

## 9. Key Resource Management Topics

The following section offers brief overviews of several topics that are highly relevant to current and future forest management. The issues addressed in this section have been discussed throughout the assessment; however, this section offers a more detailed analysis of their potential impact on the socioeconomic environment surrounding the Apache-Sitgreaves National Forests (ASNf). Forest planners from Arizona's six national forests identified these topics as being key to forest management. Although each topic can affect forests in distinct ways and to varied extents, they represent issues of common concern to national forests and communities throughout the state.

### 9.1 Forest health

Maintaining and improving overall forest and ecosystem health is an important goal of the USFS. However, forest health is a complex and wide-ranging concept, and its exact meaning can be difficult to define. At the national level, the Forest Service has identified four key threats to the health of the nation's forests and grasslands, namely (USFS 2005j):

- Fire and fuels,
- Invasive species,
- Loss of open space, and
- Unmanaged recreation.

Each of these threats, along with the trends associated with them and the implications for managing forest and grassland health will be considered.

#### *Fire and Fuels*

Nationally, fire on FS lands has been a subject of considerable attention. The Federal Wildland Fire Management Policy estimates that during the pre-industrial period (1500-1800), an average of 145 million acres burned annually in what is now the contiguous United States. Today, an average of about 14 million acres burn on both federal and non-federal lands. Nonetheless, wildland fire regimes and fire-management practices are a major concern for a wide variety of forest stakeholders, including Forest Service staff, recreational users, tribes, and neighboring communities. The White House Healthy Forests initiative describes 190 million acres of national forest land as dangerously susceptible to wildfires, and it states that ponderosa pine density is now fifteen times greater than it was 100 years ago (Office of the President 2002). Federal and state fire-management agencies have reported fires on over more than 5 million acres in five of the last ten fire seasons. During the 2000 fire season, these agencies reported 8,422,237 acres of wildland fire, a record in the more than forty years for which the National Interagency Fire Season has compiled data (NIFC 2005). These numbers pale in comparison to the fires experienced in the western United States before modern fire suppression techniques.

The last few fire seasons have provided several examples that illustrate the costs, financial and otherwise, that can be associated with large wildland fires in the state of Arizona as a whole. The Rodeo-Chediski fire of 2002 spread across over 450,000 acres of land, including over 170,000 acres of the Tonto and Apache-Sitgreaves National Forests. Costs associated with the fire surpassed \$40 million (USFS 2003d). According a CLIMAS report of September, 2004, the number of such fires continues to rise with the total in Arizona and New Mexico surpassing 3,000, showing a noted increase in the final months of 2004. Locally, on average, about 300-350 fires occur annually in the Apache-Sitgreaves forests. This general

increase in wildfire threat is likely due, at least in part, to the increased population of those counties surrounding the national forests (USFS 1999a).

Due to this fire activity, Arizona's national forests are at the center of the fuels and fire debate. The Coconino, for instance, appears in the White House's Healthy Forests Initiative as an example of the interactions of fire and endangered species and is often cited as an example of mechanical fuels reduction projects and the litigation issues surrounding them (Office of the President 2002, Bonnicksen 2000, Suckling 1996, Elperin 2004). The White House's initiative calls for aggressive thinning projects and places much of the blame for the recent Rodeo-Chediski fire and other fires in the region on the overly dense forests and "nuisance" litigation. Nationally, some researchers echo this claim, blaming no-cut environmentalists for creating a setting for apocalyptic wildfires, while others join environmentalists in arguing that thinning projects that remove larger trees may actually increase the frequency and/or intensity of fires (Segee and Taylor 2002, Omi and Martinson 2002). Other citizen groups in this region argue against what they consider a preoccupation with fuel-reduction projects at the expense of other protection efforts, such as the recent postponement of a project to protect Anderson Mesa (Elperin 2004). At the state level, litigation has undeniably delayed, prevented, or changed some fuel-reduction projects. For example, the Grand Canyon Partnership Assessment Project, which was scuttled by litigation in 2001, was replaced by smaller projects. However, several studies have shown that the impact and scope of litigation on national forest logging plans nationwide has been substantially overstated (Cortner et al. 2003, Carter 2003).

It is important to note, however, that wildland fire has also proven to be a useful management tool in many areas. For example, the wilderness areas associated with the Gila National Forest in New Mexico now make extensive use of fire as a wilderness management tool, utilizing prescribed fire and naturally-ignited "wildland fire use" projects to help meet management objectives on more than 175,000 acres in 2003 (Madrid, pers. comm.).

Generally, wildland fire behavior is determined by several factors, including climate and weather conditions and the type, distribution, and abundance of fuels. Because other elements are difficult or impossible for managers to control, management efforts generally focus on changing the likelihood of ignition and the behavior of fires by modifying fuels. For a fire to ignite and burn, fine fuels must be abundant, and fuel moisture must be low (Wright and Bailey 1982, Wink and Wright 1973). However, the chemical and structural properties of fuels also greatly influence a fire's behavior. Particularly abundant or combustible fuels result in fires that are more intense and are more likely to show extreme behaviors such as spotting; firewhirls; crowning; and long, fast runs (Pyne 1997). Intense fires can threaten species and landscapes that are better adapted to slow-burning, low-intensity fires, such as some ponderosa pine forests, and extreme fire behavior can make cultural resources and developed areas more difficult to protect. Heavy surface fuels, such as thick needle layers, can result in long-burning, low intensity fires while dry grasses are consumed very quickly. Understory shrubs and small trees can act as ladders, carrying surface fires into the crowns of trees (Graham, McCaffrey, and Jain 2004). The most common strategies for managing wildland fire are mechanical treatments<sup>1</sup>, controlled fire treatments (used here to include both prescribed and natural-ignition "wildland fire use" fires), and direct suppression of fires.

Managers often also attempt to control human-caused ignitions. As of September 2004, more than 3,260 large, non-prescribed fires had been reported in Arizona and New Mexico. Humans caused 1,308 of these, affecting more than 62,000 acres (CLIMAS 2004, Sept.). Increases in human-ignited fires are likely due at least in part to the increased population of the counties surrounding the national forests (discussed further in the "Unmanaged Recreation" section below). With increased population in Arizona comes an

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<sup>1</sup> Although mechanical treatments and fire use projects generally have the common goal of altering fuels to reduce fire intensity, they are discussed separately here because risks and benefits of each are substantially different. Many policies implicitly or explicitly favor one method over the other.

increase in visitors and in potential ignition sources, including campfires, debris burning, and faulty vehicle exhaust (USFS 1999a).

The focus of fire policy is now shifting from fire suppression to fire management (CNF 2003b). The protection of life and property is always the first priority; however, forests also aim to protect and improve overall ecosystem health through fire-management practices. The 2001 Federal Wildland Fire Management Policy states that “the role of wildland fire as an essential ecological process and natural change agent” should be incorporated into the planning process (NIFC 2003). In addition, the more recent Healthy Forests Initiative has also emphasized that the “real solution to catastrophic wildfires is to address their causes by reducing fuel hazards and returning our forests and rangelands to healthy conditions (Office of the President 2002).

One of the more controversial topics to come out of fire management in recent years is the use of post-fire “salvage” logging to extract some economic gain from burnt areas. Locally, following the Rodeo-Chediski fires, several salvage operations to collect the fallen trees began, using Categorical Exclusions (CE) to hasten the process (ALA 2003). Although salvage logging is generally considered to “rescue” any remaining economic value from affected trees, recent reports have questioned the efficacy and benefits to the national forests of such enterprises. Forest Service documents suggest, for example, that such logging further disrupts the landscape, increasing soil erosion and disturbing wildlife, and can actually increase the likelihood of another fire (USFS 2003d, USFS 1999a).

### *Invasive species*

The view held by some that ecosystem health has declined since the arrival of Europeans on the North American continent is linked in large part to a reduction in biodiversity; the falling population numbers of native species; and a concomitant explosion in non-native, invasive species (Ecological Restoration Institute 2005). Native species populations have fallen drastically under pressure from changing land uses and habitat fragmentation, but invasions of non-native species have been identified as the second greatest cause of species extinction (Vitousek et al. 1997). Pimentel, Zuniga, and Morrison (2005) estimate that approximately 50,000 alien-invasive species have been introduced into the United States, costing an estimated \$120 billion per year (including both damages and control efforts). Furthermore, nearly half of the species federally listed as threatened or endangered are in jeopardy primarily because of competition with or predation by non-native species.

Nationwide, invasive species affect forest ecosystems to the detriment of biological diversity, forest health, forest productivity, soil and water quality, and socioeconomic values (Chornesky et al. 2005). Researchers estimate that the roughly 360 non-native insect species that have invaded U.S. forests cost about \$2.1 billion per year in the loss of forest products alone. A similar value is also lost to non-native plant pathogens (Pimentel, Zuniga, and Morrison 2005). The invasions of several species of bark beetles currently pose a serious threat to Arizona’s forest resources.

In the Southwest regional scale, a 2002 bark beetle infestation in Arizona and New Mexico caused significant damage. The infestation was likely the result of a combination of factors, including drought and high tree density. This outbreak killed millions of ponderosa pine and piñon trees, and mortality, which reached up to 90% at a few localized sites, was highly visible in some areas. 2003 brought an increase in juniper and Arizona cypress mortality, which was also partially attributed to bark beetle infestations (USFS 2004o). Statewide, the round-headed pine beetle actually decreased its impact area from 11,120 acres in 2002 to 4,530 acres in 2003. Almost all of the 2003 round-headed pine beetle damage occurred within the Coronado National Forest. In the Apache-Sitgreaves NF, spruce aphid defoliation affected upwards of 100,000 acres in the White Mountains, and *Ips* beetle activity was recorded on over 122,000 acres of ASNF pine forest land. Piñon mortality in the forest from the beetles affected 145,485 acres (USFS 2004d).

In western deserts, invasive grass species have also resulted in significant ecosystem damage. Annual grasses from Europe were unintentionally introduced through grazing and have changed fire regimes, increasing fire frequency, intensity, and extent (D'Antonio and Vitousek 1992). Likewise, invasions of cheatgrass (*Bromus tectorum*) and Lehman lovegrass (*Eragrostis lehmanniana*) in grassland ecosystems increase fire frequency and intensity. This can be particularly problematic when these invasions occur adjacent to dense forests that are susceptible to wildfire (Chornesky et al. 2005). In the spring and early of summer of 2005, above-average winter rains led to significant accumulations of grass and weeds in desert environments, which then carried several large human-ignited fires through desert ecosystems (Johnson 2005, Meahl 2005, Becerra and Pierson 2005). These ecosystems are normally characterized by high concentrations of succulents, which evolved with little or no fire and are poorly adapted to withstand it (D'Antonio and Vitousek 1992). Many non-native plant species also reduce forage quality. Forage losses due to invasive weed species have been estimated at nearly \$1 billion per year (Pimentel, Zuniga, and Morrison 2005).

As invasive species threaten a wide variety of forest resources and uses, including both recreational and extractive uses, Chornesky and others (2005) suggest three complementary strategies for controlling non-native species invasions on forested lands:

- Prevention of harmful new introductions by identifying and impeding pathways for invasive species introduction and spread,
- Detection and eradication of invaders that elude prevention, and
- Long-term management of well-established invasive species.

The U.S. Bureau of Entomology and Plant Quarantine, Forest Health Protection, part of the U.S. Department of Agriculture, provides technical assistance on forest health issues and focuses much of its attention on non-native insects, pathogens, and plants (USFS 2005q). Forest Health Protection provides a variety of services aimed at lessening the impacts of these invasive species, including management, monitoring, technology development, pesticide use guidance, and technical assistance programs. A joint project of the University of Georgia and the USDA, available at <http://www.invasives.org>, provides detailed information on a wide variety of invasive weeds, diseases, insects, and other species. The Forest Service has also developed the National Strategy and Implementation Plan for Invasive Species Management, which aims to “reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of invasive species across all landscapes and ownerships” (USFS 2004o).

### *Loss of Open Space*

Changing patterns in demography and land use (discussed in more detail in the following section) are leading to a loss of open spaces in U.S. landscapes. In the western United States, “exurbanization,” the shift of populations to semi-rural areas outside suburban areas, is a major contributor to this phenomenon. Much of the rapid growth currently sweeping the Rocky Mountain States is occurring outside of metropolitan areas on land that was previously used for grazing, agriculture, private forestry, and/or recreation (Esparza and Carruthers 2000). The USFS has identified this fragmentation of forests and grasslands as a major threat to ecosystem health (USFS 2004n). Vitousek and others (1997) describe land transformation (including transformation of natural ecosystems to row-crop agriculture, urban and industrial areas, and pastureland) as “the primary driving force in the loss of biological diversity worldwide.”

The negative effects of these changes are wide-ranging and also include local and global climate changes, air pollution, sediment and nutrient runoff, the destruction of aquatic ecosystems, and a reduction in opportunities for outdoor recreation (Vitousek et al. 1997). The FS notes that, although the loss of open space through residential and commercial development generally increases land values and taxes, it also

increases the cost of providing social services to local communities and undermines traditional and rural land uses (USFS 2004n).

A study of exurbanization in southeastern Arizona described how city- and county-level planning can inadvertently encourage exurban development by increasing the cost and complexity of residential development within the city limits and by promoting low-density development through zoning designations (Esparza and Carruthers 2000).

### *Increased Recreation on National Forests*

In its Agricultural Fact Book, the USDA identifies the Forest Service as supplying more recreational activities than any other federal agency. Given a rising involvement in wilderness recreation, the continuing availability of such opportunities is increasingly important (Cordell et al. 1999). Sixty years ago, public use of the national forests was limited, with only 600,000 visitor days in the state of Arizona. Twenty years ago, however, visitor days had increased to nearly 15 million, making the national forests the main recreational resource in the Southwest (Baker et al. 1988). Today, the National Forest System is an impressive source of outdoor recreation, education, and involvement. Nationwide, more than 200 million recreational visits are logged annually, and the national forests provide 50% of the nation's forested trail area and 60% of the skiing opportunities (USDA 2002). In the Apache-Sitgreaves National Forests alone, there are between 1.6-2.2 million visitors each year and between 20,000-70,000 wilderness visits, making tourism one of the single most vital economic factors to the communities surrounding the forest—eclipsing agriculture and trading (Kocis et al. 2002a). The area including the White Mountains and the Mogollon Rim provide some of the few winter sport environments in the state. When snowfall is adequate, cross-country skiing and snowmobiling are popular activities. In addition, pedestrian and biking activity for pleasure and exercise accounts for heavy use on the existing trails. The forest is “the communities' backyard” (Dykstra 2003). As a result, tourism has become one of the most vital economic factors to the communities surrounding the forests. Additionally, in 1996, almost half of all hunters used public lands and one-third of hunting days occurred entirely or in part on public lands (Flather, Brady, and Knowles 1999), and activities such as rock climbing have greatly increased in popularity although their inherent risk has caused park officials on the national level to consider special use fees to cover added ranger responsibilities surrounding climbing-related injuries (Cordell et al. 1999).

In the ASNF, following the 2002 Rodeo-Chediski fires, damage to forest resources constrained some recreational opportunities. Trails and OHV roads were damaged or closed and camping, smoking, and wood cutting restricted in many of the affected areas. Dead and felled trees and burned trail signs and markers have affected many recreational users. In addition, fishing opportunities have been reduced at Canyon Creek and Black Canyon Lake.

In Arizona, access to recreational activities on federal- and state-protected land is important and valuable. Over the past half-century, the demand for such outdoor experiences has grown tremendously nationwide. This change can be attributed to several trends, including an increase in leisure time and discretionary income and a greater appreciation for nature in response to growing urbanization (Clawson 1985). About 45% of registered Arizona voters frequently or occasionally go hiking, while 40% go picnicking or animal watching. Along with fishing, off-roading, boating, hunting, visiting archeological sites, mountain biking, and horse riding, it is clear that a substantial portion of Arizona residents make use of the National Forest System at one point or another (Merrill 1998). For example, on the local level, 93% of respondents in a Forest Service report on the Heber-Overgaard area of the Apache-Sitgreaves National Forests agreed that the availability of public lands for recreational activity was at least somewhat important, and nearly all of the respondents felt hiking should be allowed within reasonable parameters. 87% of these respondents even felt that OHVs should have access to forests with only very limited restrictions (USFS 1999a).

The explosive growth of recreational use presents challenges to managers even as the public gains ever-broader benefits from its forests and grasslands. The FS has acknowledged the increasing pressure on forest resources, particularly in the Rocky Mountain and Southwest regions. Similarly, it is currently emphasizing the need to effectively manage recreation, especially the use of OHVs (see Section 9.3, Forest Access and Travel). With the growing trend toward exurbanization, changing land patterns may threaten easy access to those environmental recourses of escaping urban stress and enjoying the serenity of a natural environment—the foremost reasons for forest usage (Peart 1995, Knopf 1987).

A related issue that has drawn some attention recently is the use of recreation fees for public lands. Some users feel that such fees amount to double taxation, adding costs on top of the money donated in taxes, and that these fees discourage lower-income individuals from accessing the park. These arguments echo the ideas of Frederick Law Olmstead, one of the designers of New York’s Central Park and an instrumental voice in the formation of America’s national parks. For Olmstead, public open spaces oiled the gears of democracy by bringing disparate classes together. Nevertheless, fees remain relatively low, and studies have shown that the primary cost-incurring activities involved with visits to public lands are those related to travel and lodging (Grewell 2004). However, given that in 2001 nearly 92% of the wilderness visitors to the ASNF were Caucasian (in a state with a 25% non-white population), the question of how fees might affect diversity on the public lands system merits some discussion (Kocis et al. 2002a).

## **9.2 Land and water resources**

Previous sections have provided substantial information on recent demographic changes within the area surrounding ASNF. Here, the focus is not on the quantitative nature of demographic change but on the qualitative characteristics of change likely to affect forest management.

Arizona is among the fastest growing states. The United States’ aging population—one in eight people in the U.S. is now over 65 as opposed to one in twenty-five 100 years ago—is leading to more and more people escaping to the warmer climates of the South and West (Alig et. al. 2003). The population in Arizona increased by more than a factor of four over the 1950-1995 period, and the demographic data within this report show that this trend exhibits no immediate signs of slowing. Some researchers predict another doubling in population between now and 2040 (Peart 1995). As noted throughout this report, Arizona is also becoming increasingly “exurban” (that is, residences are spreading further from metropolitan areas and becoming more widely spaced), and the popularity of many outdoor recreation activities continues to rise. It has been described how, as a result, many forests are seeing a growing trend toward recreational use and “ecosystem services” (i.e., the management of public lands to provide services such as improved water quality, wildlife habitat, and clean air to surrounding communities) and away from extractive uses such as mining, logging, and grazing. Availability of land and water is a growing concern for Arizona’s rapidly expanding urban areas. Although national forests in the state are affected by urban growth to different extents, each will need to consider its role as a provider of open space and healthy watersheds. Livestock grazing, changes involving state trust lands, the increased utilization of forests’ water resources, and roadless area rules were identified by forest planners as points of particular interest.

### *Grazing*

Livestock grazing has a long history in Arizona. The prominence of grazing in this area dates back to the middle of the 18<sup>th</sup> century, when Spanish explorers transported livestock into the region by way of Mexico (Allen 1989). Formal ranching began in the late 1800s following the Civil War and the widespread suppression of the local indigenous populations (Sheridan 1995). The U.S. government’s primary interest was in land acquisition until the 1850s. The distribution of lands to Anglo settlers began

in earnest with the Homestead Act of 1862. Over the century following the Civil War (1865-1965), there was a 600% increase in the number of cattle in the western states. However, this transition was by no means linear. For example, the 1880s saw an immense boom in livestock numbers. Nearly a million head of cattle were reported in Arizona by the end of that decade, up from about 38,000 in 1870. However, a combination of environmental and economic pressures soon decimated the herds (and the range, which was devastatingly overgrazed by the mid-1890s), and by the end of that century, an estimated 50-75% of southern Arizona's cattle had perished (Sheridan 1995). The establishment of forest reserves in Arizona during the late 1800s appeared to threaten ranching in the state. A report submitted by Gifford Pinchot in 1900, however, changed the fate of grazing rights on federal lands. In his report, Pinchot stated that livestock grazing was compatible with the major objectives for establishing forest reserves and was essential to the economy of the region. Based on Pinchot's findings, the government began implementing the use of fees for grazing of private livestock on public land as early as 1901 (Putt 1995). As a consequence, when the Forest Service was established in 1905, they inherited the problems caused by decades of overgrazing. For this reason, a main focus of the Forest Service during the early years of operation was to work with ranchers to control existing herds and reduce any conflicts on the land. By the 1920s, however, continued damage by livestock was interfering with the range improvement programs initiated by the Forest Service. As early as 1910, studies of range conditions were being conducted which indicated that overgrazing was seriously impacting the growth of Ponderosa pine (Putt 1995). Such conditions forced the Forest Service to impose a strict range improvement program in 1925.

Nationally, in 1906, the Forest Service implemented the practice of collecting fees for grazing private livestock on public land. The amount of FS land devoted to livestock grazing has been stable over the past three decades, as has been the amount of BLM land (USFS 2000a). However, some studies have suggested that changes in land use will result in a decrease of grazing land in the Pacific and Rocky Mountain Assessment Regions (Mitchell 2000). At present, nearly 167 million acres of BLM land and 95 million acres of Forest Service land are allotted to fee-based grazing rights, the latter accounting for 65% of the entire National Forest System. Livestock graze over 90% of federal lands in the eleven western states (Carter 2003). The forage grazed on this land accounts for about 2% of the beef-cattle feed in the continental U.S. and financially supports one-tenth of western livestock producers, whose grazing fees continue to be charged based on the formula initiated by the Public Rangelands Improvement Act of 1978 (PRIA) (Cody 2001). The grazing leases provided by the Forest Service account for nearly one-quarter of the grazing land utilized by Arizona ranchers, and most Arizona ranching operations rely on one or more federal or state grazing permits (Ruyle et al. 2000).

The PRIA began the fee formula for the FS and the BLM on an experimental basis, but following continuing presidential and congressional support, it has remained the standard. Grazing fees have become controversial in part because the fee has increased only marginally from its inception and has not kept pace with the market rates. In 2002, for example, the grazing fee remained \$1.35 per AUM<sup>2</sup> on federal land while the USDA estimated the average rate for grazing leases on non-irrigated private land among sixteen western states at \$13.50 per AUM (NASS 2003). Some citizen groups assert that this leads to disproportionate financial output by the Forest Service in the interests of grazing (Coalition 2001). In Arizona, for example, conservation groups note that the Forest Service recently spent nearly \$250,000 to establish and maintain cattle fences and borders for land that generates only \$7,000 per year in grazing revenue as part of an attempt to protect Apache Trout and other threatened fish in livestock-impacted watersheds (Wolff 1999). Many groups also argue that livestock ranching interferes with other uses of the national forests

The National Forest System contains much of the summer range and a portion of the year-round grazing in the area, and as such, regional administrators help determine the success of southwestern livestock

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<sup>2</sup> One AUM is defined as the amount of forage required by an animal unit (the equivalent of one 1,000 pound cow and her suckling calf) for a one-month period. Thus, the total number of AUMs is equal to the number of animal units multiplied by the number of months they are on the range.

industries. However, ecological impacts of ranching, including the persecution of “problem animals,” the alteration of fire regimes, impacts to water supplies and riparian areas, introductions of exotic weeds, and the construction of fences and roads, can bring it into conflict with other uses (Freilich et al. 2003). For example, soil compaction from grazing herds can affect the water table and rainfall infiltration as well as erode streambanks. Watersheds that have been subjected to prolonged overgrazing are more susceptible to flooding and accelerated channel lowering (Belsky, Matzke, and Uselman 1999; Dreeson et al. 2002; USFS 2002a). A suitable balance and relationship between livestock grazers, environmentalists, and the Forest Service is important and, given the continuing decline of grassland ecosystems, even critical (Baker et al. 1988).

Many proponents of ranching point to the social and economic benefits of rural lifestyles, arguing, for example, that “the best way to preserve the open spaces, arid ecosystems, and diverse biota of the Southwest is to keep rural people on the land” (Brown and McDonald 1995). Thus, ranching on public and private lands may also be seen as a viable method of limiting urban sprawl and promoting the economic independence and cultural uniqueness of rural communities.

### *State Trust land reform*

The practice of allocating public lands for various beneficiaries in Arizona dates back to the founding of the territory in 1863. The current system of managing these lands, referred to as State Trust lands, was established with the Arizona State Land Department (AZSLD) in 1915. Since that time, the department has worked actively to manage these lands to help fund schools and other public institutions. In addition to original allotments granted by the federal government through Territorial and State Enabling Acts, the State Selection Board was allowed to select various lands throughout Arizona sufficient to ensure future financial support for selected beneficiaries. The selection of lands for state acquisition was completed in 1982 although most land selections were made between 1915 and 1960. Federal laws prohibited acquiring mineral lands or agricultural areas previously claimed by homesteaders, so the Selection Board chose lands with the greatest grazing potential. As a result, the majority of land selected between 1915 and 1960 was in central and southeastern Arizona with some additional “checkerboard” parcels near railroads in the north central portion of the state. Since that time, land exchanges have led to relocation of limited trust lands in western desert areas toward the region surrounding Phoenix and Tucson as well as western Yavapai County (AZSLD 2005).

Since its inception, the State Land Department has been granted authority over all trust lands as well as the natural products they provide. This authority over trust land is central to the AZSLD’s primary mission of maximizing revenues for its beneficiaries, a role that distinguishes it from other agencies charged with management of public lands (national parks, national forests, state parks, and the like). As of 2005, the AZSLD managed land holdings for fourteen beneficiaries, the most prominent of which is the K-12 public school system. The public schools currently hold 87.4% of State Trust lands. The vast majority of Arizona trust lands currently are intended solely for livestock grazing. However, the Urban Lands Act, passed by the state legislature in 1981, has allowed the State Land Department to capitalize on the increased value of trust lands surrounding the state’s rapidly growing municipalities. As a result, the Land Department’s urban lands lease and sale program has become the largest revenue producer for the trust (AZSLD 2005).

Pressure for reform of the State Trust land system has been fed in recent decades by a relative scarcity of private developable land in areas that are continuing to experience massive population growth. Although various kinds of reforms have been proposed, the variety of stakeholders involved makes resolution a challenge. The competing interests involved include city and town governments and political lobbies representing educators, environmentalists, grazing interests, and homebuilders. Several cities throughout the state are striving to work with builders in order to ensure a sufficient supply of land for future housing. At the same time, educators would like to collect as much money as possible from the sale of

trust lands in order to supplement limited financial support from the state legislature. Finally, environmentalists and ranchers have an interest in preserving lands for their conservation value and existing grazing rights. Despite continued efforts to reach a compromise among these interests, a number of proposed reform plans have thus far failed to pass from committee in the Arizona State Legislature (Nintzel 2005, Davis 2004).

At issue is the process by which the State Land Department takes advantage of increased land values for educational funding while still preserving sensitive areas for conservation in the face of increasing urbanization. Policy makers suggest that the impasse over proposed reforms for the State Trust Land System can be broken down into the following key issues, all of which have been viewed as “deal breakers” by one or more of the interested parties: 1) the amount of land available to be set aside for conservation; 2) open, competitive auctioning for grazing leases; 3) federal and state land exchanges; and 4) the composition of the State Trust Land Board (Sherwood and McKinnon 2005, Nintzel 2005, Riske 2005).

Legislators have balked at proposals favored by organizations such as the Sonoran Institute and Grand Canyon Trust that call for protection of nearly 700,000 of the state’s 9.3 million acres of Trust Land. Meanwhile, the Arizona Preserve Initiative, a measure that would allow the state to match payments from local jurisdictions to buy state land that qualified for open-space preservation, has been delayed by legal challenges to its constitutionality. Similarly, legal court challenges to State Trust Land reform have been posed by groups seeking to overturn the Arizona Supreme Court’s decision in 2001 that allows non-ranchers to bid on state grazing leases as well as a 1990 Supreme Court ruling which prohibits the state from swapping parcels with federal agencies and/or private speculators. Finally, comprehensive reform of Arizona’s State Trust Land system has also been held up by the education lobby’s insistence that any reforms should be approved by a newly composed Board of Trustees charged with overseeing the management and disposal of trust lands (Sherwood 2005, Nintzel 2004).

These and other challenges have been addressed by various proposals for reform submitted by state lawmakers. As recently as October 2004, a coalition seeking the overhaul of state land management was “pronounced dead” after the facilitator resigned in the wake of failed attempts to pass a measure through the legislature. Still, Governor Napolitano, along with a number of state senators and representatives, remains committed to Trust land reform and aims to present voters with a reform package by the 2006 general election. Whatever the outcome, it should be noted that the ultimate resolution of these issues will likely have a significant impact on national forests in Arizona given the extent and value of State Trust lands in close proximity to forest boundaries (Davis 2004, Riske 2005). More information on the management of State Trust Lands by the Arizona State Land Department is available online at <http://www.land.state.az.us/>.

## *Water*

The U.S. uses a lot of water, and the primary uses are not always obvious to the general public. Even though per capita public consumption of water resources has increased by 400% over the past century, less than one-tenth of total freshwater removal is utilized in the areas most often considered under “primary water use”: domestic and private use. The judicious use of water resources is particularly important in the West, and water is an immediate and everyday concern to Arizona residents. The National Forest System in the state is central to the question of water resources. Although USFS lands account for only 14% of the total land area, those lands contain 40% of the region’s water resources (Brown 1999, Baker et al. 1988). In fact, national forests and grasslands function as the largest provider of water in the continental U.S., containing nearly 10 million acres of wetland and riparian areas and the headwaters of 15% of the nation’s supply of water. These resources, valued at billions of dollars, supply water to more than 60 million people and provide opportunities for recreation, preservation, and employment (Schuster and Krebs 2003).

Throughout Arizona, a number of watersheds and aquifers provide communities with their water supplies. Among those in the Apache-Sitgreaves region is the Eagle Creek watershed at the base of the White Mountains, which serves a good portion of southern Arizona and helps recharge the Coconino aquifer. The latter, in turn, serves as the main aquifer for most of the northeast of the state. Additionally, reservoirs such as Lake Powell, Lake Mead, Show Low Lake, Lake Mohave, and Lake Havasu provide necessary water to various areas of the state (Pinetop-Lakeside 2004, ADWR 2005).

Regionally, below-average precipitation over the past several years has once again brought water to the forefront of natural resource management concerns. According to the U.S. Geological Survey, the period following 1999 is the driest in the hundred years that the Colorado River has been monitored. That river supplies 25 million people in seven states with water (USGS 2004, CRWUA 2005, Pontius 1997). Recently, the Secretary of the Interior noted that, barring changes, action would be necessary at the federal level within two or three years. Low rainfall has led to periodic drops in water levels in nearly all primary reservoirs in Arizona. Statewide, although Lake Mohave and Lake Havasu raised their levels by 1% and 3% respectively over the second half of 2004, other reservoirs dropped precipitously. The Salt River system dropped 8% against the maximum storage level, and Lyman Reservoir dropped 16%. By early 2005, both Lake Mohave and Havasu had already returned to the previous, lower levels. Above average rains last winter, however, have had a profound effect upon Arizona's primary reservoirs with four at over 90% capacity and nearly all at higher levels than the year before. One of the major watersheds closest to the ASNF, Show Low Lake, was up to 100% of capacity in June 2005. Lyman Reservoir, by contrast, remained very dry at 40% of capacity. The capricious nature of Southwest precipitation is one of the aspects that make management of water resources particularly difficult in this region (CLIMAS, September 2004; CLIMAS, February 2005; CLIMAS, May 2005; CLIMAS, June 2005).

Much of the previous years' water worries can be attributed to below-average precipitation starting in October 2003. Below-average snow-pack in Payson, Arizona, has caused that community, and many others like it, to implement programs aimed at conserving water. The Salt River Project Board of Directors, which instituted cutbacks in residential, agricultural, and municipal use for 2005, has taken similar precautions. That was the third straight year such methods were implemented (CLIMAS, September 2004; CLIMAS, February 2005). Water providers in the Pinetop-Lakeside region of Navajo County are engaged in aggressive planning on how to meet demand through 2020 and beyond. Meanwhile, at the state level, the creation of groundwater Active Management Areas (AMAs) have initiated requirements for proof of 100-year water viability before any new development can begin (Pinetop-Lakeside 2004). These requirements lead some communities with adequate water supplies, like Pinetop-Lakeside, to foresee increased growth as developers search for areas with water resources within the purview of AMA requirements. Additionally, projects by the FS to protect Cottonwood/Sundown and other watersheds are either planned or currently underway. Statewide, other longstanding water protection initiatives are suffering setbacks. Regionally, the Colorado River Compact of 1922, for example, was meant to limit withdrawals from the Upper Colorado Basin to the lower basin states, including Arizona, to 8.23 million acre-feet (maf); however, deliveries at the end of the last decade were up to about 10 maf, well above the requirements of the compact (Brown 1999).

In the Apache-Sitgreaves National Forests, water quality has been a major point of concern in recent years. The Canyon Creek Aquatic Habitat Improvement Plan, developed in 1986, aimed to reduce water temperature in that area. Human activities had been increasing water temperatures through changes in pool depth, shade, and sediment levels. These changes threatened both native and sport fish populations. Over the eight years that followed its inception, water temperatures in Canyon Creek dropped dramatically, which showed marked results on trout populations in the area (Loftus and Flather 2000). Another, less recent success story was a project undertaken outside Show Low, where a wetlands environment sustained through treated effluvia has drawn more than 120 species of birds. These included no less than ten species listed on the endangered species list. In addition, vegetative species such

as cattail, spike rush, and different types of sedges naturally established themselves in the area. Meanwhile, project members have successfully planted some other species, including alkali bulrushes and sego pondweed (EPA 1993).

Active management of the water resources on public and private lands is a complex and multifaceted endeavor. Considering the value of water resources on forest service lands, continuing such management activities while working in partnership with tribal and other nongovernmental agencies is, in the words of Schuster and Krebs (2003), “simply good business.”

### *Catron County and the County Movement*

The intersection of land use and community relations is particularly germane when it comes to those federal holdings that interact with Catron County, New Mexico. For much of the early and mid-nineties, a tense power struggle existed between the Forest Service—and, to a lesser extent, the State Land Department and the BLM—and residents of the county who felt that the resource benefits of the surrounding lands belonged to them. The conflict became a national story and spurred scores of other counties in the West and Midwest to either incorporate elements of the “county movement” into their local county plans or at least to research the possibility of incorporating such elements despite seemingly insurmountable legal complications in the long run. The roots of the county movement’s position lie in a stringent Jeffersonian understanding of local rule which would argue that county seats represent the highest form of government and should retain direct control of their resources, with the federal government being limited to issues of international relations (Davis 1996, Ford 1995).

The specific disagreements in New Mexico led to standoffs between county representatives and federal lands agents following the closing of much of the county’s timber industry as a result of Mexican spotted owl protection and a loss of significant portions of the surrounding grazing tracts as a result of environmental deterioration. In the opinion of many local residents, these shifts in local industry threatened to dismantle the very community itself. The county responded by amending its land use plan to make certain federal mandates illegal by county law. There were also concordant threats to exercise punishment for the breach of these laws upon the forest service rangers and environmentalists themselves ranging from the more legalized enforcement of county penalties to a more vigilante exercise of physical threats (Ford 1995, McCarthy and Hague 2004).

Much of the rationale for the county’s dissent is the assertion that local residents and governments have not had a representative say in the management of local lands and desire to be fundamentally involved in decisions that affect the county’s natural resource utilization. However, difficulties arise when those voices demand full and uninhibited usage of the lands without federal oversight of any kind, which the USFS, for its part, cannot grant (Davis 1996, Ford 1995).

Successes and setbacks followed for both sides of the conflict, but the height of the disagreements has passed in the intervening decade. While tensions have eased through the use of Memorandums of Understanding (MOUs) and other cooperative apparatuses, resolutions challenging federal authority remain in the *Catron County Comprehensive Land Plan*, and underlying tensions remain regarding to whom the lands in the county really belong (Davis 1996, Ford 1995, Catron County 1992).

### **9.3 Forest access and travel**

Earlier chapters discussed forest access and travel, focusing on the transportation characteristics of communities surrounding the ASNF. This section provides a detailed assessment of recent interpretations of the Roadless Rule and current trends in OHV use—two internal access issues that are of particular concern to many forest planners and that are likely to have a significant impact on future forest planning.

### *Roadless areas in the National Forests*

The larger roadless areas in national forests have long received different treatment than more developed areas. Through Roadless Area Review and Evaluation (RARE) studies, these areas have been inventoried and their wilderness characteristics considered for potential designation as wilderness under the Wilderness Act of 1964 (Baldwin 2004). The National Wilderness Preservation System is comprised of federal lands, “where the earth and its community of life are untrammelled by man, where man himself is a visitor and does not remain” (16 USC 1131 et seq.). Wilderness areas are designated only by Congress and are generally protected from commercial enterprises, road construction, mechanical vehicles, and structural development.

Roadless areas provide a variety of social and ecological benefits, and these unfragmented lands have become even more important as unprotected areas are increasingly developed and converted to urban uses. Among other benefits, they provide clean sources of drinking water and help prevent downstream flooding, protect threatened and endangered species, provide a wide variety of recreation opportunities, and serve as barriers against invasions of nonnative species. The Apache-Sitgreaves National Forests include approximately 285,000 acres of inventoried roadless areas (USFS 2001c).

In 2001, the Forest Service published a final rule that prohibited several activities in inventoried roadless areas (IRAs). These activities were prohibited because they threatened to diminish the areas’ suitability as designated wilderness (USFS 2001b). With significant exceptions, road construction and reconstruction and timber cutting were prohibited in IRAs. Implementation of this rule was administratively delayed, then enjoined by two separate Federal District Courts, and remains enjoined under appeal (Baldwin 2004). Subsequently, a new rule was adopted by the USDA on May 5<sup>th</sup>, 2005, that provides individual states with significant flexibility in managing IRAs by allowing governors to petition the Secretary of Agriculture to create special, state-specific rules (USFS 2004g). According to a report from the nonpartisan Congressional Research Service, the new rule suggests that IRAs “would be presumed available for a variety of uses, including timber harvests, subject to unit-by-unit planning processes” (Baldwin 2004).

### *Off Highway Vehicle Use*

Historically, recreational use of the forests was non-motorized except on major forest roads. Beginning in the 1980s, however, the use of motorized recreational vehicles significantly increased (USFS 1999a). Currently, 1.1 million Arizonans, slightly more than 20% of the state’s residents, identify themselves as motorized trail users (USFS 2003a, Arizona State Parks 2004). The popularity of OHVs creates yet another challenge to the FS’s commitment towards balancing recreational use and forest health. OHV use can provide substantial economic advantages to surrounding communities. According to Silberman (2003), OHV users spent a combined 436.1 million in 2002 in Apache, Navajo, Greenlee, and Coconino Counties, representing 46.8 million in state tax revenue. However, a number of studies have shown that OHV use also poses a threat to resources through trail deterioration, vegetation damage, reduced air and water quality, noise pollution, wildlife disruption, and social conflicts arising between different groups of recreational users such as hikers or bikers.

This, combined with the increased problems caused by illegal use, makes managing OHVs a topic of importance to the forests (Stokowski and LaPointe 2000, Bluewater Network 1999). In response, the ASNF and four other Arizona national forests initiated a five-forest Amendment for OHV travel. Still in the early stages at the time of this assessment, the Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests adopted a Draft Environmental Impact Statement (DEIS) that proposes limitations and/or restrictions on cross-country travel by OHV users on lands managed by the five forests. Several issues need to be resolved before these amendments can be adopted into existing forest plans, among them the feasibility of enforcing new OHV restrictions and the right of entry for individuals into certain

areas for the purposes of cultural practices, fuelwood gathering, or retrieval of big game (USFS 2003a, USFS 2003c, Arizona State Parks 2004). Only the Coronado NF is not a party to the proposed amendment, having previously established forest rules regarding cross-country travel. Contrary to existing regulations in the ASNF and other forests in Arizona, areas within the Coronado are considered closed unless otherwise posted. This has effectively prohibited the cross-country travel by OHVs that the five-forest amendment currently seeks to address.

A review of the FS-wide policy regarding OHV travel is also taking place at the national level. The draft national OHV policy, published in July 2004, would require forests to designate a system of roads and trails for OHV use. This process will likely require a considerable amount of time, personnel, and financial resources to complete (Roth, pers. comm.).

## 10. Summary of Key Findings and Recommendations

The communities surrounding the Apache-Sitgreaves National Forests (ASNF) have undergone substantial social and economic changes over the last twenty years. The purpose of this assessment has been to illustrate some of the more dramatic trends in key indicators and discuss their likely implications for future forest planning and management.

Among the most noteworthy trends in the area of assessment is a relatively limited increase in population over the past two decades. Data show that overall population within the five counties surrounding the ASNF increased by 41%: less than half the rate of increase for the state of Arizona over the same period. Within the area of assessment, population growth was greatest in Coconino County. Between 1990 and 2000, growth in the retirement-age population and an upsurge in individuals of multiple race and Hispanic origin were particularly strong. Although increases in total housing were also below average for the state of Arizona, the area reported substantial increases in seasonal housing, particularly in Apache and Navajo Counties. Similarly, median home values in the area surrounding the ASNF increased much more than was average for the state of Arizona over the same period. Together, these trends warrant careful consideration by forest planners. Ultimately, a larger and more diverse population suggests not only an increased number of potential forest users but also a change in the level and nature of interaction between the ASNF and surrounding communities.

The economies of eastern Arizona and western New Mexico are also likely to have a substantial impact on future planning and management of the ASNF. Data suggest that economic growth in the region is relatively slow. This conclusion is supported in part by limited gains in total part- and full-time employment in for each of the five counties. The most significant economic gains between 1990 and 2000 were reported for the construction, F.I.R.E. (finance, real estate, and insurance), and government sectors. Despite significant increases in per capita and family income and decreasing rates of poverty, data show that each of the five counties remained economically limited when compared to statewide figures over the same period. Meanwhile, recent indicators of dependence on natural resources have shown mixed results. As a whole, the area of assessment experienced a substantial decline in income from wood and an even stronger increase in income from special products and processing between 1990 and 2000. Each of the counties reported a relatively strong increase in tourism-related employment over the same period. Although activities such as ranching and timber harvesting continue to play an important role in rural areas, recent years have seen a continued shift away from extractive industries and toward a regional economy that is increasingly dependent on the construction, real estate, and service sectors supporting growing urban populations. When combined with ongoing demographic changes, such factors are likely to have a direct impact on the ASNF's role within the local and state economy.

A review of county comprehensive plans and long-range policies has demonstrated the importance of both travel patterns and land use characteristics surrounding the ASNF. Though road conditions have generally improved over the last several decades, research shows that expansion of regional road networks has not kept pace with travel demands arising as a result of population and industry growth. Furthermore, previous transportation planning has not always been implemented in a way that supports long-range land use plans. Such plans reveal that the preservation of open space, the sustainable use of natural resources, and the use of public lands are of growing importance to regional planning authorities, government agencies, environmental advocates, and community residents. Increasing land values, the cost of infrastructure development, and limited water supplies are among the numerous factors that have made policy formation increasingly contentious in recent decades. The ASNF has an opportunity to play an important role in the resolution of current and future transportation and land use issues by promoting sustainable regional planning policies, informing local stakeholders of the environmental and economic impacts of transportation and land use alternatives, and effectively involving surrounding communities in forest planning and management.

Concurrent with trends in the regional economy, there has been a measurable shift away from extractive uses of national forests. This trend is supported by national surveys showing continued declines in timber harvesting as well as recent data on the Apache-Sitgreaves National Forests that suggest a gradual decline in grazing and timber harvesting on forest lands between 1990 and 2000. These same reports point toward a substantial increase in recreational uses of national forests in general and the ASNF in particular. Data suggest that a significant increase in the use of OHVs is a primary reason for the Forest Service's growing concern over unmanaged recreation. These trends are consistent with the recent expansion of communities with high levels of natural resource amenities and signal a shift in the perceived role of forest lands. The ASNF has the opportunity to incorporate these data on changing forest users and uses into future forest plan revisions and management priorities.

Although the incorporation of "special places" into forest management plans is a relatively new phenomenon, the ASNF has designated hundreds of natural, cultural, and recreation sites within forest boundaries. Forest archeologists and recreation staff have also made considerable progress in identifying a number of areas throughout eastern Arizona and western New Mexico that are considered special by Native American tribes, descendants of early settlers, and wilderness enthusiasts. In the future, the ASNF should continue to seek public input in identifying special places and planning for their protection.

Regional trends and Forest Service planning regulations have influenced the relationships between the ASNF and surrounding communities. In particular, the protection of wildlife, prevention of forest fire, sustainable management of area watersheds, and the formation of land use policy have involved a diverse array of stakeholders. In recent years, growing attention has been paid to these issues given the general public's expectation for adequate participation in decisions affecting public land management. Although such relationships are inherently unique and dynamic, specific frameworks for monitoring and improving community-forest interaction may aid future ASNF management objectives.

Finally, data suggest that a number of natural resource issues will continue to influence future management alternatives of the Apache-Sitgreaves National Forests. The control of invasive species, management of fire and fuels, preservation of open space, and protection of regional biodiversity each carries important implications for future forest plans. Although an exhaustive analysis of these issues is beyond the scope of this assessment, research shows that each will be significantly impacted by ongoing socioeconomic trends.

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## Appendix A. Industry Sectors for IMPLAN Data Analysis

Income from wood products and processing	
<b>NAICS Sector</b>	
133	Logging camps and logging contractors
134	Sawmills and planing mills
135	Hardwood dimension and flooring mills
136	Special product sawmills
137	Millwork
138	Wood kitchen cabinets
139	Veneer and plywood
140	Structural wood members
141	Wood containers
142	Wood pallets and skids
144	Prefabricated wood buildings
145	Wood preserving
146	Reconstituted wood products
147	Wood products, N.E.C.
148	Wood household furniture
152	Wood T.V. and radio cabinets
154	Wood office furniture
157	Wood partitions and fixtures
161	Pulp mills
162	Paper Mills-Except Building Paper
163	Paperboard Mills
164	Paperboard containers and boxes
165	Paper Coated & Laminated Packaging
166	Paper Coated & Laminated N.E.C.
168	Bags-Paper
169	Die-Cut paper and Board
170	Sanitary Paper Products
171	Envelopes
172	Stationary Products
173	Converted Paper Products N.E.C.

Tourism employment*	
<b>NAICS Sector</b>	
<b>Retail</b>	
449	General Merchandise Stores
450	Food Stores
451	Automotive Dealers and Service Stations
452	Apparel & Accessory Stores
455	Miscellaneous Retail
<b>Restaurant / Bar</b>	
454	Eating and drinking
<b>Lodging</b>	
463	Hotels and lodging places
477	Automobile Rental and Leasing
<b>Amusements</b>	
486	Commercial Sports Except Racing
487	Racing and Track Operations
488	Amusement and Recreation Services
489	Membership Sports and Recreation Clubs

Income from special forest products and processing	
<b>NAICS Sector</b>	
22	Forest products
24	Forestry products
26	Agricultural-Forestry-Fishery Services

\* Discounted according to the Travel Industry Association of America Tourism Economic Impact Model (TEIM). TEIM attributes the following percentages of gross sales to tourism: lodging (95%), restaurant/bar (23.62%), retail (10.91%), and amusements (6.43%).

Source: Arizona Tourism Statistical Report 2003, Arizona Office of Tourism (AZOT)

Appendix B. Indirect Economic Effects of Forest-Related Products in the Apache-Sitgreaves National Forests

## Output, Value Added and Employment

July 26, 2005

Base Year: 2002

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Industry	Industry		Employee	Proprietor	Other Property	Indirect	Total
	Output*	Employment	Compensation*	Income*	Income*	Business Tax*	Value Added*
1 11 Ag, Forestry, Fish & Hunting	335.177	2,153.273	14.050	5.148	23.690	8.444	51.332
19 21 Mining	783.941	3,190.731	176.985	78.414	147.522	40.396	443.318
30 22 Utilities	79.386	319.075	17.234	1.347	25.223	7.317	51.122
33 23 Construction	767.805	7,185.058	193.167	67.341	30.083	3.457	294.048
46 31-33 Manufacturing	885.175	3,712.443	172.219	40.457	128.510	6.218	347.403
390 42 Wholesale Trade	118.376	1,181.955	42.905	4.202	18.739	19.858	85.704
391 48-49 Transportation & Warehousing	512.239	3,810.187	186.055	13.540	63.747	13.829	277.171
401 44-45 Retail trade	717.577	13,845.738	275.541	51.620	105.262	106.839	539.263
413 51 Information	264.691	1,333.742	53.944	6.570	49.540	10.109	120.163
425 52 Finance & insurance	191.353	1,518.830	50.803	3.774	54.249	3.508	112.335
431 53 Real estate & rental	264.121	3,689.273	34.504	16.760	96.335	23.223	170.822
437 54 Professional- scientific & tech svcs	176.128	2,532.445	62.824	44.747	17.207	2.343	127.120
451 55 Management of companies	30.823	277.321	13.192	0.762	6.272	0.332	20.558
452 56 Administrative & waste services	120.919	2,326.579	37.012	9.206	12.513	2.571	61.301
461 61 Educational svcs	80.250	2,266.356	47.573	-3.849	-0.747	0.116	43.093
464 62 Health & social services	758.063	10,015.277	343.097	36.474	36.116	5.403	421.091
475 71 Arts- entertainment & recreation	139.421	2,324.270	44.143	4.690	15.689	8.671	73.193
479 72 Accommodation & food services	599.812	14,260.228	202.830	14.541	69.968	37.597	324.937
482 81 Other services	299.956	5,848.352	106.551	23.188	8.487	3.375	141.600
495 92 Government & non NAICs	2,549.994	32,302.010	1,480.219	0.000	742.289	68.560	2,291.068
Totals	9,675.205	114,093.141	3,554.848	418.933	1,650.692	372.169	5,996.642

\*Millions of dollars