

## 4. Access and Travel Patterns

This section examines historic and current factors affecting access patterns and transportation infrastructure within the six counties surrounding the Coronado National Forest (CNF). The information gathered is intended to help outline current and future trends in forest access as well as identify 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 Coronado NF cite the difficulty of transportation planning in the region given its vast geographic scale, population growth and pace of development, as well as 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 suggest that the area surrounding CNF has a relatively large network of state highways compared to Arizona's other national forests. Overall increases in VMT were greatest in Pinal County between 1990 and 2000, mirroring the region's strong population growth. Research shows that there are relatively few major improvements currently scheduled for the region's transportation network and that seasonal traffic flows coincide with weather conditions which influence patterns of visitors from outside the region.

### 4.1 Historical context and current access issues

Transportation infrastructure throughout the state of Arizona was initially developed to serve the needs of a predominantly rural population while supporting expansion of the state's largely extractive economy. Transportation plans reviewed for this assessment specifically mention economic influences such as farming, ranching, and mining as having played a role in developing the region's circulation system (Graham County 1996, Santa Cruz County 2004, ADOT 2004a).

Today, many regions of the state, including the area surrounding the CNF, 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 recent rates of population growth and expansion of urban areas. 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 (Cochise County 2002, PAG 2003a, Santa Cruz County 2004).

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 (PAG 2001, Pinal County 2001, Santa Cruz County 2004). 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. They are as follows: 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 indirectly linked to forest

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

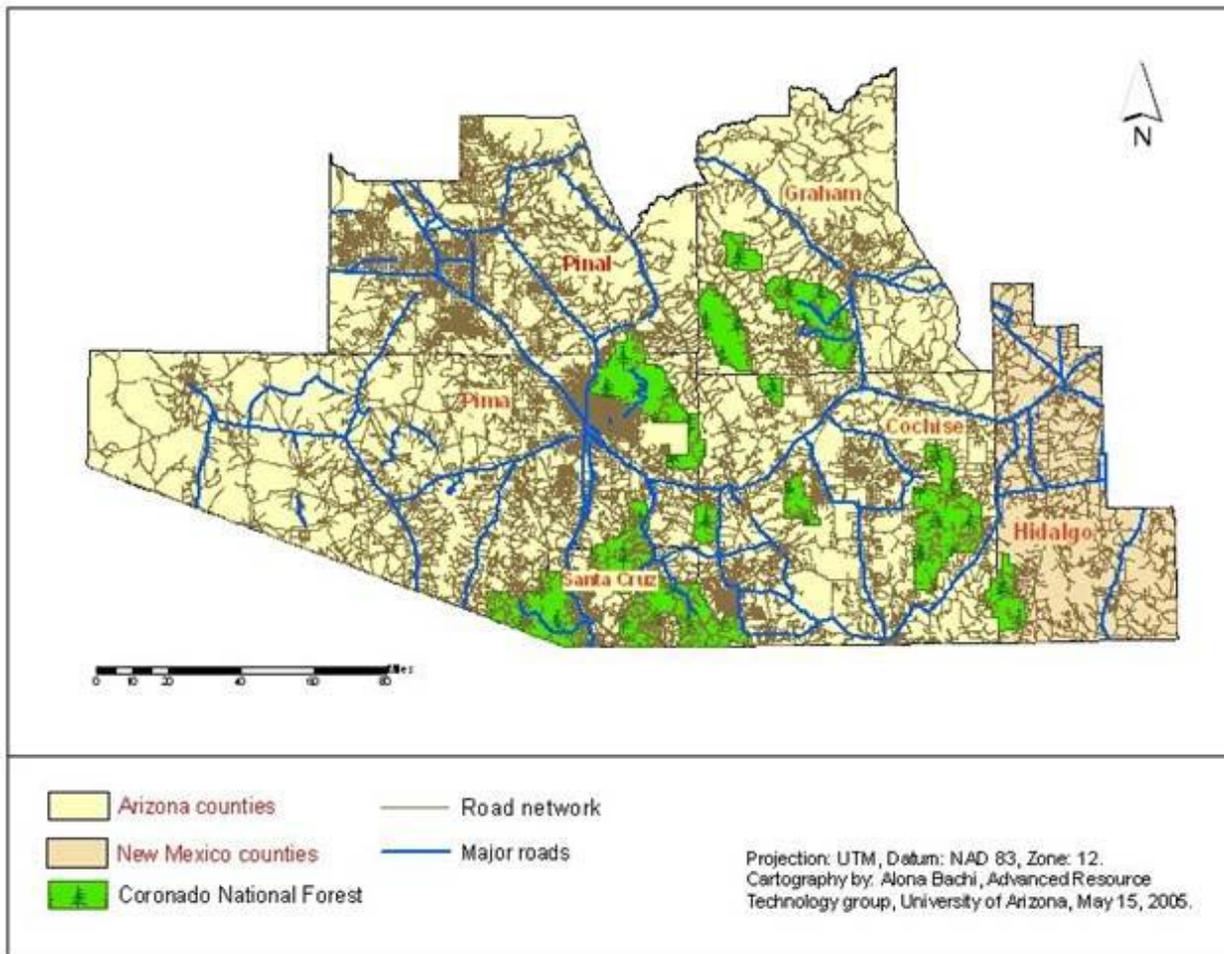
Stressing the importance of demographic change for the future of transportation planning in the state, ADOT notes that Arizona's population is projected to double over the next forty years, growing from 5 to 10 million residents. In the agency's estimation, such changes will require "major expansions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

In order to prepare adequately 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 (AZSLD). Through such efforts, ADOT plans on playing 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 result in 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 particularly dense road networks surrounding the urban population centers 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 Interstate 10 and State Route 86, which are primarily situated east to west through the area of assessment.



**Figure 14. Road Network within Area of Assessment**

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

	<b>Interstates / U.S. Highways</b>	<b>State Highways</b>	<b>Indian Routes</b>
<b>Cochise County</b>	Interstate 10 US 191	State Highway 80 State Highway 82 State Highway 90 State Highway 92 State Highway 181 State Highway 186	
<b>Graham County</b>	US 70 US 191	State Highway 170 State Highway 266 State Highway 366	
<b>Hidalgo County</b>	Interstate 10 US 70	State Highway 9 State Highway 80 State Highway 81 State Highway 90 State Highway 92 State Highway 113 State Highway 145 State Highway 338 State Highway 464	
<b>Pima County</b>	Interstate 10 Interstate 19	State Highway 79 State Highway 83 State Highway 85 State Highway 86 State Highway 286 State Highway 366	Indian Route 15 Indian Route 19 Indian Route 21 Indian Route 34
<b>Pinal County</b>	Interstate 8 Interstate 10 US 60	State Highway 77 State Highway 78 State Highway 84 State Highway 87 State Highway 88 State Highway 187 State Highway 237 State Highway 287 State Highway 347 State Highway 387 State Highway 177	Indian Route 15

**Table 23 (cont.). U.S., State, and Indian Routes by County**

	Interstates / U.S. Highways	State Highways	Indian Routes
<b>Santa Cruz County</b>	Interstate 19	State Highway 82 State Highway 83 State Highway 289	
<b>Sonora, Mexico</b>	Mexico Highway 2 Mexico Highway 4 Mexico Highway 15 Mexico Highway 49 Mexico Highway 99 Mexico Highway 108 Mexico Highway 120 Interstate 5	State Highway 59	

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 the 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 (PAG 2001, Pinal County 2001, Santa Cruz County 2004).

The Arizona highway system consists of over 58,000 miles of roadway, of which two percent are interstates, three percent are U.S. routes, and nearly six percent are state routes. Although only 12% of the total highway network are state facilities, over 57% of the daily VMT occurs on these roads. The interstate system carries 28% of all daily VMT (ADOT 2004c). Much of the Arizona state highway system passes through lands owned by federal agencies and federally recognized tribes. Federal agencies and federally recognized tribes own 70% of the land in Arizona. Federal lands agencies, including the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and others, own 42% of the land in Arizona with over 2,000 miles of state highway passing through these lands. Arizona’s twenty-one federally recognized tribal nations own 28% of Arizona land. An additional 1,200 miles of state highway passes 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. A similar, though relatively modest, increase in traffic for all roads was 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 as discussed in Chapter 2. 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 that half of the counties within the area of assessment reported decreases in travel on non-state roads between 1990 and 2000. Directly comparable data for Hidalgo County and the state of New Mexico were unavailable due to the fact that the New Mexico Department of Transportation (NMDOT) monitors traffic by *functional* classification rather than *administrative* classification. Available data however suggest that Hidalgo County experienced a significant increase in travel on rural interstates between 1990 and 2000 (35.93%) and a slight increase in VMT on rural arterial routes (8.33%). Increase in travel on interstates and rural arterial routes for the State of New Mexico were nearly identical to increases in statewide travel for Arizona (NMDOT 2005).

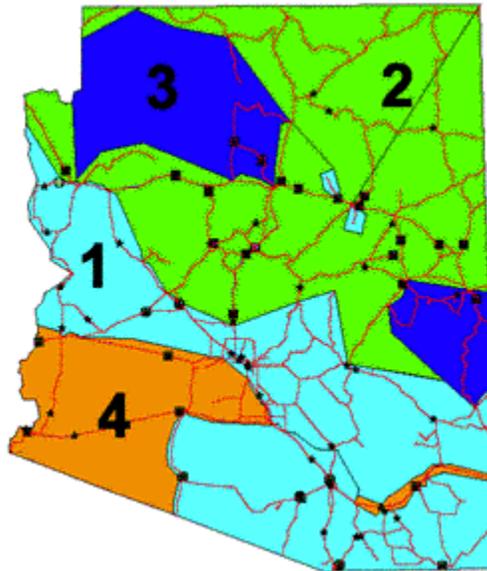
**Table 24. Daily Vehicle-Miles of Travel (VMT) by County, 1990-2000 and % Change**

Area	Total VMT all roads (000s)			Total VMT state system (000s)			Total VMT non state (000s)		
	1990	2000	% Change	1990	2000	% Change	1990	2000	% Change
<b>Cochise County</b>	3,395	4,233	24.68%	2,216	3,108	40.25%	1,179	1,125	-4.58%
<b>Graham County</b>	731	814	11.35%	374	460	22.99%	357	354	-0.84%
<b>Pima County</b>	16,065	18,928	17.82%	4,097	6,450	57.43%	11,968	12,478	4.26%
<b>Pinal County</b>	3,446	6,917	100.73%	3,361	4,805	42.96%	85	2,112	2,384.71%
<b>Santa Cruz County</b>	933	1,017	9.00%	544	726	33.46%	449	291	-35.19%
<b>Arizona</b>	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 the CNF extend into the portions of the state designated as Area One and Area Four by ADOT's Transportation Planning Department. Data in Table 25 show that peak traffic flow for Area One occurs between the months of February and April and is lowest from July to September. This would confirm the logical notion that traffic in the region fluctuates primarily according to weather conditions and patterns of visitors from outside the region. On the other hand, traffic flow for Area Four fluctuates much more with the highest traffic flows reported in December and the lowest in October. For the portion of Area Four nearest the Coronado, this pattern is likely due to seasonal fluctuation of through traffic on Interstate 10.

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

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

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

### 4.3 Regional transportation plans and roadway improvements

Each of the counties within the area of assessment shares common issues regarding transportation infrastructure. Nonetheless, various constraints and opportunities are discussed for individual areas in available ADOT documents in addition to 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 CNF.

Planned improvements to the state highway system surrounding the CNF 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, Coronado National Forest**

Year	Route	County	Milepost	Funding Source	Location	Length (miles)	Type Of Work	Cost (\$1,000s)
2008	77	Pima	82	Surface Transportation Program	Tangerine Rd. – Pinal County line, Phase 1	5.82	Construct roadway widening to 6 lanes	\$1,327
2008	77	Pima	82	PAG 2.6%	Tangerine Rd. – Pinal County line, Phase 1	5.82	Construct roadway widening to 6 lanes	\$3,235
2006	77	Pima	82	State	Tangerine Rd. – Pinal County line, Phase 1	5.82	Design (roadway widening to 6 lanes)	\$507
2005	82	Santa Cruz	3.1	Surface Transportation Program	Nogales city limits – Patagonia Lake Rd.	9.2	Resurface	\$2,666
2005	83	Santa Cruz	0	Transportation Enhancements	Sonoita – Patagonia	2	Scenic easement acquisition.	\$550
2007	92	Cochise	328.3	Surface Transportation Program	Carr Canyon Rd. – Hunter Canyon	3	Widen to four lanes with protected left turn opportunities	\$7,542
2005	289	Santa Cruz	0	State	JCT I-19 to Peña Blanca Lake	10	Seal	\$344
2006	366	Graham	118.7	State	Mt. Graham Rd.	0	District Force Account.	\$75
2005	366	Graham	118.7	State	Mt. Graham Rd	0	District Force Account.	\$75
2005	366	Graham	118.7	State	Mt. Graham Rd	0	District Force Account.	\$100

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 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 Coronado NF, the Central Arizona Association of Governments (CAAG), the Pima Association of Governments (PAG), and the South Eastern Arizona Governments Organization (SEAGO) 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 (Graham County 1996, PAG 2001, Pinal County 2001). A brief description of access issues and planned improvements, as discussed in regional and county transportation

plans, is included below. It must be kept in mind, however, that the timing and implementation of these projects is subject to considerable funding constraints and an uncertain pace of future development.

### *Cochise County*

A recent report on roadway needs explains that Cochise County maintains 1,442 miles of roads, of which 579 miles are paved and 863 miles are dirt. In describing the primary function of the county road network, the report cites recently published guidelines developed by the American Association of State Highway Transportation Officials (AASHTO). The guidelines define a “low volume” road as having an Average Daily Traffic count (ADT) of less than 400 vehicles per day (vpd). Of the 1,442 miles of county-maintained roads, approximately 1,191 miles, or 83%, carry an ADT of less than 400 vpd (Cochise County 2002). County resources for road construction and maintenance are very limited and constraining.

In response, the county has established improvements in roadway safety, preservation of public investment in existing structures and pavements, and improvements in road surface as the three main governing principles for prioritizing department resources. Roadway maintenance expenses constitute a major percentage of Cochise County’s highway budget. The Arizona Association of County Engineers (AACE) recently contracted for a report of roadway needs for all Arizona counties. The AACE report indicates that Cochise County should be spending about \$8,389,000 annually to maintain the roadways, bridges, and appurtenant facilities. The county presently spends about \$4,800,000, or 57%, of what is needed (Cochise County 2002). While growth for most of the county is moderate, development of the area south of Sierra Vista is robust, and the need for expanded roadways in the area is apparent. The Roadway Needs Report calls for an additional study to identify traffic patterns, the need for new routes, and the possible location of new routes. Potential improvements include an east-west road between Moson Road and State Route 92 to supplement Ramsey Road and a north-south road between Hereford and State Route 90 to supplement Moson Road (Cochise County 2002).

### *Pima County*

PAG has developed a long-term transportation plan for the unincorporated areas in eastern Pima County. The PAG 2025 Regional Transportation Plan (RTP) replaced the previous Metropolitan Transportation Plan for 1998-2020 (MTP) and was adopted by the PAG Regional Council on January 24, 2001. Immediately following the 2025 RTP update, a major long-range transportation plan revision was initiated to cover the years 2005 to 2030. This major plan revision will include Census 2000 data, new forecasts from that data, and completed 2000 Household Travel Demand Survey data as well as an extensive public participation outreach program (PAG 2001).

The 2025 RTP addresses transportation facilities and services in eastern Pima County, which includes unincorporated Pima County, the City of Tucson, the City of South Tucson, the Town of Marana, the Town of Oro Valley, the Town of Sahuarita, the San Xavier District of the Tohono O’odham Nation, and the Pascua Yaqui Tribe of Arizona. The regional roadway system under PAG’s jurisdiction consists of approximately 4,000 lane-miles of freeways, parkways, and major and minor arterials. There are also more than 5,000 lane-miles of local streets within the region. Most of these roadways are maintained and operated by state and/or local jurisdictions. PAG estimates that this roadway system provides for over eighty percent of the total VMT in the metropolitan area (PAG 2001).

Planned improvements submitted to PAG by area jurisdictions are funded by local, state, and federal transportation resources. Planned improvements under PAG jurisdiction are discussed in both the Five-year Transportation Improvement Program (TIP) as well as the 2025 RTP. The TIP is typically updated annually with the most recent report covering the period from 2005-2009. The TIP provides an extensive list of projects, several of which may influence access and travel patterns to and from the CNF. They include the purchase of the scenic easement adjacent to I-10 and the Davidson Canyon Preserve, the widening to six lanes of I-10 from Tangerine Rd. to Pinal Air Park Rd., the widening to six lanes of State Route 77 from Tangerine Rd. to the Pinal County line, and ongoing improvements to the Mt. Lemmon

Highway (PAG 2004). A complete list of projects approved by the 2005-2009 PAG Transportation Improvement Program can be found on-line at [http://www.pagnet.org/TIP/tip2005-2009/FY05\\_Final\\_TIP\\_approvedweb.pdf](http://www.pagnet.org/TIP/tip2005-2009/FY05_Final_TIP_approvedweb.pdf).

In addition to projects identified by the TIP, the PAG 2025 Regional Transportation Plan identifies several projects that will be given long-term priority. They include the widening to eight lanes of I-10 from the Pinal County Line to I-19, the widening to six lanes of I-19 from Ajo Way to Valencia Rd., and the reconstruction of numerous interstate traffic interchanges along I-10 and I-19 at various points within the Tucson metropolitan area (PAG 2001).

### *Pinal County*

The Pinal County roadway network consists of two interstates, one U.S. route, twelve state routes, Bureau of Indian Affairs routes, BLM and USFS roads, county roads, and municipal streets. Many of these roads, especially the main thoroughfares, are north-south aligned. East-west aligned roads connect 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 Pinal 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, people in the Superior region may travel to Globe, and those in Oracle visit Tucson for basic services. Travel patterns in the center of the county—the region that includes Casa Grande, Eloy, Arizona City, Coolidge, and Florence—are also affected by 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; instead, it refers to two previous documents which further describe existing conditions, levels of service, and identified transportation improvement projects. In April 2000, the Central Arizona Association of Governments (CAAG) adopted a *Regional Transportation Plan* that identified deficiencies along the regionally significant roadways and recommended necessary improvements for CAAG's 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.

### *Santa Cruz County*

Interstate 19 runs generally north-south through the county and connects Nogales with Tucson at Interstate 10. It is the only principal arterial roadway in Santa Cruz County and is under ADOT jurisdiction. State Routes 82 and 83 are considered by ADOT to be major collectors. SR 82 runs generally southwest-northeast from Nogales to Sonoita and into Cochise County. SR 83 traverses the northeast corner of the County from the Parker Canyon area through Sonoita and into Pima County (Santa Cruz County 2004).

Transportation planning within Santa Cruz County has been, and will continue to be, influenced by the area's proximity to the international border with Mexico. Interstate 19 and State Routes 82 and 83 have been affected by increases in the volume of international truck and tourist traffic that have occurred with

the passage of the North American Free Trade Agreement (NAFTA). These increases are projected to continue. In addition, the increases in border crossings have created a bottleneck situation at the Mariposa Port of Entry. Portions of SR 82 and SR 83 are designated as scenic roads, passing through beautiful natural areas and rural residential communities, and play an important role in the county's tourist economy. Increasing use by NAFTA-related truck traffic creates unique impacts. Designation of I-19 as the main hazardous materials route through the county could reduce some of the truck traffic on this route and contribute to sustaining SR 82 and SR 83 as rural collectors (Santa Cruz County 2004).

The I-19 corridor from Nogales to Rio Rico is the highest traffic-growth area in the county. This traffic increase is due to residential, industrial, and commercial development. In an effort to prepare for continued growth, the county is pursuing the development of design standards as well as the planning and construction of major and minor collector roads to ensure the circulation system can adequately maintain a high level of service. To reduce the impact from the developing areas, I-19 traffic flow should continue to be regulated. This can be facilitated with improvement to, and increased use of, the frontage roads and ensuring connectivity to established interchanges (Santa Cruz County 2004).

#### *Other Regional Transportation Planning Authorities*

Despite considerable effort, the assessment team was unable to access certain transportation planning data that may prove useful for determining access and travel patterns in areas surrounding the Coronado. The usefulness of the circulation element of the *Graham County Comprehensive Plan* is limited given that it discusses only four overall transportation-planning objectives. It alludes to the *Graham County Transportation Plan* developed in 1992 (later amended in 1998); however, this plan was developed by a private transportation-planning contractor and was unavailable for review at the time of this assessment.

#### **4.4 Internal modes, barriers, and access issues**

With respect to internal access issues, a common concern regarding barriers to access for the CNF is the development of private land adjacent to forest boundaries. In particular, FS personnel and members of the general public share a growing concern regarding the use and/or misuse of public lands by abutting private landowners. Currently, nearly all access points to the forest are through private lands. Other forests in the state experiencing similar access issues have noted that, at times, developers and individual private property owners have responded to perceived congestion by seeking to control access to established forest trails and roads. Another source of potential conflict regarding access to the CNF through private lands concerns the impact of undocumented migrants in areas near the U.S.-Mexico border. Private owners cite security concerns and environmental damage caused by migrants as primary reasons for closing gates and otherwise restricting access through private property (Emmett, pers. comm.; Farr, pers. comm.).

These observations from forests in Arizona are supported by similar findings issued in a report to the House Subcommittee on National Parks and Public Lands in 1992. The report claimed that access to fourteen percent (50.4 million acres) of FS and BLM lands was inadequate. Inadequate access for the purpose of the report was defined as a lack of "permanent, legal right for the public to enter federal land at the point(s) needed to use the federal land as intended by the managing agency." According to study respondents, the primary cause of inadequate access to public lands was an increase in private landowners' unwillingness to grant public access across their land. This trend coincided with an increase in recreational uses on federal land and reflected private landowners' concerns regarding vandalism, potential legal liability, and desire for private and/or exclusive use. Reduced access to public lands resulting from private landholders not only affects recreational opportunities, it also interferes with agency management activities such as construction and maintenance of trails and roads, law enforcement, fire protection, and habitat monitoring (Duffus 1992).

Another concern common among various user groups is that of OHV access to both FS and user-created roads. While virtually all user groups claim to support the limitation of damage to FS lands as a result of OHV use, opinions differ on how to do so. Organized OHV-user groups have voiced general support for limiting cross-country travel between FS and user-created roads but would like to see both remain open in the future. Various environmental groups, on the other hand, believe that access to user-created roads should be curtailed until the completion of a forest-wide Roads Analysis Process (RAP). Finally, a third perspective is offered from individuals typically unaffiliated with organized user groups. Many of these individuals are retired, physically limited, and/or long-time users of backcountry areas. They rely on OHV access to remote areas and do not believe that their intermittent use causes damage to non-roaded areas. They are therefore opposed to limitations on cross-country travel (Emmett, pers. comm.; Farr, pers. comm.). Trends in OHV use are discussed in more detail later in this assessment.

In 2003, the CNF conducted a roads analysis for maintenance-level 3, 4, and 5 roads (passenger car roads). The analysis reviewed road density, use, and maintenance. Additionally, individual roads were assessed for their effect on human-caused wildfires, wildlife, cultural resources, air quality, and watershed conditions. The analysis determined that 96.5% of the 797.75 miles of roads within the CNF should be classified as high-value roads for passenger car access. The analysis also includes recommendations for changes in the level of maintenance for certain forest roads and accurate determinations of management responsibilities and jurisdiction based on the collection of site-specific road data (CNF 2003a). Earlier this year (2005), the Engineering Staff began conducting a roads analysis for Ecosystem Management Areas (EMA's) on the CNF.

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

#### **4.5 Key issues for forest planning and management**

The 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 within the national forests. For example, the fact that the FS is required by law to permit access to private inholdings is increasingly important to the CNF given current access issues involving private property abutting forest boundaries.

The indirect economic consequences of forest roads (or the lack thereof) are also considerable for forest managers and surrounding communities. For instance, the extent and quality of forest roads is 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 CNF 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. Within the area of assessment, increases in VMT were greatest in Pinal and Cochise Counties (100% and 24% respectively). 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 of assessment and the likely increase in truck traffic as a result of the CANAMEX corridor, the Coronado is bound to be affected by increased traffic flow, congestion, and longer commute times.

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

This section examines land ownership and use within the six counties surrounding the Coronado National Forest (CNF). Land ownership and use are both variables which can significantly influence interaction between forests and surrounding communities. Regional development patterns and major land use vary from county to county, reflecting differences in climate, topography, ownership, and other cultural, social, and economic trends. Individual counties must attend to 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 CNF contains a relatively high percentage of private and State Trust land, both of which stand to have a considerable impact on future forest planning. Santa Cruz County is also notable for the amount of land managed by the USDA Forest Service (52.7%). Each of these factors contributes to a land use policy environment that is increasingly focused on the sustainability of urban development in the face of increasing calls for the preservation of open space. The proximity of private parcels and forest lands has also contributed to a number of significant land exchanges involving the CNF within the last twenty years.

### 5.1 Historical context and land use patterns

Since the federal government first began designating public-trust land in the late nineteenth century, the amount of national forest land in Arizona has remained remarkably steady. The concept of shared land 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 extracted (Baker et al. 1988). 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. While the Coronado has 30,000 roadless acres, 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.

The majority of land in the National Forest System is grassland, while about 20% of the Rocky Mountain Region (including Arizona and New Mexico) is forested (Alig et al. 2003)<sup>1</sup>. 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 30% or more, 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 there are no active timber interests in the CNF, projects on a local scale such as road construction, mining, and the harvesting of firewood for fuel and kindling may affect protected sites for owls and other wildlife (USFWS 1999). Mining remains an active industry both in Arizona and in the Coronado. The production value of Arizona's minerals five years ago

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<sup>1</sup> In this particular report, Alig and the others have defined the Rocky Mountains Regions as consisting of "the Intermountain and Great Plains subregions," including the following states: Kansas, Nebraska, North Dakota, South Dakota, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

was in the vicinity of \$3 billion and accounted for over 65% of U.S. copper production. Arizona's copper industry makes use of over 180,000 acres of the state's land. Hundreds of mines, active and inactive, are spread through Cochise County and beyond, many on USFS land (U.S. Customs 2003). In 2003, the Department of Agriculture announced a proposed mine expansion into a roadless area near the Dragoon Mountain range for Alpha Calcit Arizona, Ltd. (USFS 2003b).

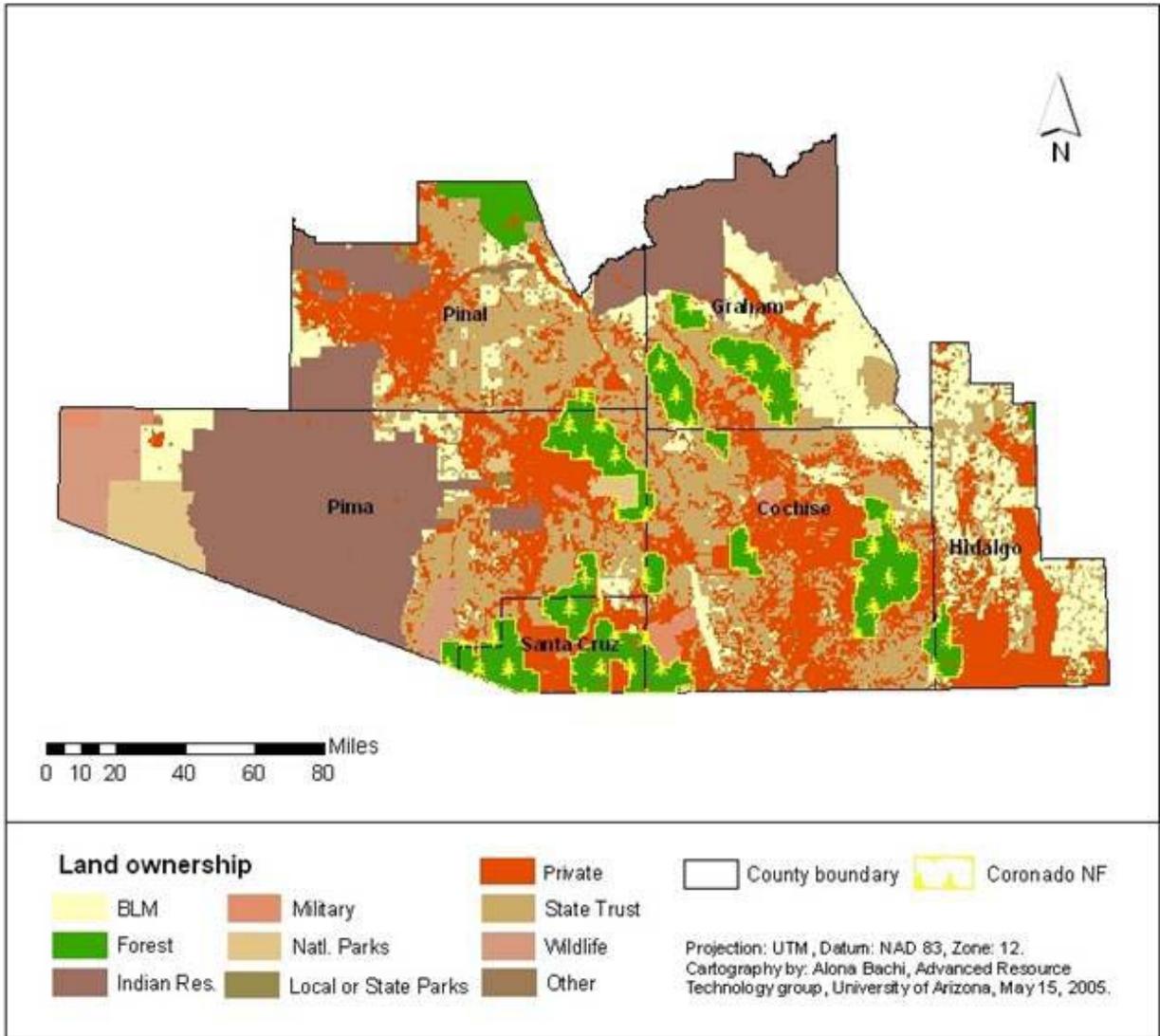
Also in the planning stages is an extended power line set for installation by the Tucson Electric Power Company (TEP). The corridor plans include a fifteen-mile segment which would pass through the CNF and which would require regular maintenance involving increased vehicular traffic to that area. In addition, there are suggestions that such a corridor might increase residential development in the project vicinity along with increased border patrol presence and security concerns involving illegal immigrants. While comprehensive studies were incomplete at the time of this report, the possibility of adverse affects on biological, visual, and cultural resources, as well as to land use and soil, were considered foreseeable and were balanced against improved electricity reliability in the region surrounding Nogales which some expect would contribute to long-term benefits in business development and regional growth.

As noted, although the total amount of land covered has remained consistent, the specific lands contained within the national forests have occasionally transferred ownership. 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). In the Coronado, land swaps like the Cote and the Camp Tatiyee land exchanges are still pending. 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 specific forests.

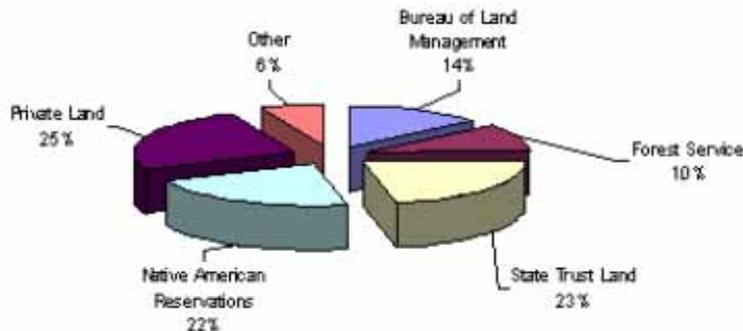
## **5.2 Land ownership and land use**

There are over 19 million acres of land in the six-county area of assessment for CNF. Within this expanse, there are distinct patterns of land ownership and use, each of which carries important implications for current and future forest management. Figures 16 and 17 provide information on land ownership for the entire area of assessment while Table 27 provides more detailed land ownership data on a county-by-county basis. Figure 16 displays a relatively large amount of 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 CNF 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 (25% versus 18% respectively) as well as a considerable amount of State Trust land (23% 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. Here again, Cochise, Pinal, and Hidalgo Counties are notable for their relatively substantial amounts of private and State Trust land. Graham and Pima Counties show the highest percentage of land owned by Native American entities (36.33% and 42.11% respectively) while Santa Cruz County reports the greatest amount of land held by the FS (52.72%). Meanwhile Santa Cruz County also reports a considerable amount of private land (37.68%) and limited State Trust land (7.78%) when compared to neighboring counties and the state as a whole.



**Figure 16. Land Ownership within Area of Assessment**



Sources: Arizona State Land Department  
 Hidalgo County Tax Assessors Office

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

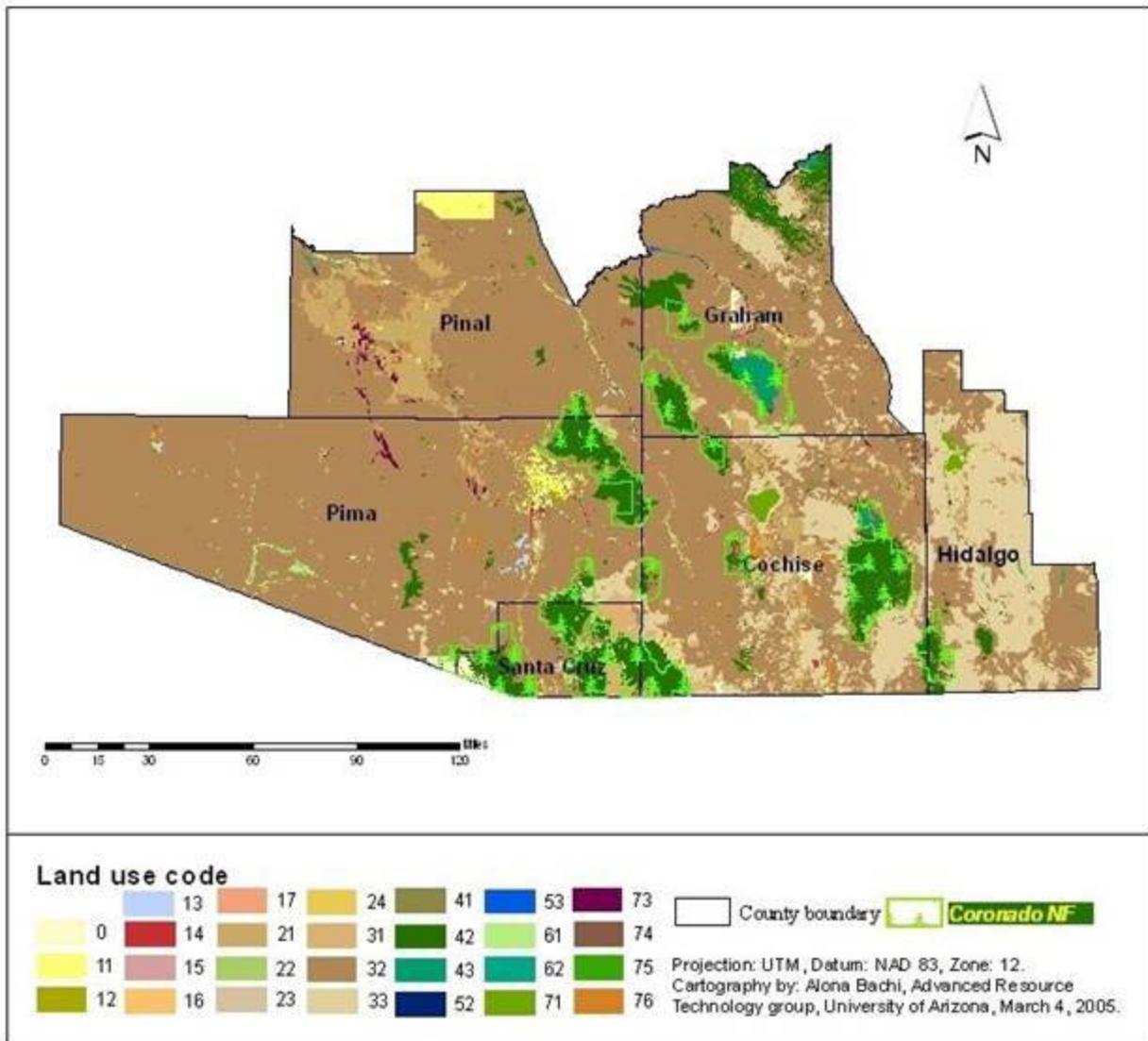
**Table 27. Land Ownership by County, 2005**

Land Ownership	Acres	Percent	Land Ownership	Acres	Percent
<b>Cochise County</b>			<b>Pinal County</b>		
BLM	390,906.48	9.83%	Ak-Chin Indian Res.	21,449.98	0.62%
Chiricahua N.M.	12,162.87	0.31%	BLM	374,035.32	10.88%
Coronado NF	490,740.92	12.34%	Bureau of Reclamation	40,204.42	1.17%
Coronado N.M.	4,172.49	0.10%	Casa Grande N.M.	469.42	0.01%
Fort-Bowie N.H.S	1,561.09	0.04%	Coronado NF	23,281.87	0.68%
Fort-Huachuca	79,364.16	2.00%	County Land	3,676.12	0.11%
Game and Fish	3,092.63	0.08%	Game and Fish	52.93	0.00%
Military Res.	664.33	0.02%	Gila River Indian Res.	276,028.20	8.03%
Other	61.77	0.00%	Hohokam Pima N.M.	1,574.81	0.05%
Private Land	1,590,299.94	39.99%	Indian Allotments	1,090.45	0.03%
San Bernardino N.W.R.	2,368.49	0.06%	Military Res.	7,300.52	0.21%
State Trust Land	1,374,463.33	34.56%	Parks and Recreation	10,527.79	0.31%
Willcox Range	27,825.94	0.70%	Private Land	877,267.20	25.52%
TOTAL	3,977,184.44	100.00%	San Carlos Indian Res.	133,544.31	3.88%
<b>Graham County</b>			State Trust Land	1,204,920.53	35.05%
BLM	733,117.44	24.64%	Tohono O' odham Indian Res.	266,350.41	7.75%
Coronado NF	380,693.78	12.80%	Tonto NF	195,735.84	5.69%
Fort Grant	40.04	0.00%	TOTAL	3,437,510.12	100.00%
Game and Fish	1,036.87	0.03%	<b>Santa Cruz County</b>		
Military Res.	399.69	0.01%	BLM	13,518.30	1.71%
Private Land	282,943.80	9.51%	Coronado NF	417,233.87	52.72%
San Carlos Indian Res.	1,080,785.68	36.33%	Other	277.10	0.04%
State Trust Land	496,181.38	16.68%	Parks and Recreation	599.87	0.08%
TOTAL	2,975,198.68	100.00%	Private Land	298,252.35	37.68%
<b>Pima County</b>			State Trust Land	61,597.17	7.78%
Barry Goldwater Air	57,433.49	0.98%	Tumacacori N.M.	9.94	0.00%
Buenos Aires N.W.R.	113,641.28	1.93%	TOTAL	791,488.60	100.00%
BLM	373,786.22	6.36%	<b>Hidalgo County, NM</b>		
Cabeza Prieta N.W.R.	400,681.23	6.82%	BLM	805,454	36.51%
Coronado NF	336,888.98	5.73%	Coronado NF	77,220	3.50%
County Land	2,573.35	0.04%	State Trust Land	354,431	16.07%
Davis-Mothan AFB	10,728.30	0.18%	Indian Allotments	11,000	0.50%
Game and Fish	1,560.84	0.03%	Private Land	957,970	43.42%
Military Res.	39.94	0.00%	TOTAL	2,206,080	100.00%
Organ Pipe N.M.	328,944.09	5.60%			
Other	440.40	0.01%			
Parks and Recreation	11,191.64	0.19%			
Pascua Yaqui Res.	556.86	0.01%			
Private Land	816,920.51	13.90%			
Saguaro NP	82,246.08	1.40%			
San Xavier Indian Res.	71,226.43	1.21%			
State Trust Land	862,221.37	14.67%			
Tohono O' odham Indian Res.	2,403,533.14	40.89%			
TOTAL	5,877,607.42	100.00%			

Sources: Arizona State Land Department  
Hidalgo County Tax Assessors Office

Figure 18 depicts land cover within the entire area of assessment while Table 28 provides detailed data on land cover within each of the six 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 constituted less than one-tenth of one percent of the county's total land area. Pinal County reported the greatest amount of residential cover at 3.38% compared to 1.11% for the assessment area as a whole. Meanwhile, Pima County 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 five of the six counties in the area of assessment. The lone exception was Santa Cruz County, which reported a considerable portion of evergreen forest land (38.05%) and a relatively high percentage of herbaceous land cover (14.28%). Graham County also reported significant evergreen forest land (13.23%) while Pinal County held the greatest amount of cropland and pasture (13.98%).



**Figure 18. Land Cover within Area of Assessment**

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

Land Use Code	Coverage Type	Cochise County		Graham County		Hidalgo County		Pima County	
		Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
0	Unknown / Background	6,696	0.17%	12,739	0.43%	1,141	0.05%	28,511	0.49%
11	Residential	13,848	0.35%	3,140	0.11%	1,078	0.05%	77,339	1.32%
12	Commercial and services	5,548	0.14%	710	0.02%	375	0.02%	18,090	0.31%
13	Industrial	2,858	0.07%	230	0.01%	412	0.02%	21,246	0.36%
14	Transportation, communication, utilities	10,885	0.27%	297	0.01%	2,288	0.10%	7,992	0.14%
15	Industrial and commercial complexes	854	0.02%	16	0.00%	-	-	-	-
16	Mixed urban or built-up land	405	0.01%	297	0.01%	-	-	3,562	0.06%
17	Other urban or built-up land	2,030	0.05%	781	0.03%	-	-	8,507	0.14%
21	Cropland and pasture	237,619	5.97%	71,032	2.39%	50,498	2.29%	79,589	1.35%
22	Orchards, groves, vineyards, nurseries and ornamental horticultural areas	2,089	0.05%	318	0.01%	-	-	8,888	0.15%
23	Confined feeding operations	167	0.00%	10	0.00%	111	0.01%	499	0.01%
24	Other agricultural land	4,207	0.11%	470	0.02%	546	0.02%	1,942	0.03%
31	Herbaceous rangeland	39,986	1.01%	13,888	0.47%	401	0.02%	22,376	0.38%
32	Shrub and brush rangeland	2,150,826	54.08%	2,023,904	68.03%	831,369	37.69%	5,091,944	86.63%
33	Mixed rangeland	900,597	22.64%	301,633	10.14%	1,201,490	54.46%	121,407	2.07%
41	Deciduous forest land	5,955	0.15%	3,086	0.10%	-	-	223	0.00%
42	Evergreen forest land	434,737	10.93%	393,686	13.23%	70,940	3.22%	279,935	4.76%
43	Mixed forest land	19,595	0.49%	102,460	3.44%	173	0.01%	275	0.00%
52	Lakes	-	-	51	0.00%	110	0.01%	15	0.00%
53	Reservoirs	272	0.01%	4,693	0.16%	-	-	434	0.01%
61	Forested wetland	6,461	0.16%	15,969	0.54%	4,274	0.19%	34,890	0.59%
62	Nonforested wetland	1,702	0.04%	4,558	0.15%	5,705	0.26%	1,068	0.02%
71	Dry salt flats	34,891	0.88%	0		27,065	1.23%	8	0.00%
73	Sandy areas not beaches	2,475	0.06%	5,640	0.19%	886	0.04%	21,497	0.37%
74	Bare exposed rock	29,571	0.74%	14,240	0.48%	6,049	0.27%	1,838	0.03%
75	Strip mines, quarries, gravel pits	2,329	0.06%	486	0.02%	530	0.02%	9,213	0.16%
76	Transitional areas	60,581	1.52%	864	0.03%	637	0.03%	36,322	0.62%
	<b>Total</b>	<b>3,977,184</b>	<b>100.00%</b>	<b>2,975,199</b>	<b>100.00%</b>	<b>2,206,080</b>	<b>100.00%</b>	<b>5,877,607</b>	<b>100.00%</b>

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

Land Use Code	Coverage Type	Pinal County		Santa Cruz County		Total Assessment Area	
		Acres	Percent	Acres	Percent	Acres	Percent
0	Unknown / Background	1,467	0.04%	20,727	2.62%	71,280	0.37%
11	Residential	116,038	3.38%	3,339	0.42%	214,783	1.11%
12	Commercial and services	3,511	0.10%	1,063	0.13%	29,297	0.15%
13	Industrial	5,510	0.16%	94	0.01%	30,350	0.16%
14	Transportation, communication, utilities	9,302	0.27%	1,847	0.23%	32,611	0.17%
15	Industrial and commercial complexes	-	-	-	-	870	0.00%
16	Mixed urban or built-up land	138	0.00%	480	0.06%	4,881	0.03%
17	Other urban or built-up land	2,399	0.07%	1,326	0.17%	15,043	0.08%
21	Cropland and pasture	480,601	13.98%	12,401	1.57%	931,741	4.84%
22	Orchards, groves, vineyards, nurseries and ornamental horticultural areas	4,837	0.14%	-	-	16,133	0.08%
23	Confined feeding operations	1,751	0.05%	-	-	2,537	0.01%
24	Other agricultural land	374	0.01%	1,050	0.13%	8,588	0.04%
31	Herbaceous rangeland	13,962	0.41%	113,038	14.28%	203,651	1.06%
32	Shrub and brush rangeland	2,649,065	77.06%	293,052	37.03%	13,040,161	67.69%
33	Mixed rangeland	-	-	39,332	4.97%	2,564,459	13.31%
41	Deciduous forest land	-	-	280	0.04%	9,545	0.05%
42	Evergreen forest land	50,467	1.47%	301,173	38.05%	1,530,937	7.95%
43	Mixed forest land	279	0.01%	169	0.02%	122,951	0.64%
52	Lakes	-	-	-	-	176	0.00%
53	Reservoirs	1,847	0.05%	316	0.04%	7,562	0.04%
61	Forested wetland	23,472	0.68%	-	-	85,066	0.44%
62	Nonforested wetland	6,347	0.18%	-	-	19,379	0.10%
71	Dry salt flats	-	-	-	-	61,964	0.32%
73	Sandy areas not beaches	32,406	0.94%	-	-	62,904	0.33%
74	Bare exposed rock	9,807	0.29%	53	0.01%	61,558	0.32%
75	Strip mines, quarries, gravel pits	5,577	0.16%	253	0.03%	18,388	0.10%
76	Transitional areas	18,354	0.53%	1,496	0.19%	118,254	0.61%
	<b>Total</b>	<b>3,437,510</b>	<b>100.00%</b>	<b>791,489</b>	<b>100.00%</b>	<b>19,265,069</b>	<b>100.00%</b>

Source: U.S. Geological Survey, 1990

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

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

### 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. Comprehensive land use plans for Hidalgo County, NM and the state of Sonora, Mexico were not available at the time of this assessment.

#### *Graham County Comprehensive Plan*

Like many areas throughout the Mountain West, patterns of existing land use in Graham County are rooted in the history of settlement by miners, ranchers, and farmers. The *Graham County Comprehensive Plan* marks 1872 as a milestone in the development of the county after the establishment that year of a copper mine in the town of Clifton (then in Graham County). At about the same time, farming communities were being established along the Gila River, which traverses the county from east to west (Graham County 1996).

Today, Graham County remains an area of rich natural resources with a rural culture and an economy supported by continued copper mining, cotton farming, and cattle ranching. The Gila River is a vital source of water for approximately 52,000 acres of cultivable land in the county, much of which is dedicated to the production of cotton, a primary component of the county's agricultural economy. Mining has also continued to play a major role the development of Graham County. In addition to a number of small mines operating throughout the county, the Phelps-Dodge Corporation manages a large open pit mine north of Safford. Graham County is also home to the Large Binocular Telescope, the world's most powerful optical telescope, which was completed in 2004. For these reasons, the *Graham County Comprehensive Plan* emphasizes the importance of protecting both the natural resources and scenic beauty that are "essential to the economic stability and unique character and lifestyles" of the area (Graham County 1996).

Graham County covers 4,650 square miles, making it the twelfth largest of Arizona's fifteen counties. In addition to twenty-two square miles of water, the *Comprehensive Plan* identifies three basic geologic areas within Graham County: 1) The Gila River basin; 2) the mountain areas comprised by the Gila, Pinaleño, Santa Teresa, and Galiuro ranges; and 3) the high desert plains north of the Gila and Pinaleño Mountains. Graham County is also the home of Aravaipa Canyon and the Gila Box, the only two federally designated riparian areas in the United States as of 1996 (Graham County 1996).

The *Graham County Comprehensive Plan* identifies fifteen land use zones in the county permitting uses from dense residential developments such as mobile home and travel trailer parks to manufacturing and industrial uses. The plan further classifies these zones into five broad land use categories: 1) urban residential, 2) rural residential, 3) agricultural and ranching, 4) commercial, and 5) manufacturing.

- Residential land use

The urban residential classification includes single-family residential, manufactured and mobile homes, and multiple-family residential uses. Minimum lot sizes range from 5,000 square feet for manufactured and mobile homes to 10,000 square feet for multi-family residential parcels. Each parcel must be served

by an approved domestic water supply system, and parcels less than 10,000 square feet must also be served by an approved sewage collection and treatment system.

The rural residential classification applies to agricultural-residential, single-family residential, residential recreation, and special development zones. Minimum lot sizes range from 20,000 square feet for single-family residential uses to three acres for special development zones. Both light farming and home occupations are permitted in the zones, and approved domestic water supply systems are required for parcels less than one acre. Parcels in special development zones may serve mixed-use purposes, including residential, commercial, and manufacturing where a minimum of three acres are part of singular or joint-planned developments (Graham County 1996).

- Commercial and industrial land use

Commercial land uses in Graham County are classified as either commercial recreation, neighborhood commercial, or general commercial uses. Minimum lot sizes range from 10,000 square feet for neighborhood and general commercial uses to one acre for commercial recreation uses. Rather than industrial land use, the *Graham County Comprehensive Plan* designates its fifth and final category as manufacturing land use. This category accounts for commercial manufacturing, general manufacturing, and unlimited manufacturing land use zones. Minimum parcel sizes range from one acre for commercial manufacturing to five acres for general and unlimited manufacturing zones. The plan stipulates that fencing or screening may be required for lots adjacent to non-industrial uses and that one dwelling unit is allowed per parcel (Graham County 1996).

### *Cochise County Comprehensive Plan*

The *Cochise County Comprehensive Plan* was last amended in September 2002, and, like other comprehensive plans throughout the state, alludes to a rural culture and a lifestyle largely influenced by traditional land uses such as livestock production, farming, and mining. Like other plans in this region, it also states the purpose of assisting residents and planners in achieving a balance between urban, rural, and public land uses which supports the protection of both the local economy and the county's natural resource base. The plan makes specific mention of Fort Huachuca as a key player in the county's history as well as a primary contributor to its current economic stability. Rather than a detailed guide to residential, commercial, and industrial zoning, the *Cochise County Comprehensive Plan* offers a description of various growth categories and plan designations as well as overall policies designed to support desired land use patterns in the county (Cochise County 2002).

The plan divides the entire area of Cochise County, with the exception of incorporated cities, into four growth-area categories based on the area's expected capacity for change. Intensive growth areas (Category A) are those that are experiencing an unusually high rate of growth and have the infrastructure and service capacity to support it. The urban growth category (Category B) is applied to areas demonstrating community sentiment in support of growth that maintains land use intensity at more moderate levels than that of Category A. Rural growth areas (Category C) are smaller rural community areas which demonstrate a slow rate of change and community attitudes that favor preservation of a rural, small-town atmosphere. Finally, rural areas (Category D) include sparsely populated rural lands in the county which serve primarily as rural/residential and agricultural areas rather than identifiable communities (Cochise County 2002).

Within each of the aforementioned growth categories, the *Cochise County Comprehensive Plan* establishes five distinct land use designations. The designations are intended to identify the existing character of smaller areas within specific growth categories. The "neighborhood conservation" designation identifies established areas that are primarily residential and will be afforded zoning

protection to maintain the desired character and intensity of land use. An “enterprise” designation identifies areas with an established pattern of commercial and/or industrial land use. A “developing” designation indicates an area experiencing “non-rural” growth which is expected to continue. It allows for flexibility in determining both the character and intensity of future development. The “neighborhood rehabilitation” designation is applied to residential neighborhoods experiencing deterioration but which show potential for revitalization. Finally, the “enterprise redevelopment” designation is assigned to existing developed areas undergoing change which may make them amenable to commercial and/or industrial land uses (Cochise County 2002).

### *Pima County Comprehensive Plan Update*

The *Pima County Comprehensive Plan Update* was specifically intended to reflect the land use policies, principles, and concepts identified in the *Sonoran Desert Conservation Plan*. Adopted in September 2001, the plan’s purpose is to contribute to the quality of the built environment as well as the effectiveness of the conserved environment and improve the status of the region’s fiscal, natural, and cultural resources (Pima County 2001).

Over the last hundred years, Tucson’s urban area has expanded dramatically: from two square miles in 1900, to ten square miles in 1950, to 100 square miles in 1980, to nearly 200 square miles as of 2001. Although population levels have experienced a similar increase, population density has not. In fact, the *Pima County Comprehensive Plan* suggests that population density has actually *declined* from approximately 5,200 individuals per square mile in 1953 to only 2,400 per square mile today. The combined effect of population growth at low densities equates to a land consumption rate of nearly seven square miles a year, meaning that given current rates of population growth, the land base of Tucson will nearly double over the next twenty years. Acknowledging that the conservation objectives of the *Sonoran Desert Conservation Plan* are not likely to be achieved within metropolitan areas, the plan focuses its policies on over a million acres of land in unincorporated Pima County. Specifically, the comprehensive plan is aimed at responding to a current land market that encourages unregulated, leap frog development, a leading cause of natural resource depletion and urban sprawl (Pima County 2001).

The vast majority of the population of Pima County resides in the eastern portion of the county, where residential units are the primary use within the built environment. Since the adoption of the *Pima County Comprehensive Plan* in 1992, residential development has proceeded at lower densities than intended, fueled by large-lot development and lot splitting, both of which contribute to continued urban sprawl. The comprehensive plan update states that between 1993 and 2000, the county received 496 requests for rezoning, 380 of which were approved. Of the 10,988 acres entailed in the rezoning requests, 6,480 acres (59%) were for residential uses while only 356 acres (3.2%) were for commercial uses (Pima County 2001).

- Residential land use

Regarding residential land use in Pima County, the comprehensive plan focuses on dynamic changes in the residential housing market over the last decade. It claims that between 1991 and 2000, the number of housing units sold in the county nearly doubled while the average sale price, expressed in actual dollars, rose from \$97,352 to \$155,907. Meanwhile, the average square footage of single-family residences has more than doubled since 1950. The plan goes on to explain that the local real estate market has benefited higher-income residents of Pima County but left an affordability gap for many low-income residents. According to the Tucson Association of Realtor’s Residential Sales Statistics, less than four percent of all residential units sold in Pima County in 2000 were affordable for the lowest earning twenty percent of county residents. Meanwhile, the American Community Survey of 2000 found that forty-seven percent of renters in Pima County were spending one-third or more of their household income on housing. This lack

of affordable housing has contributed to detrimental land uses and unregulated development. The comprehensive plan also cites studies which show that despite growing more rapidly than many similar counties throughout the country, Pima County spent less on a per capita basis, collected less in growth-related fees, and provided less in the way of affordable housing programs than similarly situated county governments. In response to these issues, the *Pima County Comprehensive Plan Update* establishes regional policies which create a Mixed Use Compact Development (MUCD) land use designation and promote the creation of strategies to provide affordable housing to median, low, and very low income level households (Pima County 2001).

### *Sonoran Desert Conservation Plan*

Beginning in 1998, the Pima County Board of Supervisors initiated a review of previous county planning efforts with an eye toward integrating effective natural resource management with sustainable urban development. Although not a “comprehensive plan” in the traditional sense, the *Sonoran Desert Conservation Plan* (SDCP) addresses many of the critical land use planning issues currently faced by Pima County. Mindful of the distinct correlation between urban growth and consumption of natural resources, the SDCP serves three primary purposes: it creates a science-based conservation plan, it supports the update to the *Pima County Comprehensive Plan*, and it ensures compliance with federal regulations requiring protection of endangered species to be addressed through a multiple species conservation plan. A primary goal of SDCP is to direct future urban growth in Pima County toward areas with the fewest natural, historic, and cultural resource values. In addition to guiding future land use decisions in the county, the plan is also intended to serve as a reference for allocation of public resources for acquisition of open space and protection of cultural resources. Given the plan’s emphasis on a comprehensive analysis of available science and the use of available geographic information system (GIS) data, an extensive list of stakeholders is credited with contributing to its development (Pima County 2004).

- Critical habitat and biological corridors

The SDCP states that when the process of developing the plan began in 1998, basic information on the area’s most vulnerable species, biological standards, and distribution of vegetation were not compiled in a format that could serve as a starting point for conservation planning. Since that time, an intensive research effort involving members of the local, regional, and national science community has resulted in a list of species and maps of corridors for nine mammals, eight birds, seven reptiles, seven plants, six fish, two amphibians, and numerous invertebrates in need of habitat protection. Selected priority habitats and corridors identified by the SDCP Science Technical Advisory Team include the Altar Valley, Baboquivari Mountains, Cienega Creek, Eastern Tucson Riparian Complex, Organ Pipe/Goldwater Complex, Sabino Canyon, San Pedro River, Santa Rita Mountains, Silverbell Mountains, Tortolita Mountains, and the Tucson Mountains (Pima County 2004).

- Riparian protection

The SDCP claims that sixty to seventy-five percent of all species in Arizona rely on a riparian environment at some point during their life cycle. This assertion adds urgency to the need for riparian protection given that several perennial water courses in Pima County have ceased flowing or have been significantly impacted by lower water tables. In addition to the obvious impact from development activities, the SDCP warns of the negative effects of ground water pumping and the introduction of invasive, non-native species into the county’s riparian areas. The plan cites previous riparian restoration and protection efforts in Cienega Creek, Tanque Verde Wash, the San Pedro River, and Sabino-Bear

Canyon as positive examples of conservation strategies that have not only protected wildlife and plants but also provided recreational opportunities, promoted groundwater recharge, protected water quality, and mitigated flooding. Selected priority riparian resources identified by the SDCP Science Technical Advisory Team include Rincon Creek, Cienega Creek, Arivaca Creek, Brown Canyon, Wakefield, Sutherland, Happy Valley, portions of the San Pedro River, Davidson Canyon, Gardner Canyon, Madera Canyon, Agua Verde Wash, and Sopori/Papalote Wash (Pima County 2004).

- Mountain parks

The preservation of Pima County's mountain areas began in 1929 with the establishment of Tucson Mountain Park. Since then, similar protection efforts have led to the creation of Tortolita Mountain Park, Ironwood Forest National Monument, Colossal Cave Mountain Park, Cienega Creek Natural Preserve, and Buehman-Bingham Natural Preserve. Nonetheless, the SDCP states that a continuing decline in the county's natural resource base shows that this incremental approach to conservation over the last seventy years has not adequately protected vulnerable habitats and species. Priority mountain parks and natural preserves identified by the SDCP Science Technical Advisory Team include Buehman-Bingham Natural Preserve, Cienega Creek Natural Preserve, Santa Rita Mountain Park, Colossal Cave Mountain Park, Davidson Canyon Natural Preserve, Tucson Mountain Park, Catalina State Park, Tortolita Mountain Park, and Ironwood Forest National Monument (Pima County 2004).

- Cultural resources

The SDCP notes that Pima County has had a continuous human presence for approximately 12,000 years. In an effort to protect the county's historical and cultural resources, the plan identifies numerous archaeological sites, historic buildings, national registers, historic communities, ghost towns, and historic trails as worthy of protection. An important task in delineating areas and sites for protection involved the development of digital data layers that compare core biological, habitat, and riparian areas with specific historic locations to determine where they overlap and where they are distributed separately. Priority cultural resources identified by the SDCP include ancient Native American villages, the Mission San Xavier del Bac, Mexican- and U.S. Territorial-era ranches, Fort Lowell, historic mines, existing examples of traditional Sonoran and Victorian architecture as well as several churches, schools, bridges, and parks, many of which lie at the core of the Tucson metropolitan area (Pima County 2004).

- Ranch conservation

The SDCP credits ranching with having been "the single greatest determinant of a definable urban boundary in eastern Pima County," explaining that over half of the county's 2.4 million acres of open land has been in continual use for the purpose of ranching enterprises. Expected benefits of ranch conservation identified by the plan include preservation of open space and mitigation of urban sprawl as well as maintenance of habitat continuity and the rural heritage and culture of the Southwest. The primary threat facing rangelands is urban encroachment and land fragmentation as a result of conversion to real estate development. Ongoing drought, legal challenges to grazing leases, and lucrative land prices also contribute to the trend of ranch conversion. The SDCP states that, currently, ranch conversion and fragmentation is greatest within a twenty-five-mile radius of the Tucson urban core. The SDCP identifies a number of "subareas" where ranching comprises a significant proportion of land use and is supported by sufficient grazing capacity and stability to support future sustainable ranch use. These subareas include Altar Valley, Empire-Cienega Valley, Upper Santa Cruz Valley, San Pedro Valley, and the Ironwood Forest National Monument area of Avra Valley. Meanwhile, the SDCP identifies the central Santa Cruz

Valley and portions of the Tortolita Fan as areas “least likely to retain ranch uses in the future” (Pima County 2004).

Detailed maps of each of the protection areas under the SDCP are available for viewing at <http://www.co.pima.az.us/cmo/sdcp/maps.html>.

### *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 (du/ac) 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) du/ac. 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>.

### *Santa Cruz County Comprehensive Plan*

Land use patterns in Santa Cruz County have long been shaped by the traditional activities of farming, ranching, and mining. Increasingly, however, development in the area is influenced by its proximity to the major international border crossing in the city of Nogales and by a burgeoning community of retirees. Adopted in June 2004, the *Santa Cruz County Comprehensive Plan* seeks to protect both natural resources and a rich cultural heritage by concentrating and regulating future land development (Santa Cruz County 2004).

Historically, development in Santa Cruz County has been concentrated along the Santa Cruz River, a pattern sustained since the construction of Interstate 19, which follows the same north-south orientation. The comprehensive plan claims that, between 1990 and 2000, the unincorporated areas of Santa Cruz County grew by 79% while the cities of Nogales and Patagonia experienced relatively minimal growth

(7% and -4% respectively). Of all the growth in unincorporated areas, 93% occurred on the western side of the county along the I-19 corridor in the communities of Amado, Tubac, Rio Rico, and south to the Nogales city limits. It is expected that development over the next decade will continue to be concentrated along this corridor. The *Santa Cruz County Comprehensive Plan* projects a high rate of population growth (6.5% per annum through 2010) resulting from natural increase as well as substantial immigration from other areas (Santa Cruz County 2004). In anticipation of this growth trend, the comprehensive plan includes a specific element devoted to county growth areas. Identified are seven growth areas, each of which is located west of the Santa Rita Mountains. They include the following: the airport, Amado, the I-19 Corridor (Rio Rico to Nogales), the Kino Springs Village Center, Rio Rico Drive East, Ruby Road, and Tubac.

Given the likelihood for continued population growth and the resulting need for residential and commercial development, Santa Cruz County intends to concentrate future land use in a way that maintains a rural character, protects natural resources, and makes efficient use of existing and future infrastructure. While the comprehensive plan claims that the county has a substantial amount of private, undeveloped land which is easily accessible from primary roadways, future growth is likely to have a pronounced impact on the county's natural resources and existing development patterns. For instance, new development within the county has begun to shift from individual homes constructed on private lots to production housing. In the past five years, approximately thirty percent of requests for residential rezoning were for parcels larger than 100 acres. Of these, over forty percent are at densities exceeding four dwelling units per acre. In response, the plan encourages maintaining existing land use intensities and densities in the Sonoita-Elgin area while allowing for urban-style development in the Rio Rico area and, to some extent, around Tubac and Kino Springs. According to the plan, future employment centers will be focused south of Rio Rico along the I-19 corridor, and commercial uses specific to the county's tourism industry will be encouraged at the Sonoita crossroads of SR 82 and SR 83 (Santa Cruz County 2004).

Based on the clear demarcation of land uses along the I-19 corridor and those in other locations throughout the county, the land use element of the comprehensive plan refers to two general types of land use intensities and densities: urban and rural. The land use categories described under each of these two classifications are described below.

- Rural land use

The "Ranch 40" category signifies very low-density residential, ranching, agricultural, viticultural, low-impact tourism, or resource conservation uses. Maximum residential density in this category is 1/40 dwelling unit per acre (or 1 unit per 40 acres). A "Ranch" designation allows for the same land uses as Ranch 40; however, in this category, maximum residential density is, at one-quarter dwelling unit per acre (1 unit per 4 acres), much greater. The "Public Lands" category includes all federal public land managed by the Department of Agriculture and the Department of the Interior as well as state lands managed by the State Parks Department. Land use in the "State Trust" category includes grazing and conservation as well as other uses in accordance with regulations of the State Land Department. Principle land uses in the "Preservation" category include historic sites, museums, research study areas, and permanent open space. Residential and light commercial uses related to the principle preservation function are also permitted. The "Local Services" designation is applied to areas whose primary land use includes retail, restaurants, tourism services, and low impact neighborhood services (Santa Cruz County 2004).

- Urban land use

Principle land uses in the “Low Density Residential” category include residential use as well as low-intensity tourism services, restaurants, and neighborhood services. Maximum residential density in these areas is one du/ac. “The Medium Density Residential” category allows for residential, office, and commercial services with a maximum density of three du/ac. The principle land uses in the “High Density Residential” areas include residential, retail, office, and commercial services. Maximum density for single- and multi-family residences in this category is ten du/ac. In the “Mixed Use” category, high-density residential uses are integrated with retail, services, and employment uses in areas accessible to infrastructure and public services. Maximum residential density in the Mixed Use category is ten du/ac. The “Regional Services” designation is applied to areas where the primary uses are high-intensity commercial, employment, and retail uses which are regionally significant and are easily accessible from major transportation corridors and population centers. The primary land uses in the “Enterprise” category are heavy commercial and industrial enterprises with major employment potential. This category is situated to take advantage of facilities and major transportation corridors.

A detailed map of land use within Santa Cruz County is available at <http://scc-mail.co.santa-cruz.az.us/commdev/commdev1/Santa%20Cruz%20County%202004%20Comprehensive%20Plan.pdf>

### *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 Cochise and Graham 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. Specific policies support the removal of critical habitat and wilderness designations and warn of the negative impact on development resulting from measures such as the *Sonoran Desert Conservation Plan* (Cochise County 2002, Graham County 1996, Santa Cruz County 2004). Meanwhile, areas with rapidly growing urban populations—such as Pima 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. Area comprehensive plans also note the increasing role of organizations such as the Audubon Society of Arizona, the Nature Conservancy, the Sky Islands Alliance, the Wildlands Project, and the Sonoran Institute in the ongoing debate over open space (Pima County 2001, 2004; Santa Cruz County 2004; Pinal County 2001).

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; Santa Cruz County 2004; Pima County 2001, 2004; Cochise County 2002).

Another factor certain to influence the pattern of future development is the conversion of private land within the area surrounding CNF. 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 (Cochise County 2002; Graham County 1996; Pima County 2001, 2004; Pinal County 2001; Santa Cruz County 2004). 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 (Cochise County 2002, Graham County 1996, Pima County 2001, Santa Cruz County 2004, Pinal County 2001).

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. ADWR has designated five AMAs in the state, three of which extend into the area of assessment for the Coronado NF. They are the Pinal AMA (4,000 sq. miles), the Tucson AMA (3,800 sq. miles), and the Santa Cruz AMA (750 sq. miles). In a related measure, ADWR has also established an Irrigation Non-expansion Area (INA) surrounding the city of Douglas, restricting increases in the number of irrigated acres in the area. 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 four of the five 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, Cochise County 2002, Graham County 1996, Pima County 2001, Santa Cruz County 2004, Pinal County 2001).

#### **5.4 Changes in land ownership affecting Coronado National Forest**

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

- Rosemont Ranch Land Exchange (2005)

On June 2<sup>nd</sup> 2005, Augusta Resource Corporation announced it had agreed to purchase 2,760 acres known as Rosemont Ranch from Triangle Ventures LLC. The majority of the property is located within the boundaries of the Coronado National Forest approximately twenty-five miles south of Tucson. Triangle Ventures previously purchased the property from ASARCO Inc., a Tucson-based mining company. Although the parcel had originally been slated for preservation by Pima County, the citizens advisory committee reviewing the acquisition decided that the purchase price of \$11.5 million was too high. The property has long been considered for its potential as a copper mine, but previous owners such as ASARCO and Anaconda have met with significant opposition to mining operations in the area. The CNF and the Sky Islands Alliance have joined others in voicing concerns about the long-term environmental impacts of proposed copper mining operations while property owners and citizens' groups have claimed opposition due to inadequate oversight of the disposal of federal lands (Nijhuis 1998, Mitchell 1997).

- Gray Wolf Land Exchange (2005)

The current Statement of Proposed Action (SOPA) (April 1 – June 30, 2005) for the Coronado at the time of this assessment states that this exchange is intended to provide land for the expansion of the Gray Wolf sanitary landfill site, approximately ten miles east of Dewey, Arizona in Yavapai County. As proposed by Waste Management of Arizona (WMA), the exchange calls for the acquisition of approximately 255 acres of national forest land on the Prescott National Forest (PNF) in Yavapai County, Arizona. In exchange, the PNF, Apache-Sitgreaves National Forest (ASNF), Kaibab National Forest (KNF), and the CNF would receive title to seven parcels of private land, totaling approximately 872 acres. The Coronado is minimally involved, acquiring only thirty acres. This parcel is currently held by the Ash and Cedar Mining Claims, located approximately nine miles southeast of Patagonia in the Sierra Vista Ranger District. A final decision on the Gray Wolf land exchange is expected in May 2005 with implementation taking place in August 2005 (CNF 2005b, PNF 2004).

- Camp Tatiyee Land Exchange (2005)

The current SOPA for the ASNF at the time of this assessment (April 1 – June 30, 2005) describes this land exchange as an opportunity to provide land for children's camps currently operating under a special use permit while consolidating isolated parcels within forest boundaries. The proposed action involves the exchange of private parcels in the ASNF, CNF, PNF, and TNF for federal lands currently held within the Pinetop-Lakeside town limits. A final decision on the Camp Tatiyee land exchange is expected in October 2005 with implementation taking place in January 2006 (ASNF 2005).

- Cote Land Exchange (2005)

According to the Coronado NF SOPA, this land exchange involves parcels in all districts of CNF and portions of the ASNF. The SOPA explains that the land acquisition involves parcels in Cochise, Graham, Pima, and Santa Cruz Counties. As of May 15, 2004, the Sonoita Valley Planning Partnership raised concerns that the exchange would sever the last remaining corridor between FS lands and the Las Cienegas National Conservation Area. The current SOPA for the CNF at the time of this assessment (April 1 – June 30, 2005) describes the Cote Land Exchange as being "on hold" (CNF 2005b, SVPP 2004).

- Lone Mountain Land Exchange (2004)

As proposed in its Environmental Assessment (EA), this action involved the exchange of 1,603 acres of CNF land for 1,407 acres of private land held by Lone Mountain Ranch, Inc. in an area approximately twenty miles southwest of Sierra Vista in both Cochise and Santa Cruz Counties (CNF 2004).

- Santa Rita Experimental Range (2001)

Established in 1903, the Santa Rita Experimental Range is located approximately thirty miles southeast of Tucson and is the oldest such range in the FS. The 53,000 acres of the range were originally categorized as “Other Federal Lands” under the jurisdiction of the BLM while surface activities were managed by the Rocky Mountain Research Station of the FS. In 1990, the range was relinquished to the State of Arizona through an exchange that involved lands from several agencies including the FS, the BLM, and the U.S. Fish and Wildlife Service. The headquarters site, which is on FS lands, was turned over to the Coronado NF except that the station has the responsibility to remove soil contaminated by leaking gas tanks. A contract was awarded and cleanup operations were due to start in September 1992. As of 2001, the AZSLD intended to transfer lands from the range to the University of Arizona via an “institutional takeover.” The Coronado NF grants the university access to the headquarters site via a special use permit (USFS 2001b).

- Sierra Grand Land Exchange (1999)

On May 21, 1999, CNF Supervisor John McGee signed a Decision Notice (DN) and Finding of No Significant Impact (FONSI) on the proposed Sierra Grande Ranch, Inc. Land Exchange. The exchange was to transfer approximately 500 acres of national forest land on the southeastern slope of the Santa Rita Mountains into private ownership in exchange for approximately 429 acres of non-federal holdings in Big Casa Blanca Canyon and Mansfield Canyon. The Sonoita Crossroads Community Forum (SCCF) appealed the supervisor's decision for several reasons, including failure to properly analyze the impacts of the proposed exchange and connected actions and an accusation that the supervisor's decision was based on factual error. The primary concern of the SCCF was that the land exchange would increase the potential for unregulated subdivision in the area (Dierking 1999).

- Lewis Land Exchange (1997)

This exchange involved the trade of approximately 9.83 acres of CNF land for 61.98 acres of private land held by Venice, Lelia, and Gordon Lewis. The DN of the Southwestern Regional Director of Lands and Minerals was unsuccessfully appealed by Susan McDonald and Bob McClain. The appellant's objections to the land exchange included compromised access to forest lands, deterioration of adjacent property values, and a petition opposing the exchange signed by 170 individuals. In the judgment of the presiding Appeal Reviewing Officer in the Washington D.C. Office of the Director of Minerals and Geology Management, the response to the appeal by the Coronado was sufficient to uphold the decision (USFS 1997).

- Kentucky Camp (1989)

The buildings and land of this former mining camp on the eastern side of the Santa Rita Mountains were sold to the ANAMAX Mining Company in the 1960s. The CNF acquired the site through a 1989 land exchange. The FS has worked with volunteers and other partners to restore and interpret Kentucky Camp as an important relic of the region's mining history (CNF 2005a).

## 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 the transition of public and private lands in Arizona is rooted in an 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 were located have typically enjoyed a certain amount of control over activities on surrounding dry areas. Likewise, large private land owners, such as railroads and mining companies, have also sought to influence access to the state’s vast public lands. Although many of the industries associated with Arizona’s early history have declined in recent decades, controversy between public and private land interests has steadily increased under the pressure for continued urban development. According to the Land and Water Law Review, “The proper allocation of rights to private landowners and federal land conservation interests has become one of the most contentious and emotional issues in public land law” (Stuebner 1998).

The area surrounding the CNF exemplifies many of the trends and controversial issues involving economic stability and effective management of public lands. Within the area of assessment, Santa Cruz County serves as a particularly poignant example of an area engaged in vigorous debate over land management practices. Collected data show that over 52% of land within the county is owned and managed by the FS and another 37% is currently held in private ownership. Meanwhile, Santa Cruz 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 home builders over the immediate and long-term value of open space. Taking an example from within the area of assessment, Pinal County has undergone a dramatic shift from a predominantly rural area to one in which farm and rangeland are being converted to support a booming urban population. 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 CNF given the relatively high percentage of such lands within the area of assessment.

Finally, all of the national forests in Arizona are likely to find themselves in the center of a growing debate over the management of the state's water resources. This is due to the fact that the forests share primary responsibility for 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 and New Mexico originates on lands administered by the FS (USFS 1983). The role of the Coronado NF in protecting the integrity of area watersheds is likely to become increasingly important given rates of projected growth in Pima, Pinal, and Santa Cruz Counties.

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