

**DRAFT ELEMENT:** *Below is proposed text to be found within the Regional Plan. Please review and provide comments, suggestions, corrections, addition/deletions.*

## Outline

1. Introduction
2. Relationship to Vision and Guiding Principles
3. Climate
4. Ecosystem Health
5. Noxious and Invasive Weeds
6. Wildlife
7. Environmentally Sensitive Lands
8. Soils
9. Water Quality
10. Air Quality
11. Dark Skies
12. Natural Quiet

**Comment [SL1]:** Expert Forum General Comment:  
Suggest that policies be cross-referenced to other Elements when they apply to more than one.

**Comment [SL2]:** P. Pilles and D. Wilcox:  
Planning and conservation related to archaeological resources belong in this element, not in "Community Character." Environmental impact statements typically include cultural as well as natural resources. Land use and development do impact cultural resources, especially pre-Columbian. State law mandates compliance with regulations even on private land. Integrate some aspects of Cultural Resources into other elements as appropriate, but archaeological resources are irreplaceable and must be addressed in the environmental planning and conservation elements just as natural resources are.

**Comment [SL3]:** B. Higgins  
Throughout the document, point to existing regulations and policies including federal, state, county, and municipal.

**Comment [SL4R3]:** Expert Forum expects strategies to be developed for all goals and policies.

## 1. Introduction

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The abundance of natural resources was instrumental in the early settlement of Flagstaff in the 1870s. The availability of water, timber, and forage was the basis for the economy upon which the town was founded. As time passed, the economy shifted from a focus on the extractive use of natural resources to an amenity-based approach. For example, tourism, recreation and quality of life based on the natural environment have become more important to the economy than the former extractive uses such as logging. Notwithstanding the change in emphasis from “extractive use” to “amenity,” the natural environment remains critically important to the economy, character, and quality of life of the region and remains of primary importance to residents and visitors.

Arizona Revised Statutes require both an Environmental Planning element and a Conservation element to be included in this plan. In the Flagstaff region, where the environment is such an important part of the character and economy of the community, it would be difficult, if not impossible to consider Environmental Planning separately from Conservation – the two topics are inextricably linked. Therefore, for purposes of this plan, they are merged into one element based on the presumption that the conservation of natural resources and the natural environment is critically important for the future prosperity of the Flagstaff community. In other words, underlying the Regional Plan is the basic principle that a healthy natural environment is necessary for a healthy and prosperous human community.

This element of the plan addresses climate, ecosystem health, noxious and invasive weeds, water quality, air quality, soils, wildlife, and environmentally-sensitive lands. Other resources such as dark skies and natural quiet are also discussed in this element in the context of natural resources worthy of conservation and protection.

## 2. Relationship to Vision and Guiding Principles

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The protection of the natural environment is a common thread running through virtually all elements of the 2001 *Flagstaff Area Regional Land Use and Transportation Plan*, as well as this plan update. The stewardship of the region’s ecological setting and the future vitality of its natural environment are featured prominently in the Vision Statement contained in this plan. Likewise, conservation of the natural environment is consistent with the adopted Guiding Principles, especially pertaining to sustainability, healthy ecosystems, smart growth and quality development, a vibrant and resilient economy, sense of place and community character, and partnerships. The long-term health and viability of our natural landscapes is essential to achieving the future envisioned by this plan.

### 3. **Climate**

**Comment [SL5]:** R. Scott, N. White, B. Higgins  
add “:Adaptation and Mitigation”

As a result of its high elevation, geographic location and low humidity, Flagstaff is characterized by a pleasant four-season climate and clear skies that help define our community character and quality of life. Winter and summer temperatures are mild, with average winter highs of 45 degrees and average summer highs of around 80 degrees, and the area experiences almost 300 days of sunshine a year (data from National Weather Service station at Flagstaff Pulliam Airport for the period 1950-2007 and reported in Hereford 2007). These characteristics make the greater Flagstaff area a year-round recreational haven for residents and visitors alike. Climate also plays a pivotal role in shaping the abundance and quality of our region’s natural resources, including our water supply, the composition of our ecosystems, and the availability of wildlife habitat. Consideration of Flagstaff’s current and future climate is thus foundational to the development of Environmental Planning and Conservation policies in the Regional Plan.

True to the general pattern of precipitation across the southwest, on average almost two-thirds of Flagstaff’s annual rain falls in distinct winter and summer peaks. Afternoon thunderstorms originating to the south typically develop during the July to September “monsoon” season. Summer rain is more abundant than winter, and less variable than rainfall in winter and spring. Long-term average annual precipitation in Flagstaff is 21.6 inches per year and the amount can vary considerably from year to year (Hereford 2007). Winter and summer precipitation do not contribute equally to Flagstaff’s water supply. Due to the greater amount of evaporation and surface runoff that occurs during monsoon season, summer precipitation does not appreciably increase available water supply, but can reduce peak water demand. Conversely, winter precipitation in the form of rainfall or snow increases the annual springtime surface water yield of bodies such as Lake Mary reservoir and the Inner Basin springs, despite its greater variability (Hereford 2007). Adequate snowfall plays a key role in providing the economic benefits that arise from Flagstaff’s abundant winter recreational opportunities. Snow may fall in any season and averages about 100 inches annually in the city and extreme winter snowstorms are not uncommon, as the blizzard of early 2010 demonstrated.

Local variation in climate plays a major role in shaping the range of vegetation communities, ecosystems and associated wildlife found in the region. While ponderosa pine forests predominate, elevational gradients of temperature and precipitation result in a diversity of plant communities ranging from arid grassland and pinyon-juniper shrubland at lower elevations to mixed conifer and alpine tundra at the summits of the San Francisco Peaks. This relationship between climate and vegetation was noted as early as the late 19<sup>th</sup> Century by the famous ecologist C. Hart Merriam, and helped inspire his ‘life zone concept’ following his field studies of the Peaks (Merriam and Steineger 1890). This diversity of vegetation in turn affords a range of habitats for wildlife that depend on particular plants and plant communities to meet their daily and seasonal needs. Seasonal changes in climate also shape the migratory movements of animals such as elk, deer and pronghorn through the planning area as populations move between their summer and winter ranges.

Historic records from weather stations and prehistoric climatic indicators such as tree ring widths suggest that Flagstaff and the southwest in general have long been characterized by alternating dry and wet periods, and that these have sometimes lasted for many decades or even longer (Hereford et al. 2002, Hereford 2007). These alternating periods of high rainfall and drought appear to be associated with multi-year weather cycles originating in the western Pacific commonly referred to as El Nino and La Nina, which are particularly important for winter precipitation levels (Garfin et al. 2006). By contrast, Flagstaff’s summer monsoons are most directly affected by northerly winds which develop along the western coast of Mexico, but this relationship is less well-understood by climatologists. The past decade has seen a prolonged period of elevated temperatures and drought across the southwest and associated water level drops in many regional reservoirs (Univ. Colorado at Boulder 2009), and 1950-2007 records from the National Weather Service station at Pulliam Airport indicate the period since 1996 has been the driest during this interval in the Flagstaff area (Hereford 2007). Compared to other areas of the

country, the increase in average temperatures in the southwest in recent years has been among the highest (U.S. Global Change Research Program 2009).

An unanswered question with large implications for future planning and conservation efforts in the Flagstaff area is the extent to which the recent trend toward a drier and hotter climate reflects a permanent shift associated with global climate change, and how the predicted future warming of the planet will impact our region. There is now a broad consensus among climate scientists that the recent rise in global surface temperatures is largely due to the “greenhouse effect”: the trapping of heat by elevated levels of carbon dioxide and other gases produced by the burning of fossil fuels, deforestation, and other human activities (Intergovernmental Panel on Climate Change 2007). There is also abundant evidence from around the globe that climate change is already affecting natural phenomena ranging from increased high-severity wildland fires to decreased mountain snowpack to outbreaks of insect pests to shifts in species distributions (Westerling et al 2006, IPCC 2007, US Global Change Research Program 2009, NABCI 2010, Parks and Bernier 2010).

Scientists cannot yet predict with precision how global temperature increases in coming decades will affect our regional climate, due to uncertainty regarding future rates of greenhouse gas emissions and the relatively coarse resolution of current global climate models. Nonetheless, most models predict that the American southwest will become warmer and drier overall and experience decreased snowfall and shorter winters (Seager et al. 2007, U.S. Global Change Research Program 2009, Mearns, 2010). Climate models differ primarily in the extent, rather than the direction, of the changes they predict, though scientists are less certain about how climate change may alter summer monsoon patterns in our region (Bachelet et al. 2007). The future climate predicted for the southwest is expected to cause a range of effects, many of which may interact and be exacerbated by a growing population. These include a dwindling water supply, increased frequency and severity of wildland fires, spread of invasive species and insect pests, tree die-offs, increased risk of flooding and erosion in areas of vegetation loss, and shifts in the location of suitable habitat conditions for various plant and animal species (Southwest Climate Change Network 2008, U.S. Global Change Research Program 2009, Allen et al. 2010).

While planning in the face of uncertainty presents considerable challenges, the consequences of predicted climate change for Flagstaff and their implications for natural resource policy can already be glimpsed on the landscape. A recent interagency study of northern Arizona’s water supply led by the U.S. Bureau of Reclamation (U.S. Department of the Interior 2006) projected unmet demands in the region by 2050 even with enhanced conservation measures unless further resources are developed, and cautioned that further development of the Colorado Plateau’s C- and N-aquifers could become unsustainable. All of the study’s proposed alternatives included some provision of water from Lake Powell, yet the likely reduction in Colorado River reservoirs expected under most climate change scenarios was not factored into the analysis. Therefore, it would be proactive to ensure that planning efforts incorporate the likelihood that future water supplies may be even more limited than predicted.

Climate also influences a range of conditions in the ponderosa pine ecosystem of the Coconino National Forest, which may be particularly vulnerable to the warmer and drier climate of the future (U.S. Department of Agriculture 2010). The stress of drought combined with high tree density caused the severe bark beetle infestation and tree die-off observed in Flagstaff’s forests beginning in 2002. Ponderosa forests are adapted to relatively frequent low- to moderate-intensity fires and benefit from regular burning, but the shift to a longer fire season and to more frequent severe stand-replacing fires associated with warming may represent a threat to their persistence absent aggressive restoration efforts. Modeling efforts by local scientists suggest that the ponderosa pine ecosystem may also be threatened by climate change independent of changes to fire and other disturbances, as some models predict that Arizona’s future climate may be unfavorable to the species in many areas where it is currently found (Ironside et al. 2010). These possibilities reinforce the urgency of implementing large-scale proactive restoration efforts such as the Four Forests Restoration Initiative (see the “Ecosystem Health” section of this element), which will improve the resiliency of our forests to climate change while reducing fire risk to our community.

Consideration of how climate change may affect conservation of our region's natural resources underlies the goals and policies in this element, in accord with the growing consensus among scientists and land managers in academic, agency, government, and non-governmental circles that this connection be explicitly addressed in resource management plans (Association for Fire Ecology 2006, U.S. Government Accountability Office 2007, U.S. Global Change Research Program 2009, U.S. Department of Agriculture 2010). While the promotion of regional, national and global policies to reduce greenhouse gas emissions via conservation and alternative energy development is vital (see for example "Energy" and "Transportation" in this Plan), policies designed to help minimize and mitigate the effects of projected climate change on our natural resources are equally necessary. Such climate change "adaptation strategies" inform many of the policies in the sections that follow and include actions designed to improve the resiliency of our treasured natural landscape to respond to long-term climate change. We can take actions such as thinning and prescribed fire to improve the health and resiliency of our forests, and conservation of wildlife corridors so species can move in response to shifts in their habitat. Above all, climate change will likely affect the quality of life for Flagstaff's residents in coming years in both predictable and unexpected ways and influence the long-term sustainability of our community. The stability of our water supply, outbreaks of insect pests, and the frequency and severity of wildfires may all be affected, with potentially severe economic and social consequences as Flagstaff residents continue to experience in the aftermath of the 2010 Schultz Fire (Arizona Daily Sun 2010). Adaptation to climate change should thus also be integrated into our approach to other key plan elements including energy, water use, and transportation.

**Goal:** To integrate the best available science about climate change and its projected regional effects into all policies governing the use and conservation of Flagstaff's natural resources, including development of adaptation strategies to promote sustainable use of energy, water, air, ecosystems, and wildlife for current and future generations.

**Policies:**

1. Develop water use policies which attempt to integrate current best projections of climate change effects on the Colorado Plateau's water resources, emphasize conservation and water harvesting, and minimize the energy-intensive transport and pumping of water.
2. Encourage energy efficiency and conservation in the public, commercial and residential sectors through policies that promote more efficient lighting, better insulation, and increased use of alternative energy for generation of electricity.
3. Promote management strategies such as the Four Forests Restoration Initiative to increase the resiliency of our ecosystems to the effects of climate change, including thinning and other restoration techniques for our ponderosa pine forests to reduce their vulnerability to catastrophic wildfire and insect pest outbreaks.
4. Promote transportation options such as increased public transit and more bike lanes that will reduce congestion, fuel consumption, and overall carbon emissions.
5. Maintain and restore important wildlife corridors throughout the planning area to allow wildlife to find suitable habitat in the face of climate change by moving along vegetational and elevational gradients.
6. Revisit relevant Policies and Strategies in this element as better knowledge of the likely effects of climate change for the region's resources is developed.

**Comment [SL6]:** preventing habitat fragmentation, and conserving wildlife corridors

**Comment [SL7]:** M. Jackson most accurate scientific information

**Comment [SL8]:** M. Jackson and conservation of water and energy resources, and to preserve local ecosystems and environmentally sensitive lands, wildlife diversity and habitats, and water and air quality,

**Comment [SL9]:** N. White, B. Higgins, R. Scott  
Need two Goals: 1. Adapt (to climate change)  
2. Mitigate (do what we can to decrease our contribution to the problem)

**Comment [SL10]:** R. Scott  
Declare an overarching goal to "Conserve natural resources."

**Comment [SL11]:** from R. Miller and encourage cooperation with our neighbors.

**Comment [SL12]:** Expert Forum: strategies such as weatherization,

**Comment [SL13]:** R. Miller while maintaining natural diversity of plants and animals

**Comment [SL14]:** M. Jackson traffic

**Comment [SL15]:** M. Jackson and urban growth

**Comment [SL16]:** Prevent habitat fragmentation to enable migration of plant communities in response to changing conditions.

**Comment [SL17]:** R. Miller  
7. Encourage concentrated development following an urban village concept to conserve resources and open space.

**Comment [SL18]:** R. Miller  
8. Continue to promote cooperation between levels of governments, the public and business.

#### 4. Ecosystem Health

Flagstaff residents place a high value on the environment in which we live. The community is situated in the midst of the largest contiguous ponderosa pine forest in the western hemisphere. Scattered throughout this forested landscape are a number of other less extensive but ecologically significant ecosystem types, including mixed conifer forest, alpine tundra, pinyon-juniper woodlands, grasslands, wetlands and wet meadows, and riparian areas. Ecosystem health is important in the Flagstaff region because the forest crosses all ownership and management boundaries including private lands, Coconino National Forest, Walnut Canyon and Sunset Crater National Monuments, State Trust Lands, and Camp Navajo. Almost three quarters of the land within the Regional Plan study area lies within the Coconino National Forest (72.24% -- see Table 1). Ecosystem health issues do not respect jurisdictional and ownership boundaries, and therefore it is important that all landowners and land management agencies work in concert to achieve common goals. Similarly, while much of this discussion focuses on ecological conditions in the ponderosa pine forest itself, this ecosystem and the others found in the planning area represent a biologically interconnected landscape for which land use and management decisions should be approached holistically.

Comment [SL19]: well said!

**Table 1: Flagstaff Region Land Ownership**

Owner	Acres	Percent
<i>Public Multiple-Use Lands</i>		
Coconino NF Lands	243,005	72.24
State Trust Lands	25,627	7.62
Camp Navajo	12,017	3.57
Walnut Canyon NM	3,228	.96
Sunset Crater NM	3,048	.91
County Land	374	.11
Other	705	.21
<b>Total Public Lands</b>	<b>288,004</b>	<b>85.62</b>
<b>Total Private Lands</b>	<b>48,375</b>	<b>14.38</b>
<b>Total FMPO</b>	<b>336,379</b>	<b>100.00</b>

When early settlers first entered northern Arizona, they found an open forest of large, widely-spaced pines growing in a pattern of scattered clumps and openings. They reported the ability to ride a horse at full gallop through open park-like stands of trees with an understory of waist-high grasses and wildflowers. A century later, the largest trees are gone, mature yellow pines make up a much smaller percentage of the forest composition, and dense thickets of immature black jack pines are more common. Much of the grasses, forbs, and shrubs are absent in the understory having been replaced by a carpet of pine needles.

As the largest land management agency in the region, the U.S. Forest Service manages national forest lands for multiple uses including timber, grazing, mining, watersheds, and recreation among others. For much of the 20<sup>th</sup> century, management objectives were focused primarily on logging, grazing, and fire suppression. These practices – although well-intended and based on generally accepted management practices and the public policies of the time – resulted in a general decline of forest health. Most notably, the attempt to eliminate fire from a fire-adapted ecosystem resulted in drastically increased fire danger – instead of periodic low-intensity surface fires which help to keep the forest healthy, more extreme stand-replacing crown fires completely destroy large areas. In addition to the threat of catastrophic wildfire, the forests surrounding Flagstaff are increasingly threatened by insect infestation, disease, and loss of native biodiversity. Long term climate change is another factor that could

have dramatic effects on the composition, structure, and function of the forests surrounding Flagstaff in the years to come.

In recent years there has been less emphasis on commercial logging and more emphasis on forest health, the wildland-urban interface, forest road issues, and a tremendous increase in recreational use. A better understanding of forest ecosystem health has helped scientists, land managers, and the general public to understand the important role that periodic low-intensity fire plays in a healthy ponderosa pine forest. A number of uncharacteristically large fires in the Flagstaff area in 1996 focused attention on the risk to our forests and our community posed by catastrophic wildfire. One result of this increased public awareness was the formation of the Greater Flagstaff Forests Partnership (GFFP).

The GFFP is a collaborative community partnership committed to restoring the natural ecosystem functions of the ponderosa pine forests in the Flagstaff region. The partnership is an incorporated nonprofit organization working in cooperation with the Coconino National Forest and the Rocky Mountain Research Station, and an advisory board representing diverse community interests. Participants include the City of Flagstaff, Coconino County, the State Forestry Division, other state and federal agencies, environmental organizations, university researchers, scientists, wildlife biologists, land managers, fire managers, and private citizens. The partnership is dedicated to testing, implementing, and adapting new approaches to restoring forest ecosystem health in the forests surrounding Flagstaff. Specifically, the partnership seeks to:

- Restore natural ecosystem composition, structures and function in ponderosa pine forests.
- Manage forest fuels to reduce the probability of catastrophic fire and to protect the community of Flagstaff.
- Research, test, develop, and demonstrate key ecological, economic, and social dimensions of restoration efforts.

Since 1996, the GFFP has been working collaboratively with the Forest Service to plan and implement restoration treatments within 180,000 acres of forest in the Flagstaff wildland-urban interface. By 2010, 115,850 acres of national forest land have been analyzed with a resulting 70,725 acres scheduled to be treated. Some of the methods being tested and applied include selective thinning of overcrowded stands of trees, prescribed fires, control of exotic species and reintroduction of native vegetation, restoration of riparian areas, improved grazing practices, and assessing human use and needs in the forest. In addition to such treatments on national forest land, similar efforts are being applied on private lands through the efforts of the Flagstaff Fire Department in the city, as well as Summit and Highlands Fire Districts in the unincorporated areas. Cost share funding through State Fire Assistance grants has helped fund much of the work by the respective fire departments on private lands.

Although extensive work has been done around Flagstaff to improve forest health and reduce wildfire risk, much remains to be done. Forest health was in decline for more than a century before restoration efforts began, and it will be a long term and ongoing process to restore the ecosystem to a healthier condition. While significant progress has been made in the last decade, it is important that such efforts continue into the future.

More recently, a group known as the Four Forest Restoration Initiative (4FRI) has come together to work in a collaborative fashion with the US Forest Service to accelerate restoration of 2.4 million acres of ponderosa pine forest across four national forests (including the Coconino NF) in northern Arizona. Although the focus of this initiative is mostly outside the Flagstaff Regional Plan area, it is important to think about forest health in a broader landscape-scale context. This group is made up of federal, state and local governments, environmental organizations, wood products industry representatives and other interested stakeholders who have come together around the consensus that landscape-scale restoration across the Mogollon Rim will support healthy, diverse stands of ponderosa pine, supporting abundant populations of native plants and animals; thriving communities in forested landscapes that pose little threat of destructive wildfire; and sustainable forest industries that strengthen local economies while conserving natural resources and aesthetic values.



The greater Flagstaff area features a number of other important habitat types found within or adjacent to the ponderosa pine forest, each with its own unique characteristics and conservation needs. For example, much of the region's grasslands, including Forest Service areas on Anderson Mesa and private ranchlands north and east of the San Francisco Peaks, have been altered by historical grazing, invasive weeds, shrub encroachment, and climatic changes. Recent collaborative restoration projects by private landowners and public agencies including the Forest Service have recreated more healthy grassland conditions through shrub and weed removal and the return of native plants, and further efforts should be encouraged. Similar projects to restore pinyon-juniper woodlands through thinning, seeding, and selective prescribed fire may help to return these habitats to a more natural fire regime and species composition, while improving the diversity of understory forbs and grasses to provide more desirable forage for wildlife.

Our area boasts a number of largely ephemeral wetlands including Rogers Lake, Dry Lake, ephemeral ponds on Anderson Mesa, and spring-fed wet meadow systems such as Pumphouse Meadow near Kachina Village. While these habitats are rare in Coconino County and in Arizona more generally, they represent highly valuable resources for wildlife, recreation, flood control, aquifer recharge, and other functions. Thus, their continued conservation including restrictions on nearby development and where possible the maintenance of water flows should remain a high priority. Greater Flagstaff features riparian areas with primarily intermittent flows which, like our wetlands, are prized by residents for their scenic, recreational, ecological, flood control, and other values; the Rio de Flag, Walnut Creek, and Pumphouse Wash are among our more prominent examples. The riparian ecosystems associated with these channels have been affected by urbanization and human use to different extents and in many cases could benefit from active restoration. Restoration can include reconstruction of bank morphology, noxious weed removal, the return of native plants including grasses, forbs, and oaks depending on site conditions, and when possible the increase of in-stream flows, e.g. from treated sewage. The multi-stakeholder effort to restore and preserve Picture Canyon on the Rio de Flag east of the city provides a good example of collaborative conservation, and further efforts along other reaches of this highly-valued urban watercourse and others in the planning area should be supported.

**Comment [SL20]:** (Note: Following information could be reiterated in the "Wildlife" and "Environmentally Sensitive Lands" subsections). Within each of these habitat types, topography plays an important part in creating microclimates which in turn foster biodiversity. North-facing slopes harbor very different plant communities than south-facing slopes. The steeper the slope, the more diversity is enhanced. The mingled boundaries of these microclimates increase plant, invertebrate, and bird interactions, invigorating the populations of each.

**Goal:** Improve and restore ecosystem health across all land ownerships in the Flagstaff region.

**Policies:**

1. Recognize the region's ponderosa pine forest is a fire-dependent ecosystem and strive to restore more natural forest composition, structure, and processes.
2. All landowners and land management agencies are encouraged to emphasize forest ecosystem restoration and fire risk reduction for the lands under their respective jurisdictions.
3. The City of Flagstaff and Coconino County support the efforts of the U.S. Forest Service to manage dispersed camping, campfires, off-road motor vehicle travel, and other forms of recreation consistent with resource protection and community fire risk reduction.
4. Community residents, property owners, and other agencies are encouraged to participate in forest planning, management, and restoration efforts as opportunities arise.
5. Residents, property owners, and government agencies are encouraged to pursue opportunities for interagency cooperation and community collaboration to accomplish natural resource goals that might not be accomplished individually.
6. Promote conservation and ecological restoration of the region's diverse ecosystem types including grassland, pinyon-juniper, wetland, and ponderosa pine forests on both public and private lands in a landscape context.

**Comment [SL21]:** R. Miller and maintain plant and animal community diversity

**Comment [SL22]:** E. Nelson Improve, restore, and maintain ecosystem health and plant and animal community diversity

**Comment [SL23]:** M. Jackson Encourage public awareness that

**Comment [SL24]:** M. Jackson and sustainable

**Comment [SL25]:** B. Higgins as well as flood and

**Comment [SL26]:** Marie Jackson through the following strategies

**Comment [SL27]:** M. Jackson Encourage all landowners and land management agencies to emphasize forest ecosystem restoration and

**Comment [SL28]:** M. Jackson Encourage community residents

**Comment [SL29]:** M. Jackson (delete)

**Comment [SL30]:** E. Nelson and associated animals



7. Support and encourage collaborative multiple-stakeholder riparian restoration efforts along the Rio de Flag and other watercourses, including the return of native vegetation, channel structure and, where possible, preservation of in-stream flows.
8. Preserve Flagstaff's wetland areas and discourage inappropriate development on adjacent lands that may adversely affect wildlife habitat, recreational opportunities, viewsheds, and ecosystem health.

**Strategies**

- Promote and contribute to widespread environmental education efforts through the public schools and beyond to build awareness of local ecological settings and issues, including how to adapt to life in a fire adapted ecosystem.
- Promote forest restoration efforts on non-federally administered lands to complement ongoing restoration efforts on the national forests of the region, while participating in the Four Forest Restoration Initiative collaborative process.
- Promote responsible recreation, tourism ventures and other uses of national forest system lands which are sustainable and of value to the local community.

- Comment [SL31]:** R. Miller  
Recognize the high value of land and preserve
- Comment [SL32]:** M. Jackson  
Recognize the high value of riparian lands and preserve Flagstaff's wetland areas through discouraging development
- Comment [SL33]:** R. Miller  
~~and~~-ecosystem health, and environmentally sensitive land.
- Comment [SL34]:** Policy 9. Protect slopes and other topographic features in order to protect and invigorate biodiversity.
- Comment [SL35]:** M. Jackson  
public education programs
- Comment [SL36]:** E. Nowak:  
Need a strategy to protect/preserve wetlands (see 8 above)

DRAFT

## 5. Noxious and Invasive Weeds

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For the purposes of this plan, noxious weeds and invasive species are defined as follows:

**Noxious Weeds:** “Noxious weed” is a legal term applied to plants regulated by state and federal laws. Arizona Administrative Codes (AZ Department of Agriculture) define noxious weed as “any species of plant that is detrimental or destructive and difficult to control or eradicate and includes plant organisms found injurious to any domesticated, cultivated, native or wild plant.”

**Invasive Species:** An invasive species is one that spreads and establishes over large areas and persists. Some native plants can be considered invasive in certain circumstances. The national Invasive Species Council defines invasive species as a species that is: (1) non-native (or alien) to the ecosystem under consideration; and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Invasive and noxious weeds pose an increasing economic and ecological threat throughout the West, and the Flagstaff region is no exception. The ecosystem and vegetative community of Flagstaff has already been negatively affected by the introduction of numerous invasive non-native plant species and noxious weeds. Invasive weeds have increased costs for landscape and maintenance along roads, school yards, and other areas. Forest and grazing lands have been degraded, and unchecked infestations threaten greater losses. Such plants tend to spread rapidly, out-compete and displace native species, and disrupt ecosystem processes. If not controlled, invasive non-native plants reduce biodiversity, degrade wildlife habitat, and jeopardize endangered species. Some of the noxious and invasive weeds present in the Flagstaff area include camelthorn, cheatgrass, diffuse knapweed, toadflax, bull thistle, and scotch thistle, among others. When small weed infestations are left unchecked, they can grow exponentially and spread across the landscape much like a slow-moving biological wildfire.

**Comment [SL37]:** E. Nowak  
Add woody plants such as Russian Olive.

The Arizona Department of Agriculture is responsible for regulating noxious weeds in the State. They maintain a list of noxious weeds that are subject to legal restrictions and potential quarantine. However, weed control is an issue for land managers of all agencies, as well as private citizens. An effective weed management plan includes four strategies: prevention, early detection, timely management, and site rehabilitation. By focusing on these strategies, new infestations can be prevented or controlled before they spread. By the time an infestation is firmly established, it can be extremely costly to control and often impossible to completely eradicate.

Coordinated Weed Management Areas consisting of local and federal agencies, 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. The San Francisco Peaks Weed Management Area (SFPWMA) is the group coordinating weed management in the Flagstaff Regional Plan area. The SFPWMA includes participating staff from the U.S. Forest Service, Coconino Natural Resource Conservation District, Coconino County Cooperative Extension, National Park Service, 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, support to planning, and direct weed control. Controls include **mechanical** treatment such as pulling or mowing; **chemical** treatment such as herbicides; **cultural** treatment such as grazing; and **biological** treatment such as predatory insects or pathogens.

In addition to efforts by the SFPWMA and the participating land management agencies, individual citizens can participate in weed management efforts on private land by learning to identify and properly remove the appropriate plants. The SFPWMA may assist in this effort by developing educational materials and weed lists categorized into gardening pests versus economic pests with appropriate strategies for eradication, control, or management. In addition, the City and County can require weed management plans to be incorporated into new development projects to control existing populations and prevent new infestations. Neither the City nor the

County, however, currently has minimum criteria for such plans. The SFPWMA can assist with establishing these minimum criteria.

Other efforts that could contribute to weed management in the area include interagency agreements for cross-fence operations. Interagency cooperation is important because weeds don't stop at fence lines. Coordinating schedules between agencies can allow for more efficient weed management operations across different jurisdictions. In addition, the County Public Works Department operates a burn tank for the disposal of weeds and other burnable material. Continued or expanded operations could be a valuable component of weed management activities.

**Goal: Control populations of invasive noxious weeds, eradicate where possible, and prevent new infestations.**

**Policies:**

1. The City and County will cooperate with the SFPWMA to inventory, eradicate, and control invasive non-native weeds, including those required for compliance with State regulations; prevent establishment of new infestations through public awareness and education; and restore disturbed areas with native species.
2. Weed management plans shall be required for new development projects where applicable to control existing populations and prevent new infestations.
3. The City and County will adopt weed control measures to be applied to road and utility infrastructure construction and maintenance projects, and will pursue aggressive weed-control strategies in public rights-of-way and other City and County-owned properties.
4. The City and County Parks and Recreation Departments will pursue opportunities with other agencies and volunteer groups to control the spread of non-native invasive plants and noxious weeds on public park lands and natural areas.
5. Landscaping for new developments shall emphasize the use of native plants and drought-tolerant species appropriate to the area. Disturbed areas shall be restored and revegetated with native species to the greatest extent possible.
6. The City and County will support public education programs to help residents learn how to identify and control the spread of noxious weeds and invasive plants on private property.

7.

**Strategies**

- Develop a list of noxious and invasive weeds present in the Flagstaff region and prioritize threat level and management approach, i.e. eradicate, control, or manage.
- Develop criteria for evaluating weed management plans associated with development projects.
- Develop a set of "best practices" for capital improvement projects and private development projects.
- Continue operations of County burn tank in support of weed control operations.
- Coordinate interagency weed control operations to promote synergistic efforts, i.e. publish schedules of operations.
- Continue active participation by the City and County in the San Francisco Peaks Weed Management Area.
- Consider adoption of a weed abatement ordinance by the City and County.

**Comment [SL38]:** Expert Forum insert "and eradication"

**Comment [SL39]:** R. Scott  
Need a policy stating explicitly that any decision to introduce a biological control (i.e. tamarisk beetle) be preceded by thorough research. Point to state and any other existing laws on this issue.

**Comment [SL40]:** E. Nowak  
Strategy: prohibit or discourage the sale of any plant classified as a noxious weed under USDA policies (this would include Russian olive as well as Vinca spp., which are a problem in riparian areas like Oak Creek but are sold by local nurseries).

## 6. Wildlife

The greater Flagstaff area boasts an abundance and diversity of wildlife that is highly valued by residents and visitors alike. Due to Flagstaff's location amidst the ponderosa pine ecosystem of the Coconino National Forest, diverse habitats including rocky canyons, seeps and springs, and open meadows and grasslands, and wilderness areas such as Kachina Peaks and Walnut Canyon National Monument, wildlife are a prominent aspect of our local environment and help define our regional character. Wildlife-based recreation ranging from birdwatching to hunting draws visitors from around the state and contributes directly to the region's economy. Our community supports the stewardship of the full range of our native wildlife, from highly visible large mammals such as elk and bear to birds, reptiles and amphibians, and less conspicuous invertebrates as well as the ecosystems on which they depend. We recognize the role of proactive planning in minimizing the impacts of human activities on important wildlife habitat and wildlife movement corridors and promoting wildlife conservation.

Variations in physical features of the landscape including topography, elevation, slope, and surface water influence vegetation type and resource availability at particular locales around Flagstaff, which in turn shapes local biodiversity by providing varied habitat for wildlife species. For example, the ponderosa pine forests in and around Flagstaff provide habitat for mammals ranging from Rocky Mountain elk and mule deer to tassel-eared squirrels and a range of bird species, including the federally threatened Mexican spotted owl. Arizona black rattlesnakes, a species found almost exclusively in the higher elevations of Arizona, live near rocky outcrops. Pronghorn require the more open pinyon-juniper and grassland landscape found on Anderson Mesa southeast of the city. Open prairie and meadow habitats, which are regionally abundant but have undergone severe decline within Flagstaff's city limits, harbor significant biodiversity of plants and animals including species which are not found in closed canopy forests such as the declining Gunnison's prairie dog. Prairie dogs are unique in that they in turn alter their environment and in the process create habitat for other species: considered a "keystone species," their burrowing and foraging activities provide habitat for many other species and their populations serve as prey for migrating raptors and local carnivores. Taking proactive steps to promote the conservation of sensitive and declining species such as prairie dogs now may prevent their listing as threatened or endangered species in the future, and by doing so help avoid the considerable land use restrictions which listing often entails.

Water, whether from seasonal runoff and snowmelt or the perennial flows from seeps and springs, plays an important role in creating wildlife habitat in our region. Wetlands and wet meadows such as Rogers Lake and Pumphouse Meadow support species such as bald eagles, waterbirds, and foraging swifts and swallows, while resident and migratory birds ranging from waterfowl and songbirds to raptors can be found along the Rio de Flag. Our wetland and riparian areas also provide the only habitat for native amphibians, including chorus frogs, Arizona treefrog, canyon treefrog, and tiger salamander. Due to their dependence on water for breeding and survival, their limited ability to disperse to new areas when conditions become unfavorable, and their permeable skins rendering them susceptible to environmental perturbation and contaminants, amphibians are good indicators of habitat quality and water persistence.

Most of our native wildlife species require the use of multiple habitats during the day and/or seasonally to support their activities. Breeding songbirds often forage in areas different from where they nest, while animals ranging from bald eagles to pronghorn to elk migrate seasonally each year in response to the distribution of food or other conditions. Less predictable annual variations in resources, such as water, can also influence animal movements. Species with large home ranges, including mountain lions and black bears, typically depend on large areas of contiguous habitat and individual animals can range from the San Francisco Peaks to the Mogollon Rim. Both the quality of the different habitats animals utilize and the connectivity between habitats across the landscape can affect individual survival and reproductive success and influence the long-term stability of whole populations. For these reasons it is important to consider the effects of land use decisions on wildlife and develop conservation strategies in the broader landscape context. It is also important to conserve localized habitat types that provide

**Comment [SL41]:** from S. Golden: "shapes" should be changed to "shape"

**Comment [SL42]:** from S. Golden: add "and the outlying areas of the county,"

**Comment [SL43]:** from S. Golden: insert "Thereby promoting healthier, more nutrient-rich native grasses and providing for more water percolation into the water table. In the process habitat is created for other species. Prairie dogs are considered to be a "keystone species" because their burrowing and foraging activities create habitat for many other species and their populations serve as prey for migrating raptors and local carnivores."

**Comment [SL44]:** E. Nowak and historically, Northern Leopard Frog.

habitat for less-mobile species with small home ranges such as amphibians (wetlands and riparian areas), reptiles (rocky outcrops), and small mammals (open prairie and other habitats). These species, which often form the prey base for larger, wider-ranging carnivores and other animals, are less likely to move to new habitats if their environment is degraded.

Maintaining habitat connectivity through conservation of important wildlife movement areas or “corridors” in the greater Flagstaff area is a critical and growing conservation need. In addition to allowing animals to obtain essential resources and avoid climatic extremes through daily and seasonal movements, intact wildlife movement areas serve many essential functions including: helping to maintain genetic diversity; aiding in dispersal of young from their natal area; facilitating the “rescue” of populations decimated by fire, flooding, or other extreme weather events; and, in coming years, will allow wildlife to shift their range and colonize new habitat in response to climate change. Wildlife movement areas may be relatively broad and diffuse or limited to narrower corridor-like features such as forested ridges, canyons, and riparian zones, or even more localized as in the case of Arizona treefrogs and chorus frogs, which make short-distance seasonal breeding movements from uplands to ephemeral ponds in the spring and rainy summer months.

Using a combination of field research, personal observation, and expert opinion, the Coconino County Comprehensive Planning Partnership Wildlife Workgroup and the Arizona Game and Fish Department’s current Wildlife Linkages project with Coconino County have together identified a number of critical wildlife movement areas around Flagstaff. These include relatively narrow corridors linking the Peaks to Woody Ridge via Observatory Mesa and A-1 Mountain and broader movement areas north and east of the Peaks providing links to lower-elevation grassland habitats. Some of these “linkage” areas connect local wildlife populations to essential habitat beyond the Regional Plan area and their conservation should be approached in this broader context. Further disruption of habitat connectivity, also known as habitat fragmentation, by roads, housing, wind energy facilities, utility corridors, and other infrastructure will also increase the likelihood of adverse human-wildlife interactions such as vehicular collisions and unfriendly encounters with predators. As our community grows we will need to utilize a range of strategies to preserve habitat connectivity including clustered development, wildlife-friendly overpasses, underpasses and culverts, land acquisition, and habitat management in areas adjacent to corridors to minimize disturbance to wildlife due to lighting, fences, noise, domestic animals, proximity to trails, and other sources. While some wildlife species are more tolerant than others to human presence, efforts should be made to avoid the co-location of hiking and walking trails along, and the development of yards adjacent to, known wildlife corridors that are utilized by more disturbance-sensitive species, or by animals such as mountain lions with which humans may experience adverse encounters.

Wildlife are adapted to cope with the range of environmental variation associated with the ecosystems in which they are found, including even large-scale disturbances such as fire or flooding. However, ongoing natural and human-caused modification of our regional landscape may drastically change wildlife habitat quality and quantity within our local ecosystems. Altered fire frequency and severity stemming from forest management practices, shrub encroachment of grasslands, invasion of ecosystems by non-native plants and animals, drought, introduction of domestic pets, fragmentation of habitat by urban and rural development, and climate change can alter resource availability, directly reduce and/or degrade habitat, and affect ecological processes such as competition, predation, and disease transmission, and impact ecosystem services provided by the habitat to humans. Invasive species – animals, plants, and fungi that are not native to an ecosystem and whose introduction is likely to cause economic, environmental or human harm -- represent an emerging area of concern for the conservation of Arizona’s wildlife. Invasive plants are a significant problem in the Flagstaff area and may affect wildlife by outcompeting native species, reducing plant diversity, modifying fire regimes, and altering habitat structure and resource availability (see also the section “Noxious and Invasive Weeds”).

The impacts of invasive animals have been perhaps most acute in areas of Arizona with perennial waters including portions of the Coconino National Forest, particularly in aquatic ecosystems following the introduction and spread of non-native mollusks, crayfish, bullfrogs, turtles, and sportfish. While we currently have no wide-scale problems with invasive animals in the greater Flagstaff area, species such as bullfrogs are already locally

Comment [SL45]: S. Golden: insert "and destruction"

established (e.g. Rio de Flag at the Wildcat Treatment Plant). Domestic animals such as feral cats may represent a significant source of mortality for our resident and migratory birds, and unleashed dogs may harass or attack native wildlife at the urban-wildland interface. In addition, some native species such as skunks and raccoons exist in high densities in and around Flagstaff, due to intentional or unwitting human subsidies. Efforts to discourage the feeding of wildlife and restrain domestic pets should be encouraged, while proactive planning and public education will help ensure that future impacts from introduced species are avoided or minimized.

Often the consequences of landscape alteration for wildlife populations and ecosystem interactions are not understood until long after they are initiated. Land use decisions in the greater Flagstaff area including the planning and layout of subdivisions, siting of transportation and utility corridors, siting of public trails, and other projects can have a significant impact on the amount and quality of habitat for wildlife. Proactive restoration efforts, such as the interagency Four Forest Restoration Initiative and efforts to restore the riparian ecosystem along reaches of the Rio de Flag through Picture Canyon and other areas, promise multiple community benefits including the improvement of wildlife habitat. Thus enactment of many of the goals and policies associated with other sections of the Revised Regional Plan including Ecosystem Health, Noxious and Invasive Weeds, and Water may indirectly but positively benefit Flagstaff's wildlife.

Ensuring stable and resilient populations of our native wildlife has benefits beyond the survival of individual species. Wildlife perform a wide range of ecological functions including pollination, control of pest and disease organisms, limiting populations of prey species through predation, seed dispersal, and many other functions that collectively help to maintain the integrity of our local ecosystems. In doing so they may also provide the community with indirect "ecosystem services" such as maintaining water quality and healthy soils and limiting populations of disease-spreading insects. While the contributions made by individual wildlife species to ecosystem services are likely to be indirect and are currently not well-understood, conservation which aims to maintain and enhance the full spectrum of native wildlife and the habitats on which they depend will help ensure that Flagstaff residents continue to receive these natural benefits for years to come.

As the Flagstaff region continues to prosper we will be continually challenged to weigh the needs of our population with effective conservation of wildlife habitat and our other vital natural resources. This requires maintaining functional ecosystems and intact wildlife movement corridors at the landscape scale. One strategy the community may want to consider is the development of a conservation lands system, a comprehensive science-based approach to conservation which would involve prioritization of parcels based on ecological value and which can be used to specify open space set-aside levels for development projects (see the "Open Spaces" element for further elaboration). Whatever strategies we choose, open space conservation and thoughtful management at the parcel, project and landscape levels will help ensure the vitality of our wildlife and habitats well into the future.

**Goal:** Protect wildlife populations, localized and larger-scale wildlife habitats, ecosystem processes, and wildlife movement areas throughout the planning area.

**Policies**

1. Encourage local development that protects, conserves, and when possible enhances and restores important wildlife habitat through proactive planning, creative design, and flexible zoning, e.g. by allowing higher-than-zoned housing density in one area of a parcel in exchange for maintenance of open space with high value for wildlife.
2. Use open space acquisition to conserve important wildlife habitat, and consider the effects of proposed recreational uses of open space on a variety of wildlife species. Explore the development of a conservation lands system as a means to achieve comprehensive open space conservation across the planning area.

**Comment [SL46]:** S. Golden: delete "and are currently not well-understood"

**Comment [SL47]:** S. Golden: delete "One strategy the community may want to consider is the development of" and replace with "It is recommended that the city and county work together to develop"

**Comment [SL48]:** S. Golden: delete "One strategy the community may want to consider is the development of" and replace with "It is recommended that the city and county work together to develop"

**Comment [SL49]:** M Jackson indigenous

**Comment [SL50]:** R. Miller diversity and

**Comment [SL51]:** S. Golden: delete "important" (use of "important" may serve as a way to allow policies that would harm habitat because "important" is not defined - the Open Space Commission can set the priority guidelines for what is important habitat)

**Comment [SL52]:** Expert Forum Make this a separate policy.

**Comment [SL53]:** S. Golden: delete "Explore the possibility of" and replace with "Begin the process of developing"

**Comment [SL54]:** S. Best add "for the entire County"



3. Protect sensitive and uncommon habitats such as ephemeral wetlands, riparian habitats, springs and seeps, rare plant communities, and open prairie ecosystems including the physical elements such as water sources and soil types on which they depend.
4. **Protect** populations of rare and sensitive animal species and their habitats, including threatened and endangered species and species of special conservation concern.
5. Identify, conserve and manage important wildlife movement corridors for a broad range of species through planning and open space conservation, and when possible integrate wildlife passage structures such as overpasses and culverts into roadway, bridge and culvert design.
6. Support the control and removal of exotic and invasive plants and animals, both terrestrial and aquatic, which can alter and degrade wildlife habitat, and develop targeted educational strategies to help prevent their introduction.
7. Use a combination of proactive planning, public education, and enforcement of existing regulations to limit the negative impacts of domestic pets and the size of populations of "pest" wildlife species, and minimize human-wildlife conflicts by discouraging the feeding of wildlife.
8. Encourage developers **to avoid or minimize impacts to Gunnison's prairie dog colonies whenever possible** and encourage the humane relocation of prairie dogs to suitable habitat **when necessary**. Promote public awareness of the positive "keystone" role of prairie dogs in grassland ecosystems and consider the development of a mitigation policy to obtain suitable habitat for prairie dog translocation with financial support from project developers.
9. Update maps of wildlife movement corridors and species and habitat distributions included in this plan on an ongoing basis as new research data become available from sources such as federal, state and local agencies, Northern Arizona University's GRAIL laboratory, and local biologists.

**Comment [SL55]:** Expert Forum  
"Support, restore, and protect"

**Comment [SL56]:** E. Nowak  
**Forbid releasing aquatic pets.**

**Comment [SL57]:** Expert Forum  
add "and feral"

**Comment [SL58]:** E. Nowak  
I would ground the notion of "pest" in supporting biological data, or use some other specific term, like "overpopulation of large ungulates that is likely a factor in preventing aspen regeneration."

**Comment [SL59]:** E. Nowak  
People should be educated on how to safely recreate in bear/rattlesnake/lion country, in a way that emphasizes safe human behavioral responses to potential predators and venomous snakes; a response that does not result in the killing or long-distance translocation of individual animals as a way to mitigate potential conflicts.

**Comment [SL60]:** Expert Forum  
add "institutions, and public agencies"

**Comment [SL61]:** S. Golden  
delete "whenever possible" (it's *always* possible, and this policy is only encouraging - not requiring anything)

**Comment [SL62]:** S. Golden  
delete "when necessary" (it's arguable that it is *never* necessary, and this policy is only encouraging - not requiring anything)

**Comment [SL63]:** S. Golden  
add "and comply with relevant guidelines established by Arizona Game and Fish Department."

**Comment [SL64]:** E. Nowak  
**Prohibit the City's use of poisoning prairie dogs as a management tool.**

**Comment [SL65]:** R. Miller  
Use those maps and the maps of environmentally sensitive lands from the next section to encourage discussion of impacts of development on quality of life in the Flagstaff area as part of all zoning decisions.

**Comment [SL66]:** T. Bogan-Ozmun  
suggest the following policy or strategy:  
**10. Support the implementation of the Watchable Wildlife Recreation Vision for the Flagstaff Region (written by Game & Fish) through a collaboration of the appropriate government and private parties.**

**Comment [SL67]:** E. Nelson  
Address interactions in existing situations, such as golf courses and prairie dogs. Need strategies for these.



## 7. Environmentally Sensitive Lands

Environmentally-sensitive lands in the Flagstaff region include floodplains, riparian areas, wetlands, seeps and springs, and steep slopes. These areas contain critical resources and require special consideration in the development design and review process. Floodplains, riparian areas, and wetlands not only provide for the discharge of floodwaters and the recharge of aquifers, but also provide important habitat for plants and animals, wildlife movement corridors, and seasonal habitat for numerous bird species. Watercourses of all types act as magnets for human settlement, recreation, and other activities. Seeps and springs provide essential water sources for natural ecosystems, as well as human communities. Steep slopes and ridgelines can be environmentally-sensitive in the sense that they often have unstable, highly erodible soils; they contain a wide range of vegetation types; and they provide habitat for a diversity of bird and wildlife species – at the same time, prominent slopes and ridgelines can be attractive to property owners as building sites with spectacular views. Considering the rarity of these types of environmentally-sensitive lands and their high environmental values, it is important to ensure a balance between environmental and human needs when development decisions may impinge upon such areas.

Early human settlement in the area tended to occur along drainageways and floodplains for practical purposes – these areas provided tillable land for farming and shelter, shade, and a source of water. Today’s private land ownership patterns reflect these early settlement patterns. Some of the main watercourses in the region include the Rio de Flag, Sinclair Wash, Pumphouse Wash, Walnut Creek, Volunteer Wash, and the headwaters of Sycamore Creek. (Note: This list is not exhaustive and many other drainages in the area have high environmental value as well.) The floodplains and riparian areas associated with these watercourses provide wildlife movement corridors and provide food, water, and cover for many species. At the same time, such drainageways provide for human needs including drinking water, recreation, irrigation, building sites, and other uses. With so many different uses competing for riparian resources, finding an appropriate balance between environmental values and human use is a challenge.

Wetlands, particularly high-elevation wet meadows, are extremely rare in Arizona, but there are several notable examples in the Flagstaff region. Rogers Lake is the largest example, and when full, is the second largest natural water body in the State after Mormon Lake – it is essentially a large ephemeral wetland. Other examples include Dry Lake just west of town; Marshall and Vail Lakes and several ephemeral wetlands on the north end of Anderson Mesa; and Pumphouse Meadow at Kachina Village. While most of these wetlands are situated on national forest land, and therefore not subject to private development, some are on State or County land and could be subject to or affected by nearby development. Because of the extreme rarity of wetland habitats, they are highly valuable for wildlife. They are also popular for recreation such as bird watching, hunting and fishing, and in some cases canoeing and kayaking. Furthermore, wetlands provide ecosystem services such as accommodating the discharge of floodwaters; the recharge of groundwater aquifers; and the natural filtration of surface waters and stormwater runoff.

Seeps and springs are also extremely rare and extremely valuable for both the natural environment and the human community. They provide unique habitats for a variety of invertebrates and plants, as well as providing water sources for larger animals. Springs in the inner basin of San Francisco Mountain contribute to the City’s municipal water supply.

The Flagstaff region is notable for its dramatic topography. In addition to iconic views of the San Francisco Peaks, many local landscapes include prominent slopes and ridgelines that serve as a visual backdrop for individual neighborhoods or communities. Steep slopes and ridgelines can be environmentally-sensitive for many of the same reasons mentioned previously. They provide habitat and movement corridors for a diversity of bird and wildlife species. They also contain a wide variety and mix of vegetation. Slopes and ridgelines also often

**Comment [SL68]:** R. Miller  
Need to define Environmentally Sensitive Lands with a definition that could be used in zoning. How about something like this: Environmentally Sensitive Lands are defined as lands which if altered would have an impact greatly out of proportion to the acreage affected. They include wetlands, streams and drainage channels, rare plant communities, movement corridors and other unique sites.

**Comment [SL69R68]:** M. Jackson  
re: R. Miller’s comment (above)  
add “ecological and economic” impact

provide spectacular views making them desirable for residential building sites, notwithstanding the fact that many such areas have unstable and highly erodible soils. Development of steep slopes and ridgelines often involves massive cut-and-fill operations, which not only disturb the immediate environment, but also create negative visual impacts that can be seen from many vantage points and distances.

Environmentally-sensitive lands provide a myriad of environmental values and ecosystem services, while at the same time they attract a wide range of human activities and uses. The rarity of these areas and their environmental richness and biological diversity, however, indicate the importance of their preservation.

**Goal:** Preserve and enhance the natural qualities of environmentally-sensitive lands.

**Policies:**

1. The City and County encourage the preservation and restoration of natural wetlands, floodplains, riparian areas, seeps and springs, distinctive landscape features, and other environmentally-sensitive lands.
2. Development projects shall be designed to minimize the alteration of natural landforms and maximize conservation of distinctive natural features.
3. Development proposals and other land management activities shall be assessed in a broad landscape context.
4. The City and County favor the use of all available mechanisms for the preservation of environmentally-sensitive lands, including but not limited to public acquisition, conservation easements, transfer of development rights, or cluster development with open space designations.
5. Development proposals affecting natural wetlands shall require a wetland delineation by the U.S. Army Corps of Engineers prior to the public review process in order to provide complete and essential information for decision makers.
6. Integrated conservation design practices, such as open space dedication, conservation subdivisions, and cluster development are encouraged for new developments in order to conserve sensitive and unique natural areas.
- 7.

**Comment [SL70]:** R. Miller  
Where possible and with greater frequency than the average for this area, preserve

**Comment [SL71]:** well said!

**Comment [SL72]:** R. Miller  
including the community value of any environmentally sensitive lands affected.

**Comment [SL73]:** R. Miller  
larger than one acre or ¼ acre for a single site

**Comment [SL74]:** M. Jackson  
Encourage

**Comment [SL75]:** M. Jackson  
(delete)

**Comment [SL76]:** R. Miller  
Encourage residents, property owners and government agencies to pursue opportunities for interagency cooperation and community collaboration to accomplish natural resource goals that might not be accomplished individually.

**Comment [SL77]:** R. Miller  
8. Promote conservation and ecological restoration of the region's diverse ecosystems types including grassland, pinyon-juniper, wetland, and ponderosa pine forests on both public and private lands in a landscape context.

**Comment [SL78]:** R. Miller  
9. Work with governmental agencies, organizations, landowners and residents to promote and accomplish conservation of the most sensitive areas.

## 8. Soils

The geology of Coconino County has directly affected the formation of various soils due, in part, to the composition of bedrock materials, topography, geologic structures and the influence of topography on climatic patterns. Soils in the area vary widely in type and character, ranging in composition from coarse grained well-drained materials to expansive fine grained soils. Site development requirements differ accordingly.

Soils with high expansive potential can heave if the water content of the soil increases. Typical moisture sources that initiate this type of movement are rainfall, snow melt and excess landscape watering. This movement can result in drywall cracking, warped windows and doors, and eventually structural distress. Water leaks from utilities can cause extreme damage in these types of soils. Conventional shallow spread footings and slabs-on-grade are often not suitable for use on expansive soil sites. More specialized foundation systems and/or site preparation procedures could be required. Post-tensioned slab-on-ground or drilled pier and grade beam foundation systems are some of the typical solutions. Other possible site preparation treatments for this type of condition include removal of the clay soils and replacement with low expansive engineered fill material, or lime stabilization of the site soils.

Other considerations include areas with collapsible soils and areas of high groundwater. High groundwater can create substantial limitations for conventional septic systems. The areas with limitations are generally dispersed throughout the planning area. A site specific geotechnical evaluation is required to identify limitations and provide detailed design parameters.

**Goal:** Protect soils through conservation practices

### Policies:

1. Development projects shall be reviewed for soil and dust mitigation practices.
2. County Policy: In areas of shallow or poor soils where standard on-site wastewater systems are not feasible, very low density development, integrated conservation design, a centralized treatment facility and/or technologically advanced environmentally sensitive systems shall be preferred.

**Comment [SL79]:** from *Ecological Restoration of Southwestern Ponderosa Pine Forests, Chapter 9 (Soils and Nutrients)* pub. by ERI/NAU:

"... the physical and chemical characteristics of soil strongly influence virtually all ecosystem processes. The soil matrix, consisting of solids, liquids, and gases, provides water and nutrients to plants and microbial microorganisms, acts as the physical support system in which plants are rooted, and provides habitat for decomposers, nitrogen-fixing bacteria, and symbiotic mycorrhizal fungi. Besides climate, soil properties are the major factor governing ecosystem processes, and managers should carefully consider potential impacts on them..."

"Nutrients are lost from [soil] ecosystems via leaching into water, soil erosion, and gaseous losses such as denitrification and volatilization by fire..."

"... soil respiration rates under relict grassy openings are higher than those under either postsettlement or pre-settlement tree canopies, suggesting higher biological activity in bunchgrass-dominated soils... suggesting that the invasion of grassy openings by pines over the last century has reduced nitrogen cycling rates."

"... Soils compacted by mechanized equipment may remain compacted for decades."

"... Fire duration often has the greatest effect on below-ground properties, because a longer burning time in one place... can result in intense soil heating [and result in permanent alteration or destruction of biological functioning in the soil]."

"... Another factor to consider when using prescribed burning is the formation of hydrophobic soil layers, which can lead to reduced infiltration rates and erosion of surface soils after fires."

**Comment [SL80]:** Scientists estimate that over half of the earth's biodiversity is in its soils.

**Comment [SL81]:** soil plays a major role in carbon sequestration

**Comment [SL82R81]:** Intact vegetation can prevent soil erosion from runoff.

**Comment [SL83]:** M. Jackson conservation,

**Comment [SL84]:** Policy 3. Construction projects shall employ strategies to minimize soil compaction or destruction of vegetation. [From the ERI book: ]"... If mechanized equipment is to be used, soil moisture content should be monitored closely before treatment in order to avoid operation on overly saturated soil."

**Comment [SL85]:** Policy 4. Areas where prescribed fires will be conducted should be prepared adequately to keep the fire cool and fast-moving in order to avoid damaging or sterilizing the soil.

**Comment [SL86]:** M. Jackson Policy 5. Encourage slope stability practices to reduce the effects of erosion and soil transport into ephemeral stream drainages during periods of high precipitation and snow melt.

**Comment [SL87]:** Policy 6. Grassy openings shall be evaluated and conserved with the same care devoted to forested areas.

**9. Water Quality**

(Section under review. Once completed, section will be distributed.)

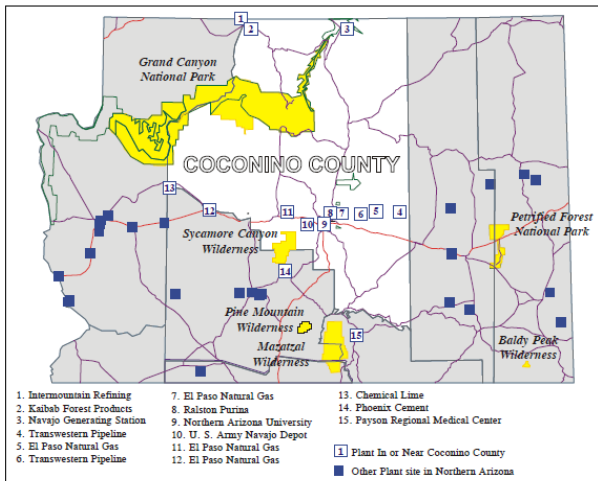
**10. Air Pollution**

The excellent air quality found within Flagstaff region not only benefits the community with clean air to breathe but also a thriving, healthy ecological environment. In general, our community desires to preserve our way of life of balancing the environment with progress. Therefore, effective land use planning and proactive measures are critical to maintaining our air quality in the future. New development and industry should be planned so that it does not unreasonably contribute towards a violation of the National Ambient Air Quality Standard.

The Flagstaff's high alpine environment with large surrounding undeveloped open space and relatively dense population in Flagstaff's corporate limits, produces a clean, fresh environment which residents and visitors seek to enjoy. During the past decade, Flagstaff's region realized growth that inevitably accompanied an increase in the number and intensity of air pollution-generating activities, such as: on road automobile and truck traffic; off-road vehicles; rail traffic; residential, commercial and industrial development; and, wood-burning fireplaces. Not only does air pollutants affect our ecosystem's health, they also affect our visual, aesthetic quality due to the occasional, short-term problem of urban haze or "brown cloud" obscuring views of the mountains and canyons. <sup>1</sup>

In addition to growth impacts, upwind stationary sources such as electrical power plants mining operations and other industrial industries emit air pollutants that may be affecting our region. More than a dozen facilities operate within or adjacent to Coconino County that produce significant amounts of carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOC), sulfur dioxide (SO2), particulate matter (PM10 and PM2.5), or ammonia (NH3).

**FIGURE 1. LOCATIONS OF INDUSTRIES EMITTING CO, NOx, VOC, SO2, PM10, PM2.5, OR NH3 IN OR NEAR COCONINO COUNTY**



The Environmental Protection Agency (EPA) sets the National Ambient Air Quality Standards (NAAQS) standards for six pollutants: ozone, particulate matter (PM 2.5 & PM 10) carbon monoxide, sulfur dioxide,

nitrogen dioxide, and lead. The air in Coconino County is healthy to breathe, according to monitoring data collected by the Arizona Department of Environmental Quality, the National Park Service, and the Salt River Project. Violations of the national ambient air quality standards have not occurred in Coconino County. However, on some days regional haze causes perceptible reductions in visibility.

Stricter EPA standards are anticipated to become effective August 2011 and Arizona State Implementations Plan to be effective December 2013 which is well within the planning horizon of this Regional Plan. The potential impact is that Coconino County will be the responsible agency for any nonattainment air quality issues which may initiate restrictions and limitations. (e.g. reduction or elimination of burn permits and, potentially vehicle emissions testing.) Over the years, city and county policy-makers realized the benefits of a clean-air environment and have been proactive to minimize potential impacts with regulation and the goal to attract non-polluting industry to the region. The following goals and policies continue build upon these efforts and direction.

**GOAL:** Proactively improve and maintain the region's air quality for continued compliance with National Ambient Air Quality Standards

**POLICIES**

1. Engage public agencies concerned with the improvement of air quality, and implement state and regional plans and programs to attain overall federal air quality standards and in particular ozone, particulate matter and carbon monoxide on a long-term basis.
2. Pursue reduction of total emissions of high priority pollutants from commercial and industrial sources and area-wide smoke emissions
3. Reduce vehicle miles travel by promoting land-use that incorporates walkable, mixed-use, compact development.
4. Promote the use of alternative modes of transportation such as ridesharing, bicycling, walking, and transit throughout the region.
5. Where locally desired, formation of road improvement districts, dust control districts and road maintenance districts shall be encouraged as a means of solving dust problems and allocating costs to those affected.
6. All new City roads shall be paved to prevent fugitive dust.
7. Attract through economic development activities and incentives, clean, non-polluting industry and commercial enterprises
8. Seek feasible alternatives to prescribed burns.

**Comment [SL88]:** M. Jackson policies

**Comment [SL89]:** M. Jackson encourage the

**Comment [SL90]:** M. Jackson (delete)

**Comment [SL91]:** M. Jackson ("allocating costs to those affected" needs clarification)

**Comment [SL92]:** low-water use,

**Comment [SL93]:** M. Jackson to alleviate the smoke produced through prescribed burns, through encouraging thinning of overgrown forest.

## 10. Dark Skies

Proudly, Flagstaff has become one of the deep space research sites in the world and is home to the Lowell Observatory, the U.S. Naval Observatory's Flagstaff Station, the National Undergraduate Observatory and the Navy Prototype Optical Interferometer (NPOI). Our success in observatory and planetary sciences is attributed to the region's vanguard approach to protecting Dark Skies with the passing of Ordinance 400 in 1958 that banned advertising search lights that threatened the night sky. In 1989, Flagstaff and Coconino County strengthened its commitment to dark skies and the planetary industry by passing land development codes that restrict the amount of light (per acre) in outdoor lighting installations as well as establishing light district codes and standards. On October 24, 2001 the City of Flagstaff was recognized as the first International Dark Sky City for its pioneering work in the development and implementation of lighting codes that balance the need for preserving Flagstaff's dark sky resources and with the need for safe lighting practices.

To remain one of the premier astronomical sites in the world and be astronomically productive, controlling for artificial light and air pollution must be kept under control as the region grows, yet recognize that outdoor lighting is necessary and appropriate for a safe environment in urban centers. This will require not only the continued enforcement and improvement of local, modern lighting codes as lighting technologies emerge and evolve, but as development begins to spread into the areas near the observatories, thoughtful analysis and consideration of impacts upon the observatories need be addressed upon development application. To allow for the continued pursuit of astronomical research and the enjoyment of the nighttime visual environment, the detrimental effects of light pollution should be minimized while conserving energy and resources.

**Goal:** Preserve Dark Skies as a natural resource, urban character and economic generator to a thriving astronomy, planetary and space science industry.

### Policies:

1. Balance needs of astronomical research and industry needs with community character, growth and sustainability.
2. Research and employ emerging, energy efficient, illumination technologies and update regulations as necessary
3. Mandate new uses, zone changes and retrofits be compliant to lighting code.
4. Promote the benefit of dark skies through outreach.
5. Any regional plan amendment within the Zone I district shall include a preliminary Lumen Analysis calculating potential maximum lumens permissible.

**Comment [SL94]:** Expert Forum Policy 1. Maintain dark skies.

**Comment [SL95]:** Expert Forum questions the terms "Balance" and "industry needs." These terms should be clarified/made more specific.

**Comment [SL96]:** Expert Forum Strategy: City and County shall vigorously enforce existing lighting codes.

**Comment [SL97]:** N. White Remember to include "Viewsheds" in the Community Character Element with a policy/strategy that discourages inappropriate lighting because of its impact on community aesthetics.

## 11. Natural Quiet

*“Indigenous sounds are part of what is called natural quiet. The National Park Service simply identified natural quiet as the absence of man-made sounds. Natural quiet is not necessarily the absence of sound, although it is the absence of human generated sound. It is the condition that allows enjoyment of naturally occurring sounds, the sounds native to an area. Natural quiet, sometimes in the form of primeval silence, is fundamental ....” -- The Power of Place And the Importance of Natural Quiet At Grand Canyon National Park, by Jim McCarthy. Published in Boatman’s Quarterly Review, Spring 2001*

### Soundscape

Just footsteps from Flagstaff’s urban core, one leaves the commotion of the city and can simply walk into forested serenity or vast open spaces. This convenient and quick access to nature is one of the many reasons why people live and visit Flagstaff and, as such, a reason to protect this way of life. As development occurs on the urban fringe and visitor/recreation traffic increases, maintaining the natural soundscape is becoming a growing concern both nationally and locally. Residents, visitors and wildlife are exposed to a variety noise sources such as airplanes, railroads, highway traffic, off-road recreational vehicles, industrial and commercial uses as well as everyday household activities. Locally, there is the desire to create a Noise Ordinance that regulates noise and prohibits sound above a certain threshold from trespassing over property lines during designated hours. Other local opportunities to address noise issues are through land use and site planning by appropriately locating intensive land uses and including buffers between uses and highway corridors.

Since a majority of the land within Coconino County is owned by the National and State Parks as well as the State Land Trust, regulatory powers typically rests with the agency. However, Flagstaff and Coconino County has the ability to influence decision-makers through being actively engaged in agency review, studies and relationship-building.

**Goal: Preserve natural quiet, soundscapes through reduction of noise pollution.**

### Policy:

1. Recognize urban environment soundscape differs greatly from rural areas through the creation of applicable noise ordinance with respective criteria.
2. Major commercial and industrial land use and transportation proposals adjacent to residential and natural areas shall be evaluated as to their potential noise impacts utilizing criteria to be established by the City of Flagstaff and Coconino County. Criteria shall include mitigation provisions of the adverse impacts of noise on existing and proposed land.

**Comment [SL98]:** from “Now Don’t Hear This” NY Times op-ed by George Prochnik on 5-2-2010: “In recent years rigorous studies on the health consequences of noise have indicated that noise elevates heart rate, blood pressure, vasoconstriction and stress hormone levels, and increases risk for heart attacks. These reports prove that even when we’ve become mentally habituated to noise, the damage it does to our physiologies continues unchecked. Studies done on sleeping subjects show that signs of stress surge in response to noise like air traffic even when people don’t wake. Moderate noise from white-noise machines, air-conditioners and background television, for example, can still undermine children’s language acquisition...  
“Evidence for the benefits of silence continues to mount. Studies have demonstrated that [silent meditation improves](#) practitioners’ ability to concentrate. Teachers able to introduce silence into classrooms [report that it fosters learning](#) and reflection among overstimulated students. Professionals involved with conflict resolution have found that by incorporating times of silence into negotiations they’ve been able to foster empathy that inspires a peaceable end to disputes. The old idea of quiet zones around hospitals has found new validation in studies linking silence and healing... “work being done today by urban planners involved with soundscaping demonstrates that it’s easier to create oases of quiet — by, for example, creating common areas on the rear sides of buildings with plantings that absorb sound — than it is to lower the volume of a larger area by even a few decibels. And having access to these oases can greatly enhance quality of life ... even people who live in loud neighborhoods report a 50 percent drop in their general noise annoyance levels if residential buildings have a quiet side. These modest sanctuaries can provide at least a taste of silence, which is then recognized not to be silence at all, but the sounds of the larger world we inhabit: birdsong and footsteps, water, voices and wind.”

- Comment [SL99]:** M. Jackson that the
- Comment [SL100]:** M. Jackson and create applicable noise ordinances to preserve natural quiet in residential neighborhoods and open space preserves.
- Comment [SL101]:** M. Jackson Evaluate major...
- Comment [SL102]:** M. Jackson (delete)
- Comment [SL103]:** M. Jackson “existing and proposed land” is not clear
- Comment [SL104]:** 3. Encourage creation of quiet spaces in urban areas with plantings that absorb sound.
- Comment [SL105]:** E. Nowak Need goal, policies and strategies to address the effects of traffic and other noise on wildlife populations.



[The following members of the Expert Forum contributed to the attached comments:](#)

- [Rick Miller - private citizen, background in wildlife management planning with AZ Game & Fish;](#)
- [Erika Nowak - herpetologist and part-time NAU faculty, Habitat Harmony, Inc.;](#)
- [Nat White – astronomer emeritus, Lowell Observatory;](#)
- [Marie Jackson – geologist;](#)
- [Susan Olberding- USFS Rocky Mtn Research Station, historian;](#)
- [Emily Nelson - wildlife biologist, prairie dog researcher, Director of Grand Canyon Wolf Recovery Project, Habitat Harmony;](#)
- [Larry Stevens - Curator of Ecology, Museum of Northern Arizona, and Senior Ecologist, Grand Canyon Wildlands Council.](#)
- [Randy Scott - NAU biology professor;](#)
- [Peter Pilles – archaeologist, Coconino National Forest;](#)
- [Bruce Higgins - U. S. Forest Service planning consultant;](#)
- [Nate Renn - Forester, NAU graduate student in GIS, Habitat Harmony;](#)
- [Sat Best - Coconino County Planning and Zoning Commissioner;](#)
- [Dave Wilcox – archaeologist, Museum of Northern Arizona;](#)
- [Sherry Golden - nonprofit attorney, Habitat Harmony;](#)
- [Tish Bogan-Ozmun - retired real estate broker, Habitat Harmony;](#)
- [Susan Lamb Bean – writer/ naturalist, Conservation Chair - Arizona Native Plant Society, Flagstaff Chapter.](#)