Natural Environment

Introduction

The quality of its natural environment defines Coconino County. Dramatic landscapes and recreational opportunities attract visitors and provide amenities to residents. Unfragmented habitats and WILDLIFE CORRIDORS maintain ecological and species diversity. Scenic viewsheds, air quality, water quality, and other environmental features like dark skies provide important quality of life values for residents. Time and again, county residents have supported the conservation and STEWARDSHIP of natural resources, as well as the maintenance and restoration of healthy ECOSYSTEMS. Many county residents have strong, traditional connections with lands, waters, and wildlife that go back many hundreds of years. This Plan strives to honor this relationship by both supporting traditional uses and practices and by promoting wise stewardship of our natural environment. The goals and policies of this chapter reflect this commitment to CONSERVATION of the environment in relationship to land uses that intersect with important natural features.

As discussed in the Sustainability and Resiliency Chapter, Coconino County is committed to recognizing the interconnectedness of environmental, economic and social factors in negotiating sustainable land-use outcomes. It is fully acknowledged that a balance must be found between conservation efforts and the recognition of economic trade-offs and private property rights. This important balance will conserve natural systems and landscapes, expand growth in the tourism related economy, and help to maintain property values.

This chapter establishes goals and policies that will conserve ENVIRONMENTALLY SENSITIVE FEATURES, wildlife habitat, native plant communities, improve the health of forest ecosystems, minimize soil erosion and improve air quality so that residents continue to enjoy this unique natural heritage.

Collaboration is Necessary

Most lands within Coconino County are managed by federal, state and tribal agencies. In this context, it is essential that the County work collaboratively with these entities, incorporated communities, and private land owners to carefully plan so as to minimize the future development impacts to water resources, environmentally sensitive features and wildlife habitat. Looking ahead, this context will require the County to work across boundaries to find creative and functional solutions to regional challenges.

Environmentally Sensitive Features

Environmentally sensitive features are elements in the landscape that play a particularly large role in supporting wildlife and plant diversity, and are at the same time especially sensitive to degradation. Environmentally sensitive features such as surface water and associated vegetation, floodplains, critical habitat, steep slopes, ridgelines and large-diameter trees and snags need to be

considered during the initial stages of the development-design process. Through INTEGRATED CONSERVATION DESIGN or similar measures, we can maintain or increase land values by retaining as much of their natural characteristics as possible. In some cases, development setbacks or buffers from environmentally sensitive features provide adequate protection, while in others, surrounding topography and land use are important considerations in planning for their protection.

Because water is scarce in Coconino County, water features such as streams, wetlands, lakes, springs, riparian areas, floodplains and their associated ecosystems are particularly valuable and vulnerable to impacts. Riparian and wetland areas comprise less than ½ of 1 percent of the surface area of Arizona, yet 80 percent of Arizona's wildlife species use this HABITAT at some point in their lives[1]. Floodplains and RIPARIAN AREAS often also serve as wildlife movement corridors. Likewise, springs and seeps provide unique habitats for a variety of invertebrates and plants, many of which occur nowhere else in North America. Seventeen (17) of the twenty (20) federally THREATENED OR ENDANGERED SPECIES (animal) that occur in Coconino County live in water or riparian habitat *(see **Table 1** at the end of the chapter)*. In addition, FLOODPLAINS, WETLANDS, and riparian areas perform important ECOSYSTEM SERVICES to humans; such as flood attenuation, water filtration and groundwater recharge. Importantly, some springs and sensitive habitats are not only critical environmental attributes but are often considered sacred cultural sites.

Water sources can be easily degraded by human activities. Ground disturbance can degrade aquatic environments through changes in hydrology and water quality. When groundwater levels drop due to human use or changes in precipitation, springs and streams can dry up. The potential for conservation action depends on our ability to influence water resource development, influence public land-management decisions, and provide guidance and incentives to private landowners for conserving and restoring these important features. The Natural Resource Conservation map (*at the end of this chapter*) displays some of these features throughout the county.

Steep slopes and ridgelines are also environmentally important and sensitive to disturbance. Steep slopes frequently host a wide range of vegetation and habitat types that support high biodiversity. Ridgelines are often used by migrating birds and mammals to navigate across the landscape. At the same time, property owners often desire steep slopes for residential construction because they can offer spectacular views. Because of the unstable and erodible soils that often occur on steep slopes, development can result in soil loss and degradation. Structures built along these features can also disrupt or inhibit animal movement. As of 2015, the County's ability to manage development on such features is limited, though it does have the authority to adopt a regulation that would do so.

Many tracts of grasslands in northern Arizona have deteriorated in the last 130 years due to a number of factors including historic overgrazing, fire suppression, encroaching woodland

[1] Chaney, E., W. Elmore, and W. S. Platts. 1990. Livestock grazing on western riparian areas. U.S. Environmental Protection Agency. 45 pp.

vegetation and housing development[2]. Some wildlife species associated with grasslands have also declined; including American pronghorn antelope, Gunnison's prairie dog, and black-footed ferret[3]. The majority of grasslands in Coconino County are privately held, so restoration and conservation of this ecosystem will fall primarily to ranchers and other private citizens. Grasslands and the wildlife that depend on them should be conserved through appropriate livestock and range management, removal of encroaching woodland vegetation, preventing the spread of invasive weeds, minimizing new roads and fences, modifying fences to allow wildlife passage, and reintroducing fire where appropriate.

Timber harvesting practices during the last 130 years have resulted in few remaining stands of old growth ponderosa pine trees in Coconino County. The large-diameter trees and the snags that remain provide important habitat features for many forest-dependent wildlife, including endangered and sensitive species. Where possible, old growth trees should be retained and forest thinning practices elsewhere should strive to create a distribution of tree age classes that create habitat diversity.

Goal: Protect the integrity and resiliency of the natural environment with special attention to environmentally sensitive features.

Policies:

1. The County encourages the protection and restoration of environmentally sensitive features as opportunities arise and resources become available.

2. The County recognizes the overlap between some environmentally sensitive features and their importance as traditional tribal, sacred, and cultural sites, including but not limited to springs, caves, eagles nests, and plant gathering areas.

3. The County will consider adopting ordinances that explicitly protect environmentally sensitive features from the impacts of development.

4. The County will pursue developing a **Coconino County Natural Resource Inventory System** that houses publically-available datasets related to environmental assets for use in project planning and review.

5. Development projects and subdivisions, including placement of lots, alignment of roads, and installation of other structures and infrastructure, will be designed to minimize alteration of natural landforms, hydrology, and native vegetation and maximize conservation of environmentally sensitive features.

[2] The Landsward Institute, 2005. The Importance of Grasslands in Northern Arizona. http://www.landsward.nau.edu/document_forms/Final%20Grasslands%20Brochure%202005%201%20MB.pdf

[3] Arizona Game and Fish Department. 2012. Arizona's State Wildlife Action Plan: 2012-2022. Arizona Game and Fish Department, Phoenix, Arizona.

6. Development projects will be located outside of floodplains in order to prevent property damage, protect riparian areas, and facilitate water infiltration into the ground. Floodplains will be delineated by the County using the best available data.

7. The County promotes the use of conservation tools such as conservation easements, integrated conservation design, open space dedication, fee-simple acquisition and transfer of development rights to protect environmentally sensitive features, habitat and open space.

Wildlife

Coconino County features impressive, grand LANDSCAPES, valued not only for their scenic qualities, but also for the wildlife that inhabit them. Like soils and vegetation, healthy wildlife populations and biodiversity are integral to ecosystem health. Wildlife also provide high aesthetic value to residents who enjoy seeing wildlife and knowing that populations are robust. In addition, wildlife-oriented recreation such as hunting, fishing and viewing typically contribute roughly $325 million to Coconino County's economy every year[4] [5].

Coconino County contains large blocks of federally-owned land that is managed to remain in a natural state. These public lands contribute significantly to the mobility and persistence of many native wildlife populations. Private and State Trust land also provide important habitat in the county while serving the additional role of providing key linkages between these blocks of public land. Many species such as elk and black bear have large home ranges and depend on this habitat connectivity to access needed resources across seasons and years. Consequently, the best way to sustain wildlife populations into the future is to minimize fragmentation and ensure that habitat remains connected by viable wildlife movement corridors. Roads and development are examples of activities that can fragment habitat and reduce wildlife movement, which can result in fewer animals supported by the environment.

Wildlife movement corridors are swaths of land that allow wildlife to move through, even when the surrounding landscape is converted to other uses. For highly mobile species such as birds and bats, a series of migration stopovers (such as wetlands) can function like a movement corridor. However, for most wildlife species, a movement corridor must be continuous and free of barriers such as roads, railways, high fences, and human development.

With significant funding from Coconino County, the ARIZONA GAME and FISH DEPARTMENT (AGFD) has mapped wildlife movement corridors[6] [7] using information from

[4] Arizona Game and Fish Department. 2013. Economic Impact of Fishing in Arizona. Study conducted by Responsive Management for the Arizona Game and Fish Department.
[5] U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2011. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.
[6] Arizona Game and Fish Department. 2011. The Coconino County Wildlife Connectivity Assessment: Report on Stakeholder Input. Flagstaff, Arizona. http://www.azgfd.gov/w_c/conn_Coconino.shtml.
[7] Arizona Game and Fish Department. 2013. Coconino County Wildlife Connectivity Assessment: Detailed Linkages. San Francisco Peaks – Mogollon Rim Linkage Design. Phoenix, Arizona. http://www.azgfd.gov/w_c/conn_Coconino.shtml.

wildlife biologists, radio-collared animals, and GIS models *(see Natural Resource Conservation map at the end of the Chapter).* As these mapped corridors are reviewed during the land use planning process, resource experts evaluate identified corridors and the best available data to make management recommendations. It may not be necessary to preserve the entire corridor in order to maintain its ecological function. Rather, the corridor should be managed to minimize and mitigate barriers that would otherwise constrain animals from moving through as they access adjacent habitat. If continuous portions of these wildlife corridors can be conserved into the future, it will allow seasonal movement of species, keep populations genetically connected, and potentially increase wildlife resilience to climate change[8].

Another effort led by AGFD and the ARIZONA DEPARTMENT of TRANSPORTATION (ADOT) has identified sections of highways in the county that currently inhibit wildlife movement and could be improved by providing wildlife crossing systems in the future. Wildlife crossing systems usually include fences that "funnel" wildlife through existing or constructed highway underpasses or overpasses. ***Figure 1*** shows a depiction of a proposed American pronghorn overpass on State Highway 89. Initial results of a wildlife crossing system along Interstate 17 south of Flagstaff show that elk and deer learn to use the crossings, resulting in a 97% decrease in wildlife-vehicle collisions on the freeway (from 20 collisions per year to 1)[9]. Expanding these efforts along highways across the county will benefit both people and wildlife in coming years by reducing wildlife-vehicle collisions and increasing wildlife connectivity and mobility across major highways.

Twenty species in Coconino County are federally listed as THREATENED OR ENDANGERED (T&E) under the Endangered Species Act (ESA) (Table 1). The majority of these species are dependent on aquatic environments which are primarily fed and dependent on stable groundwater levels in regional aquifers. Impacts to these federally listed species are assessed and regulated by the U. S. Fish and Wildlife Service. The Arizona Game and Fish Department also maintains a list of Species of Greatest Conservation Need (SGCN). In Arizona which categorizes species by their level of rareness and vulnerability. Coconino County supports the conservation of T&E-ESA and SGCN-Listed Species. Because land conversion and development have the potential to impact these species the County will proactively work with developers to minimize and mitigate impacts to them.

American pronghorn antelope once roamed widely across the county but herds are now greatly restricted in their movements by roadways and fences. Many standard barbed wire fences entangle and kill wildlife. However most can be modified to allow pronghorn and other wildlife passage while still containing livestock. Removal of unnecessary fences and modification of existing fences can greatly benefit pronghorn and other species in Coconino County. More guidelines for wildlife-friendly fencing can be found online[10].

[8] The Arizona Wildlife Linkages Workgroup, 2006. Arizona's Wildlife Linkages Assessment. Phoenix, Arizona. http://azdot.gov/docs/planning/arizona_wildlife_linkages_assessment.pdf?sfvrsn=7

[9] Arizona Game and Fish Department. February 2014. Evaluation of a Wildlife Fencing Retrofit along Interstate-17; Munds Park to Woods Canyon, Quarterly Progress Report. Prepared for ADOT Research Center.

[10] Arizona Game and Fish Department. Wildlife Compatible Fencing Guidelines. http://www.azgfd.gov/w_c/documents/110125_AGFD_fencing_guidelines.pdf

California condors are an endangered species that occurs in northern Coconino County. Lead poisoning is the leading cause of death in condors, and the main obstacle to condor recovery. The primary source of this lead is from ammunition used by hunters when game carcasses and gut piles are left in the field. This lead affects other species of scavengers too. The solution is for hunters to use non-lead ammunition. The County supports condor recovery and will work with partners to promote the use of non-lead ammunition.

***Figure 1**. Artist's rendering of a proposed American pronghorn overpass to facilitate movement across State Highway 89 at milepost 441*[11].

Gunnison's prairie dog is native to Northern Arizona and is on the list of Species of Greatest Need. As an example of partnerships that increase the County's awareness of these issues and solutions to habitat loss, local non-profits work with jurisdictions to identify prairie dog habitats and relocate prairie dog colonies in areas being considered for development. Working with conservation partners, such as Habitat Harmony, during the review of development projects, increases the County's ability to respond to concerns regarding sensitive species and habitats and contributes to meeting conservation objectives as stated in this Plan.

Goal: Conserve wildlife, their habitats and movement corridors.

Policies:

8. The County encourages use of integrated conservation design, zoning, and other land use strategies to conserve wildlife habitat, wildlife movement corridors and environmentally sensitive features.

9. Development projects (including roads, fences and trails) should minimize and/or mitigate impacts to federally listed (T&E-ESA) and state sensitive species (SGCN-Listed Species).

10. The County supports appropriate road design as well as closure and rehabilitation of unnecessary roads causing resource damage.

[11] Arizona Game and Fish Department. 2011. Assessment of Pronghorn Movements and Strategies to Promote Highway Permeability: US Highway 89. Final Report 619. Prepared for ADOT Research Center.

11. The County favors projects that conserve open space, wildlife movement corridors and wildlife watering areas.

12. The County will work with partners to protect state sensitive and federally threatened and endangered wildlife and plant species.

13. The County will continue to support a wildlife planner position that contributes to land use recommendations and consults with staff, decision-makers, and the public about natural resources stewardship.

14. The County will cooperate with AGFD, ADOT and other willing parties to maintain wildlife permeability within wildlife movement corridors and across restrictive sections of major roads, fences, and other barriers.

Vegetation

Healthy plant communities play many vital ecological roles; such as soil building and stabilization, water infiltration, watershed health, heat absorption, carbon and pollutant sequestration and providing habitat for animals and other plants. Coconino County's diverse topography creates a range of temperature and precipitation zones that support a broad array of plant communities. The bottom of the Grand Canyon (2,460 feet), for example, contains desert shrubs such as yucca, mesquite, and ocotillo, while the San Francisco Peaks (12,637 feet) feature alpine tundra above tree line. Between these elevations lie grasslands, piñon-juniper woodlands, and ponderosa pine and mixed conifer forests. Coconino County contains the largest contiguous expanse of ponderosa pine forest in North America. In addition, riparian areas like Oak Creek Canyon support highly diverse natural communities, where deciduous trees like cottonwood and sycamore prevail *(see Vegetation Types map at the end of the Chapter)*. Seven (7) plants in Coconino County are listed as threatened or endangered species under the *Endangered Species Act of 1973 (see **Table 2** at the end of the chapter)*.

INVASIVE and NOXIOUS WEEDS pose an increasing economic and ecological threat to Coconino County. They are typically non-native species that get established on disturbed soil, spread rapidly into adjacent areas, can displace native species and disrupt ecosystem processes. Efforts to manage and monitor infestations on public and private land are costly and time consuming. Some of the most problematic weeds in the county include cheatgrass, diffuse knapweed, kochia, Scotch thistle, yellow starthistle, dalmation toadflax, and leafy spurge.

The Arizona Department of Agriculture is responsible for regulating invasive weeds in the State. They maintain a list of weeds that are subject to legal restrictions and potential quarantine. However, the control of these weeds is the responsibility of the land owner. An effective weed management plan includes four strategies: prevention, early detection, timely management and site rehabilitation. By focusing on these strategies, most new infestations can be prevented or controlled before they spread. Unfortunately, by the time an infestation is firmly established, it can be extremely costly to control and nearly impossible to eradicate.

Coordinated WEED MANAGEMENT AREAS consisting of local and federal agencies, non-governmental organizations (NGOs), and citizen volunteers exist to spearhead invasive plant

management throughout the county in the areas surrounding Flagstaff, Williams, Grand Canyon National Park, Fredonia, and the Hopi and Navajo Reservations. For example, the San Francisco Peaks Weed Management Area (SFPWMA) is the group coordinating weed management in the greater Flagstaff area. The SFPWMA includes participating staff from the U.S. FOREST SERVICE (USFS), Coconino Natural Resource Conservation District, Coconino County Cooperative Extension, NATIONAL PARK SERVICE (NPS), the City and County, as well as other agencies and NGOs for a total of about 27 cooperating partners. The partnering organizations are actively pursuing education and outreach, weed surveys, threat analysis, and direct weed control. Controls include mechanical treatment such as pulling or mowing, chemical treatment with herbicides, cultural treatment such as grazing and biological treatment such as predatory insects or pathogens.

Effective control of invasive weeds requires cooperation across agencies, ranchers, and private citizens. When control efforts are coordinated across property lines, they are much more effective at removing infestations. New development projects in Coconino County are usually required to submit and adhere to a weed management plan. Individual citizens are encouraged to participate in weed management efforts by learning to identify and remove them from private property. More information and outreach materials are needed for Coconino County residents in order to help land owners identify and effectively remove weeds.

To support the successful outcomes discussed in this section it is recommend that a position be established for a plant community liaison with the following responsibilities; (1) Coordinate with other agencies to assess risk and promote the management of healthy plant communities, (2) Coordinate invasive plant education and outreach activities, (3) Coordinate weed management efforts across County departments, (4) Consult on proposed development projects.

Goal: Conserve and restore native plant communities while controlling populations of invasive weeds through prevention and environmentally-responsible eradication.

Policies:

15. The County will create comprehensive invasive weed management guidance and/or a weed ordinance. Weed management plans will be required for most development projects and forest restoration projects involving ground disturbance or road maintenance. Management plans will be required to address preventing weed establishment and timely control.

16. Construction plans for development, infrastructure improvements and forest restoration projects will include a plan for minimum disturbance of native vegetation and soils.

17. Landscaping for new developments shall emphasize minimizing the area disturbed and using native plants and drought-tolerant species appropriate to the area. Revegetating disturbed areas will be required in most cases and planting/seeding native species strongly encouraged.

18. The County will cooperate with all willing partners to inventory, eradicate and control invasive non-native vegetation.

19. The County will cooperate with private, state, federal, tribal and/or NGO partners to identify and establish a position for a plant community liaison to support and implement efforts to conserve and restore healthy native plant communities on a regional basis.

20. When new developments are proposed adjacent to public land, the County will coordinate with Forest Service or other entity to minimize the spread of invasive species from private to public land.

21. The County will pursue aggressive weed-control strategies in its public rights-of-way, other County-owned properties, utility lines, and construction and maintenance projects.

22. The County Parks and Recreation Department will pursue opportunities with other agencies and volunteer groups to control the spread of invasive weeds on public park lands and natural areas.

23. The County will support public education programs to help residents learn how to identify and control invasive weeds on private property.

Forest and Land Health

Historic land management practices have altered Coconino County's ecosystems in the last 150 years. In particular, historic overgrazing and fire suppression have changed our grasslands, pinyon-juniper WOODLANDS and ponderosa pine forests. The result is that these ecosystems now contain more trees and shrubs per acre than they did historically, leading to decreased tree vigor, less grassland cover and more soil erosion[12].

In the ponderosa pine forest, this ecosystem change has also led to larger, more severe and destructive wildfires than occurred historically. Today's wildfires tend to burn with greater severity, resulting in the consumption of most trees, ground cover and organic soil. This can result in EROSION, downstream flooding[13] and damage to watershed health and water quality. It is estimated that forest recovery could take decades to hundreds of years following such fires[14]. Also, because severely burned areas become vulnerable to invasive and noxious weeds, these vegetative changes can be significant and often irreversible.

Ponderosa pine forest management is needed in both the WILDLAND/URBAN INTERFACE as well as the wildland setting in order to reduce the likelihood of destructive wildfires and restore ecosystem health. In the wildland/urban interface and private inholdings within National Forest land, forest management should focus on thinning trees, reducing fuels and creating defensible space around structures. Tools and approaches for avoiding fire in these settings are discussed in detail in the Public Safety Chapter of this Comprehensive Plan.

[12] Covington, W.W. and M.M. Moore. 1994. Postsettlement Changes in Natural Fire Regimes and Forest Structure. Journal of Sustainable Forestry 2(1-2).

[13] Neary, D.G., K.A. Koestner, A. Youlberg, P.E Koestner. 2012. Post-fire Rill and Gully Formation, Shultz Fire 2010, Arizona, USA. Geoderma 191, p. 97-104.

[14] Savage, M. and J.N. Mast. 2005. How Resilient are Southwestern Ponderosa Pine Forests After Crown Fires? Canadian Journal of Forest Research, 35(4): 967-977.

The Coconino and Kaibab National Forests and the ARIZONA STATE LAND DEPARTMENT manage most of the forested lands in Coconino County. Forest restoration practices on these lands typically focus on restoring historic forest structure, composition and function. These practices should aim to improve WATERSHED, forest and soil health by creating a more open, mixed-aged structure with clumps and groups of mixed-aged trees separated by grassy openings. These restoration activities often require cutting a significant portion of the trees in a stand using heavy machinery. For a few years following such work, the forest can appear denuded and unhealthy to residents. However, with time, grasses and forbs fill in, and the resulting forest is healthier and more resilient.

Fire is a natural and necessary component of forest and land health in northern Arizona. In ponderosa pine forests, for example, fire is needed approximately every 5 to 15 years. Necessary changes to U.S. Forest Service fire policy now prescribe fire and allow many natural fires to burn in a controlled fashion. Although these fires create smoke that can be a nuisance to residents, it is necessary to let these fires burn. In order to restore our forests, these longer-lasting, lower intensity fires are necessary, and can be expected throughout the region in the coming years.

Recognizing the need to apply forest restoration across the landscape, several partnerships have formed across private, public and non-profit sectors to facilitate large-scale efforts. The Greater Flagstaff Forestry Partnership and the Ponderosa Forest Advisory Council have been integral to the advancement of forest restoration science and implementation throughout the region. Currently, two large-scale projects are underway to help improve forest and land health *(more detail on both projects in the Public Safety Element)*. The *Flagstaff Watershed Protection Project* is designed to avoid fire and flooding and protect drinking water for the City of Flagstaff. The *Four Forest Restoration Initiative (4-FRI)* is slated to move towards restoration of hundreds of thousands of acres across the Kaibab and Coconino National Forests. These two efforts are just beginning implementation in 2015, but promise to yield environmental, social, and economic benefits throughout the county in the years to come.

Goal: Improve forest and land health and promote the restoration of forest ecosystems.

Policies:

24. Work with public and private partners to restore forest ecosystems in order to improve ecosystem resiliency and reduce the risk of high-severity wildfire.

25. Educate and encourage property owners to participate in fuels reduction and other measures that reduce risk to human safety and property.

26. Support fuels reduction efforts by helping find disposal methods for the resulting green waste.

27. New developments in forested areas will be assessed in terms of vulnerability to wildfire and required to adhere to firewise practices.

28. Forest restoration and fuels reduction projects will consider risk to and from nearby adjacent land owners' property, resources, and environmentally sensitive features.

Soils

Soils are important in the planning and development process for several reasons. They serve basic functions in ensuring that roads, buildings and structures are adequately supported and wastewater systems function properly. Healthy soils also form the basic building blocks of a healthy environment because they support vegetation, recycle nutrients, and absorb and purify water. They are integral with the native vegetation where they develop and host a complex community of insects, fungi, roots and bacteria that enable these functions. When soils are disturbed during land development, these essential functions are disrupted. If soils are not quickly stabilized with vegetation after disturbance, erosion, airborne dust, invasive weeds, and degraded water quality can quickly result. Topsoil (typically the top 4-12 inches) contains most of the microbial community and should be set aside before construction and re-applied after construction to facilitate reestablishment of vegetation. If proposed projects are likely to result in erosion, an Erosion and Sediment Control Plan may be necessary in project design. Such a plan may specify approaches such as slope grading and seeding with native or desirable non-native plants.

Soils are important in the management of wastewater. In Coconino County, a large proportion of the residential development contains on-site (or septic) systems for the treatment and disposal of WASTEWATER. These systems rely on soil bacteria to break down waste material as water PERCOLATES downward. Loamy soil (mixture of clay and sand) is the ideal texture to facilitate water filtration. Coarse sand and bedrock are examples of soils or substrates that are unsuitable for septic systems because they do not adequately filter water before it reaches the groundwater below.

Shallow or unsuitable soils make the installation of septic systems difficult and expensive because conventional septic tanks and leach fields may not be feasible. Surface water and groundwater contamination associated with septic systems often stem from failures due to their age or improper maintenance; however, even properly functioning facilities can cause water quality degradation and pose public health risks. In fact, the ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ) has identified septic systems as a contributing factor to water quality impairment in Arizona.

Coconino County Community Development Environmental Quality, (CDEQ) reviews and approves plans for both conventional and alternative on-site wastewater treatment facilities in order to ensure that they are designed and constructed in accordance with the *Arizona State Aquifer Protection Permit (APP) Rules*. Facility approval requires a "Construction Authorization" issued by CDEQ. See Water Resources Chapter for a discussion of the County's efforts to enable the reuse of residential wastewater for landscaping and other uses.

Goal: Protect soil resources and improve soil conservation practices.

Policies:

29. The review process for subdivision and other development proposals shall consider mitigation measures for drainage, erosion, sedimentation, and related issues with regards to the soil type, substrate, and slope.

30. Encourage the conservation of topsoil in construction and best management practices to prevent erosion and its impacts. Seeding and planting with native species after ground disturbance will be strongly encouraged.

31. In areas of shallow or poor soils where standard septic systems are not feasible, very low density development, integrated conservation design, a centralized treatment facility, and/or technologically advanced environmentally sensitive systems will be preferred.

32. Through its Community Development Department, the County will educate the public in selection of the best wastewater system for their site through designs that use fewer resources, may cost less to operate, and have fewer impacts on human health and the environment.

33. Educate septic system owners and pumpers who maintain the facilities, as well as designers, installers, contractors, regulators, and health officials on the proper siting, design, installation, operation, and maintenance of onsite wastewater treatment facilities.

Air Quality

Coconino County's predominantly excellent air quality is an important asset that contributes to environmental and human health, impressive views, and quality dark skies. Air quality is a function of local and regional activities and influenced by prevailing wind and weather. Primary sources of air pollution in Coconino County are vehicles, power plants, wood burning stoves, and dust[15]. Prescribed fire and wildfire can also significantly impact air quality. All areas in northern Arizona currently meet federal standards set by the U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA). The Arizona Department of Environmental Quality (ADEQ) is responsible for issuing air quality permits, monitoring air quality, and enforcing regulations.

Of the many pollutants measured, ozone is of the greatest concern in Coconino County. It is often found at moderate levels during the summer in Flagstaff and the Grand Canyon and occasionally reaches levels considered unhealthy to people prone to respiratory problems[16]. Ozone is not associated with diminishing visibility, but can impact plant health, which is why it is of concern to Grand Canyon National Park.

[15] Arizona Department of Transportation. 2004. Air Quality Sustainability Program in Coconino County. Prepared by Lima and Associates. http://azdot.gov/docs/default-source/planning/finalreport04.pdf?sfvrsn=2

[16] Environmental Protection Agency. Air Quality Index Reports: 2007-2014. http://www.epa.gov/airdata

Particulate matter generally remains below levels that would impact human health[17], current levels are associated with diminished visibility at the Grand Canyon and consequently also of concern to the National Park Service and others. Using coal from the Kayenta Mine, the Navajo Generating Station (NGS) is the largest single source of air pollution in the county[18]. Found to be out of compliance with the federal Clean Air Act, a 2015 EPA agreement with NGS has created a new operating plan for the plant.

Improving public health, protecting views of scenic areas, and maintaining the astronomical sector of our economy requires Coconino County to continue working to improve air quality. There are several tools Coconino County can use to encourage this: support energy efficiency and renewable sources of energy, promote alternative means of transportation, dust control measures, and require wood stove efficiency standards. Additionally, attracting new, nonpolluting industries will help us maintain high air quality standards.

Complaints about dust from unpaved roads are common amongst residents. There are hundreds of miles of private roadways in residential areas that the County does not maintain, and roads where the surface material is not regulated by the County nor maintained by the homeowners. The County regulates the surface of roads for commercial and industrial development and subdivisions but not for all local roadways.

PRESCRIBED BURNS are necessary to reduce fire risk, improve forest and land health, maintain wildlife habitat, and improve grazing resources. While this practice can cause respiratory problems for residents and effects should be mitigated, the County strongly supports efforts for forest restoration. ADEQ permits this burning, and fire managers model the smoke dispersion characteristics to determine the best timing for prescribed burns. Additionally, burning yard materials and trash is a common practice for rural residents. ADEQ and local fire districts may require permits depending on the scope of the burn.

Goal: Improve the county's air quality.

Policies:

34. Where desired, formation of road improvement districts, air quality districts, and road maintenance districts will be encouraged as a means of minimizing dust problems and allocating costs to those most affected.

35. The County, individual property owners, property owners associations, and road improvement and maintenance districts are encouraged to provide low-dust surfaces or pursue dust control measures on roadways under their jurisdiction.

36. The County commits to taking appropriate dust control measures while constructing and maintaining its capital improvement projects.

[17] Environmental Protection Agency. Air Quality Index Reports: 2007-2014. http://www.epa.gov/airdata

[18] Arizona Department of Transportation. 2004. Air Quality Sustainability Program in Coconino County. Prepared by Lima and Associates. http://azdot.gov/docs/default-source/planning/finalreport04.pdf?sfvrsn=2

37. The County supports conservation planning and management for dust control by land users involved in ranching, farming and forestry.

38. Economic development efforts should focus on non-polluting industry and commercial enterprises.

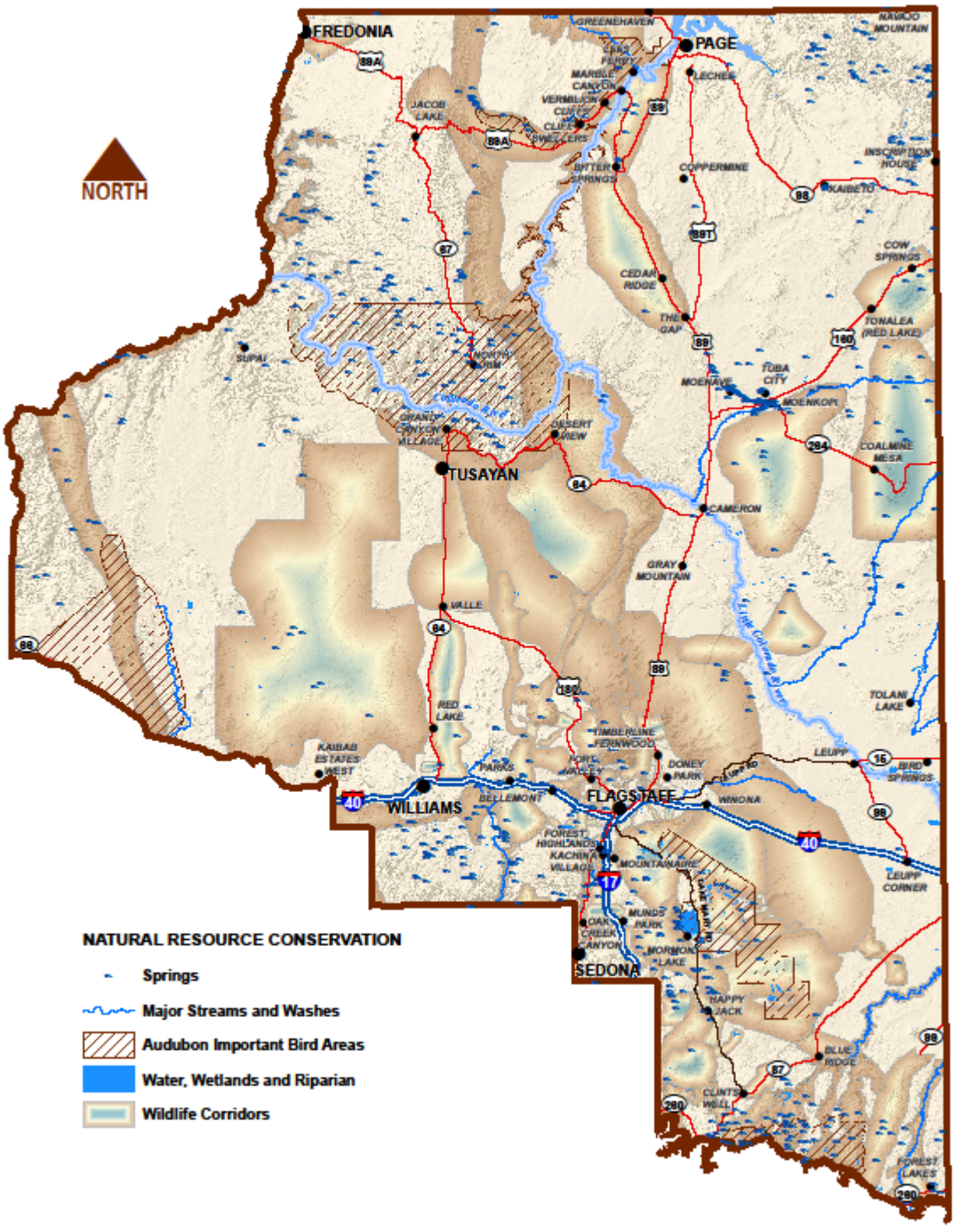
39. The County will encourage public and alternative means of transportation for its residents.

Table 1: Animal Species listed on Endangered Species Act - within Coconino County

Common Name	*Scientific Name*	*Status*	*Animal*
Chiricahua leopard frog	*Lithobates chiricahuensis*	Threatened	Amphibian
California condor	*Gymnogyps californianus*	Endangered	Bird
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Bird
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Bird
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	Bird
Gila chub	*Gila intermedia*	Endangered	Fish
Gila topminnow	*Poeciliopsis occidentalis*	Endangered	Fish
Bonytail chub	*Gila elegans*	Endangered	Fish
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Fish
Apache trout	*Oncorhynchus apache*	Threatened	Fish
Gila trout	*Oncorhynchus gilae*	Threatened	Fish
Humpback chub	*Gila cypha*	Endangered	Fish
Little Colorado spinedace	*Lepidomeda vittata*	Threatened	Fish
Razorback sucker	*Xyrauchen texanus*	Endangered	Fish
Loach minnow	*Tiaroga cobitis*	Endangered	Fish
Spikedace	*Meda fulgida*	Endangered	Fish
Kanab ambersnail	*Oxyloma haydeni kanabensis*	Endangered	Invertebrate
Black-footed ferret	*Mustela nigripes*	Endangered	Mammal
Narrow-headed gartersnake	*Thamnophis rufipunctatus*	Threatened	Reptile
Northern Mexican gartersnake	*Thamnophis eques megalops*	Threatened	Reptile

Table 2: Plant Species listed on Endangered Species Act - within Coconino County

Common Name	*Scientific Name*	*Status*	*Plant*
Brady pincushion cactus	*Pediocactus bradyi*	Endangered	Plant
Fickeisen plains cactus	*Pediocactus peeblesianus var. fickeiseniae*	Endangered	Plant
Navajo sedge	*Carex specuicola*	Threatened	Plant
San Francisco Peaks ragwort	*Packera franciscana*	Threatened	Plant
Sentry milk-vetch	*Astragalus cremnophylax var. cremnophylax*	Endangered	Plant
Siler pincushion cactus	*Pediocactus sileri*	Threatened	Plant
Welsh's milkweed	*Asclepias welshii*	Threatened	Plant



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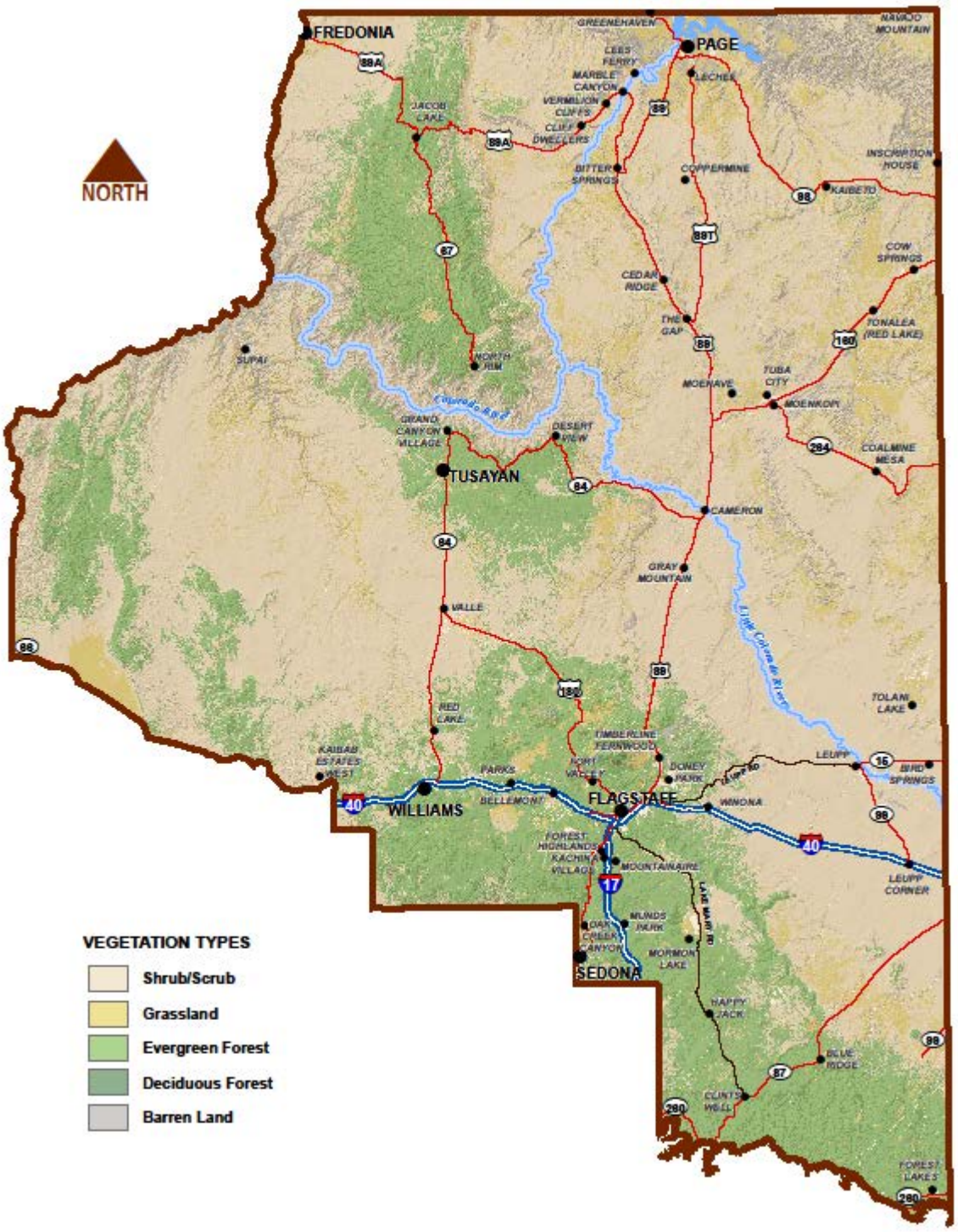

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