4. Access and Travel Patterns

This section examines historic and current factors affecting access patterns and transportation infrastructure within the four counties surrounding Tonto National Forest (TNF). The information gathered is intended to outline 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 (ADOC), 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 TNF cite the difficulty of transportation planning in the region given its vast geographic scale, population growth, 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 the area surrounding Tonto National Forest saw relatively large increases in VMT between 1990 and 2000, mirroring the region's relatively strong population growth over the same period. Information gathered from the Arizona Department of Transportation (ADOT) and county comprehensive plans suggest that considerable improvements are currently scheduled for the region's transportation network, particularly when compared to areas surrounding Arizona's other national forests.

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 extractive economy. Today, many regions of the state, including the area surrounding the TNF, 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 particularly challenging given the vast geographic scale of the area, the rate of population growth, and expansion of commercial, industrial, and residential land uses. 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 (MAG 2003, Gila County 2003, Yavapai County 2003, ADOT 2004a).

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 (MAG 2003, Pinal County 2001). 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 directly pertain 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, 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 on 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 the 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. Figure 14 shows a particularly dense road network surrounding the metropolitan Phoenix are and a considerable network of interstates, state highways and Indian routes. Additionally, the majority of major roads follow a north-south orientation, with the exception of Interstates 10 and 8 which are primarily situated east to west through the area of assessment.

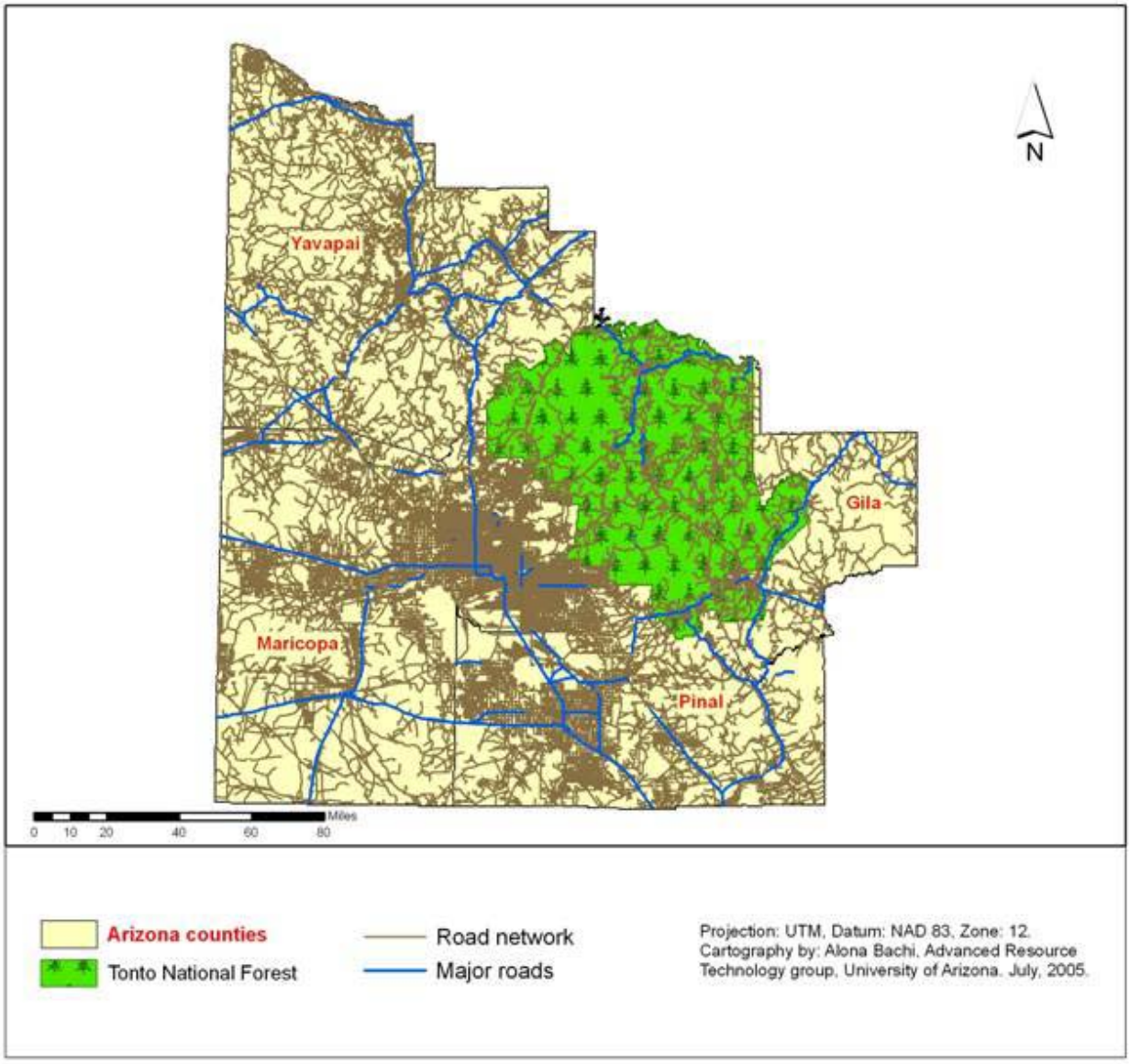


Figure 1. Road Network within the Area of Assessment

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

	Interstates / U.S. Highways	State Highways	Indian Routes
Gila County			
	US 60	State Highway 73	
		State Highway 77	
		State Highway 87	
		State Highway 88	
		State Highway 170	
		State Highway 188	
		State Highway 260	
Maricopa County			
	Interstate 8	State Highways 51	
	Interstate 10	State Highways 74	
	Interstate 17	State Highways 85	
	US 60	State Highways 87	
		State Highways 88	
		State Highways 101	
		State Highways 143	
		State Highways 153	
		State Highways 202	
		State Highways 238	
		State Highways 303	
		State Highways 347	
Pinal County			
	Interstate 8	State Highways 77	Indian Route 15
	Interstate 10	State Highways 78	
	US 60	State Highways 84	
		State Highways 87	
		State Highways 88	
		State Highways 187	
		State Highways 237	
		State Highways 287	
		State Highways 347	
		State Highways 387	
		State Highways 177	
Yavapai County			
	Interstate 17	State Highways 69	
	Interstate 40	State Highways 71	
	US 93	State Highways 89A	
		State Highways 96	
		State Highways 97	
		State Highways 169	
		State Highways 260	

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. 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, planning agencies 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 (MAG 2003, Gila County 2003, Yavapai County 2003, Pinal County 2001).

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 twelve percent of the total highway network are state facilities, over fifty-seven percent of the daily vehicle miles traveled (VMT) occur on these roads. The Interstate System—which is part of the state highway system—carries twenty-eight percent 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 seventy percent of the land in Arizona. Federal lands agencies, including the USFS, the BLM, and others, own forty-two percent 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 twenty-eight percent of Arizona land. An additional 1,200 miles of state highway pass through these lands, with over one-half of these road-miles 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 Pinal County over the ten-year period. Similar, though relatively modest, increases in traffic for all roads were also reported within the county over the same time period. These increases are obviously due in part to substantial increases in population and housing units in Pinal County. The extraordinary increase in travel on non-state roads is likely attributable to significant increases in VMT on county roads and roads serving private residential and commercial developments. Table 24 also shows a substantial increase in VMT on state roads within Maricopa County. This increase is likely to the expanded use of state routes in an around the Phoenix metropolitan area.

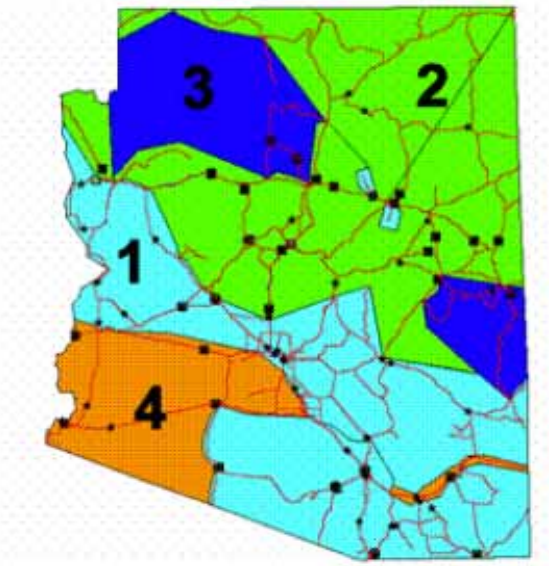
Table 24. Daily Vehicle-Miles of Travel (VMT) by County, 1990-2000 and % Change

	Total VMT all roads (000s)			Total VMT state system (000s)			Total VMT non state (000s)		
Area	1990	2000	% Change	1990	2000	% Change	1990	2000	% Change
Gila County	1,312	1,948	48.48%	1,005	1,470	46.27%	307	478	55.70%
Maricopa County	47,388	67,486	42.41%	11,599	25,963	123.84%	35,789	41,523	16.02%
Pinal County	3,446	6,917	100.73%	3,361	4,805	42.96%	85	2,112	2,384.71%
Yavapai County	3,439	6,803	97.82%	3,182	4,776	50.09%	257	2,027	688.72%
Arizona	97,139	134,345	38.30%	40,252	66,671	65.63%	56,887	67,674	18.96%

Source: Arizona Department of Transportation, Transportation Planning Division
HPMS Data for the Calendar years 1990 and 2000

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 TNF extend into the portions of the state designated as Areas 1 and 2 by ADOT's Transportation Planning Department. Data in Table 25 show that peak traffic flow for Area 1 occurs between February and April and is lowest from July to September. Conversely, peak traffic flow for Area 2 occurs between June and August and is at its lowest from December to February. These distinct seasonal flows 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 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 Tonto NF.

Planned improvements to the state highway system surrounding TNF are presented in Table 26. Although the data may not account for all ADOT projects within the area of assessment, they present a useful guide to the timing, nature, and extent of highway projects that are likely to influence travel to and from the forest.

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

Year	Route	Milepost	County	Funding Source	Location	Length (miles)	Type Of Work	Cost ($1000)
2006	60	212.17	Pinal	Surface Transportation Program	Florence Junction T-Picket Post	6	Reconstruct roadway (widening)	$37,000
2007	60	230	Pinal	STATE	Pinto Valley Bridge - Mine Turnoff		Design passing lane	$300
2008	60	230	Pinal	Surface Transportation Program	Oak Flat - Devil's Canyon		Construct passing/climbing lane	$3,000
2006	60	236.2	Gila	Surface Transportation Program	County Line - Pinto Valley	3.3	Resurface & passing lane	$4,033
2005	87	194	Maricopa	STATE	Forest Boundary - Dos "S" Ranch Rd.		Design	$500
2006	87	194.1	Maricopa	National Highway System	Forest Boundary to Dos "S" Ranch	9.8	Construct Roadway	$3,000
2005	87	263	Gila	STATE	Tonto Natural Bridge	0.1	Road Design, Phase II	$125
2006	87	263	Gila	STATE	Tonto Natural Bridge	0.1	Construct Road, Phase II	$775
2005	88	213.3	Maricopa	STATE	Apache Trail	29.4	District Force Account.	$150
2006	88	213.3	Maricopa	STATE	Apache Trail	29.4	District Force Account.	$150
2006	88	223	Maricopa	Surface Transportation Program	Fish Creek Hill		Construct retaining walls	$1,500
2005	88	223	Maricopa	STATE	Fish Creek Hill		Design (retaining walls)	$150
2005	188	214.87	Gila	Surface Transportation Program	Wheatfields - US 60	4.1	Construct Roadway	$10,000
2008	260	263.1	Gila	National Highway System	Little Green Valley	6.9	Reconstruct Roadway	$21,700
2009	260	269	Gila	National Highway System	Doubtful Canyon Section	3.5	Reconstruct Roadway	$31,000
2009	260	269	Gila	STATE	Doubtful Canyon Section	0.2	Utility Relocation.	$30
2005	260	269	Gila	STATE	Doubtful Canyon Section	0	Design (Roadway)	$1,500
2005	260	280	Gila	STATE	SR 260, Gordon Canyon Bridge & Mogollon Rim Viaduct	1.18	Construction of erosion control and stream stability facilities.	$337

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 TNF, the Maricopa Association of Governments (MAG), the Central Arizona Association of Governments (CAAG), 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 (Gila County 2003, Yavapai County 2003). 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.

Gila County

The primary routes within Gila County consist of State Routes, including US 60, US 70, SR 87, SR 188, SR 288, and SR 260. Most of the secondary routes are FS roads that provide access to pockets of private lands located within the TNF boundaries. Most roadways directly under the jurisdiction of Gila County are located in rural areas and consist of two-lane collector and local roadways. The urban roadways under Gila County's jurisdiction include those within the communities of Claypool, Central Heights, Strawberry, and Pine.

Among the primary transportation-related issues identified in the *Gila County Comprehensive Master Plan* are adequacy of emergency access, all-weather property accessibility, lack of alternative transportation mode facilities, and deficiencies in roadway construction and maintenance funding. In an effort to address these issues, the county has recently developed the *Gila County Roadway Design Standards Manual* to standardize the construction of all new roadways and improvement for existing roadways under its jurisdiction as well as to establish policies regarding roadway issues such as all-weather access standards, emergency access standards, etc. (Gila County 2003). As of 2003, the county was in the process of developing a Capital Improvement Plan to identify and prioritize all transportation improvement projects for county roads; however, a copy of the plan was not available at the time of this assessment.

Maricopa County

As the designated Metropolitan Planning Organization for the Maricopa region, MAG plans and finances the regional transportation system. These responsibilities include the development of a Regional Transportation Plan (RTP), management of the regional Transportation Improvement Program, collection of traffic data, and monitoring of transportation safety programs.

The RTP planning area includes all of Maricopa County, encompassing the cities of Apache Junction, Avondale, Chandler, El Mirage, Glendale, Goodyear, Litchfield Park, Mesa, Peoria, Phoenix, Scottsdale, Surprise, Tempe, Tolleson, Buckeye, Carefree, Cave Creek, Fountain Hills, Gila Bend, Gilbert, Guadalupe, Paradise Valley, Queen Creek, Wickenburg, Youngtown, and the Gila River and Salt River Pima-Maricopa Indian Communities. Given the rates of current and projected growth throughout the region, much of the RTP focuses on the impacts of development on the regional transportation system. In recent decades, regional development patterns have been characterized by sustained residential growth on the fringes of the urbanized area, combined with infill development within the urban core. Together, these patterns contribute to increases in urban density which the RTP claims necessitate a variety of transportation approaches to respond to the different types of development occurring in the region. In

response to these trends, the RTP presents an improvement plan that includes increases in highway capacity, expanded mass transit service and alternative mode options (MAG 2003).

In describing current roadway conditions, the RTP describes certain advantages of the established transportation system. For example, it claims that the existing regional freeway system, having been built over the past twenty years, is relatively new and not yet in need of extensive rehabilitation. Furthermore, it claims that an extensive grid of regional arterial roads adds significant flexibility to the system. The RTP also explains that further development of the region's system for traffic management has the potential to increase system capacity with less expansion of lane capacity than would otherwise be required (MAG 2003).

The RTP presents planned freeway and highway improvements according to individual transportation corridors. The plan states that overall funding for new corridors under MAG jurisdiction totals $3.7 billion. It is expected that these new corridors will provide approximately 490 additional new lane miles to the network. Funding for widening and other improvements to the existing regional freeway/highway network totals an additional $4.4 billion. These improvements include an additional 530 lane miles of general purpose lanes and 300 lane miles of HOV lanes, covering essentially the entire existing system, including the loop elements now under construction (MAG 2003). Planned improvements to transportation corridors are summarized below. Maps of the current freeway and highway system as well as planned improvements for the MAG area are available at http://www.mag.maricopa.gov/pdf/cms.resource/RTP-Final-11-25-03.pdf

- **Interstate 10**

This freeway provides links to population centers throughout the southwestern U.S. and also provides passenger and freight mobility within the region. It connects built-up urban areas within the MAG Region and areas planned for commercial, industrial, and residential development. It is the only existing major east-west freeway serving the central urban area of the MAG Region. Already highly congested, I-10 is also a major truck route. Major improvements to increase the capacity of I-10 include the addition of general purpose lanes between I-17 and State Route 85 as well as an extension of HOV lanes as far west as Loop 303. In the southeast, general purpose lanes will be added between Baseline Road and Riggs Road, and HOV lanes will be extended as far south as Riggs Road.

- **Interstate 10 Reliever**

The RTP also funds the development of a new six-lane freeway corridor parallel to and south of the existing I-10 in order to relieve congestion in the corridor. The facility will be constructed in stages with the initial stage including construction of a full freeway between Loop 202 and Loop 303. An interim (minimum two-lane) roadway will also be constructed between Loop 303 and SR 85. Between Loop 303 and SR 85, sufficient right-of-way for the future construction of a full freeway will also be acquired. Construction of a full freeway in this section is planned as part of the ultimate concept for this facility.

- **Interstate 17**

This freeway route connects the Phoenix metropolitan area with I-40 to the north and serves as the north-south backbone of the MAG region. It terminates at the junction of I-10 in the center of the urban area. As with I-10, this facility carries very high volumes of traffic and experiences lengthy periods of congestion. New residential and commercial development in the vicinity of Loop 101 and rapid development to areas north of Loop 101 are expected to add to traffic demands on I-17. Planned improvements aimed at

alleviating congestion on I-17 include the addition of general purpose lanes from Peoria Avenue to New River Road and the extension of HOV lanes as far north as Anthem Way.

- **Loop 101**

This circumferential freeway route loops around the northern part of the MAG Region. It is divided into three segments: the Agua Fria Freeway (I-10 to I-17), the Pima Freeway (I-17 to Loop 202/Red Mountain), and the Price Freeway (Loop 202/Red Mountain to Loop 202/Santan). Several segments of the facility are already experiencing considerable peak period congestion. In order to address current and future demands on the route, the RTP calls for the addition of both general purpose lanes and HOV lanes along the entire length of Loop 101. Once completed, Loop 101 will have a minimum of four general-purpose and one HOV lane in each direction, or ten lanes total.

- **Loop 202**

This circumferential freeway serves the southeastern part of the MAG Region. It is divided into two segments: the Red Mountain Freeway (I-10 to US 60) and the Santan Freeway (US 60 to I-10 East). The areas served by both the Red Mountain and Santan facilities are expected to reach build-out levels of population and employment within the next twenty years. In addition, areas in northern Pinal County adjacent to Maricopa County are projected to experience major growth. In an effort to respond to projected growth expansion of Red Mountain and Santan freeway facilities to three lanes in each direction (six lanes total) is currently underway. Construction is scheduled to be completed by FY 2007. The RTP also calls for the addition of both general purpose lanes and HOV lanes on the Red Mountain and Santan Freeways, from Loop 101 (Pima) to US 60 (Superstition) and to I-10 East. Once completed, the Red Mountain and Santan Freeways will each have a minimum of four general-purpose and one HOV lane in each direction, or ten lanes total.

- **Loop 303**

Originally part of the MAG Plan in 1985 but dropped due to funding shortfalls, Loop 303 was carried as an expressway in the 2002 update of the MAG Long Range Transportation Plan. The route is intended to provide service to a number of West Valley communities which collectively represent a large area of growth in the region. The RTP funds the construction of Loop 303 as an initial six lane freeway from I-17 near Lone Mountain Road to Grand Avenue and then south to I-10 and the I-10 Reliever. The segment of Loop 303 between I-17 and 75th Avenue, as well as the portion in the Surprise area, will be initially constructed as an at-grade expressway.

- **State Route 85**

This two-lane highway travels in a north-south direction in the Southwest Valley, extending from I-8 at Gila Bend north to I-10. This segment is a component of the CANAMEX Corridor within the MAG Region. Between I-8 and I-10, State Route 85 is a major link for automobile and truck traffic traveling to points west on I-8. In conjunction with I-8, it also serves as by-pass for the metropolitan area for truckers using I-10. In order to increase the currently limited capacity, the RTP funds the widening of SR 85 between I-8 and I-10 to a four-lane, divided facility.

- **US 60**

This east-west freeway route serves the Southeast Valley and continues into Pinal County and eastern Arizona. At its eastern end, new areas of residential, commercial, and industrial development extending into Pinal County are expected to contribute to future congestion. Planned improvements include the addition of general purpose lanes at various points along the facility, primarily from Val Vista Drive and east to the Pinal County line. HOV lanes will also be extended as far east as Meridian Road.

- **Williams Gateway Freeway**

The RTP includes funding for the Williams Gateway Freeway, a new six-lane freeway corridor extending from Loop 202 (Santan) south to the Williams Gateway Airport and east to the Pinal County line. The high-level facility is expected to address future needs for access to job centers, commercial areas, and residential development as the eastern MAG region and northern Pinal County continue to build out. RTP funding for this project is limited to the section of freeway located within Maricopa County.

Pinal County

The Pinal County roadway network consists of two interstates, one US route, twelve state routes, Bureau of Indian Affairs routes, BLM and National Forest roads, county roads, and municipal streets. Many of these roads, especially the main thoroughfares, are north-south aligned. The concentration of east-west aligned roads connects the larger communities such as Casa Grande, Apache Junction, Coolidge, and Florence (Pinal County 2001).

The *Pinal County Comprehensive Plan* points to the rapid population growth in northern areas of Pinal County and southern portions of Maricopa County as the single most pressing issue affecting transportation planning in the region. Current travel patterns in the county are not focused on a central area where services and employment are concentrated. Rather, residents in different parts of the county flow toward the closest area for services or employment. For example, residents of Apache Junction are closely tied to the Phoenix area, persons in the Superior region may travel to Globe, and persons in Oracle access Tucson for basic services. The travel patterns in the center of the county—the region that includes Casa Grande, Eloy, Arizona City, Coolidge, and Florence—also include significant travel to and from the metropolitan area, due to the proximity of Phoenix and Tucson, the strong employment base that Casa Grande and Florence provide, and the varied and specialized services that can be found in the metropolitan areas. In an effort to respond to projected growth, Pinal County has emphasized the need for an efficient multimodal transportation system with special priority given to expanded public transit capacity (Pinal County 2001).

The *Pinal County Comprehensive Plan* does not provide details on planned improvements to the county roadway network but instead refers to two previous documents which further describe existing conditions, level-of-service, and identified transportation improvement projects. In April 2000, the CAAG adopted an RTP that identifies deficiencies along the regionally significant roadways and recommends necessary improvements for short-term, mid-term, and long-term transportation improvement plans. The 2000 Pinal County Transportation Plan discusses expected land use and transportation impacts of comprehensive plan implementation as well as the role of planning partnerships between human service providers, major employers, and municipalities throughout the county (Pinal County 2001). Both of these documents were produced by a private transportation-planning contractor, and were unavailable for review at the time of this assessment.

Yavapai 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/northeasterly through the county, SR 89 and I-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 large residential developments in Chino Valley and north of the Paulden community have been proposed and are expected to have a significant impact on SR 89 North, necessitating 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. Following 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).

4.4 Internal modes, barriers and access issues

At present, there are few, if any, prominent barriers to access within the Tonto National Forest. Unlike other forests in Arizona, there is a limited amount of private land abutting the TNF boundary. This limits the number and nature of access issues faced by private property owners seeking access to the forest. Similarly, the TNF does not regularly experience barriers associated with inclement weather, with the possible exception of seasonally impassible roads in the extreme northern portions of the forest. Currently, the primary barriers to access throughout the forest are simply due to extremely difficult terrain. Additionally, the forest currently maintains four individual wilderness areas. Access to these areas is regulated to prevent damage to sensitive areas (Alford, pers. comm.).

Currently, there are no significant differences in access afforded to different user groups on the TNF. From the perspective of Forest Planners, there has been a greater change in various percentages of modes of travel than in the overall number of forest visitors. In other words, the TNF has not experienced a significant increase in the numbers of individuals seeking access to the forest but has seen a substantial increase in certain modes of travel, most notably OHV use. Similarly, the majority of recent public feedback with respect to access issues on the TNF has been directed toward proposed OHV restrictions (Alford, pers. comm.).

There are currently no road projects scheduled for the TNF.

4.5 Key issues for forest planning and management

The FS has long been aware of the considerable impact of internal roads 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 tends 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 (or lack thereof) within the national forests. 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 growing OHV use.

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 TNF 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 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. Every county within the area of assessment experienced much greater increases in VMT over the same period with the greatest gains reported in Pinal and Yavapai Counties (100% and 97% respectively). Despite a smaller increase in VMT between 1990 and 2000, Maricopa County reported far and away the greatest amount of traffic with 67 million miles traveled in 2000. 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 Federal Highway Administration 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, the TNF is bound to be affected by increased traffic flow, congestion, and longer commute times, particularly surrounding the Phoenix Metropolitan Area.

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 of 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 four counties surrounding the Tonto National Forest (TNF) are examined. Land ownership and use are both variables that 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 TNF contains a relatively high percentage of private and State Trust land, both of which stand to have a considerable impact on future forest planning. Pinal and Yavapai Counties are particularly notable for their 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. Additionally, the sustainability of regional water supplies will continue to have an impact on the nature and pace of development, particularly in and around rapidly expanding municipalities.

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 has 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 the use of these lands since their inception. The amount of land under public domain stood at 75% in Arizona in 1891, and by 1977, that number remained at over 70%. Today, the National Forest System itself accounts for about 15% of the land in Arizona. This small segment of the state's land represents a substantial portion of Arizona's natural resources, including 40% of the watersheds and nearly 60% of the timber. For this reason, maintaining the integrity of the forest boundaries by acquisition of land to form contiguous borders has historically been an essential objective of the USFS. Recently, trends have reflected the increasing importance of national forests as a resource for recreational use. 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 Tonto National Forest is discussed in more detail in section 2.1.

The majority of forest land is grassland with 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).

Although the total amount of land covered has remained consistent, the specific lands contained within the National Forests have occasionally been juggled about. The forests have added or released land regularly in an attempt to consolidate land within the outer boundaries of the national forests (Baker et al. 1988). Several House and Senate initiatives have involved land transfers around the TNF, specifically HR 622 which earmarked the exchange of 108 acres of FS land for nearly 500 acres of non-federal land near

Young, Arizona. The bill also suggested that just over 220 acres of federal land near the Payson Municipal Airport be exchanged for roughly 150 acres of private land near the Montezuma Castle National Monument and a private parcel of land just over 100 acres from within the boundaries of the Coconino National Forest. The bill became law in December, 2003. Earlier, Senate initiative S. 1752 recommended a transfer of land totaling about 550 acres to the private sector to replace facilities that, although once on the edges of local communities, had moved through town growth to the middle of commercial districts not easy accessible by visitors. However, much of the land in the TNF, specifically in Maricopa County, is immune from development (Maricopa 2001).

Naturally, the private citizens who live on the outskirts of the forest represent a formidable influence on the forests themselves. Originally, grazers and lumbermen expanded their own privately held lands into those earmarked for the national forests although this was eventually suppressed. Nonetheless, the communities that build and grow on the edges of these public lands frequently apply for trades involving these lands to allow towns to grow—applications which may either be accepted or rejected by the USFS depending upon how such trades threaten to impact the specific forests.

5.2 Land ownership and land use

There are over 17 million acres of land in the four-county area of assessment for TNF. 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 significant amount of State Trust 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 TNF differs from overall ownership patterns for the state of Arizona. For example, the area contains a relatively large amount of private acreage compared to the state (23% versus 18% respectively) as well as a considerable amount of State Trust land (18% versus 13% respectively). Both of these factors exercise a great deal of influence on regional development patterns as is discussed later in this section (AZSLD 2004).

The more detailed data provided in Table 27 indicate important differences in ownership among the six individual counties within the area of assessment. Yavapai and Pinal Counties are notable for their relatively substantial amounts of private and State Trust land. Maricopa County also contains a relatively high percentage of private land. Gila County contains both the highest percentage of land owned by Native American entities (37.89%) as well as the greatest percentage of land held by the FS (55.44%). The FS also manages a considerable portion of land in Yavapai County (38.17%). Meanwhile, Gila County reports the least amount of private land (3.43%) and State Trust land (1.02%) of all counties within the area of assessment.

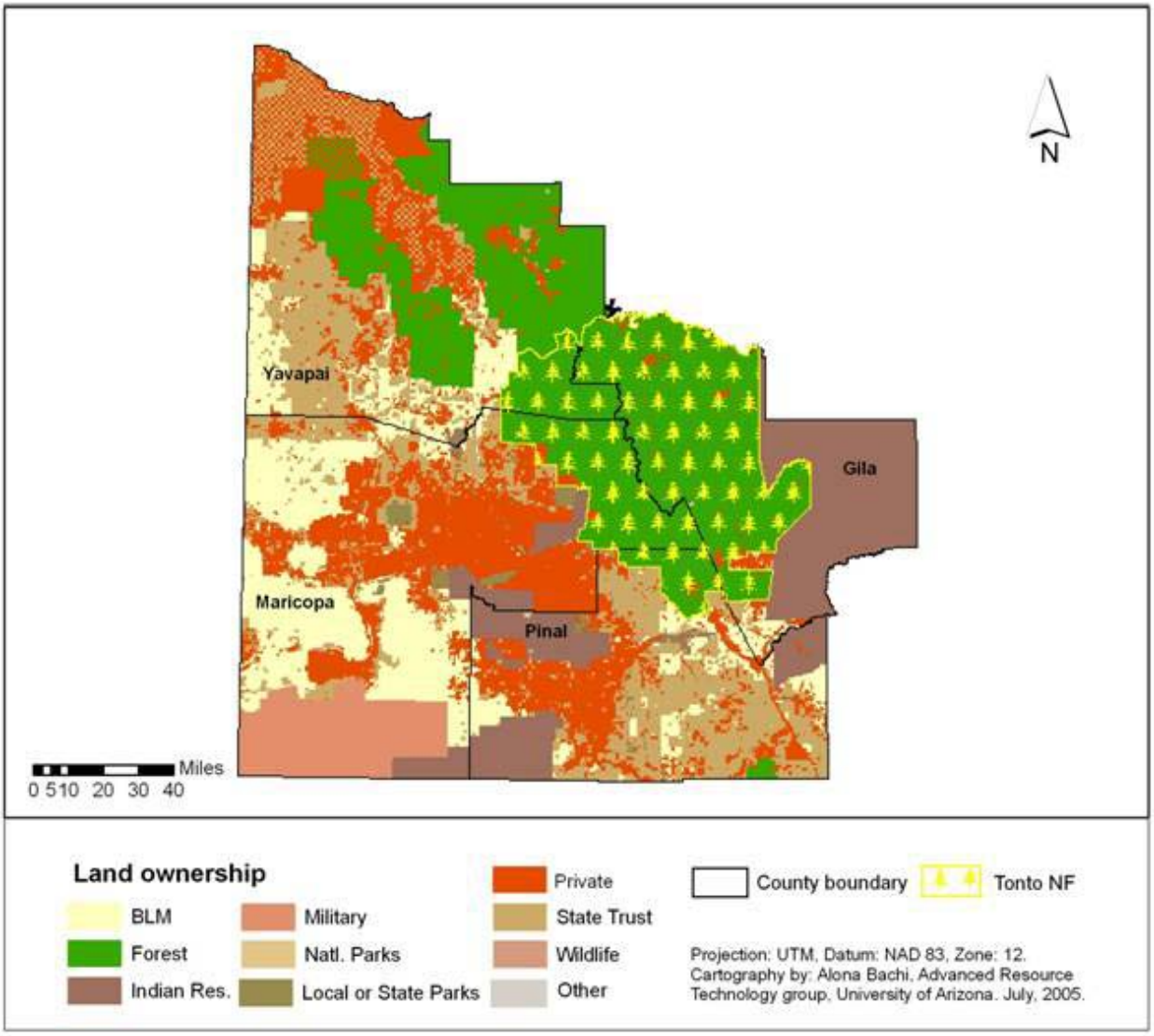
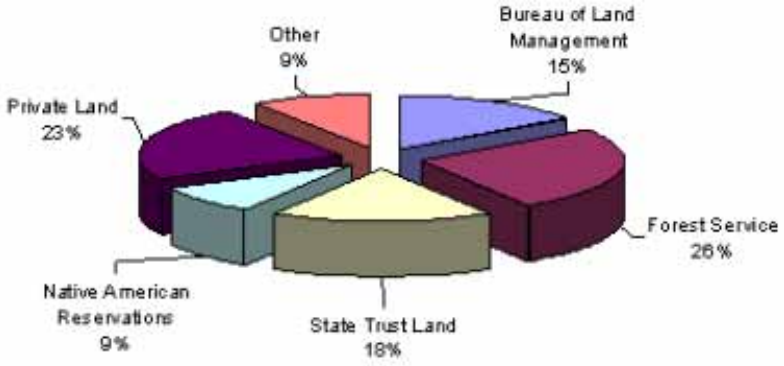


Figure 16. Land Ownership within Area of Assessment



Source: Arizona State Land Department

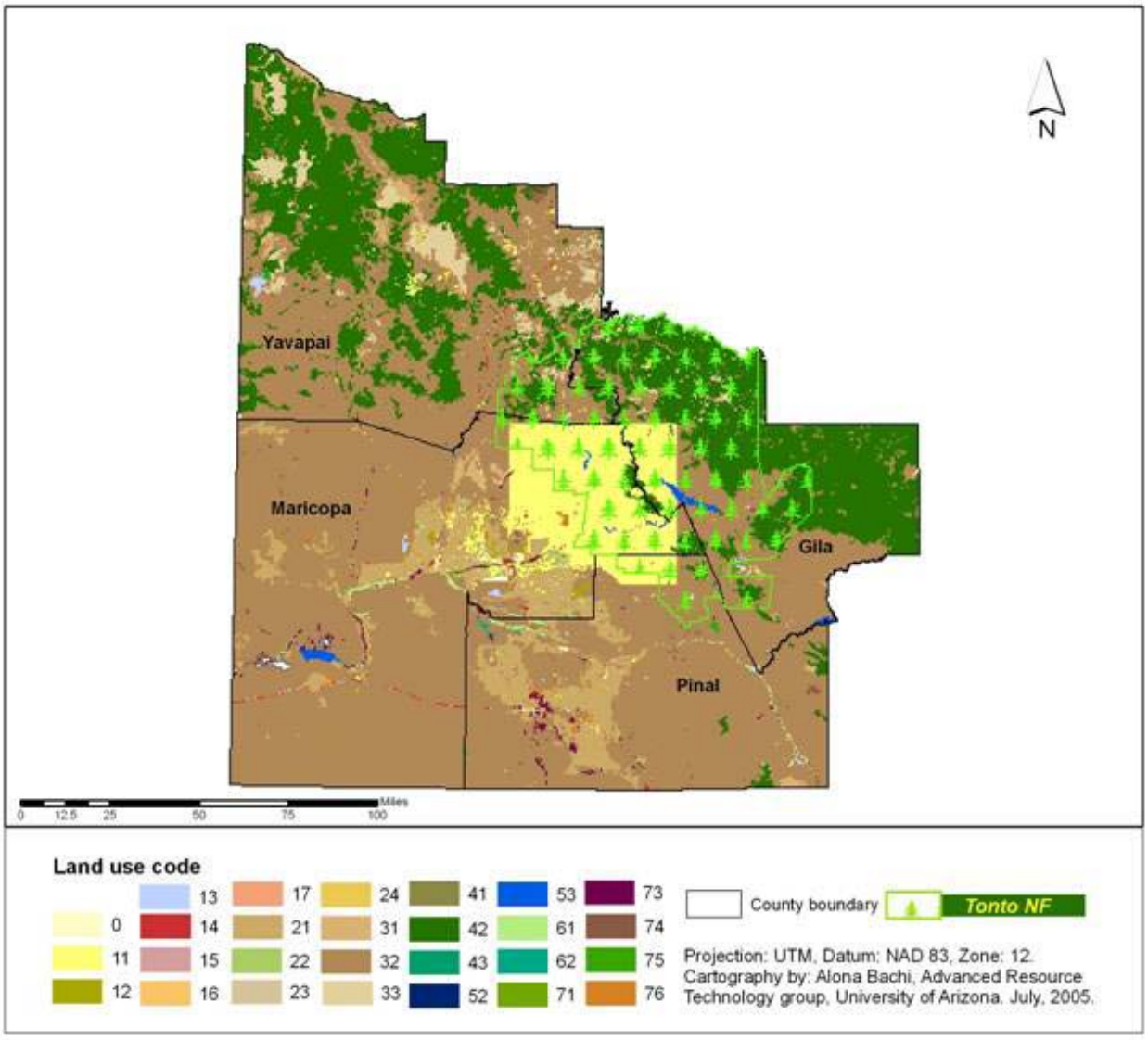
Figure 17. Percent Ownership by Major Land Owners in Four-County Area of Assessment

Table 27. Land Ownership by County, 2005

Land Ownership	Acres	Percent
Maricopa County		
Barry Goldwater Air	819,366.89	13.88%
BLM	1,631,562.36	27.64%
Bureau of Reclamation	13,811.93	0.23%
County Land	3,945.01	0.07%
Fort McDowell Indian Res.	24,868.97	0.42%
Game and Fish	5,337.47	0.09%
Gila Bend Indian Res.	452.6	0.01%
Gila River Indian Res.	96,024.92	1.63%
Luke A.F.B.	2,822.61	0.05%
Military Res.	2,447.58	0.04%
Painted Rock Wildlife Ref.	5,056.07	0.09%
Parks and Recreation	100,939.82	1.71%
Private Land	1,742,282.54	29.52%
Salt River Indian Res.	53,710.98	0.91%
State Trust Land	649,563.37	11.01%
Tohono Indian Res.	95,002.2	1.61%
Tonto NF	655,026.41	11.10%
Williams A.F.B.	2.30	0.00%
TOTAL	5,902,224.03	100.00%
Pinal County		
Ak-Chin Indian Res.	21,449.98	0.62%
BLM	374,035.32	10.88%
Bureau of Reclamation	40,204.42	1.17%
Casa Grande N.M.	469.42	0.01%
Coronado NF	23,281.87	0.68%
County Land	3,676.12	0.11%
Game and Fish	52.93	0.00%
Gila River Indian Res.	276,028.20	8.03%
Hohokam Pima N.M.	1,574.81	0.05%
Indian Allotments	1,090.45	0.03%
Military Res.	7,300.52	0.21%
Parks and Recreation	10,527.79	0.31%
Private Land	877,267.20	25.52%
San Carlos Indian Res.	133,544.31	3.88%
State Trust Land	1,204,920.53	35.05%
Tohono Indian Res.	266,350.41	7.75%
Tonto NF	195,735.84	5.69%
TOTAL	3,437,510.12	100.00%

Land Ownership	Acres	Percent
Gila County		
BLM	66,386.65	2.16%
Bureau of Reclamation	204.36	0.01%
Game and Fish	105.56	0.00%
Private Land	105,218.18	3.43%
San Carlos Indian Res.	633,998.74	20.67%
State Trust Land	31,220.90	1.02%
Tonto NF	1,700,171.68	55.44%
Tonto NM	1,107.14	0.04%
White Mountain Apache Res.	528,141.70	17.22%
Yavapai Tonto Apache	81.74	0.00%
TOTAL	3,066,636.65	100.00%
Yavapai County		
BLM	605,411.62	11.64%
Bureau of Reclamation	8,682.85	0.17%
Coconino NF	425,932.99	8.19%
County Land	5,784.83	0.11%
Game and Fish	1,033.74	0.02%
Hualapai Indian Res.	851.14	0.02%
Indian Allotments	254.12	0.00%
Kaibab NF	25,380.40	0.49%
Military Res.	257.75	0.00%
Montezuma Castle	534.34	0.01%
Montezuma Well	270.16	0.01%
Other	8.24	0.00%
Parks and Recreation	403.81	0.01%
Prescott NF	1,211,345.57	23.30%
Private Land	1,324,643.23	25.47%
State Trust Land	1,265,474.56	24.34%
Tonto NF	321,677.16	6.19%
Tuzigoot NM	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%

Source: Arizona Land Resource Information Service



* The apparent G.I.S. data anomalies in Maricopa, Gila and Pinal Counties (LULC 11, Residential) 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

Figure 18 depicts land cover within the entire area of assessment while Table 28 provides detailed data on land cover within each of the four 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. Maricopa County reported by far the greatest amount of residential cover at 15.80% compared to 7.13% for the assessment area as a whole. Maricopa County also reported the highest amount of commercial, services, industrial, and urban land cover of all counties in the area. Shrub, brush, and mixed range constituted the predominant land cover in three of the four counties in the area of assessment. The lone exception was Gila County, where evergreen forest land was the predominant land cover. Yavapai County also reported significant evergreen forest land cover (39.11%). Pinal County reported the largest percentage of crop and pasture land cover (13.98%).

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

Land Use Code	Coverage Type	Gila County		Maricopa County		Pinal County	
		Acres	Percentage	Acres	Percentage	Acres	Percentage
0	Unknown / Background	1,397	0.05%	13,922	0.24%	1,467	0.04%
11	Residential	177,606	5.79%	932,705	15.80%	116,038	3.38%
12	Commercial and services	635	0.02%	35,827	0.61%	3,511	0.10%
13	Industrial	3,771	0.12%	13,623	0.23%	5,510	0.16%
14	Transportation, communication, utilities	112	0.00%	16,202	0.27%	9,302	0.27%
15	Industrial and commercial complexes	0	0.00%	32	0.00%	0	0.00%
16	Mixed urban or built-up land	139	0.00%	2,741	0.05%	138	0.00%
17	Other urban or built-up land	516	0.02%	11,515	0.20%	2,399	0.07%
21	Cropland and pasture	3,296	0.11%	568,916	9.64%	480,601	13.98%
22	Orchards, groves, vineyards, nurseries, and ornamental horticultural areas	0	0.00%	26,474	0.45%	4,837	0.14%
23	Confined feeding operations	11	0.00%	4,653	0.08%	1,751	0.05%
24	Other agricultural land	23	0.00%	717	0.01%	374	0.01%
31	Herbaceous rangeland	7,350	0.24%	41,435	0.70%	13,962	0.41%
32	Shrub and brush rangeland	1,051,802	34.30%	4,036,382	68.39%	2,649,065	77.06%
33	Mixed rangeland	37,833	1.23%	32	0.00%	0	0.00%
41	Deciduous forest land	0	0.00%	0	0.00%	0	0.00%
42	Evergreen forest land	1,750,257	57.07%	52,332	0.89%	50,467	1.47%
43	Mixed forest land	286	0.01%	0	0.00%	279	0.01%
52	Lakes	0	0.00%	135	0.00%	0	0.00%
53	Reservoirs	23,153	0.75%	26,279	0.45%	1,847	0.05%
61	Forested wetland	206	0.01%	21,089	0.36%	23,472	0.68%
62	Non-forested wetland	31	0.00%	1,211	0.02%	6,347	0.18%
71	Dry salt flats	0	0.00%	797	0.01%	0	0.00%
73	Sandy areas not beaches	2,424	0.08%	26,915	0.46%	32,406	0.94%
74	Bare exposed rock	274	0.01%	12,078	0.20%	9,807	0.29%
75	Strip mines, quarries, gravel pits	5,145	0.17%	5,988	0.10%	5,577	0.16%
76	Transitional areas	368	0.01%	38,412	0.65%	18,354	0.53%
77	Mixed Barren Land	0	0.00%	11,813	0.20%	0	0.00%
	Total	**3,066,637**	**100.00%**	**5,902,224**	**100.00%**	**3,437,510**	**100.00%**

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

Land Use Code	Coverage Type	Yavapai County		Assessment Area	
		Acres	Percentage	Acres	Percentage
0	Unknown / Background	2,549	0.05%	19,335	0.11%
11	Residential	28,107	0.54%	1,254,457	7.13%
12	Commercial and services	3,431	0.07%	43,404	0.25%
13	Industrial	10,397	0.20%	33,301	0.19%
14	Transportation, communication, utilities	13,348	0.26%	38,964	0.22%
15	Industrial and commercial complexes	0	0.00%	32	0.00%
16	Mixed urban or built-up land	1,610	0.03%	4,628	0.03%
17	Other urban or built-up land	851	0.02%	15,281	0.09%
21	Cropland and pasture	94,142	1.81%	1,146,955	6.51%
22	Orchards, groves, vineyards, nurseries and ornamental horticultural areas	86	0.00%	31,398	0.18%
23	Confined feeding operations	90	0.00%	6,505	0.04%
24	Other agricultural land	1,412	0.03%	2,526	0.01%
31	Herbaceous rangeland	54,394	1.05%	117,140	0.67%
32	Shrub and brush rangeland	2,563,774	49.30%	10,301,023	58.51%
33	Mixed rangeland	343,004	6.60%	380,868	2.16%
41	Deciduous forest land	315	0.01%	315	0.00%
42	Evergreen forest land	2,033,524	39.11%	3,886,580	22.07%
43	Mixed forest land	1,214	0.02%	1,778	0.01%
52	Lakes	216	0.00%	351	0.00%
53	Reservoirs	4,441	0.09%	55,720	0.32%
61	Forested wetland	0	0.00%	44,768	0.25%
62	Non-forested wetland	0	0.00%	7,590	0.04%
71	Dry salt flats	0	0.00%	797	0.00%
73	Sandy areas not beaches	1,585	0.03%	63,330	0.36%
74	Bare exposed rock	13,536	0.26%	35,695	0.20%
75	Strip mines, quarries, gravel pits	13,387	0.26%	30,097	0.17%
76	Transitional areas	14,571	0.28%	71,705	0.41%
77	Mixed Barren Land	0	0.00%	11,813	0.07%
	Total	**5,199,986**	**100.00%**	**17,606,356**	**100.00%**

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 the region, the patterns of development, desired conditions, and current county land use policies. It should 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 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.

Gila County Comprehensive Master Plan

Like many areas throughout the Mountain West, current patterns of existing land use in Gila County are rooted in the history of settlement by miners, ranchers, and loggers. The influence of mining activity on patterns of development is still seen in communities such as Hayden, Winkelman, Miami, and Globe, compact towns characterized by platted grid street networks and historic downtown cores. By comparison, the rural patterns of development that have been maintained in the northern communities of Young, Pine, and Strawberry reflect a past rooted in logging and ranching. While mining and ranching continue to make significant contributions to the county's overall economy, industries supported by recreation and tourism are becoming increasingly important and are likely to influence development patterns in the future (Gila County 2003).

Gila County covers an area of approximately 3,052,096 acres, just 4% of which (124,000 acres) is private property. 18,500 acres of private property in the county lie within incorporated municipalities such as Payson, Globe, and Miami. The remaining 105,000 acres of private property are held in parcels scattered around unincorporated communities such as Pine, Strawberry, Star Valley, Gisela, and Young as well as within larger land areas managed by the USFS and the BLM. In the southern part of Gila County, large parcels of private land are owned by ranching and mining interests north and west of Miami. Over ninety-five percent of the county's land area is collectively managed by the Fort Apache and San Carlos Apache Indian Reservations (38%), Tonto National Forest (55%), BLM and National Park Service (1.7%), and other local and state government agencies (Gila County 2003).

The limited amount of private land combined with moderate population growth in Gila County has resulted in a continuation of historical development patterns in unincorporated areas of the county. Recent development has been concentrated in northern portions of the county in the towns of Payson and Globe as well as the unincorporated areas surrounding Pine, Strawberry, Tonto Basin, and Star Valley. This concentrated growth has been due in part to the practices of developing pockets of residential use on vacant parcels as well as subdividing and lot splitting of scattered private properties (Gila County 2003).

The *Gila County Comprehensive Master Plan* was adopted by the Board of Supervisors on November 4, 2003. In addition to a discussion of existing conditions and land use preferences for the remote and sparsely inhabited areas of the county, the plan also includes five distinct "Area Land Use Plans" (one each for the northwest, northeast, west central, east central, and southern portions of the county) as well as individual "Community Land Use Plans" for the unincorporated communities of Pine, Strawberry, Star Valley, Tonto Basin, Young, Gisela, and Claypool. Rather than an exhaustive discussion of these more detailed plans, this assessment is limited to the more generally applicable policies and land use designations contained in the land use element of the *Gila County Comprehensive Master Plan*. Area and community land use plans can be reviewed at http://co.gila.az.us/default.aspx.

- Residential land use

The *Gila County Comprehensive Master Plan* provides for eight distinct residential designations based on the density of dwelling units. These designations range from very low-density rural detached residential development (one dwelling unit per ten-or-more acres) to high-density suburban residential detached or attached development (more than ten dwelling units per acre). Much of the residential development outside of unincorporated communities has been the result of lot splitting on large parcels and historic land grants and purchases. Many of these areas are located within the TNF, are accessed by unimproved forest roads, and have little, if any, developed infrastructure. Potable water is either hauled or provided by private wells, and waste water is disposed of in individual septic tanks.

In rural areas of northern and eastern Gila County, residential development is characterized by a mixture of seasonal, secondary, and full-time site-built and manufactured homes. Meanwhile residential development in southern portions of the county is concentrated in the Tonto Basin, Lake Roosevelt, and Dripping Springs area. The plan states that the southern areas of the county have a significantly lower number of seasonal and part-time residences (Gila County 2003).

- Commercial and industrial land use

The plan designates two distinct types of commercial land use: neighborhood commercial and community commercial. Neighborhood commercial areas are to be no larger than five acres and located at intersections of local roads. They are intentionally limited to serving the needs of residents in the immediately surrounding unincorporated areas. Community commercial land uses, such as grocery stores and supporting commercial services, are intended to provide for both community and regional commercial needs.

Similarly, industrial land uses are divided into two categories: light industrial and heavy industrial. Light industrial uses include low-intensity employment, manufacturing, and fabrication activities buffered from residential uses and are generally not served by heavy truck or delivery traffic. Heavy industrial uses include heavy manufacturing, smelting, mining, and other tasks that involve significant noise, dust, odor or other emissions. Historically, significant portions of southern Gila County have been designated as heavy industrial areas due to the substantial impact of the mining industry in the region (Gila County 2003).

Regarding the impact of land use on forest management, the plan notes that the *Gila County Land Use and Resource Policy Plan for Public Lands* was adopted by the Board of Supervisors in February 1997. It is described as a "tool to assist county, state, and federal decision makers in protecting, evaluating and enhancing Gila County's customs, culture, social sustainability, economy, tax base and overall public lands ecosystem health" (Gila County 2003). Copies of this plan were not available at the time of this assessment.

Maricopa County Comprehensive Plan

Land use in Maricopa County has undergone considerable change in recent decades due primarily to a dramatic increase in population. Historically, the agriculture industry has been a key determinant of county land use. Currently however, the county's agricultural land base is being rapidly converted to support urban uses. Meanwhile, reliance on automobile transportation by a growing number of residents has led to a significant expansion of the county roadway network, a factor that has resulted in patterns of dispersed development. For example, housing and employment centers have not often been well-coordinated, leading to increased congestion, longer commuting times, and a general concern for the future quality of life for county residents (Maricopa County 2002).

Maricopa County holds comprehensive planning and zoning authority for over 3,000 square miles of land. The Land Use element of the *Maricopa County Comprehensive Plan* seeks to promote a more efficient land use pattern in order to attract high-quality development, provide for projected growth, maximize the utility of infrastructure investments, and maintain the county's quality of life. The comprehensive plan identifies nine distinct land use designations intended to direct future land development within Maricopa County. Given the considerable area under county jurisdiction, as well as the rapid pace of development and population growth, the land use designations identify generalized land use, development or preservation concepts, rather than specific land uses or densities.

- Incorporated Areas

Maricopa County has no authority to regulate land use within incorporated areas. However, the comprehensive plan encourages the location of all new development within, or in close proximity to, established incorporated areas.

- Established Communities

Many established communities exist within unincorporated areas of Maricopa County. These communities typically have an established character and pattern of development. The intent of the Established Communities designation is to recognize such traits and ensure that the current character and lifestyle within these communities is maintained. Established communities in Maricopa County include New River, Desert Hills, Morristown, Tonopah, Laveen, Palo Verde, Wittman, Arlington, Little Rainbow Valley, Chandler Heights, Mobile, Circle City, Wintersburg, Agua Caliente, Cotton Center, Hopeville, Santa Maria, Norton's Corner, Gladden, Perryville, Liberty, Sunflower, Harquahala Valley, Hassayampa, Paloma, Aguila, and Sentinel.

- General Plan Development Area

General Plan Development Areas are those areas that are likely to be annexed by incorporated cities or towns as part of adopted municipal general plans. Under A.R.S. §11-831, a rezoning or subdivision plat of unincorporated areas will be guided by the adopted general plan and zoning standards of the concerned city or town.

- Rural Development Area

Rural Development Areas are typically vacant or rural in character, with minimal, if any, infrastructure or public services. Within such areas, residential development is allowed, but should not exceed one dwelling unit per five acres except where higher density zoning or an approved Development Master Plan exists. These areas are generally serviced by wells and on-site septic systems and do not have the level of access to schools, libraries, commercial industries, or parks that are common in more urban areas. Common uses in Rural Development Areas include residential, agriculture, agricultural support services, ranching, hunting clubs, recreational areas, dude ranches, RV parks, churches, home-based businesses, and small-scale cottage industries. Given the rate of conversion of agricultural land in previously rural areas, the general plan identifies specific methods of providing technical guidance to ensure the future viability of agriculture in Maricopa County. These methods include the transfer of development rights to areas more appropriate for urban development, encouragement of infill development and the directing of high density development toward urban service areas, establishment of land use buffers to mitigate the impact of urban development on agricultural resources, and provision of incentives to promote the preservation of agricultural lands such as clustered development and community-supported farms.

- Municipal Planning Areas

Municipal Planning Areas are unincorporated areas identified by surrounding municipalities as being of future interest, but which are not presently included in adopted general plans. As long as such areas remain unincorporated, they remain under the jurisdiction of Maricopa County.

- Dedicated Open Space

The majority of Dedicated Open Space areas are under public ownership and exhibit considerable environmental and physical qualities such as mountains and foothills, rivers and washes, canals, desert vegetation, wildlife habitat, and cultural resources. In Maricopa County, dedicated open spaces exist within regional parks, wilderness areas, wildlife areas, and the TNF. Together, these open space areas cover nearly 2,000 square miles, providing numerous recreation opportunities and visual resources for the residents of Maricopa County.

- County Area Plans

County Area Plans apply to areas outside municipal general plans that are contained within a county area land use plan. As long as they are unincorporated, these areas will maintain rural densities unless otherwise provided for in an approved Development Master Plan. Existing Area Plans within Maricopa County include the New River Land Use Plan, Goldfield Land Use Plan, Grand Avenue Land Use Plan, Little Rainbow Valley Land Use Plan, Tonopah Land Use Plan, Williams Regional Planning Study, Desert Foothills Policy and Development, Wickenburg Highway Scenic Corridor Development Guide, and the White Tanks-Agua Fria Policy and Development Guide.

- Proposed Open Space

There are nearly 650 square miles of Proposed Open Space in the unincorporated areas of Maricopa County. Approximately 350 square miles are publicly-owned. Privately-owned land, including that under the management of the State Land Department, accounts for approximately 290 square miles. If acquired for the public domain, these areas will be planned for the protection and maintenance of their recreational, aesthetic, and biological values and will be managed in such a way as to ensure public access and continued preservation. Potential methods of acquiring lands for proposed open space include fee simple purchase, dedication/donations, conservation easements, preservation easement, purchase of development rights, hillside ordinances, purchase of right-of-way easements, cluster development, environmentally sensitive land designations, conveyance of property to ordinance homeowner associations, right of first refusal, the Arizona Preserve Initiative, density transfers, lease/use agreements, and performance based zoning.

- Existing Development Master Plans

A number of Existing Development Master Plans have been established within Maricopa County. Each of these development master plans have been built out, are under construction, or have been formally proposed to county planners. Currently Existing Development Master Plans include, but are not limited to, Belmont, Sun City, the Villages at Desert Hills, Dreamland Villa, Sun City West, Tonto Hills, Leisure World, Sun Lakes Tonto Verde, Rio Verde, and The Preserve.

A detailed map of land use within Maricopa County is available at http://www.maricopa.gov/planning/compln/plan/plan.pdf

Pinal County Comprehensive Plan

The *Pinal County Comprehensive Plan* stresses the cultural and economic importance of managing land use in such a way as to protect the county's natural resource base. Although traditional land uses such as ranching, farming, and mining have experienced a gradual decline throughout the county, an increase in urban, commercial, and industrial developments has placed increasing pressure on the area's natural resources. Protection of desert open space, wildlife corridors, and undeveloped mountain areas is seen as a critical step towards sustaining a rural lifestyle as well as the economically vital components of retirement housing and tourism (Pinal County 2001).

Currently, Pinal County covers 3,441,920 acres, portions of which lie within the Gila River, Ak-Chin, Tohono O'odham, and San Carlos Native American communities. In addition to several rapidly growing incorporated cities and towns, the county is home to the unincorporated communities of Arizona City, Dudleyville, Gold Canyon, Maricopa, Oracle, Picacho, Queen Valley, Red Rock, San Manuel, and Stanfield. The comprehensive plan specifically mentions maintenance of mountain views as vital to the long-term economic and environmental interests of the county. These mountains include the San Tans, Superstitions, Sierra Estrella, Santa Catalina, Table Top, Palo Verde, Casa Grande, Sacaton, Picacho Peak, Sawtooth, Tortolita, Black, and Samaniego Hills (Pinal County 2001).

Adopted in December 2001 and amended in December 2004, the *Pinal County Comprehensive Plan* is seen as an important tool for managing land use during a period of dramatic growth and transition. In it, planners call for a reexamination of planning methods in order to ensure the sustainability of both the regional economy and standard of living in light of a projected sixty-percent increase in county population over the next decade. Stated objectives in the land use element of the comprehensive plan include the following: 1) more efficient land use enabled by clustered development, architectural controls and development standards; 2) an improved county roadway network that effectively links residential and employment centers while retaining panoramic views, natural washes, and wildlife habitat; and 3) a diverse mix of employment and housing opportunities that balances resource conservation and development needs. The comprehensive plan divides land use into several designations. The intent of the land use categories is to determine development patterns that will be both economically and environmentally sustainable during a period of rapid urban growth (Pinal County 2001).

"Rural Areas" are areas suitable for lower-density development and uses such as agriculture, grazing, mining, sand and gravel operations, large acreage home sites, and small farms. Multi-family development is discouraged in rural areas and single-family residency should not exceed one dwelling unit per acre. The "Transitional Area" designation is used for areas that are predominantly rural but are expected to serve as future centers of growth. A primary purpose of this designation is to retain existing large tracts for potential development. Here again, maximum residential density is one single-family unit per acre. A "Foothill Area" designation is intended to preserve sensitive areas by limiting foothill development to low densities that are in harmony with the natural landscape. Maximum density is one dwelling unit per acre. The "Rural Community Area" designation signifies a rural area with the capacity to provide goods, services, and increased residential uses. Growth is typically slower in these areas and is dependent on the level of public services, facilities, and infrastructure. Future rural community areas should be designed to allow for commercial uses, governmental activity, health and educational facilities, industrial uses, and parks and open space. For Planned Area Developments (PADs), under this designation, the maximum density is three-and-a-half single-family dwelling units per acre. This designation also allows for five attached homes (town houses, patio homes) per acre or twelve multiple-family units (apartments) per acre (Pinal County 2001).

The **"**Urban Area" designation is applied to areas with higher-density residential development and the existing infrastructure to support larger populations. Urban areas primarily include towns and cities and are likely to account for the majority of future growth in Pinal County. The purpose of the Urban Area designation is to encourage the provision of high quality, efficient public services as well as diverse housing and employment opportunities. Maximum density guidelines are three-and-a-half dwelling units per acre for PAD, five du/ac for attached homes, and twelve du/ac for multiple-family units. A "Commercial Activity Center" designation allows intense concentrations of commercial and high density residential development. Land uses include retail stores and services, office development, business parks, and high-density, multi-family development. An expected benefit of this designation is the proximate location of housing and employment centers. Multiple-family housing density ranges from twelve to twenty du/ac with an ideal density of sixteen du/ac. An "Interchange Mix Area" designation caters to the needs of travelers and businesses along the county's highways. Land uses include, but are not restricted to, hotels and motels, vacation resorts, restaurants, RV parks, service stations, and other small-scale commercial uses. "Corridor Mix Areas" are similar in that they provide for a variety of land uses and intensities oriented toward and compatible with interstate highways. In addition to the land uses prescribed for Interchange Mix Areas, Corridor Mix Areas may include industrial parks, research and development facilities, light industry, warehousing, and recreation facilities. Open space, landscaping, and noise buffering are encouraged to ensure compatibility with adjacent land uses and traffic (Pinal County 2001).

An **"**Industrial Area" designation applies specifically to areas suitable for industrial and other intense land uses. The plan specifies that these areas will be concentrated and separated from residential and

commercial uses in order to manage the impact of heavy truck traffic, noise, vibration, light, dust, and odors. A "Mining Area" designation applies only to those areas where mineral resources have been identified or are likely to be identified in the future. The designation recognizes the rights applied to exploration, mining, and mineral resource processing. All mining operations within the county are required to comply with federal, state, and local laws providing environmental protection. "Development Sensitive Areas" are intended to preserve natural resources and open space in areas that are particularly sensitive. Potential land uses include parks, ranching, livestock grazing, conservation leases, guest ranches, and single-family uses. Density is not to exceed three-tenths (.3) dwelling unit per acre. The "Natural Resource Area" designation is applied to private and public lands, which may be enhanced by the maintenance of large, undivided parcels. Land uses may include river corridors, natural areas, livestock grazing, conservation leases, national forests, wilderness areas, and State Trust lands (Pinal County 2001).

A detailed map of land use within Pinal County is available at http://www.co.pinal.az.us/PlanDev/PDCP/files/CompPlanFinal2004.pdf

Yavapai County General Plan

Like that of Coconino County, Yavapai County's 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% live 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.

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.

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 from urban and economic development. While residents and planners prefer to maintain a rural character throughout unincorporated county lands, rapidly increasing populations and expanding city boundaries present challenges for doing so. Despite many similarities, the policies of the county comprehensive plans reviewed for this assessment also offer an array of differing perspectives on how best to deal with these issues.

Preservation of open space is a particularly important land use issue among planners and property owners within the area of assessment. While the counties generally share a common interest in preserving open space, comprehensive plans suggest different motivations for doing so. For more rural areas such as Gila and Yavapai Counties, a high priority is placed on the preservation of open space for the purpose of protecting and sustaining traditional farming and ranching land uses. Meanwhile, areas with rapidly growing urban populations—such as Maricopa and Pinal Counties—emphasize the cultural and environmental value of protected watersheds, mountain areas, wildlife habitat, native vegetation, riparian areas, and archeological sites. Several policies aimed at preserving open space are mentioned in each of the county comprehensive plans. These methods include the encouragement of "clustered development," purchase of development rights, and dedication of land such as conservation and agricultural easements (Gila County 2003, Maricopa County 2002, Pinal County 2001, Yavapai County 2003).

Related 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 but also preserves open space and high natural resource value areas. Perhaps most importantly, infill maximizes the efficiency of infrastructure and minimizes traffic congestion, thereby lowering the overall cost of development. Policies aimed at encouraging infill include the provision of density bonuses and density transfers as well as zoning changes allowing for mixed uses in low-density areas (Pinal County 2001, Maricopa County 2002).

Another factor certain to influence the pattern of future development is the conversion of private land within the area surrounding TNF. Combined with the proximity of many rural communities to large parcels of public land, transition of private parcels has led to calls for greater collaboration on land use planning between county and municipal governments and their federal and state counterparts. County residents are particularly interested in coordinating efforts on land acquisition and exchange in order to address a variety of long-term land use concerns.

Proponents of development advocate consolidation and conversion of the current patchwork of State Trust lands in order to guide growth of expanding municipalities. They argue that the exchange and/or sale of these trust lands will alleviate land scarcity and provide much-needed funds for the state educational system. Others promote conversion and/or consolidation of public lands as a means of protecting environmentally and biologically sensitive lands while granting communities greater authority on local land-use decisions such as fire prevention and forest restoration (Pinal County 2001, Maricopa County 2002, Yavapai County 2003). A more detailed discussion of current policy regarding state trust land is presented later in this assessment.

The scarcity of private land has also fueled efforts to capitalize on the current land market and accommodate the need for residential and commercial development resulting from population growth. In response, each of the comprehensive plans reviewed for this assessment includes policies aimed at addressing the detrimental effects 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 the cost 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 in order to ensure county infrastructure that meets state standards (Pinal County 2001, Maricopa County 2002, 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 Active Management Areas (AMAs) to identify a 100-year assured water supply, participate in banking water, expand use of effluent water, and convert homes and buildings to low water use fixtures. The ADWR has designated five AMAs in the state, three of which extend into the area of assessment for the Tonto NF. They are the Phoenix AMA (5,600 sq. miles), the Pinal AMA (4,000 sq. miles), and the Prescott AMA (485 sq. miles). Additionally, the 1998 *Growing Smarter* legislation passed by the state congress requires the inclusion of a Water Resource element in the comprehensive plans of all counties with a 2000 population of 125,000 or greater. Currently three of the four comprehensive plans reviewed for this assessment contain Water Resources elements that support making water availability a key consideration for all major developments and subdivision applications. Policies for effectively managing future growth with respect to projected water supplies include the development design requirements for low-water plumbing devices, drought-tolerant landscaping, and enhanced recharge of treated effluent for

water table and riparian area restoration (ADWR 2005, Maricopa County 2002, Pinal County 2001, Yavapai County 2003).

5.4 Changes in land ownership affecting the Tonto National Forest

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

- Tonto Apache Land Exchange (2005)

This proposal involves the exchange of a 278-acre parcel of land adjacent to the Tonto Apache Reservation for four privately held parcels within the Lakeside, Verde, Payson, Tonto Basin, and Red Rock Ranger Districts. Implementation of the land exchange was expected in May 2005 (TNF 2005).

- Cave Creek Administrative Site Land Conveyance (2005)

Portions of the Cave Creek Administrative Site were scheduled to be sold in March 2005. The sale was intended to reduce boundary irregularities as a result of certain parts of the property being isolated by county road easements (TNF 2005).

- 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 (TNF 2005).

- Montezuma Castle Land Exchange (2003)

In July 2003, a Senate report from Committee on Energy and Natural Resources directed the Secretary of Agriculture to implement house bill H.R. 622. The bill approves the Montezuma Land Exchange which calls for the transfer otherwise known as the Tonto and Coconino National Forests Land Exchange Act. The bill calls for two individual land exchanges. The Montezuma Castle Land Exchange involves the transfer of 222 acres of National Forest System land in the Tonto National Forest adjacent to the town of Payson and near the municipal airport for approximately 157 acres of private land adjacent to Montezuma Castle National Monument and nearly 108 acres of private land known as the Double Cabin Park Lands. Both private parcels involved in the exchange were located within the Coconino National Forest (Domenici 2003).

- Diamond Point/Q Ranch Land Exchange (2003)

The same bill, H.R. 622, called for the transfer of 108 acres of National Forest System land to the Diamond Point Summer Home Association in exchange for 495 acres of private land. The federal land was located approximately eight miles northeast of the city of Payson and was specifically identified for exchange in the TNF Management Plan. The private land, previously the Q Ranch, was the third and final parcel of a major private inholding conveyed to the TNF. The land was initially purchased by the Conservation Fund and optioned to the association for use in the land exchange. There was reportedly broad public support and no opposition throughout the exchange process (Domenici 2003, WLG 2005)

- Bellemont Land Exchange (2003)

In February 2003, the Director of Lands and Minerals for the Southwest Region of the Forest Service issued a Decision Memo approving the exchange of approximately 754 acres of federal land on the Coconino National Forest for approximately 1,160 acres of state land located within the COF, CNF, KNF, PNF, ASNF, and TNF. The land exchange was processed by the State of Arizona through the Arizona Game and Fish Department and was intended to allow the department to directly develop and operate a permanent shooting facility in a safe and efficient manner. Of the ten state parcels offered in exchange for federal lands, two were located in the Pleasant Valley Ranger district of the TNF. The acquisition of this non-federal parcel was intended to reduce boundary irregularities while providing for the key resource values of visual protection and critical wildlife habitat (USFS 2003g).

- Oak Flat Land Exchange (2005)

In May 2005, Representative Rich Renzi introduced House Bill H.R. 2618, entitled the Southeast Arizona Land Exchange and Conservation Act of 2005. On the same day, Senator Jon Kyle introduced S. 1122, the senate version of the same bill. Both versions call for the Delaware-based Resolution Copper Mining, LLC to transfer approximately 4,800 private acres scattered throughout five counties to the federal government in exchange for approximately 460 acres of federal land near the city of Superior. The private lands offered in the exchange include 147 acres of land in Gila County, 148 acres in Yavapai County, 149 acres in Maricopa County, 3,339 acres in Pinal County, and 1,031 acres of land in Santa Cruz County. The private land involved in the exchange involves land with considerable environmental value including parcels along the San Pedro River, grasslands in southern Arizona, and riparian areas north of Cave Creek. The federal lands involved in the exchange, sought by the resolution for their potential copper deposits, contain a popular rock climbing and camping spot known as the Oak Flat area of the Tonto NF. Audubon Arizona and the Sonoran Institute are among proponents of the exchange that believe it will allow federal protection for environmentally sensitive land. On the other hand, opponents, including the Sierra Club, the Maricopa County Audubon Society, and the Friends of Queen Creek, state that proposed mining on the exchanged lands will lead to significant subsidence and that the exchange process sidesteps adequate environmental review. By implementing the exchange as a legislative act, the transfer would avoid many of the requirements for environmental review typically involved in a direct land exchange involving the federal government. Particularly strong opposition to the exchange has been voiced by rockclimbers, birders, and campers who have been visiting the Oak Flat area since 1955, when President Eisenhower withdrew the area from mining activity. The land exchange does have the support of nine of Arizona's ten congressional delegates, Governor Janet Napolitano, and the Superior Town Council largely on the basis of expected economic benefits from increased mining activity (Kyl 2005, Pitzl 2005, Renzi 2005).

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 landowners, 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 TNF exemplifies many of the trends and controversial issues involving the economic stability and effective management of public lands. Without question, the continued urban expansion of the Phoenix Metropolitan Area continues to be a primary land use issue, not only for Maricopa County but for the entire state. The land, water, and infrastructure needed to support the Phoenix metro area will continue to influence the management alternatives of the TNF. At the county level, 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 to best 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 homebuilders over the immediate and long-term value of open space. Meanwhile, all sides of the debate over 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 highly relevant to future management plans of the TNF in light of the amount 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 TNF in protecting the integrity of area watersheds is likely to become increasingly important given the rates of projected growth throughout the assessment area.

In order to facilitate resolution of current and future land use issues, the TNF 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).