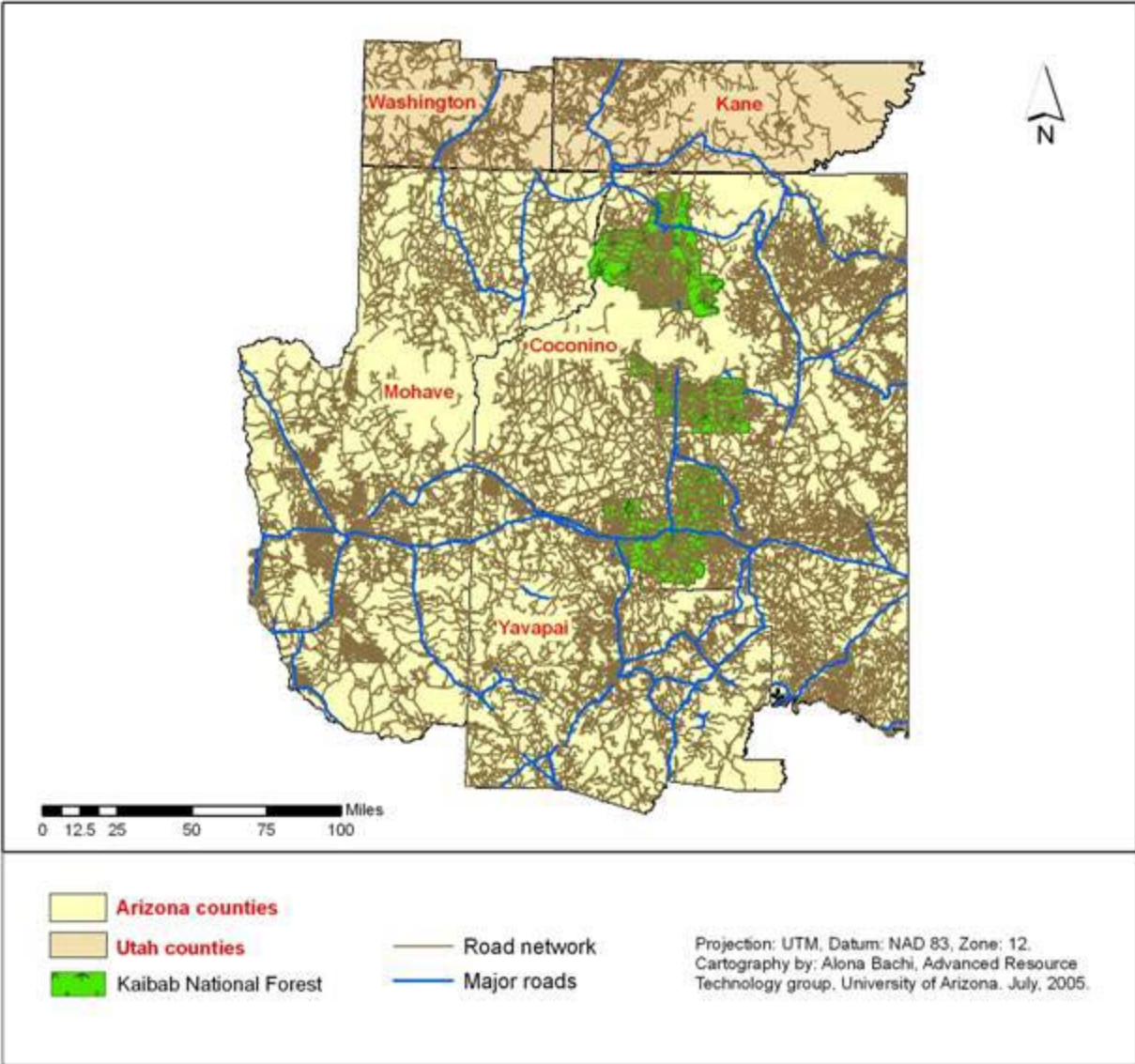


Figure 14. Road Network within the Area of Assessment

Table 23. U.S., State, and Indian Routes by County

	Interstates / U.S. Highways	State Highways	Indian Routes
Coconino County	Interstate 40 Interstate 17 U.S. 89 U.S. 160 U.S. 180	State Highway 64 State Highway 66 State Highway 67 State Highway 87 State Highway 89 State Highway 89A State Highway 98 State Highway 99 State Highway 260 State Highway 264	Indian Route 2 Indian Route 15 Indian Route 18
Mohave County	Interstate 40 Interstate 15 U.S. 93	State Highway 66 State Highway 68 State Highway 95 State Highway 389	
Yavapai County	Interstate 17 Interstate 40 U.S. 93	State Highway 69 State Highway 71 State Highway 89A State Highway 96 State Highway 97 State Highway 169 State Highway 260	
Kane County, UT	U.S. 89 Interstate 15	State Highway U 20 State Highway U 146	
Washington County, UT	Interstate 15 U.S. 89		

Source: Arizona Department of Commerce: County Profiles

The vast majority of circulation corridors throughout the area of assessment provide infrastructure for a single transportation mode—travel by motorized vehicle. For example, over ninety percent of daily person trips in the Flagstaff area currently take place in private motor vehicles. This means that less than ten percent of intercity mobility is accomplished via public transit, walking and bicycling. Given the expense of developing infrastructure for alternative modes of transportation and patterns of development throughout rural areas of the state, the predominance of motorized vehicles is likely to continue for the foreseeable future. Nonetheless, counties and cities throughout the region express a desire to reduce dependency on automobiles by supporting alternative modes—transit, walking, bicycling—thereby

reducing the demand for expanded roadways (Coconino County 2003, Yavapai County 2003, FMPO 2001, Mohave County 1995).

The Arizona highway system consists of over 58,000 miles of roadway, of which two percent are interstates, three percent are U.S. routes, and nearly six percent are state routes. Although only 12% of the total highway network is composed of state facilities, over 57% of the daily VMT occurs on these roads. The Interstate System carries 28% of all daily VMT (ADOT 2004c). Much of the Arizona state highway system passes through lands owned by federal agencies and federally recognized tribes. Federal agencies and federally recognized tribes own 70% of the land in Arizona. Federal lands agencies, including the USFS, the BLM, and others, own 42% of the land in Arizona, with over 2,000 miles of state highway passing through these lands. Arizona’s twenty-one federally recognized tribal nations own 28% of Arizona land. An additional 1,200 miles of state highway pass through these lands, with over one-half of these road-miles located in the Navajo Nation (ADOT 2004c).

Table 24 presents data on daily VMT for the years 1990 and 2000 as well as the percentage change. ADOT reported a dramatic increase in travel on non-state roads within Yavapai County over the ten-year period. Similar, though less substantial, increases were seen for traffic counts on all roads within the county over the same period. In light of the significant increases in population and housing in Yavapai County between 1990 and 2000, the increase in travel on non-state roads likely points to significant increases in travel on expanded city, county, and private road networks. Coconino County also experienced increases in VMT on non-state roads that were much higher than those for the state over the same period. Data also show that the areas of assessment in the state of Utah reported considerably lower daily VMT counts between 1990 and 2000. The lone exception to this trend is a significant increase in travel on non-state roads in Washington County during the period.

Table 24. Daily Vehicle-Miles of Travel (VMT) by County, 1990-2000 and % Change

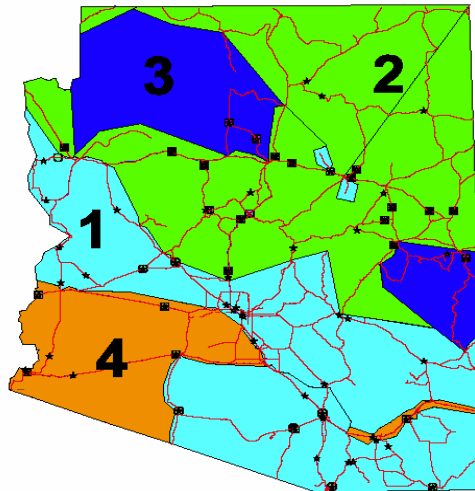
Area	Total VMT all roads (000s)			Total VMT state system (000s)			Total VMT non state (000s)		
	1990	2000	% Change	1990	2000	% Change	1990	2000	% Change
Coconino County	4,783	6,796	42.09%	3,646	5,211	42.92%	1,137	1,585	39.40%
Mohave County	4,799	6,770	41.07%	3,071	5,022	63.53%	1,728	1,748	1.16%
Yavapai County	3,439	6,803	97.82%	3,182	4,776	50.09%	257	2,027	688.72%
Kane County*	294	338	14.97%	254	287	12.99%	40	51	27.50%
Washington County*	1,842	2,465	33.82%	1,210	1,589	31.32%	632	876	38.61%
Arizona	97,139	134,345	38.30%	40,252	66,671	65.63%	56,887	67,674	18.96%
Utah*	51,467	61,648	19.78%	37,102	42,927	15.70%	14,365	18,721	30.32%

*Earliest available traffic data for Utah is from 1994

Sources: Arizona Department of Transportation, Transportation Planning Division
Utah Highway Performance Monitoring System (HPMS) and Traffic on Utah Highways

Seasonal Flow Patterns

The Data Section of ADOT’s Transportation Planning Division has delineated four distinct “cluster areas” of traffic patterns throughout the state of Arizona. The clusters represent areas that are similar in terms of their variation with respect to Average Annual Daily Traffic (AADT) for the given area. Cluster areas are arranged hierarchically such that Area 1 demonstrates the least amount of monthly variation from the AADT whereas Area 4 experiences the greatest variation. Figure 15 shows the four cluster areas within the state of Arizona as well as the various Automatic Traffic Recorder (ATR) positions.



Source: Arizona Department of Transportation, Transportation Planning Division, Data Section

Figure 15. Traffic Pattern Cluster Areas

Table 25 provides daily and monthly factors for each of the four cluster areas collected during 2003. The factors below are presented as an inverse ratio of AADT to collected traffic counts. A factor of *greater than one* shows that traffic was *less* than average for the specific time period; *less than one* shows traffic as being *greater* than the AADT during the period.

Points of access to Kaibab National Forest extend into the portions of the state designated as Area 2 and Area 3 by ADOT’s Transportation Planning Department. Data in Table 25 show that peak traffic flow for both areas occurs between the months of June through August while traffic is lowest from November to February. This would confirm the logical notion that traffic in the region fluctuates primarily according to weather conditions and patterns of visitors from outside the region.

Table 25. Daily and Monthly Traffic Variation by Cluster Area, 2003

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Area 1	1.011	0.940	0.930	0.959	0.999	1.033	1.050	1.049	1.075	0.983	0.998	1.022
Sunday	1.109	1.076	1.067	1.109	1.104	1.066	1.043	1.111	1.086	1.062	1.116	1.095
Monday	1.029	1.016	1.045	1.021	1.011	1.019	1.032	1.039	1.034	1.024	1.012	0.981
Tuesday	1.041	1.040	1.049	1.056	1.044	1.044	1.054	1.040	1.047	1.068	1.046	0.978
Wednesday	1.074	1.058	1.031	1.049	1.062	1.050	1.033	1.027	1.047	1.056	0.952	1.003
Thursday	0.981	1.009	0.995	0.962	0.984	0.998	0.947	0.988	0.991	0.983	1.033	1.100
Friday	0.879	0.883	0.893	0.884	0.873	0.878	0.911	0.863	0.865	0.872	0.901	0.915
Saturday	0.958	1.000	0.996	1.055	1.046	1.038	1.058	1.040	1.047	1.069	1.047	1.012
Area 2	1.176	1.133	1.053	1.038	0.978	0.925	0.902	0.926	0.979	0.965	1.016	1.068
Sunday	1.008	0.972	1.029	1.039	1.065	1.001	1.005	1.055	1.058	1.021	1.043	1.061
Monday	1.066	0.996	1.086	1.039	1.027	1.059	1.052	1.061	1.024	1.064	1.073	1.009
Tuesday	1.163	1.123	1.12	1.083	1.084	1.114	1.099	1.083	1.087	1.102	1.052	1.008
Wednesday	1.098	1.138	1.067	1.05	1.067	1.088	1.063	1.051	1.062	1.062	0.962	1.01
Thursday	1.026	1.064	0.991	0.977	0.997	1.003	0.964	1.012	0.997	0.998	1.05	1.076
Friday	0.861	0.876	0.86	0.869	0.865	0.864	0.925	0.866	0.866	0.883	0.915	0.935
Saturday	0.914	0.971	0.981	1.047	0.998	1.012	0.991	0.974	1.015	0.996	0.993	0.983
Area 3	1.566	1.534	1.175	1.034	0.921	0.783	0.737	0.801	0.911	0.906	1.186	1.525
Sunday	1.05	0.966	1.164	1.079	0.944	1.048	1.019	0.931	1.02	0.943	1.091	1.051
Monday	1.099	0.907	1.073	1.049	1.026	1.046	1.04	1.089	1.008	1.067	1.058	1.037
Tuesday	1.119	1.071	1.005	1.088	1.065	1.04	1.052	1.118	1.105	1.1	1.047	1.007
Wednesday	1.158	1.159	0.929	1.052	1.087	1.056	1.04	1.105	1.091	1.112	1.069	1.049
Thursday	1.069	1.19	0.962	0.937	1.069	0.999	1.055	1.081	1.041	1.057	1.084	1.093
Friday	0.889	1.006	0.93	0.908	0.964	0.952	0.999	0.941	0.925	0.961	0.856	1.029
Saturday	0.823	0.897	0.992	0.939	0.897	0.892	0.839	0.844	0.876	0.845	0.889	0.851
Area 4	0.952	0.932	0.922	1.067	1.086	1.05	0.961	1.07	1.19	1.087	0.945	0.859
Sunday	0.962	1.026	0.971	0.948	1.032	0.964	0.886	0.985	0.985	0.938	0.927	0.981
Monday	1.111	1.021	1.091	1.054	0.982	1.058	1.077	1.079	0.961	1.043	1.129	1.052
Tuesday	1.131	1.074	1.079	1.115	1.114	1.108	1.133	1.108	1.083	1.104	1.108	1.017
Wednesday	1.095	1.049	1.057	1.082	1.096	1.075	1.083	1.063	1.089	1.077	0.942	1.041
Thursday	0.991	0.98	0.997	0.968	0.996	1.002	0.931	1.013	1.028	1.014	1.034	1.186
Friday	0.878	0.874	0.86	0.848	0.824	0.867	0.927	0.847	0.87	0.866	0.937	0.915
Saturday	0.905	1.027	1.01	1.059	1.032	0.983	1.046	0.966	1.05	1.027	0.993	0.889

N.B.: Factors listed represent a ratio of recorded traffic counts to the Annual Average Daily Traffic (AADT)
 Source: Arizona Department of Transportation, Transportation Planning Division, Data Section

4.3 Regional transportation plans and roadway improvements

Each of the counties within the area of assessment shares common issues regarding transportation infrastructure. Nonetheless, various constraints and opportunities are discussed for individual areas in available ADOT documents as well as county and city comprehensive and transportation plans. This section examines both barriers to access and planned improvements for the state and county transportation networks surrounding the KNF.

Planned improvements to the state highway system surrounding Kaibab NF are presented in Table 26. Currently, the ADOT Transportation Planning Department reports only a single project affecting Kaibab National Forest as part of its Five-Year Construction Program.

Table 26. ADOT Current 5-Year Transportation Facilities Construction Program, Kaibab National Forest

Year	Route	Milepost	County	Funding Source	Location	Length (miles)	Type Of Work	Cost (\$1000)
2005	64	215	Coconino	National Highway System	MP 215 - MP 225	10	Construct Passing Lane	\$1,650

Source : Arizona Department of Transportation
<http://tpd.azdot.gov/pps/searchprogram.asp>

In an effort to facilitate coordination among the various planning authorities throughout the state, ADOT has charged various regional planning bodies with responsibility for distributing federal transportation planning and construction funds to local agencies in their respective areas. Within the area of assessment for the KNF, the Northern Arizona Council of Government (NACOG), the Flagstaff Municipal Planning Organization (FMPO), the Western Arizona Council of Governments (WACOG), and the Central Yavapai Municipal Planning Organization (CYMPO) share transportation planning responsibilities within their respective areas. Policy decisions regarding circulation infrastructure development and improvement within the regional planning area are influenced by both city and county provisions (Coconino County 2003, Yavapai County 2003, Mohave County 1995, Washington County 1994). A brief description of access issues and planned improvements as discussed in regional, county, and city comprehensive plans is included below. It must be kept in mind, however, that the timing and implementation of these projects are subject to considerable funding constraints and an uncertain pace of future development. Transportation planning documents for Kane County, Utah were not available at the time of this assessment.

Coconino County

Similar to other comprehensive plans, the circulation element of the *Coconino County Comprehensive Plan* claims that limited funding requires a continuing emphasis on maintaining existing systems rather than pursuing new roadway construction and other improvements. As with other elements in the comprehensive plan, the circulation framework for the county is grounded within an overall conservation framework. The plan explicitly states that circulation throughout the county will be planned in order to limit fragmentation or damage to habitat, disruption of wildlife movement, and introduction of pollutants or invasive species as a result of road construction (Coconino County 2003).

Two major highways serve crucial circulation roles for Coconino County—Interstate 17, which heads south to Phoenix, and Interstate 40, the only east-west roadway extending across the county. U.S. highways in Coconino County primarily serve north-south traffic. Coconino County is responsible for maintaining the roads it owns as well as those managed through cooperative agreements with ADOT, the Forest Service, and the Navajo Nation. The most pressing access issues occur on private, unpaved roads throughout the county. The county encourages the formation of improvement districts in order to ensure maintenance of private roads in previously developed areas. The Public Works Department is responsible for all roadway improvements. Projects are evaluated according to safety and efficiency and are

prioritized in the county's Capital Improvement Plan (CIP). The most recently available CIP describes no major roadway improvements affecting forest access in Coconino County (Coconino County 2003).

Yavapai County

As with Coconino County, the transportation element of the *Yavapai County General Plan* calls for transportation planning that complements the overall vision for the county. As such, the transportation element calls for improved efficiency of limited transportation corridors, maintenance of scenic routes and the exercise of restraint in the construction of new routes in order to preserve the rural character of the county as well as the natural habitat. Although Yavapai County measures over 100 miles in its width and length at its extremes, there is a limited number of major transportation corridors within the county's large geographic area. Two major highway corridors running north/north-easterly through the county, State Route 89 and Interstate 17, serve the majority of Yavapai County communities, cities, and towns. Five other state highways, SR 179, SR 260, SR 89A, SR 69, and SR 169, provide connecting corridors for the Verde Valley area and the central Yavapai region (Yavapai County 2003).

Several proposed, large residential developments in Chino Valley and north of the Paulden community are expected to have significant impacts on SR 89 North and will necessitate improvements. In the short term, ADOT proposes to complete the widening of SR 89 to a 5-lane section from the Prescott Lakes Parkway intersection to just north of the Willow Lake Road intersection. With an inter-governmental agreement with the City of Prescott, ADOT planned to begin construction of the widening in 2004. Other improvements for North SR 89 and for the intersection area of SR 89 and SR 69, such as traffic roundabouts, are in long-range planning. In addition to these scheduled road improvements, the *Yavapai County General Plan* describes ongoing efforts by the towns of Prescott, Prescott Valley, and Sedona to develop alternative transportation networks in support of pedestrians and bicyclists (Yavapai County 2003).

Mohave County

The transportation element of the *Mohave County General Plan* describes the overall transportation goals and policies of the county without a great deal of information regarding planned improvements to the current road network. The most recent revision of the plan, for which no date is given, does explain that rapid growth has increased traffic congestion along State Highways 68 and 95. While ADOT has begun upgrading State Highway 68 through the Golden Valley area, State Highway 95 continues to experience congestion through Bullhead City and South Mohave Valley. Bullhead City has built a loop road that bypasses the most congested roadway through the City, but the general plan states that this will not remedy the traffic problems south of Bullhead City (Mohave County 1995).

Perhaps the most significant development affecting transportation in Mohave County is the development of the Hoover Dam Bypass Project. United States Highway 93 (U.S. 93) has been designated a North American Free Trade Agreement (NAFTA) route. Due to the congestion caused by switchbacks in the current route, as well as restricted vehicle access to the Hoover Dam crossing, several federal and state partners have proposed the development of a 3.5 mile bypass corridor. As currently designed, the route will begin approximately at milepost 2.2 in Clark County, Nevada and cross the Colorado River approximately 1,500 feet downstream of the Hoover Dam terminating in Mohave County, Arizona near milepost 1.7 on U.S. 93. Major stakeholders on the Project Management Team currently include the Federal Highway Administration (FHWA), the States of Arizona and Nevada, the Bureau of Reclamation (BOR), the Western Area Power Authority (WAPA), the National Park Service (NPS), and the Central Federal Lands Highway Division (CFLHD) which will act in the lead management role for all elements of project procurement, design, and construction (Hoover Dam 2005).

Washington County, Utah

The circulation element of the *Washington County General Plan* does not provide mileage or engineering standards of individual road classes, but rather describes their general purpose and the county's long-term goals for their maintenance and improvement. The plan states that the freeway system within the county is completed and no expansions are anticipated in the near future. New freeway interchanges in the north Washington City area and south of Bloomington are among the improvements that may be required by the continued growth of established communities.

The plan calls for as much controlled access to major highways as possible. Where this is not possible, or is impractical due to rural patterns of development, the plan calls for the construction of collector roads as a means of limiting access and providing for efficient circulation in the event of future urban development. Finally, the standard of improvement of collector roads and local streets in unincorporated areas of the county should be compatible with development standards in adjacent communities in order to encourage and facilitate annexation by incorporated cities (Washington County 1994).

4.4 Internal modes, barriers and access issues

At present, there are few, if any, prominent barriers to access within the Kaibab National Forest. While forest planners have identified the potential for future issues involving private property owners and access rights, few such issues currently exist for the KNF. The potential of compromised access is most likely to develop in the Williams district given the scarcity of private property in north Kaibab. Planners also cited the potential for conflict between various user groups (OHV, equestrian, hikers, mountain bikers) if current recreation trends continue. Currently, however, neither of these factors is perceived as a conflict or barrier to access (Higgins, pers. comm.).

Access and travel patterns within the KNF are likely to be influenced by two current analytical processes. A proposed amendment to the five-forest off-highway vehicle environmental impact statement (OHV EIS) would prohibit all OHV travel between established routes. Currently, the Kaibab NF is also involved in a roads analysis process (RAP) for Level 1 and Level 2 forest roads. Level 1 roads represent existing primitive roads that could be closed with little or no impact on forest access. Level 2 roads are open to high-clearance vehicles only. The RAP, currently ongoing in the Tusayan district, involves the public in determining which roads are most used and needed as well as which roads may be recommended for closure. Available information suggests that the RAP will lead to a net decrease in the number and density of roads within the forest as a result of both closures and limited new construction to improve access. Both the proposed OHV amendment and the RAP are aimed at managing forest routes in a way that ensures access and prevents undue damage to forest land (Higgins, pers. comm.).

Regarding seasonal flows, the Kaibab National Forest experienced a significant increase in travel coinciding with the summer flow of visitors to the Grand Canyon. Planners noted that the forest also experiences a significant increase in travel during the fall hunting season.

Currently, there are no explicit differences in the general access afforded to various user groups on the Kaibab NF. Businesses, individuals, or groups intending to use KNF lands for a variety of special purposes ranging from commercial recreation to infrastructure must apply for a Special Use Authorization.

4.5 Key issues for forest planning and management

The Forest Service has long been aware of the considerable impact internal roads have on forest management. Increasingly, however, the short- and long-term effects of such roads have become highly controversial given the wider public's concern for roadless areas and the perceived detrimental affects on wilderness due to resource extraction. Previous research on the impact of roads in forested environments tended to focus on broadly defined positive and negative impacts of road networks. Positive impacts are generally considered to include improved access to forest areas for the purpose of timber harvesting and the collection of special forest products, livestock grazing, mining, fire control, research and monitoring, access to private inholdings, and the cultural value of the roads themselves. Potentially negative impacts of forest roads include adverse effects on hydrology and geomorphic features; habitat fragmentation; predation; roadkill; invasion by exotic species; degraded water quality and chemical contamination; degraded aquatic habitat; use conflicts; destructive human actions such as fire ignition, trash dumping, and illegal hunting; lost solitude; loss of soil productivity; and a decline in biodiversity (Gucinski et al. 2001).

Although much of the existing research on forest roads focuses on physical and ecological impacts, considerable attention has also been given to the direct and indirect socioeconomic consequences of road networks within the national forests. For example, the fact that the FS is required by law to permit access to private inholdings is likely to become increasingly important to the KNF.

The indirect economic consequences of forest roads (or the lack thereof) are also considerable for forest managers and surrounding communities. For instance, the extent and quality of forest roads are known to have a substantial impact on the economic costs and benefits associated with various user groups such as timber harvesters, energy and mining interests, fuels managers, and recreational users (Gucinski et al. 2001, Duffus 1992). Likewise, land managers in Arizona are increasingly aware of the potential economic and environmental impacts of OHV use, an issue discussed in more detail later in this assessment.

This assessment, however, is primarily concerned with the socioeconomic status and trends among communities outside of the forest, many of which are likely to directly affect future forest management alternatives. The quantity and quality of road networks to and from the KNF are no exception. A recent report to the United States Congress noted that while the condition of our national interstate highway system has improved considerably over the last fifty years, traffic congestion has also increased. Daily VMT—the principle measure of traffic density—increased 31% on the national highway system between 1990 and 2000. By comparison, the state of Arizona reported a 38% increase in VMT over the same period. Three counties within the area of assessment for the KNF reported even greater increases, the highest of which was in Yavapai County (97.82%). Although information on VMT within the state of Utah is available only since 1994, data suggest that traffic increases have been considerably less than those in Arizona and the United States as a whole. The same study also found that while “the density of traffic on urban interstate highways is higher than on rural interstates, traffic on rural interstate highways is increasing at a faster rate than on any other class of road.” Additionally, the FHWA expects to see significant increases in both passenger and freight traffic on the interstate highway system between 2001 and 2010 (17% and 28% respectively) (Siggerud 2002). Given population projections for counties within the area of assessment, the KNF is likely to be affected by increased traffic flow, congestion, and longer commute times.

Finally, current and projected trends in vehicular traffic are particularly relevant in that they are instrumental in determining local and regional land use patterns. Each of the county comprehensive plans reviewed for this assessment makes specific mention of the link between transportation networks and land use. Some acknowledge that regional approaches to transportation development and financing likely offer the best chances of accommodating expected growth without compromising residents' quality of life. Indeed, research has shown that adequate highway systems and access to regional urban centers have a direct impact on population density, reflecting the importance of transportation on the location decisions for individual residents. Furthermore, studies have shown that transportation infrastructure is directly

related to economic stability in that economic diversity, and therefore stability of local and regional economies, is dependent on an efficient highway system (Booth 2002, Case and Alward 1997).

5. Land Use

In this section, land ownership and use within the five counties surrounding the Kaibab National Forest (KNF) are examined. Land ownership and use are both variables which can significantly influence the interaction of forests and surrounding communities. Regional patterns of major land uses vary from county to county, reflecting differences in soil, climate, topography, ownership, development patterns, and other cultural, social, and economic trends. Individual counties must manage a range of land use issues including, but not limited to, water quality and availability, logging and mining activity, agricultural and recreational lands, access to state and federal land, transition of rangelands, open space preservation and residential sprawl (Northern Economics 2002).

Collected land use and ownership data reveal that the area of assessment for the KNF contains a considerable amount of Native American, private, and Forest Service (FS) land, all of which stand to have a considerable impact on future forest planning. Yavapai County is particularly notable for its relatively high amounts of private and State Trust land. Each of these factors contributes to a land use policy environment that is increasingly focused on the economic and environmental sustainability of urban development in the face of increasing calls for the preservation open space. The proximity of private parcels and forest lands has also contributed to a number of significant land exchanges involving the KNF over the last several years.

5.1 Historical context and land use patterns

Since the federal government first began designating public trust land in the late nineteenth century, the amount of national forest land in Arizona has remained remarkably steady. The concept of shared land had a long history in the southwest, mirroring Native American and Mexican American sensibilities (Baker et al. 1988). This, in part, may explain the relative stability of this use of the lands since the institution of federally protected domain in the region. Public domain territory stood at 75% in Arizona in 1891, and by 1977, that number remained at over 70%. The National Forest System itself accounts for about 15% of the land in Arizona. This small segment of the state's land accounts for a substantial portion of Arizona's natural resources, containing 40% of the watersheds and nearly 60% of the timber. For this reason, maintaining the integrity of the forest boundaries and co-opting land to form contiguous borders has historically been an essential objective of the USFS. Recently, one of the rising primary resources of the national forests has come in the form of recreational use. Of course, the primary purpose of national forest land is for "multiple use" although certain elements of its subsidiary functions, like maintaining wilderness and species habitats, can limit this practice (Baker et al. 1988). The specific land use history of the Kaibab National Forest is discussed in more detail in Section 2.1.

The majority of National Forest land is grassland, with only about 20% being forested (Alig et al. 2003). In the latter areas, logging remains an integral and controversial element of national forest land use despite the fact that private owners contribute 90% of the timber harvest in the U.S. and control 60-70% of the timberland (Haynes 2003a, Alig and Butler 2004). Five years ago, Arizona national forests produced 13 million cubic feet of saw-timber, but over the past two decades, the amount of land devoted to timber uses has declined, and these lower levels are expected to remain stable for at least the next fifty years (Mills and Zhou 2003, Alig and Butler 2004, Johnson 2000). The controversy has hit home in the KNF recently with logging on the East Rim. Proponents claim that the logging activity falls under the tree thinning clause in the Healthy Forests Act meant to reduce wildfire threat. Environmentalists argue that, even if the nearest community were not forty-eight miles away, the loggers have little use for the kind of small-diameter shrub most dangerous in wildfire spread and, instead, are targeting hundreds of large-diameter trees. Regardless of the motives behind logging and fire suppression ventures in the national

forests, the GAO has reported that they remain a financial burden, draining \$2.7 billion from other federal programs (Eilperin 2004, GAO 2004b).

Although the total amount of federal land in the area has remained consistent, the specific lands contained within the national forests have occasionally been juggled about. FS and BLM lands can be traded or sold under a process that has been in place for over fifty years. These exchanges can attempt to redirect growth away from areas deemed environmentally sensitive and attempt to keep it near communities with compatible infrastructures. The process begins when private interests wish to acquire federal lands. Following an environmental assessment, trades may be made at fair market value. Trades like the conveyance of administrative sites on 800 acres of the Coconino, Tonto, Prescott, and Kaibab forests in 1998 and the exchange of 272 acres of KNF land in Tusayan in 1999 pass by with little public comment, but other land swaps, like the Verde River Basin trade due to be debated in Congress this year (S. 161/H.R. 410), have seen high levels of public and legal resistance.

5.2 Land ownership and land use

There are over 29.9 million acres of land in the five-county area of assessment for KNF. Within this expanse, there are distinct patterns of land ownership and use, each of which carries important implications for current and future forest management. Figures 16 and 17 provide information on land ownership for the entire area of assessment while Table 27 provides more detailed land ownership data on a county-by-county basis. Figure 16 displays a relatively large amount of Forest Service land in close proximity to private land as well as considerable Native American holdings within the area of assessment. Data in Figure 17 suggest that, as a whole, the area of assessment for the KNF closely resembles overall ownership patterns for the state of Arizona. For example, approximately 16% of the land within the area of assessment is under private ownership while 10% is State Trust land. Both of these factors exercise a great deal of influence on regional development patterns, a point discussed later in this section (AZSLD 2004).

The more detailed data provided in Table 27 indicate important differences in ownership among the five individual counties within the area of assessment. Yavapai County is notable for its relatively substantial amount of private and State Trust land. Coconino County contains the highest percentage of Native American land (38.13%) while Yavapai County reports the greatest amount of land held by the FS (38.17%). Kane County contains relatively limited amounts of private (10.29%) and State Trust land (3.86%) compared to neighboring counties.

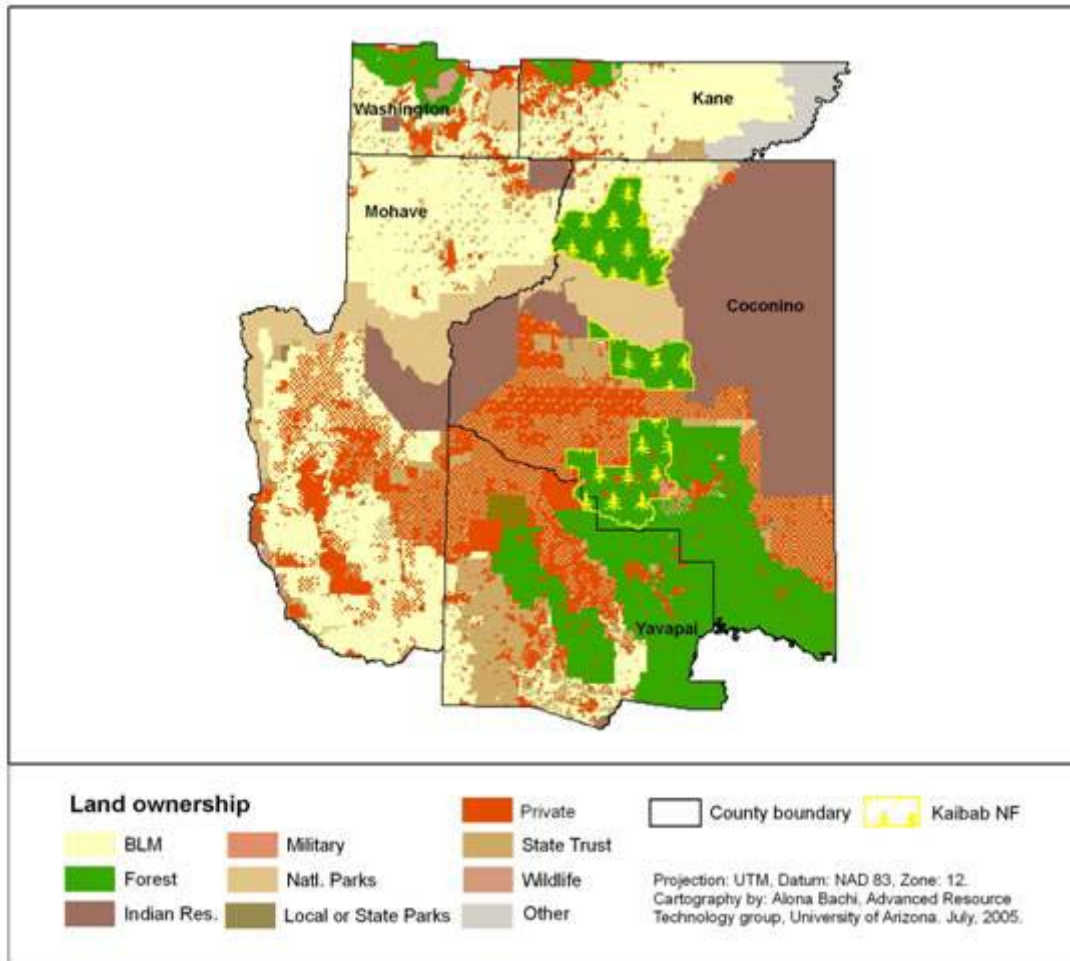
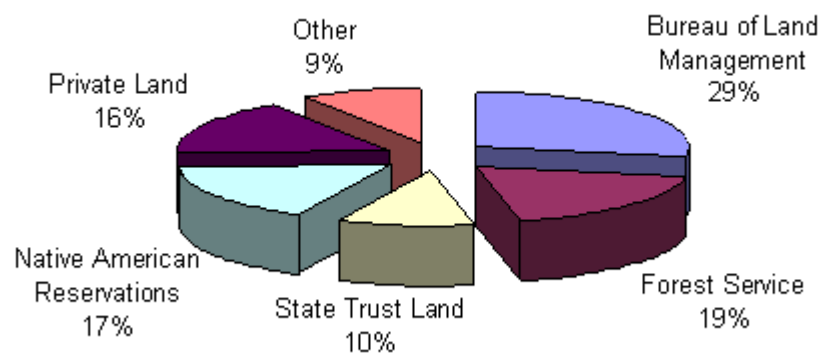


Figure 16. Land Ownership within Area of Assessment



Source: Arizona State Land Department

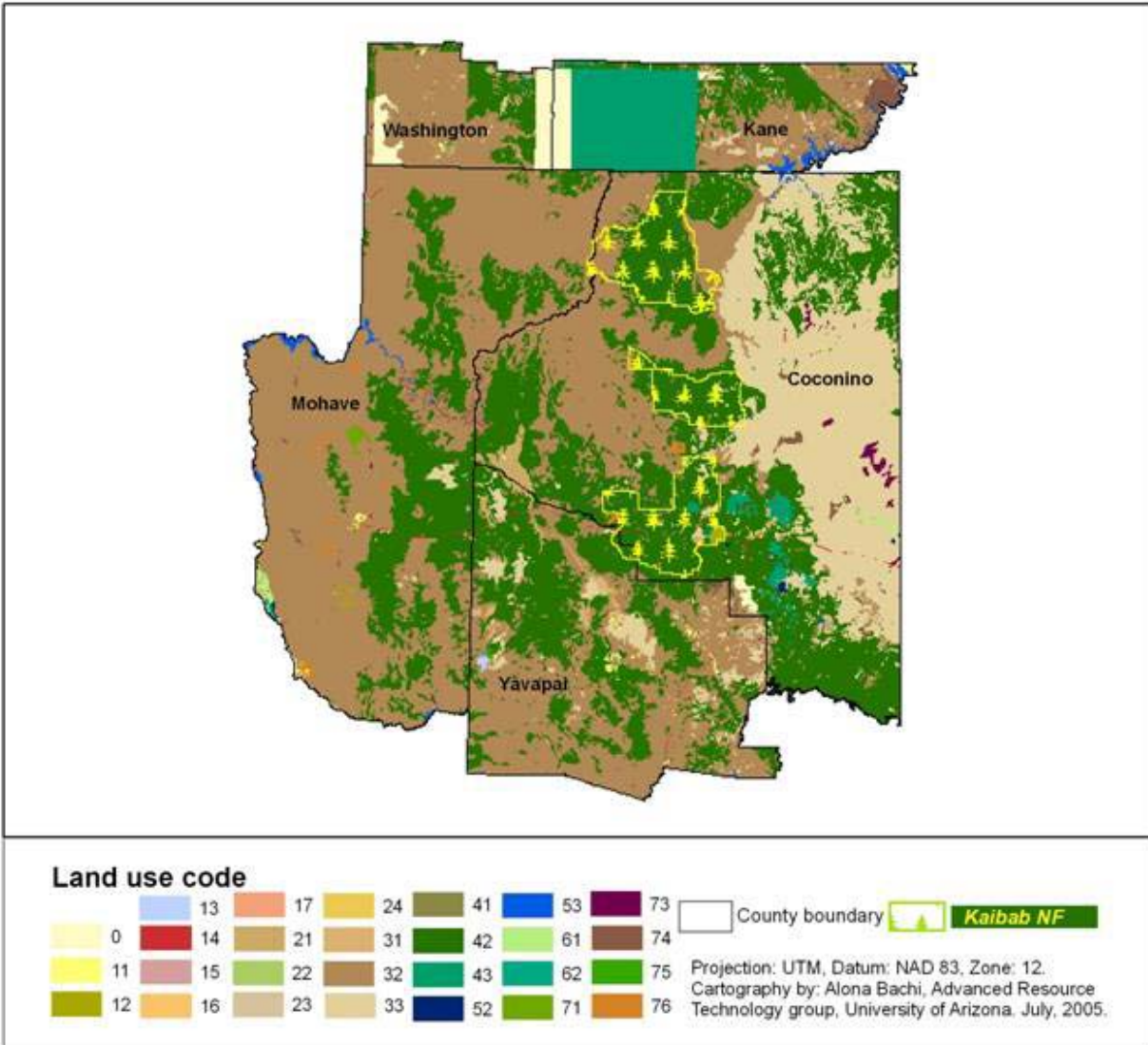
Figure 17. Percent Ownership of Major Land Owners in Five-County Area of Assessment

Table 27. Land Ownership by County, 2005

Land Ownership	Acres	Percent	Land Ownership	Acres	Percent
Coconino County			Mohave County		
Apache-Sitgreaves NF	288,821.10	2.42%	BLM	4,777,546.23	55.38%
BLM	605,491.35	5.08%	Bureau of Reclamation	12,679.83	0.15%
Coconino N.F.	1,399,784.27	11.73%	Fort-Mohave Indian Res.	23,568.52	0.27%
Game and Fish	10,073.02	0.08%	Game and Fish	1,185.74	0.01%
Glen Canyon N.R.A.	40,657.72	0.34%	Grand Canyon N.P.	495,680.96	5.75%
Grand Canyon N.P.	681,829.36	5.72%	Havasu N.W.R.	36,097.96	0.42%
Havasupai Indian Res.	171,918.92	1.44%	Hualapai Indian Res.	444,705.94	5.15%
Hopi Indian Res.	493,566.28	4.14%	Indian Allotments	637.85	0.01%
Hualapai Indian Res.	579,476.99	4.86%	Kaibab Indian Res.	107,084.46	1.24%
Indian Allotments	4,625.05	0.04%	Kaibab N.F.	4,694.66	0.05%
Kaibab Indian Res.	13,170.00	0.11%	Lake Mead N.R.A.	675,014.46	7.82%
Kaibab N.F.	1,510,895.79	12.66%	Military Res.	9,967.71	0.12%
Marble Canyon N.M.	14,600.29	0.12%	Parks and Recreation	4,722.79	0.05%
Navajo Army Depot	25,752.93	0.22%	Pipe Springs N.M.	39.44	0.00%
Navajo Indian Res.	3,166,147.29	26.54%	Private Land	1,467,782.61	17.01%
Navajo N.M.	39.18	0.00%	State Trust Land	565,970.53	6.56%
Navajo-Hopi Joint Use	123,966.85	1.04%	TOTAL	8,627,379.69	100.00%
Prescott N.F.	43,592.26	0.37%	Kane County, UT		
Private Land	1,587,305.56	13.31%	BLM	1,635,361	62.25%
State Trust Land	1,125,427.03	9.43%	Forest Service	123,044	4.68%
Sunset Crater N.M.	3,035.99	0.03%	National Parks, Monuments	18,313	0.70%
Walnut Canyon N.M.	3,049.74	0.03%	National Rec. Area	381,635	14.53%
Wupatki N.M.	36,478.85	0.31%	Private	270,264	10.29%
TOTAL	11,929,705.82	100.00%	State Park Rec. Area	1,746	0.07%
Yavapai County			State Trust	101,382	3.86%
BLM	605,411.62	11.64%	State Wildlife Reserves	266	0.01%
Bureau of Reclamation	8,682.85	0.17%	USFS & BLM Wilderness	21,427	0.82%
Coconino N.F.	425,932.99	8.19%	Water	73,479	2.80%
County Land	5,784.83	0.11%	Water Intermittent	332	0.01%
Game and Fish	1,033.74	0.02%	TOTAL	2,627,249	100.00%
Hualapai Indian Res.	851.14	0.02%	Washington County, UT		
Indian Allotments	254.12	0.00%	BLM	630,461	40.52%
Kaibab N.F.	25,380.40	0.49%	Forest Service	344,482	22.14%
Military Res.	257.75	0.00%	National Parks, Monuments	132,032	8.49%
Montezuma Castle	534.34	0.01%	Private	275,597	17.71%
Montezuma Well	270.16	0.01%	State Park Rec. Area	7,918	0.51%
Other	8.24	0.00%	State Trust	81,685	5.25%
Parks and Recreation	403.81	0.01%	State Wildlife Reserves	836	0.05%
Prescott N.F.	1,211,345.57	23.30%	Tribal	27,905	1.79%
Private Land	1,324,643.23	25.47%	USFS & BLM Wilderness	53,188	3.42%
State Trust Land	1,265,474.56	24.34%	Water	1,807	0.12%
Tonto N.F.	321,677.16	6.19%	TOTAL	1,555,911	100.00%
Tuzigoot N.M.	43.24	0.00%			
Yavapai Apache Ind. Res.	617.61	0.01%			
Yavapai Prescott Ind. Res.	1,378.16	0.03%			
TOTAL	5,199,985.52	100.00%			

Sources: Arizona Land Resource Information Service
Utah Trust Lands Administration

Figure 18 depicts land cover within the entire area of assessment while Table 28 provides detailed data on land cover within each of the five counties. As a point of clarification, cells with no data for a given category indicate that the land cover type does not exist within the county whereas a figure of 0.00% indicates that the cover type constitutes less than one-tenth of one percent of the county's total land area. Yavapai County reported the greatest amount of residential and industrial cover (.54% and .20% respectively), and Coconino County had the greatest amount of land dedicated to commercial and services uses. Shrub and brush rangeland was the predominant land cover in four of the five counties within the area of assessment, the lone exception being Coconino County, where evergreen forest was most common.



*The apparent G.I.S. data anomalies in Kane and Washington Counties (LULC 43 and 0, Mixed Forest Land and Other) are likely the result of sampling and digitizing procedures that compile previous land use data from secondary sources for the specific area.
http://sagemap.wr.usgs.gov/ftp/n_dakota/NDGS/1_250_LULC.htm

Figure 18. Land Cover within the Area of Assessment

Table 28. Land Cover by County and Assessment Area, 1990

Land Use Code	Coverage Type	Coconino County		Mohave County		Yavapai County	
		Acres	Percent	Acres	Percent	Acres	Percent
0	Unknown / Background	2,6569	0.22%	2,144	0.02%	2,549	0.05%
11	Residential	1,3388	0.11%	12,635	0.15%	28,107	0.54%
12	Commercial and services	20,442	0.17%	12,679	0.15%	3,431	0.07%
13	Industrial	2,572	0.02%	368	0.00%	10,397	0.20%
14	Transportation, communication, utilities	14,942	0.13%	10,211	0.12%	13,348	0.26%
16	Mixed urban or built-up land	4,100	0.03%	1,380	0.02%	1,610	0.03%
17	Other urban or built-up land	1,442	0.01%	1,511	0.02%	851	0.02%
21	Cropland and pasture	130,213	1.09%	15,601	0.18%	94,142	1.81%
22	Orchards, groves, vineyards, nurseries and ornamental horticultural areas	0	0.00%	51	0.00%	86	0.00%
23	Confined feeding operations	79	0.00%	32	0.00%	90	0.00%
24	Other agricultural land	335	0.00%	170	0.00%	1,412	0.03%
31	Herbaceous rangeland	9,559	0.08%	2,963	0.03%	54,394	1.05%
32	Shrub and brush rangeland	2,384,941	19.99%	6,094,445	70.64%	2,563,774	49.30%
33	Mixed rangeland	3,831,908	32.12%	40,858	0.47%	343,004	6.60%
41	Deciduous forest land	740	0.01%	0	0.00%	315	0.01%
42	Evergreen forest land	5,152,147	43.19%	2,183,171	25.31%	2,033,524	39.11%
43	Mixed forest land	147,202	1.23%	0	0.00%	1,214	0.02%
51	Streams and canals	1,252	0.01%	1,996	0.02%	0	0.00%
52	Lakes	11,380	0.10%	3,573	0.04%	216	0.00%
53	Reservoirs	17,868	0.15%	84,217	0.98%	4,441	0.09%
61	Forested wetland	17,097	0.14%	27,563	0.32%	0	0.00%
62	Non-forested wetland	602	0.01%	6,633	0.08%	0	0.00%
71	Dry salt flats	0	0.00%	22,556	0.26%	0	0.00%
72	Beaches	0	0.00%	121	0.00%	0	0.00%
73	Sandy areas not beaches	55,941	0.47%	5,666	0.07%	1,585	0.03%
74	Bare exposed rock	56,324	0.47%	42,039	0.49%	13,536	0.26%
75	Strip mines, quarries, gravel pits	6,094	0.05%	3,412	0.04%	13,387	0.26%
76	Transitional areas	21,834	0.18%	51,387	0.60%	14,571	0.28%
77	Mixed Barren Land	364	0.00%	0	0.00%	0	0.00%
85	Mixed tundra	369	0.00%	0	0.00%	0	0.00%
	Total	11,929,706	100.00%	8,627,380	100.00%	5,199,986	100.00%

Table 28 (cont.). Land Cover by County and Assessment Area, 1990

Land Use code	Coverage Type	Kane County, UT		Washington County, UT		Assessment Area	
		Acres	Percent	Acres	Percent	Acres	Percent
0	Unknown / Background	1,091,946	41.56%	208,556	13.40%	1,331,765	4.45%
11	Residential	6,663	0.25%	2,647	0.17%	63,440	0.21%
12	Commercial and services	88	0.00%	213	0.01%	36,853	0.12%
13	Industrial	0	0.00%	0	0.00%	13,337	0.04%
14	Transportation, communication, utilities	19	0.00%	1,448	0.09%	39,968	0.13%
16	Mixed urban or built-up land	0	0.00%	453	0.03%	7,543	0.03%
17	Other urban or built-up land	7	0.00%	369	0.02%	4,180	0.01%
21	Cropland and pasture	1,076	0.04%	29,566	1.90%	270,599	0.90%
22	Orchards, groves, vineyards, nurseries and ornamental horticultural areas	0	0.00%	60	0.00%	197	0.00%
23	Confined feeding operations	0	0.00%	40	0.00%	241	0.00%
24	Other agricultural land	0	0.00%	35	0.00%	1,951	0.01%
31	Herbaceous rangeland	700	0.03%	681	0.04%	68,296	0.23%
32	Shrub and brush rangeland	795,892	30.29%	929,221	59.72%	12,768,274	42.65%
33	Mixed rangeland	93,747	3.57%	14,475	0.93%	4,323,993	14.44%
41	Deciduous forest land	4,461	0.17%	1,780	0.11%	7,296	0.02%
42	Evergreen forest land	467,551	17.80%	354,231	22.77%	10,190,624	34.04%
43	Mixed forest land	16,138	0.61%	4,628	0.30%	169,182	0.57%
51	Streams and canals	0	0.00%	0	0.00%	3,248	0.01%
52	Lakes	411	0.02%	0	0.00%	15,580	0.05%
53	Reservoirs	67,614	2.57%	375	0.02%	174,515	0.58%
61	Forested wetland	0	0.00%	1,751	0.11%	46,411	0.16%
62	Non-forested wetland	350	0.01%	558	0.04%	8,144	0.03%
71	Dry salt flats	0	0.00%	0	0.00%	22,556	0.08%
72	Beaches	0	0.00%	0	0.00%	121	0.00%
73	Sandy areas not beaches	0	0.00%	1,104	0.07%	64,297	0.21%
74	Bare exposed rock	80,074	3.05%	3,469	0.22%	195,442	0.65%
75	Strip mines, quarries, gravel pits	84	0.00%	0	0.00%	22,977	0.08%
76	Transitional areas	426	0.02%	252	0.02%	88,469	0.30%
77	Mixed Barren Land	0	0.00%	0	0.00%	364	0.00%
85	Mixed tundra	0	0.00%	0	0.00%	369	0.00%
	Total	2,627,249	100.00%	1,555,911	100.00%	29,940,231	100.00%

Land use/ land cover digital data collected by USGS and converted to ARC/INFO by the EPA. Each quadrangle of land use data has a different representative date; however, dates ranging from mid-1970s to early 1980s are common.

Metadata can be found at <http://www.epa.gov/ngispgm3/spdata/EPAGIRAS/meta/general-metadata.text>

Source: U.S. Geological Survey, 1990

5.3 County land use plans and local policy environment

For the purpose of this assessment, county comprehensive plans have been used as a primary source of information on the history of land use within a region, the patterns of development, desired conditions, and current county land use policies. It must be noted, however, that county governments hold no legal authority over independent jurisdictions such as federal and state lands, incorporated cities and towns, or Native American tribal reservations. Additionally, the comprehensive plans reviewed for this assessment vary widely with respect to the date of their adoption, the nature of land use data provided, and the overall format of the documents. While some offer a broad, descriptive analysis of land use patterns and desired conditions, others present more detailed, prescriptive policies and guidelines for county land use. As such, information from the various comprehensive plans is discussed in terms of its potential for influencing land use patterns adjacent to the national forest.

Coconino County Comprehensive Plan

The *Coconino County Comprehensive Plan* estimates that nearly 60% of the county's population—an estimated 75,000 people—lives within the Flagstaff Regional Planning Area. All other residents of the county, approximately 40,000 individuals, live in unincorporated areas (Coconino County 2003). As noted earlier, Coconino County is the largest county in Arizona and the second largest in the United States, but it remains one of the most sparsely populated. Native American reservations (Navajo, Hopi, Kaibab-Paiute, Havasupai, and Hualapai) cover 38.1% of the land area. Federal and state agencies manage a combined 49% of the county's lands—the Forest Service (28.3%), the BLM (5%), the AZSLD (9.4%), and the Park Service (6.8%). Only 13% of the land in Coconino County is under private ownership (Coconino County 2003).

The *Coconino County Comprehensive Plan*, adopted in September 2003, is based in large part on a conservation framework that seeks to accommodate growth in existing communities while retaining their historic, natural, and cultural character (Coconino County 2003). The plan also claims that “conservation-based planning provides an equitable way to consider the varied interests of residents, developers, and conservationists in a cooperative manner” (Coconino County 2003). In order to facilitate implementation of the framework, the plan incorporates specific conservation guidelines into each of its elements.

The plan describes a rapidly decreasing private land base, limited water sources, and public concern over the impact of high-density development on the area's rural character as the primary planning challenges faced by the county. The majority of private land in the county is owned by ranchers and others with large holdings. Platted subdivisions are almost completely built out and development of inholdings is constrained by political pressure as a result of preference for open space. Although some growth has been facilitated through lot splits, the county's authority for reviewing such development does not extend to issues of drainage, utilities, and other infrastructure, often resulting in uncoordinated wildcat development in unincorporated areas (Coconino County 2003).

Water for residential use is either unavailable or difficult to obtain in unincorporated areas of Coconino County. The plan claims that groundwater depth typically exceeds 1,000 feet prompting residents to depend on shared wells, small public water supply systems, or the hauling of water from municipal standpipes. While the county does have the authority to require developers to reveal sources of water for planned subdivisions, it does not have the legal authority to evaluate the impact of proposed wells on neighboring water sources or the environment. The plan also alludes to the planning challenges posed by the reverence for the “rural” character of the county held by many residents in unincorporated areas. It explicitly states that the ultimate success of the conservation framework will depend on planners' success in redefining “rural character” from that of two- to five-acre lots with no protected open space to land use patterns that incorporate smaller individual lots and large areas of conserved open space (Coconino County 2003).

Land use patterns in Coconino County have historically been influenced by land ownership, topography, tourist attractions, Native American reservations, and railroad infrastructure. In the foreseeable future, demographic trends, employment growth, and the availability of water are likely to play increasingly important roles in determining patterns of development. In an effort to respond to these and other factors, the *Coconino County Comprehensive Plan* promotes mixed-use, infill development as the surest way of supporting a stable county economy while preserving healthy landscapes. The plan specifically mentions the acquisition of conservation easements and the use of Transfers of Development Rights (TDRs) as effective methods of preserving county open space. The plan cites the transfer of 40,000 acres of Cataract Ranch from Babbitt Ranches to The Nature Conservancy and Coconino County as an example of successful conservation easements (Coconino County 2003).

The plan also cites the importance of ranchlands in ensuring sustainable management of county land use, estimating that nine ranch owners with private land holdings each exceeding 10,000 acres collectively own 1.13 million acres—71% of the county’s private land (Coconino County 2003). One means of doing so is by allowing ranchers to petition the Board of Supervisors for the formation of “rural planning areas” which provide incentives for large, private landholders to set aside portions of ranchland for purposes of conservation. The use of rural planning areas was specifically provided for under the state of Arizona’s Growing Smarter legislation (Coconino County 2003).

- Residential land use

Residential areas in unincorporated Coconino County fall into various categories with most areas surrounding the cities of Flagstaff and Williams characterized as, and zoned for, agricultural-residential land uses. Exceptions include the Parks and Mormon Lake areas, several platted subdivisions, and rural ranchlands. The *Coconino County Comprehensive Plan* distinguishes between three residential development patterns: rural communities; remote subdivisions; and rural, large-parcel agricultural-residential lands. Rural communities, which may include some small-scale commercial development, include areas such as Doney Park, Parks, Pinewood, Kachina Village, Mountaineer, and Mormon Lake. Rural subdivisions in the area include Forest Lakes, Clear Creek Pines, Starlight Pines, Mogollon Ranch, Blue Ridge Estates, and Tamarron Pines. Many of the residential units in these areas are developed on lots ranging from two-and-a-half to ten acres and serve as second homes, a trend county planners expect will continue (Coconino County 2003).

The pace of residential development and the scarcity of available land have made the affordability of housing a growing issue in Coconino County. The Coconino County Comprehensive Plan asserts that median home prices in the county doubled between 1987 and 2000. Given a median household income of \$38,256 in 2000, over one-half of residents in the Flagstaff area could not afford a median-priced home. In unincorporated areas of the county, higher development costs and land prices are due in part to large lot zoning and the fact that more accessible lands with existing infrastructure have already been developed. Attempts by the county to address the issue of housing affordability have included the amendment of the county subdivision ordinance to simplify the subdivision process, the encouragement of higher densities, the clustering of subdivisions, and the selection of locations for manufactured homes. A related trend in residential housing involves the proliferation of seasonal homes in Coconino County. Census data reveal that in 2000, 17% of all homes in Coconino County were used for seasonal occupancy. At issue is the fact that the costs to the county of providing second-home communities with services such as police protection, solid waste disposal, road maintenance, and snow removal typically exceed tax revenues from seasonal populations (Coconino County 2003).

Residential development in unincorporated Coconino County is also complicated by the common use of lot splits. State law allows owners to divide land into parcels of thirty-six acres or more with no county oversight. Similarly, subsequent owners can split property up to five ways without subdivision review until the resulting parcels reach the minimum zoned size. The *Coconino County Comprehensive Plan*

claims that, as of 2002, these types of developments contained approximately 3,200 forty-acre lots that covered 200 square miles (8%) of private land in the county.

Current land regulations also permit ranchers to sell their land for development as forty-acre “ranchettes,” an increasingly attractive option for agricultural interests, particularly in light of the ongoing drought and diminishing grazing rights on state and federal land. The checkerboard pattern of development that results from this practice has the potential to affect state and federal lands by increasing pressure for consolidation of available sections. While residents and developers benefit from these practices in terms of lower density, lower initial land costs, and shorter times for approval, the county seeks greater control over lot splits and the purchase of “ranchettes” in order to mitigate some of the negative consequences. They include conflict over easements, substandard roads, inadequate drainage, and fragmentation of wildlife habitat (Coconino County 2003).

- Commercial and industrial land use

Commercial uses in unincorporated Coconino County typically are located on or near state highways and are characterized as neighborhood commercial or tourist/highway commercial uses. Common commercial land uses in the county include general retail and office facilities, grocery stores, gas stations, restaurants, post offices, and feed stores. Tourist/highway commercial uses typically include hotels, motels, campgrounds, RV parks, gift shops, and recreational facilities. Both county and municipal planners have attempted to maintain the rural character of low-density residential areas by encouraging the location of commercial development near major intersections and existing communities. The county has taken the further steps of amending the zoning ordinance to prohibit establishments of over 70,000 ft² in rural areas as well as adopting design guidelines from commercial and industrial uses through the Area Plan process in the communities of Tusayan, Doney Park, Oak Creek Canyon, Kachina Village, and Mountaineer (Coconino County 2003).

Due to the fact that most industrial facilities require municipal water, fire protection, and other services, relatively few are located outside of cities and towns in unincorporated areas of the county. As of 2002, the primary areas of heavy industrial zoning and development were located near Winona (seventy-two acres) and on Leupp Road (242 acres) in the Doney Park area. An additional 140 acres are industrially zoned in Bellemont and considerable additional development is possible at both Bellemont and Flagstaff Ranch Road. The *Coconino County Comprehensive Plan* states a preference for future industrial uses in the area that do not require large amounts of water such as warehouses, distributing, and light manufacturing (Coconino County 2003).

Yavapai County General Plan

Like that of Coconino County, the *Yavapai County General Plan* of 2003 states the overall objective of promoting development that maintains the region’s traditionally rural character while adequately planning for expected growth. The challenge of doing so is heightened given the fact that Yavapai County’s population growth over the last two decades has more than doubled that of Coconino County and has been nearly 20% greater than overall population growth for the state of Arizona over the same period. This substantial growth in the county’s population has coincided with a decline in traditional land uses such as ranching, agriculture, and mining and has led to significant expansions of existing municipalities (Yavapai County 2003).

The majority of land in Yavapai County is publicly owned and managed by federal and state agencies. 38% of total county land is under the jurisdiction of the USFS, 24% is managed by the AZSLD, and 11.6% is controlled by the BLM. Approximately 25% of land in Yavapai County is privately owned. USFS lands are concentrated in the eastern and southern portions of the county, and BLM lands are

primarily located in the southwestern and south-central areas of the county. AZSLD holdings are also concentrated in the southern areas but are additionally present in checkerboard sections throughout northern Yavapai County.

In addition to Federal and State agencies, twelve other jurisdictions control limited portions of land within the county. Nine of these jurisdictions are incorporated cities and towns, and three are Tribal Reservations (Yavapai-Prescott Indian Reservation, Yavapai-Apache Reservation, and Hualapai Indian Reservation). As of 2002, these twelve jurisdictions held approximately 236 square miles of land, comprising 2.9% of the county's total land base (Yavapai County 2003).

Many of the county's current planning efforts are directed toward the designated "major growth areas." According to the *Yavapai County General Plan*, 2000 Census data suggest that 50% of the total county population lives in the Central Yavapai Region and another 32% lives in the Verde Valley area. The areas surrounding Prescott and Prescott Valley have grown dramatically since the 1970s, largely as a result of the sale and conversion of former Fain family ranch holdings. Additionally, planned area developments such as Yavapai Hills, Hidden Valley Ranches, and Sandretto Hills have been annexed into the City of Prescott. Similar conversions of ranch and farm properties have led to substantial residential development in the Verde Villages, Chino Valley, and along the State Highway 69 and Williamson Valley Road corridors. This trend is expected to continue as other large ranches in Yavapai County are currently being proposed as sites for future development (Yavapai County 2003).

- Residential land use

The *Yavapai County General Plan* states that approximately 96% of the land in unincorporated Yavapai County is zoned for residential land use. This land is subject to two-acre minimum zoning and comprises 3.7 million acres of government-owned property and over 1 million acres of private property. Land use referred to as Rural Residential is primarily located in the southern and western portions of unincorporated Yavapai County. Rapid growth has also been experienced in areas referred to in the plan as "municipal influence areas." These areas are primarily residential developments adjacent to, but outside, the boundaries of existing municipalities.

As is the case in Coconino County, effective planning is made more difficult by the prevalent practice of lot splitting. The plan states that between April 2000 and April 2001, 1,760 parcel splits were recorded in Yavapai County, accounting for 90% of home sites developed during the period. The result is that many large, private holdings have been continuously split into numerous two-acre parcels. Under current state law, the county has little authority to require infrastructure or dedication of open space for split parcels, nor does it review split properties for suitable access, water, sanitation, drainage, or available utilities. Importantly, state law also permits installation of "exempt wells." Wells qualify as exempt if they have less than thirty-five gallons per minute pumping capacity. This includes the vast majority of wells for residential consumption as wells with three- to ten-gallon-per-minute capacity are deemed sufficient for typical households. As a result of parcel splits and well exemption, the plan claims that a large percentage of current land development in unincorporated Yavapai County is "unplanned" (Yavapai County 2003).

- Commercial and industrial land use

The *Yavapai County General Plan* states a preference for general commercial- and tourist-related businesses to be located along the major intersections found on State Highways 69, 89, 89A, 179, 260 and Interstate 17. Although the mining industry has declined throughout the county, this land use continues in the community of Bagdad as well as various small mining entities in other parts of the county.

Mohave County General Plan

The land use element of the *Mohave County General Plan* is based on an analysis of land use patterns that revealed high rates of population growth in South Mohave Valley, Golden Valley, and the areas immediately surrounding Bullhead City, Kingman, and Lake Havasu City. The plan states that four-fifths of the land in the county is owned by federal, state, or local governments, but that due to the vast size of the county, this extensive amount of public lands is not considered a constraint to growth, except where public ownership of alternating sections increases development costs. The primary constraint to future growth is the limited availability of adequate public facilities (particularly water and sewer) (Mohave County 1995).

The plan identifies four distinct planning area types, allowing for an array of land use planning policies dependent on growth characteristics. Most of the land in Mohave County falls under the “Rural Development Area” (RDA) category. Most parcels in this area are at least five acres in size, many of which are much larger and owned by federal, state, or Native American governments.

“Suburban Development Areas” (SDAs) are intended for lower density residential neighborhoods with lot changes ranging from one to five acres in size. SDAs in Mohave County include the North Kingman area, South Kingman area, parts of Golden Valley, south Mohave Valley, areas north and east of Lake Havasu City, areas west of White Hills, and areas adjacent to Highway 93 and Interstate 40.

“Urban Development Areas” (UDAs) are intended to provide for more intense residential and non-residential development. Residential diversities in these areas range from two to five dwellings per acre although high-density developments of up to twenty-five units per acre may be permitted. UDAs in Mohave County include Hualapai Ranch, South Kingman/McConnico, parts of Golden Valley, parts of South Mohave Valley, areas east of Bullhead City, areas north of Lake Havasu City, Valle Vista, North Kingman/Butler, and areas west of White Hills.

“Outlying Communities” include both rural and urban land uses and support both residential and non-residential development. “Outlying Communities” in Mohave County include Meadview, Littlefield, Chloride, Dolan Springs, Peach Springs, Truxton, Yucca, Wikieup, Topock, Oatman, Hualapai Mountain subdivision, Peacock, Hackberry, Cedar Hills, Pinion Pines White Hills, Golden Shores, Scenic, Mocassin, Centennial, and Arvada.

- Residential land use

The *Mohave County General Plan* identifies six residential land use categories. The “Rural Residential” (RR) category applies to most land within RDAs. The two suburban residential land use categories—Suburban Estates (SE) and Suburban Residential (SR)—allow low housing densities but typically require higher levels of infrastructure and service than rural areas. Three categories apply to urban residential development. They are “Low Density Residential” (LR), “Medium Density Residential” (MR) and “High Density Residential” (HR). All urban residential development requires lot sizes of less than one acre as well as urban services including paved roads, centralized water, sewers, etc. The general plan permits residential densities ranging from one dwelling unit on parcels of five or more acres within the RR category to a maximum of twenty-five dwelling units per acre within the HR category (Mohave County 1995).

- Non-residential land use

The general plan also identifies six categories of non-residential land use categories. The “Neighborhood Commercial” (NC) category allows uses that meet the needs of residents in adjacent neighborhoods, including small scale service and retail and small office buildings. “General Commercial” (GC) uses

include retail, service, and offices that serve the entire community or region. Examples include major retail centers, fast food restaurants, service stations, and multi-story office buildings. The “Commercial Recreation” (CR) category provides for a various privately owned or leased facilities where the primary activities are recreational and occur outside of buildings. Uses in this category include golf courses, equestrian centers, and recreational vehicle parks and campgrounds. The “Rural Industrial” (RI) category provides for industrial activities in rural areas while the “Light Industrial” (LI) is intended uses such as warehousing, wholesale sales, distribution, and light manufacturing. “Heavy Industrial” (HI) land uses include heavy manufacturing and construction yards. Such uses may have safety, nuisance, or environmental effects which require them to be located away from residential areas and near major transportation facilities such as rail lines, airports, or freeways. Finally, the “Airport Industrial” (AI) category provides for industrial development compatible with adjacent airport use such as manufacturing, transport service providers, wholesalers, and warehouse facilities (Mohave County 1995).

Washington County General Plan

The plan explains that the earliest efforts at land use planning in Washington County began with the first Mormon pioneer settlers, beginning at Harmony Fort in 1852. Settlers were sent to the area by Brigham Young with the mission of growing cotton for the newly established territory of Utah. The first experimental crop was planted in the Santa Clara Valley in 1855, and two years later, the town of Washington was established. The town of St. George, the present county seat, was named after George A. Smith, a prominent early leader of the Church of Latter Day Saints (Washington County 1994).

The economy of Washington County has long been supported by the tourist industry and, to a lesser extent, by farming, livestock raising, construction, education, medicine, and retirement living. The county is also home to limited mining activity. The plan describes the region including southwestern Utah, northern Arizona, and southeastern Nevada as one, “on the threshold of phenomenal growth.” This demographic increase has taken place in a region notable for major recreation destinations such as Zion National Park, Bryce Canyon National Park, the Grand Canyon, Lake Mead, and Glen Canyon National Recreation Area. According to the General Plan, Washington County is ranked second among counties in the state of Utah in terms of tourist dollars spent.

In addition, the plan identifies the mild climate, rural landscape, and LDS community as important factors for the recent growth in retirement age population, many of whom are affluent and in search of an amenity-rich environment for seasonal homes. The plan claims that Washington County is the fastest growing county in the state, accounting for eighty to ninety percent of all growth south of Utah County. In light of each of these factors, the *Washington County General Plan* calls for effective long-term planning for the provision of schools, fire and police protection, commercial and industrial growth, sanitation, and water provision (Washington County 1994).

Nearly eighty percent of the entire land base in Washington County is publicly owned and managed. For this reason, the plan stresses the importance of business activities on public lands and identifies the protection of property rights, the facilitation of a free market economy, and the establishment of a process to insure self-determination by local residents as the primary responsibilities of the county government. The plan goes on to describe a lack of effective communication and coordination between the county government and federal agencies as a critical factor in many of the current land use concerns held by local groups and individuals (Washington County 1994).

With respect to the county’s natural resources, the plan states that public lands should be managed for multiple uses to allow for full use of prior existing water rights on the Virgin River and its tributaries, including Beaver Dam. It also states that land value appraisals should, “reflect the highest and best use of the land without regard to sensitive or threatened and endangered species” (Washington County 1994). The plan asserts that public lands should be open for the sale of mineral rights except for designated

wilderness areas. It then goes on to state that “inventory designation and interim protection of wilderness areas has been a disruptive, divisive and non-productive element in the county” and that “additional inventories or protective management of wilderness, primitive or wild and scenic rivers are not necessary and should not be made” (Washington County 1994).

- Residential land use

The plan alludes to rapidly expanding residential development in both rural and urban areas of Washington County. A number of new developments not contiguous with existing municipalities have been established in recent years, including Winchester Hills, Diamond Valley, and Apple Valley. The plan states a strong preference for residential growth through a “natural pattern” of expansion of existing urban areas, thereby reducing the costs related to providing schools, libraries, parks, highways, police and fire protection, sewage and garbage collection, and all other facilities. In the event that new residential development is proposed in proximity to incorporated communities, the county should insist that every effort is made by the community to annex the area rather than allowing development on unincorporated county land (Washington County 1994).

- Commercial and industrial land use

The *Washington County General Plan* identifies two categories of commercial development in Washington County: shopping centers and highway service centers. The county discourages the development of “strip” commercial development due to its detrimental effect on property values and the existing quality of the built environment. Highway service commercial development will be supported only in areas where there is a four-way flow of traffic as well as adequate access and egress from the roadway.

The plan encourages industrial development only in areas where the industry has access to adequate labor, utility services, and transportation infrastructure. The plan includes an exception to these guidelines for mining and mineral development, stating that such industries are tied to the land and provisions should be made to ensure that utility needs and labor requirements for these interests are met (Washington County 1994).

Local land use policy issues

The primary land use issues facing county residents within the area of assessment are the result of a transition from an area defined by its rural character to one facing increasing pressure for urban development. While residents and planners prefer to maintain a rural character throughout unincorporated county lands, rapidly increasing populations and expanding city boundaries represent some of challenges for doing so.

Preservation of open space is a particularly important land use issue among planners and property owners within the area of assessment. Adequate open space is seen as a critical step toward protecting important watersheds, preventing fragmentation of wildlife habitat, and creating buffers between low-density rural development and higher-density uses within incorporated cities. Policies aimed at preserving open space have been mentioned in each of the county comprehensive plans. These methods include the encouragement of “clustered development,” the purchase of development rights, and the dedication of land such as conservation easements. Although no such measures have been adopted, the Flagstaff Area Regional Land Use and Transportation Plan mentions the possibility of adopting rural and urban growth boundaries, outside of which future development would be discouraged or prohibited (Coconino County 2003, Yavapai County 2003, Mohave County 1995).

In addition to the provision of open space, county land use planners also emphasize the need to ensure efficient and effective land use in areas suitable for development. A commonly mentioned policy for ensuring efficient land use is the encouragement of infill development. Infill development not only limits urban sprawl, it maximizes the efficiency of infrastructure and minimizes traffic congestion, thereby lowering the overall cost development. Policies aimed at encouraging infill include the provision of density transfers and zoning changes that allow for mixed uses in low-density areas (Coconino County 2003, Yavapai County 2003, FMPO 2001).

Another factor certain to influence the pattern of future development is the relative scarcity of private land within the area surrounding KNF. In an effort to capitalize on the current land market and accommodate the need for residential and commercial development resulting from population growth, large property owners commonly engage in the practice of “lot splitting.” Currently, county governments exercise little or no authority over this practice, resulting in developments that circumvent established density guidelines as well as avoiding the costs of installing critical infrastructure such as sewers, water, improved roads, and emergency access. In addition to advocating state legislation that would grant counties the power to regulate lot splitting, county planners propose sharing the cost of development with private interests through tools such as impact fees (Coconino County 2003, Yavapai County 2003, Mohave County 1995). Proponents of development also advocate the consolidation and conversion of the current patchwork of trust lands currently managed by the AZSLD. They argue that the exchange and/or sale of these trust lands will alleviate land scarcity, provide much needed funds for the state educational system, and allow for protection of environmentally sensitive landscapes. A further discussion of the impact of State Trust Lands on Arizona’s national forests is presented in the next section (Coconino County 2003, Yavapai County 2003).

Undoubtedly, the availability of sufficient water supplies is a growing concern for Arizona communities, particularly those experiencing relatively high rates of population growth. Recently, Governor Napolitano cited the “one-two punch of record drought and record growth” as the greatest threat to the state’s water supply and a serious concern for Arizona’s future development (Napolitano 2004). One of the statewide policies enacted through the Arizona Department of Water Resources (ADWR) is to require developers in AMAs to identify a 100-year assured water supply, participate in banking water, expand use of effluent water, and convert homes and building to low-water-use fixtures. Currently, the Prescott Active Management Area in central Yavapai County is the only one within the area of assessment and measures 485 square miles (ADWR 2005). Additionally, the 1998 Growing Smarter legislation passed by the state congress requires the inclusion of a Water Resources element in the comprehensive plans of all counties with a 2000 population of 125,000 or greater. The current versions of the Yavapai and Coconino County comprehensive plans both contain Water Resources elements which support making water availability a key consideration for all major developments and subdivision applications filed in conjunction with a rezoning for higher density. Policies for effectively managing future development with respect to projected water supplies include county support for the formation of water districts, incentives for low-water plumbing devices, drought-tolerant landscaping, and the identification and reuse of non-potable sources such as gray water (Coconino County 2003, Yavapai County 2003).

Finally, the proximity of many rural communities to large parcels of public land have prompted calls for greater collaboration on land use planning between county and municipal governments and their federal and state counterparts. In addition to the aforementioned issues, county residents are particularly interested in coordinating efforts on land acquisition and exchange as well as fire management and forest restoration (Coconino County 2003, Yavapai County 2003, Mohave County 1995, Washington County 1994).

5.4 Changes in land use affecting Kaibab National Forest

A number of land acquisitions and land exchanges proposed in recent years have either directly or indirectly involved lands managed by the KNF. A brief description of information available on these land transactions follows:

- Northern Arizona Land Exchange (2005)

On March 16, 2005, Arizona Senators John McCain and Jon Kyl introduced Senate bill S. 161, entitled the Northern Arizona Land Exchange and Verde River Basin Partnership Act. On the same date, the Deputy Chief of the National Forest System offered testimony before the Subcommittee on Forests and Forest Health on H.R. 410, the House version of the legislative bill. The proposed legislation is intended to provide for the exchange of 20,800 acres of land currently held by the Prescott, Kaibab, and Coconino National Forests for 35,000 acres owned and managed by Yavapai Ranch Limited Partnership and the Northern Yavapai, L.L.C. The proposed action would facilitate consolidation of approximately 15,000 acres of “checkerboard” parcels within the Prescott NF while conveying conservation and development rights to Yavapai Ranch Limited Partnership and the cities of Williams, Flagstaff, Clarkdale, and Camp Verde. Six summer church camps would also obtain purchase rights for land they currently occupy under the proposed exchange. The proposed exchange is one of the largest exchanges of federal and private land in Arizona history and has garnered both considerable support and opposition from local governments, advocacy groups, and citizens. Proponents of the exchange claim that it provides for more effective administration of FS lands and delivers direct benefits to municipalities in the implementation of economic, growth management, and open space plans. Opposition to the exchange is largely based on the fact that the legislative process involved does not require the environmental assessments, public participation, or disclosure procedures involved in typical land exchanges. Additionally, many local critics are opposed to the retention of all water rights on exchanged parcels by the Yavapai Ranch Limited Partnership. They believe that retention of such rights is an extraordinary and irresponsible concession by the FS in light of Yavapai Ranch’s development plans and the area’s scarce water supply. Both S. 161 and H.R. 410 have been introduced in committee and are awaiting further action on the floor of U.S. Senate and the House of Representatives (Holtrop 2005, Olsen 2003, Rey 2003, Yavapai Ranch 2003).

- Ellison Creek Land Exchange (2004)

This proposal called for the exchange of a 142-acre federal recreation residence parcel on the Payson Ranger District for 521 non-federal acres located throughout the Alpine, Verde, Williams, Payson, Red Rock, and Pleasant Valley Ranger Districts. Implementation of the proposed land exchange was expected in September 2004 (KNF 2005).

- Gray Wolf Land Exchange (2005)

The current Schedule of Proposed Action (SOPA) for the KNF states that this exchange is intended to provide land for the expansion of the Gray Wolf sanitary landfill site, located approximately ten miles east of Dewey, Arizona in Yavapai County. As proposed by Waste Management of Arizona (WMA), the exchange calls for the acquisition of approximately 255 acres of national forest land on the PNF in Yavapai County, Arizona. In exchange, the PNF, ASNF, KNF, and the CNF would receive title to seven parcels of private land totaling approximately 872 acres. A final decision on the Gray Wolf land exchange was expected in February 2005, with implementation taking place in July 2005 (KNF 2005, PNF 2004).

- Canyon Forest Village Land Exchange (1999)

Long before this proposed land exchange, the KNF had begun considering alternatives for expansion of the community of Tusayan in order to meet the needs of a growing number of visitors to the Grand Canyon National Park. Initially proposed in 1994, the development entitled Canyon Forest Village (CFV) was to involve the transfer of significant private inholdings in the KNF in exchange for federal forest land on which a tourist-oriented “gateway” community could be established. Canyon Forest Village II (CFVII) Corporation, a subsidiary of Grand Canyon Exchange Limited Partnership was responsible for submitting the proposed exchange. Proponents included the Grand Canyon Trust, the Environmental Defense Fund, the Natural Resources Defense Council, the Wilderness Society, and the National Parks Conservation Association. After five years of alternative development and refinement—a process that involved extensive public input and negotiation—the Regional Forester for the Southwestern Region of the Forest Service recommended the adoption of Alternative H in her Record of Decision for the Final Environmental Impact Statement for Tusayan Growth. This alternative called for the exchange of 272 acres of forest land along Arizona Highway 64 between Tusayan and the Park entrance for twelve private inholdings in the KNF, totaling 2,118 acres. The selected alternative was intended to provide land for the CFVII Corporation to construct community facilities, a transit center for Park visitors and employees, a community park, employee housing, 1,270 rooms for visitor lodging, and 270,000 square feet of retail and restaurant space. Alternative H also proposed to import all necessary water from the Colorado River via rail lines and underground pipelines as well as implement certain requirements regarding resource conservation, sustainable building practices, and a building design code. Staunch opposition to the proposal was voiced by a group of land and business owners in Tusayan organized under the name of the Grand Canyon Improvement Association (GCIA). This group joined in opposition to CFV on the grounds that the development would detract from established businesses in communities such as Tusayan, Williams, and Flagstaff that had previously served as “gateways” to the Grand Canyon. Subsequently, a Coconino County referendum on zoning approval for CFV was defeated by a 2-1 margin in November 2000. Additionally, the Southwest Office of the Sierra Club and the Center for Biological Diversity filed a lawsuit against the KNF and CFV stating that the EIS did not adequately address all of the proposal’s environmental impacts, particularly with respect to water provision. The court ruling agreed, asserting that the decision by the Forest Service to support the plan was “clearly erroneous” leading to an appeal filed in the Ninth Circuit by CFVII. On December 27, 2002, the Court dismissed the appeal, allowing the lower court decision to stand, thereby eliminating the proposal from further consideration (USFS 1999c, Colorado College 2003, Sierra Club 2003).

5.5 Key issues for forest planning and management

“A critical element in understanding the regional significance of national forest lands and resources in the Southwest is understanding the development and relationships of public and private land ownership and control.”

- Timeless Heritage: A History of the Forest Service in the Southwest

Few, if any, of the topics included in this assessment have as direct an impact on forest management as land use planning. Although land ownership and use remained remarkably stable in the century following the founding of the Arizona Territory in 1863, recent shifts in the state’s population and economic base have brought about dramatic trends in land use that are likely to influence forest management for decades to come.

Arizona has long maintained a relatively large percentage of lands under federal jurisdiction. In 1891, land held under the public domain accounted for approximately 75% of Arizona's total land base. By 1977, the proportion of federally controlled land had decreased but was still substantial at 71%. By comparison, federally controlled land accounted for 34% of New Mexico's land base in the same year. Alternatively, only 16% of land in Arizona was under private ownership in 1977 while private land constituted 45% of all land in New Mexico in the same year (Baker et al. 1988). When combined with demographic and economic trends discussed previously in this assessment, these ownership characteristics have placed increasing pressure on what has likely become one of Arizona's most valuable natural resources: land.

The current policy debate regarding transition of public and private lands in Arizona is rooted in a historic context that reflects significant economic change. Traditionally, sectors such as mining, ranching, and logging have been mainstays of the state's predominantly rural economy. In addition to owning substantial portions of Arizona's limited private land base, these interests have exerted considerable influence over the management and use of adjoining public lands. For example, private owners of scattered parcels on which springs and wells are located have typically enjoyed a certain amount of control over activities on surrounding dry areas. Likewise, large private land owners, such as railroads and mining companies, have also sought to influence access to the state's vast public lands. Although many of the industries associated with Arizona's early history have declined in recent decades, controversy between public and private land interests has steadily increased under the pressure for continued urban development. According to the *Land and Water Law Review*, "The proper allocation of rights to private landowners and federal land conservation interests has become one of the most contentious and emotional issues in public land law" (Stuebner 1998).

The area surrounding the KNF exemplifies many of the trends and controversial issues involving the economic stability and effective management of public lands. Within the area of assessment, Yavapai County serves as a particularly poignant example of an area engaged in vigorous debate over land management practices. Collected data show that over 87% of land within the county is controlled by the FS, the AZSLD, and private owners. Meanwhile, Yavapai County has seen considerable population and housing growth in recent decades, much of which is attributable to the area's wealth of natural resource amenities.

At issue is how, and whether, private owners and public land managers can come to an agreement on how best to manage the competing priorities of resource conservation and economic development. As seen in the county comprehensive plans reviewed for this assessment, planners are struggling to cope with growing demands for housing and recreation while ensuring preservation of a shrinking natural resource base that contributes to Arizona's highly valued "rural character."

Much of the current controversy involving land management is encapsulated in the debate over open space. Research shows that the rate of conversion of private parcels from farming, ranching, and forestry to more urban land uses has outpaced population growth over the last several decades (USFS 2005f). This trend has led to increasingly pointed exchanges between ranchers, farmers, seasonal residents, conservation interests, and home builders over the immediate and long-term value of open space. Meanwhile, all sides of the debate over the management of public lands have become aware of the increasingly important role of Arizona's State Trust lands in conserving natural resources and sustaining urban growth. As such, proposed reforms of the current State Trust land system are likely to be relevant to future management plans of the KNF given the presence of State Trust lands within the area of assessment.

Finally, all of the national forests in Arizona are likely to find themselves in the center of growing debate over the management of the state's water resources. This is due to the fact that the forests share primary responsibility for the management of watersheds critical to environmental sustainability as well as residential and industrial growth. Studies have shown that approximately forty percent of surface and

subsurface water in Arizona originates on lands administered by the Forest Service (USFS 1983). The role of the KNF in protecting the integrity of area watersheds is likely to become increasingly important given the rates of projected growth within the area of assessment.

In order to facilitate resolution of current and future land use issues, the KNF should continue working in partnership with affected communities and landowners adjacent to forest boundaries and promote the efforts of county and city land use planners in the institution of sustainable regional approaches to urban development and resource conservation. In particular, the FS can use its technical and organizational strengths to help stakeholders make informed decisions about land ownership and use that will undoubtedly affect their future environmental and economic well-being (USFS 2005f).