COLLEGE OF AGRICULTURE & LIFE SCIENCES
COOPERATIVE EXTENSION
WATER RESOURCES
RESEARCH CENTER

WORKING LANDCAPE OF COBRE VALLEY

ECOSYSTEM SERVICES IN PINAL CREEK WATERSHED, CENTRAL ARIZONA

Installment 1

February 10, 2021

WORKING LANDSCAPE OF COBRE VALLEY

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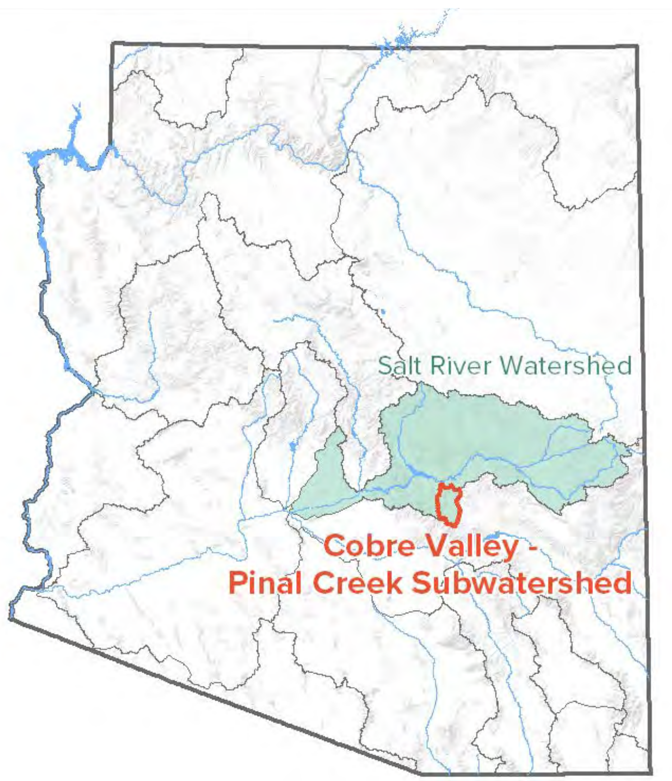
INSTALLMENT 1 - FEBRUARY 10, 2021



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The Water Resources Research Center's mission is to tackle key policy and management issues, empower informed decision-making, and enrich understanding through engagement, education, and applied research. We work with a variety of stakeholders, including decision makers, professionals, students, and the public; conduct "real-world" research; and produce and disseminate independent and reliable water information.

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INTRODUCTION

Our natural environment freely provides us with countless services (Figure 1). Some of these services can be defined and quantified as "ecosystem services," but many intangible benefits, such as spiritual and cultural significance, are no less important. To manage healthy functioning ecosystems, our decision makers and natural resources managers require specific information about the status and distribution of ecosystem services. Community members also need information and working definitions of ecosystem services, supported by data and inventories of the natural environment, in order to support their leaders in conservation planning and take part in the process.

This information helps us quantify the impacts of humans activities and land use on species and ecosystems - ecosystems that make our livelihoods and community well-being possible. This report quantifies and assesses a selection of those ecosystem services in the Pinal Creek Watershed in central Arizona based on both economic and inherent value, as well as the vulnerability or threat to those services.

To support resource planning and management in the Cobre Valley (i.e. Pinal Creek Watershed), this report provides watershed information along with identified ecosystem services of benefit to the region. It serves as a visual overview and resource for stakeholders, natural resources managers, and decision makers to consider for the generation of water and land use plans.

ECOSYSTEM SERVICES (ES)

The term "ecosystem services" describes the direct and indirect benefits obtained by humans from their environment. ES benefits are as wide ranging as imaginable. They include tangible products such as firewood and tourism. The less tangible benefits are no less important in providing services that affect and improve daily life such as micro-climate control, erosion control, and water purification – services that would otherwise require expensive infrastructure projects, maintenance, and planning. Stewarding ecological health is essential if these services are to provide their potential range of environmental, social, and economic benefits.

Despite the relatively small footprint of urban areas - less than four percent of the Cobre Valley land surface - ES have a disproportionate importance due to their proximity to human activities. A functioning ecosystem that properly filters water, mitigates heat island effects, sequesters carbon emissions, and helps prevent flooding can also be thought of as money saved by taxpayers and natural resources managers.

In review of ES studies in US watersheds between 2000-2014, a few services were studied more frequently: maintaining species populations and habitats, water filtration, and nutrient sequestration/storage. Meanwhile educational and aesthetic values were the least frequently studied. These highly studied ES are also identified in this report, while educational and aesthetic values are more difficult to study.

In the Cobre Valley context, recreation is an ES benefit highly valued by the community. Statewide, the economic value of trail use is an estimated $13.5 billion per year, and Arizonans engage in trail-based recreation 103.2 million times per year. Water-related outdoor recreation in Gila County contributes an estimated $387 million in economic output, supports 3400 jobs, and generates $130 million in wages annually.

Nearly half of the Pinal Creek Watershed (97 square miles out of 200) has been identified by a state or federal agencies as critical habitat, wildlife linkages, or sensitive biological lands. The Pinal Creek Watershed is home to over 60 square miles of Mexican spotted owl final critical habitat.

Another important benefit is carbon sequestration, or carbon uptake by trees, in Cobre Valley. Based on established methods, it is estimated that 140 metric kilotons are sequestered annually in trees in the Cobre Valley, which is a service valued at $20 million dollars.

NOTE: This report installment serves as an introduction to watershed context and ES benefits in Cobre Valley. The final report will be revised and expanded as research findings are reviewed and substantiated between 2020 and 2021. The final report will be released in September 2021.

Figure 1. Categories and Examples of Ecosystem Services Benefits

FIGURES

TABLES

ACRONYMS

Acronym	Meaning
A&We	Aquatic and Wildlife Ephemeral
A&Ww	Aquatic and Wildlife Warm water
A.R.S.	Arizona Revised Statutes
ACC	Arizona Corporation Commission
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AGL	Agricultural Livestock Watering
AMA	Active Management Area
ANSAC	Arizona Navigable Stream Adjudication Commission
AOEO	Arizona Office of Economic Opportunity
AWC	Arizona Water Company
AWEDW	Aquatic and Wildlife Effluent-Dependent Water
AWS	Assured Water Supply
AZDFFM	Arizona Department of Forestry and Fire Management
AZGFD	Arizona Game and Fish Department
BLM	Bureau of Land Management
CAR	Communities at Risk
CES	Cooperative Extension Services
CWA	Clean Water Act
DAWS	Designation of Adequate Water Supply
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERU	Ecosystem Response Unit
ES	Ecosystem Service(s)
ESA	Endangered Species Act
ESP	Enhancement of Survival Permit
FBC	Full-Body Contact
FC	Fish Consumption
FEMA	Federal Emergency Management Administration

GIS	Geographic Information System
HUC	Hydrologic Unit Code
INA	Irrigation Non-Expansion Area
ITP	Incidental Take Permit
LSDA	Lower Sonora Decision Area
LURPP	Land Use and Resource Policy Plan
MGD	Millions of Gallons Per Day
M-SEVI	Modified Socio-Environmental Vulnerability Index
NDVI	Normalized Difference Vegetation Index
NEPA	National Environmental Policy Act
NLCD	National Land Cover Dataset
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
PBC	Partial-Body Contact
SRP	Salt River Project
USACE	United States Army Cory of Engineers
USDA	United States Department of Agriculture
USDM	United States Drought Monitor
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCATT	Watershed Condition Assessment and Tracking Tool
WCF	Watershed Condition Framework
WOTUS	Waters of the United States
WPL	Where People Live
WQARF	Water Quality Assurance Revolving Fund
WRRC	Water Resources Research Center
WUI	Wildland-Urban Interface

WORKING LANDSCAPE

The Cobre Valley is a hardworking part of the state. Its name hints at the history of the region. El Cobre is Spanish for copper, and copper was the backbone of communities in Arizona for over a hundred years into the present. As a classic Western copper boomtown, mining first began in the Pinal mountains around the town of Miami in the 1870s, and continues today to be the region's main industry - though diminished. The cultural place name of "Cobre Valley" is used interchangeably throughout the report with the geographic designation of Pinal Creek Watershed.

Cobre Valley is located in central Arizona, nestled in the Tonto National Forest about 80 miles east of Phoenix. This Copper Corridor region includes southern Gila County communities such as Globe, Miami, Claypool, Central Heights, and other unincorporated areas along the edge of the Salt River Basin. As a subwatershed of the Salt River Watershed, Pinal Creek runs through the City of Globe, drains to the Salt River, and ends up in Roosevelt Lake, where it is used as a water supply for the metropolitan area of Phoenix (Figure 2). In effect, what happens in the Pinal Creek Watershed matters to the greater expanses of the watershed.

As the social landscape and economic activities shift in the region, it is a prime moment to consider how ecosystem services are being considered in the grand scheme of long-term community resilience. This section underscores where ecosystem health sits within the bigger picture of population growth, existing environmental policies, and planning paradigms for the region.

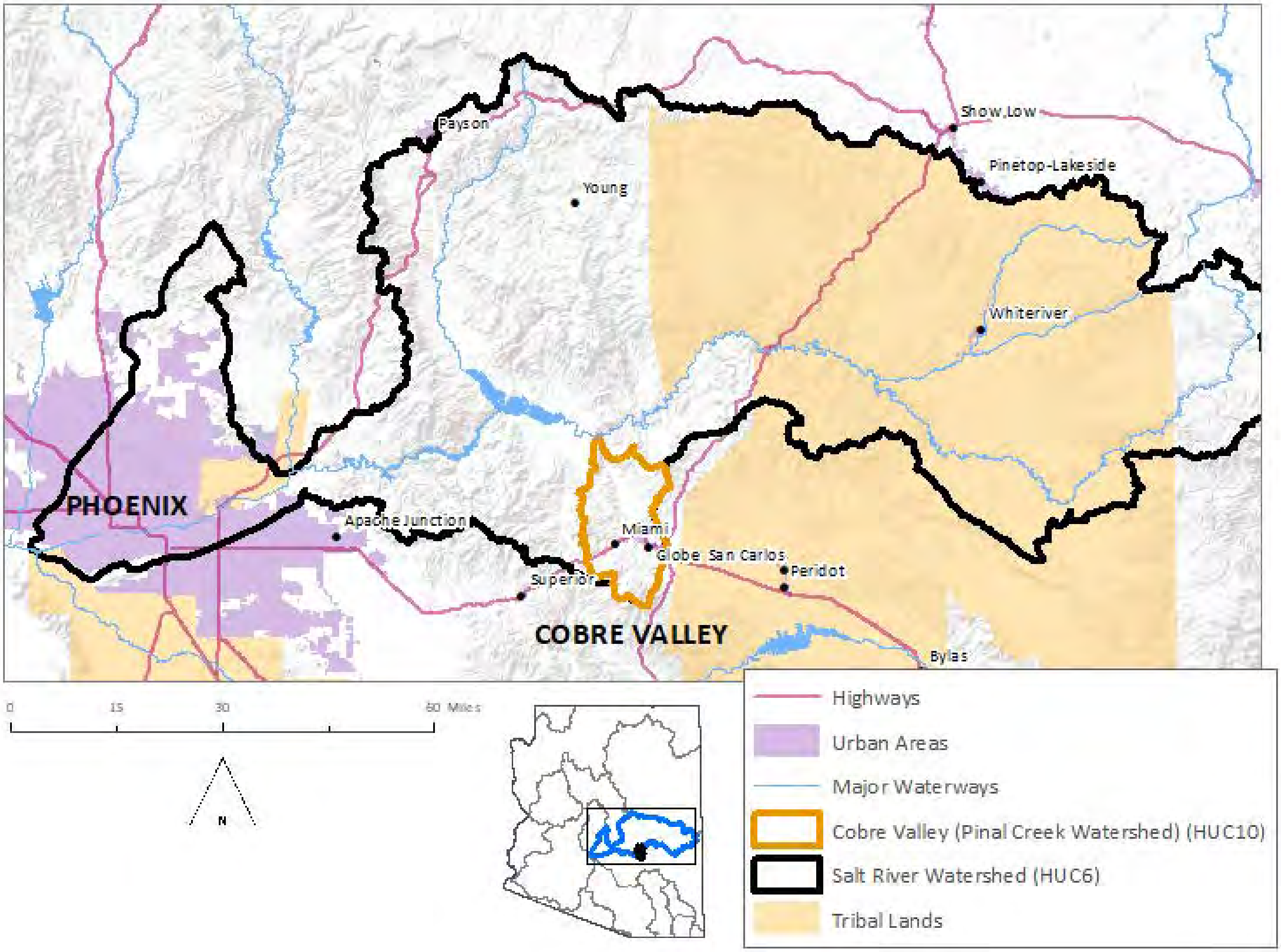

Figure 2. Urban Areas in the Salt River and Pinal Creek Watersheds

SOCIAL TRENDS

Regional demographics and population trends provide important context to our understanding of the status of the watershed and how changes may impact ecosystem services. The following series of charts depict historical population trends and project growth through 2053. Estimates of population change in Cobre Valley communities are largely consistent with Gila County generally.

Figure 3 shows both historical and projected population change. Historically, Gila County saw periods of strong population growth, likely tied to broader periods of economic growth. After the 2008-2009 recession, growth was less than one percent and is projected to remain flat through most of the coming decade. Towards the end of the decade Gila County is projected to see negative population growth (Figure 3).

Whereas Gila County's population growth becomes flat or even negative, the neighboring population in Maricopa County continues to grow, but at a lower rate compared to his historical growth of 4-7 percent. This nearby urbanization and associated increases in carbon emissions and other human-made impacts could likely have an effect on the surrounding watersheds, such as the Cobre Valley.

Demographic changes in neighboring Maricopa County with its dense populations also have the potential to influence the demographics and economic conditions in Cobre Valley and play an important role in the assessment of ecosystem services, especially recreation. National studies examining the roll of metropolitan demographic changes on neighboring rural communities indicate a positive economic relationship. A 2018 study from Brookings found that since the last recession (2008-2009), rural counties directly adjacent to developing metropolitan areas have fared better in terms of job and economic development than isolated rural counties, though they have still experienced emigration and job losses. The study was on the national scale and did not specifically evaluate the conditions in Gila County, but the trend is likely similar. Another national study by the USDA Economic Research Service found that where rural counties saw net migration, the trend is associated with dense rural population, attractive scenery, or proximity to large cities. Additionally, the study found these trends were related to the rural counties having strong recreation and retirement economies. This is a particularly interesting and relevant finding to Gila County and Cobre Valley because it highlights the potential for regional recreation (and possibly retirement age populations) to foster economic growth. Gila County population projections for the 65+ age group is estimated to grow at a faster rate than all other age groups, though the rate is still less than one percent.

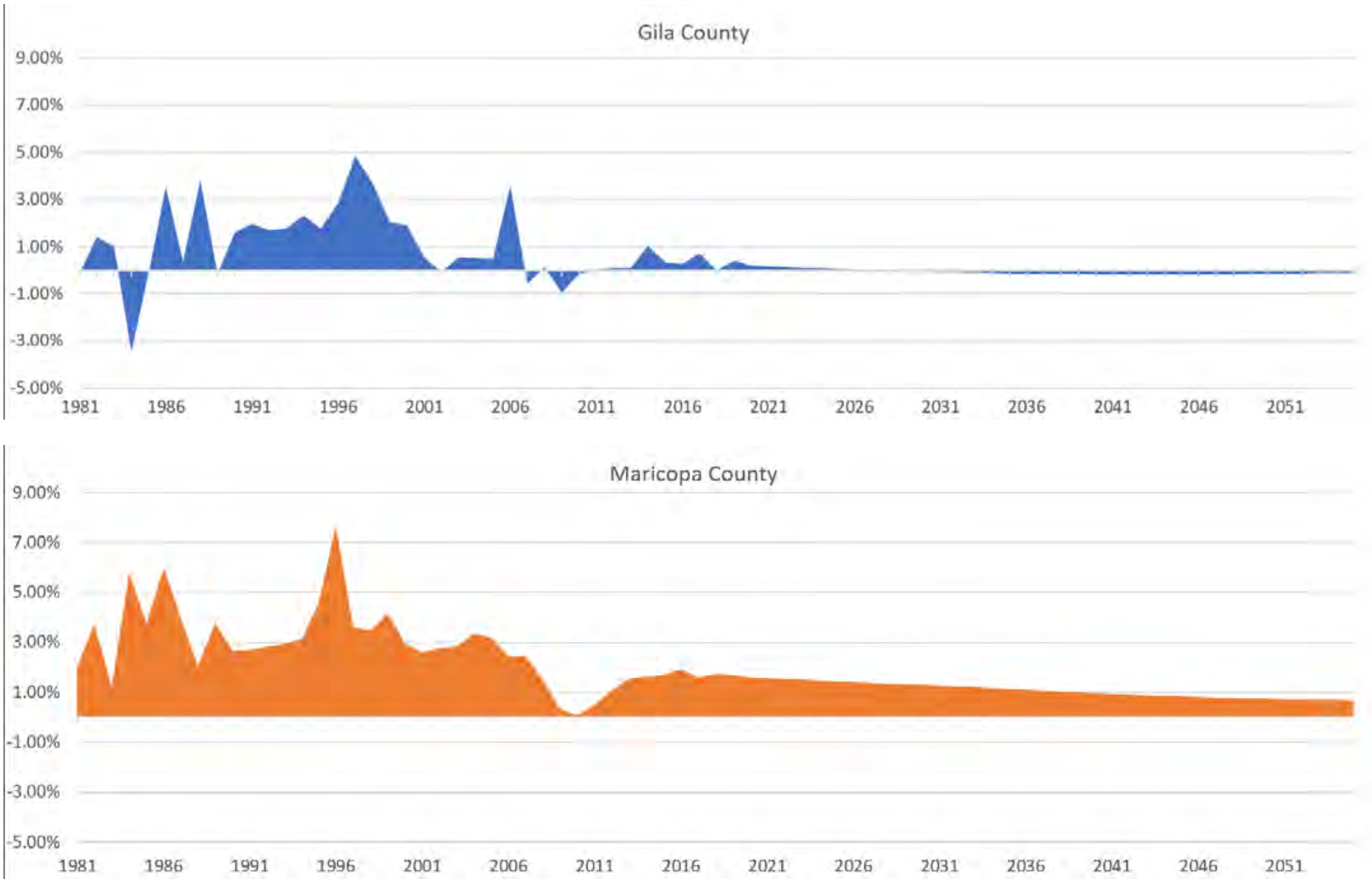

Figure 3. Historic and Projected Population Change in Gila County and Maricopa County, 1981-2051 (AOEO 2018)

APPLICABLE POLICIES

This research fits within a regional land management context, a layered network of interconnected regulations, policies, guidelines, and plans that apply to watershed planning in the Cobre Valley. Planning efforts may be influenced by one or more of these regulations or policies, many of which are in turn affected or triggered by each other, requiring careful navigation of the regulatory landscape.

Many federal regulations act in concert with, or are triggered by, other federal, state, and local agency rules. For example, a watershed project may require both a permit under the Clean Water Act (CWA) and an environmental review under the National Environmental Policy Act (NEPA), both requiring careful coordination between multiple state and federal agencies. See **Appendix 1** for additional information and resources relating to these and other federal, state, and local regulations, policies, and guidance documents.

The NEPA process requires that all major federal actions, i.e., projects requiring a federal permit, involving federal land, federal funding, or in partnership with federal agencies, take specific actions to consider environmental quality concerns. Depending on the scope of the action, NEPA requires an assessment of the environmental impacts of the project and a public comment or inclusion process. NEPA triggers one of two procedural documents to satisfy its regulations. Actions that may significantly affect the human environment (the definition of which acknowledges the relationship between humans and their natural environment) are required to complete an Environmental Impact Statement (EIS). Federal actions that are not expected to meet the EIS “significant affect” threshold require only an Environmental Assessment (EA), a less onerous evaluation of environmental impacts (Ruyle et al. 2020).

The CWA establishes the regulatory framework governing surface water quality and discharges into Waters of the United States (WOTUS). A 2020 joint Environmental Protection Agency (EPA) and US Army Corps of Engineers (USACE) Rule redefined WOTUS, likely limiting the jurisdiction of CWA regulations on the intermittent waterways in Cobre Valley such as Pinal and Pinto Creeks. The new Biden Administration, however, may again redefine WOTUS, either reverting to the Obama Administration definition adopted in 2015, the definition established prior to the 2015 Clean Water Rule, or a completely new definition. Section 404 of the CWA regulates the discharge of dredge or fill materials into WOTUS. The applicability of Section 404 and other CWA permitting requirements to watershed projects in Cobre Valley hinge upon the adopted definition. A project requiring a Section 404 permit constitutes is considered a federal action, triggering the NEPA process.

The Endangered Species Act (ESA) is another federal framework with important implications for watershed planning in Cobre Valley and, like CWA permitting rules, interacts with the NEPA process. Cobre Valley is home to multiple species that are protected under the ESA. The early stages of environmental assessment required by NEPA are concurrent with ESA evaluations of potential impacts to species that are threatened, endangered, or proposed for listing. The relationship between the ESA and watershed planning is discussed in more detail later in this report.

The General Mining Law of 1872 is another policy of great importance to Cobre Valley, and indeed all of Arizona and the West. The Mining Law allows companies or individuals to stake a claim and obtain exclusive rights to hardrock minerals on public lands. The USFS and US Bureau of Land Management oversee the mining claims and operations on the lands they manage. The Mining Law serves and excellent example of another policy that lies within the broader context of state and federal environmental regulations. While the Mining Law does not itself contain any environmental protections, it is subject to most if not all the other federal and state regulations listed in **Appendix 1**, including the rules and regulations under NEPA, CWA, and ESA, described here.

In addition to the federal regulations described here, Appendix 1 also references local planning policies and guidelines that can be used to guide action plan development, helping to bolster community cooperation and alignment with local priorities.

PLANNING PARADIGMS

Land under different ownership is managed in different ways. Discoordination of land and water management with different goals or paradigms has the potential to negatively impact ecosystem functioning. In the Pinal Creek Watershed, only 24 of the land percent is privately owned, used primarily for mining and housing (Figures 4-5). The majority of the watershed falls under the management of the US Forest Service (USFS) - approximately 71 percent. These federally managed lands surround the communities within the watershed and play an important role in the land management dynamics of the region. To the east, the watershed meets the Upper Gila River Watershed and the San Carlos Apache Nation lies beyond that physical boundary. While not in the same watershed, the economic, environmental, and social connections between these areas is important to consider for planning.

One way to approach the collage of land ownership and management in this region is through established planning areas. Planning areas allow communities and leaders to identify and narrow in on subsections of the watershed and assess ecosystem functioning based on natural boundaries rather than political jurisdictions.

An example is the USFS's Watershed Condition Classification system, which rates watershed conditions on Forest Service lands in HUC12 watersheds that contain more than 5% USFS ownership. The feature class also includes data on high priority watersheds identified in the Watershed Condition Framework (WCF) process. The WCF data identifies priority watersheds, rationale for their designation as such, and information on Watershed Restoration Action Plans. The data are compiled from the Natural Resource Manager Watershed Condition Assessment and Tracking Tool (WCATT) application. By USFS's rating standards and observations, about three-quarters of the Pinal Creek Watershed is considered impaired, with the other quarter to be considered "at risk" (Figure 6).

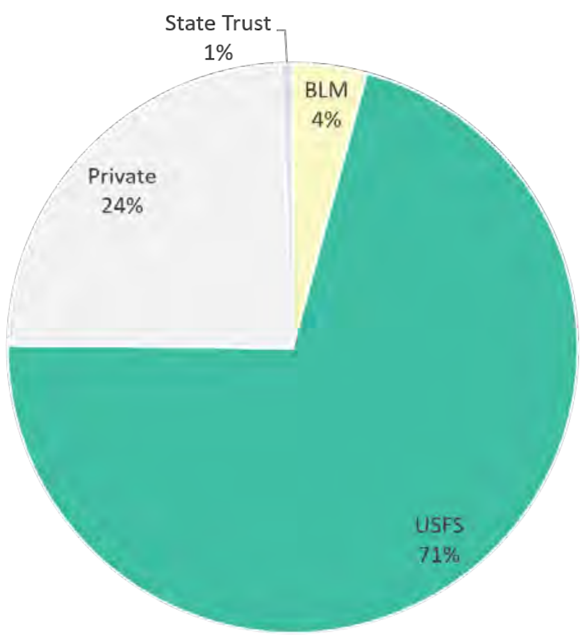

Figure 4. Percent of Landownership in Cobre Valley (ARLIS 2018)

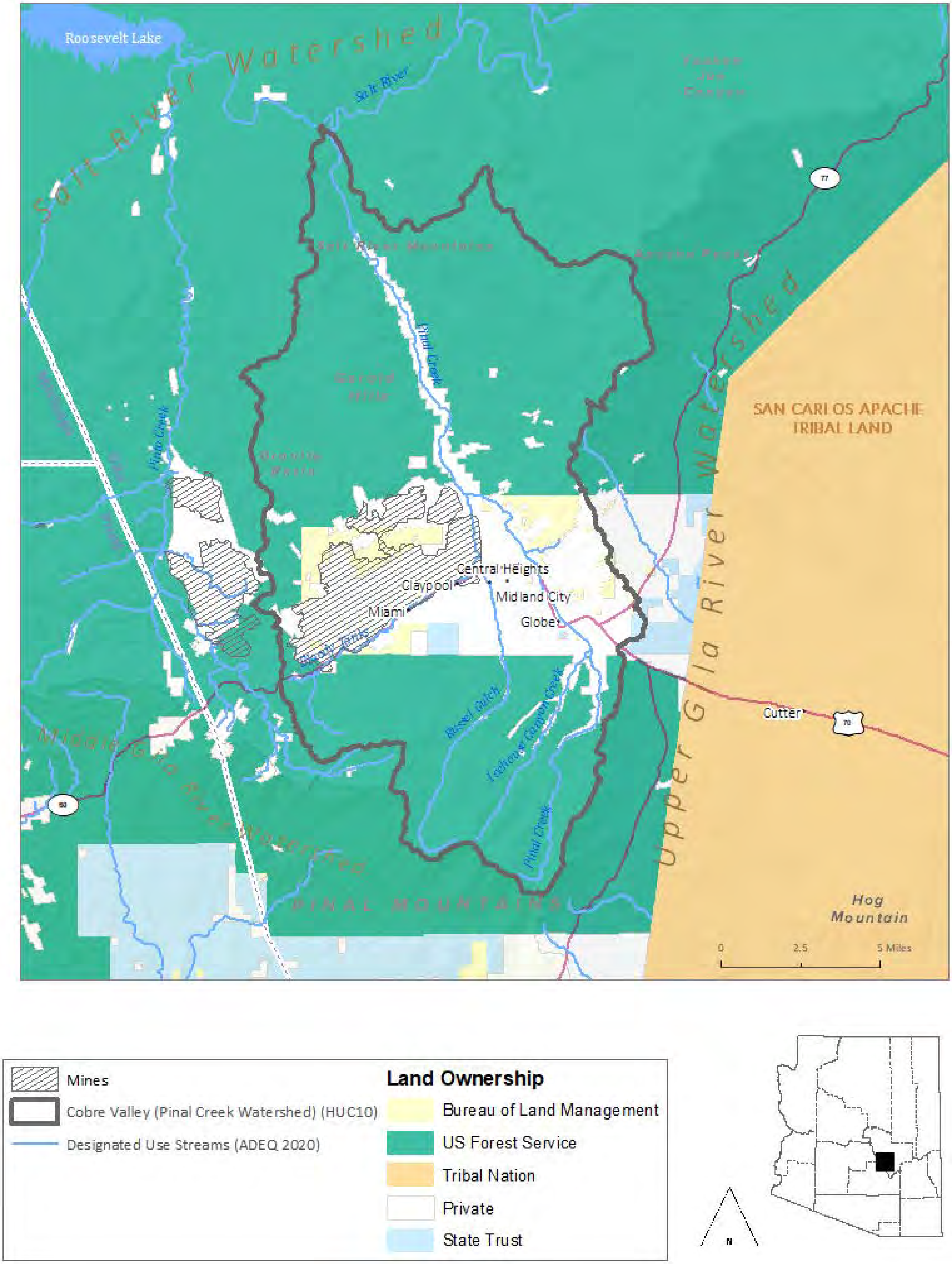

Figure 5. Landownership in the Cobre Valley (ARLIS 2018)

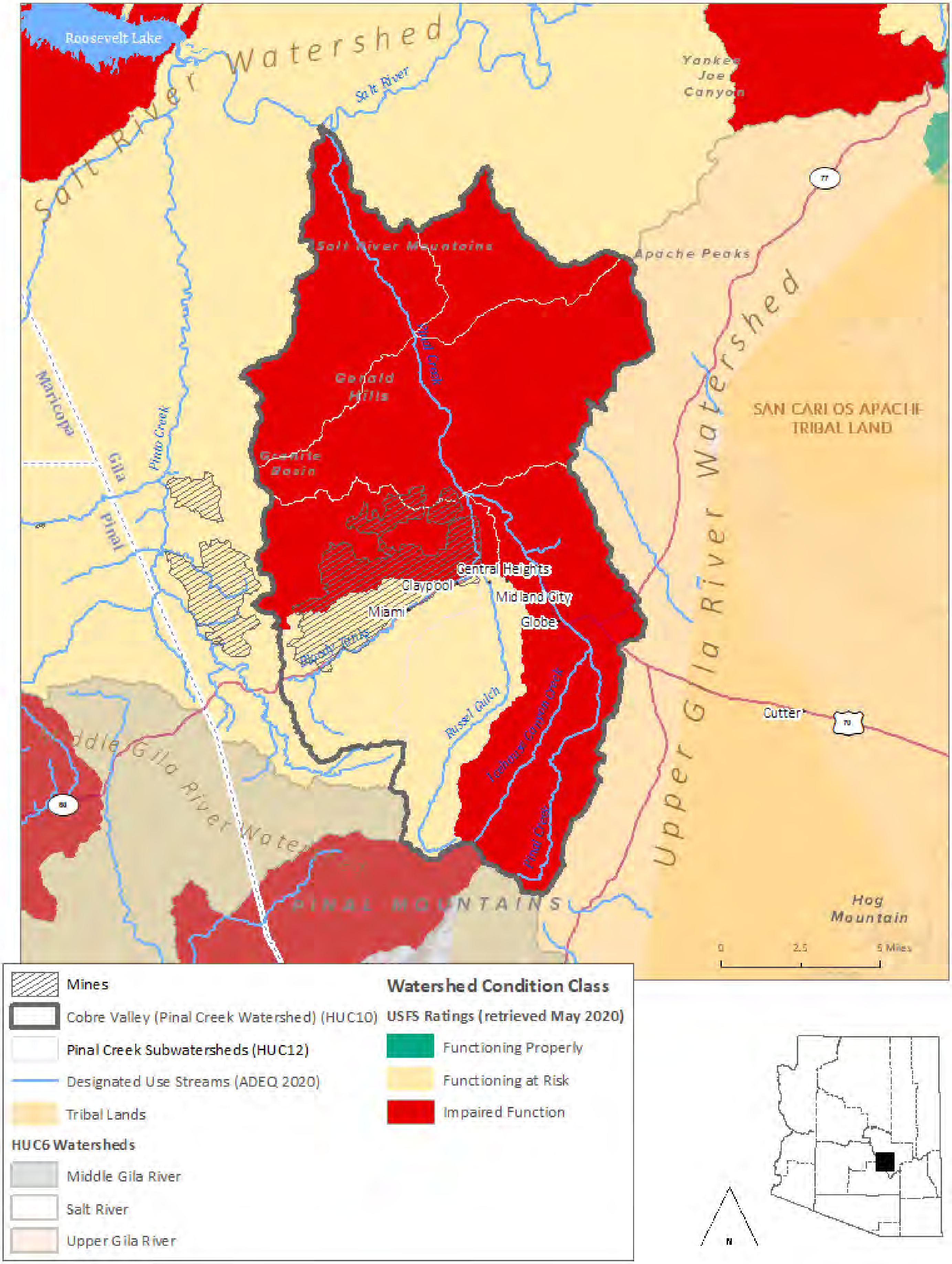

Figure 6. Watershed Condition Class Ratings for the Cobre Valley - Pinal Creek Watershed (USDA 2020)

PHYSICAL LANDSCAPE

Conditions and changes in the physical landscape are tied to the overall health of a watershed and its communities, both human and ecological. This section establishes the status of key components of the landscape: hydrogeology, surface water conditions, and biotic communities, including ecological reference conditions and land cover change between 2001 and 2016.

HYDROGEOLOGY

Cobre Valley is a mountainous basin that spans approximately 200 square miles. Cobre Valley is located in the Salt River Basin, neighboring the Upper Gila River Basin to the east. These are individual basins that are virtually independent hydrologic systems (in contrast to a continuous groundwater system). The basins are structural depressions that were subsequently filled with alluvial sediments, which are enclosed or partly enclosed by mountains. The Pinal Creek watershed is characterized by typical Basin and Range geography of the Southwest, which is known for abrupt changes in elevation that alternate between steep, parallel north to northwest mountain ranges separated by flat valleys. Cobre Valley's alluvial formations are separated by distinct geographic features in each direction. The region's highest elevations are found along the southern end of the basin where the Pinal Mountains reach a maximum height of 7,848 ft at Pinal Peak. To the north the basin is surrounded by the Mogollon Rim, which is a dramatic 2,000-ft high escarpment. The White Mountains to the east, and Sierra Ancha and Superstition Mountains to the west and southwest, create natural boundaries. The communities of Globe-Miami are located at approximately 3,500 ft and overlay Pinal Creek just below its headwaters, which then drains to the lowest point - Roosevelt Lake at an elevation of 2,000 ft.

Understanding groundwater trends requires a general understanding of the subsurface geology that comprises the groundwater system. Mountainous areas generally have little groundwater storage capacity. Extensive bedrock exposure causes relatively high runoff during precipitation events, resulting in low water infiltration and aquifer recharge compared to southern parts of the state. Groundwater recharge is most likely to occur in the alluvial formations that make up less than three percent of the watershed (see Qo and Qy formations in Figure 7, Table 1).

Additionally, geologic formations and topography contribute to patterns of erosion and deposition in the watershed. Surface and groundwater quality is directly affected by the geology of the watershed in this way. Soil properties (texture, depth, and fertility) and topography interact to influence plant abundance and distribution. These factors also determine how surface water, a critical resource in the desert, is distributed and used.

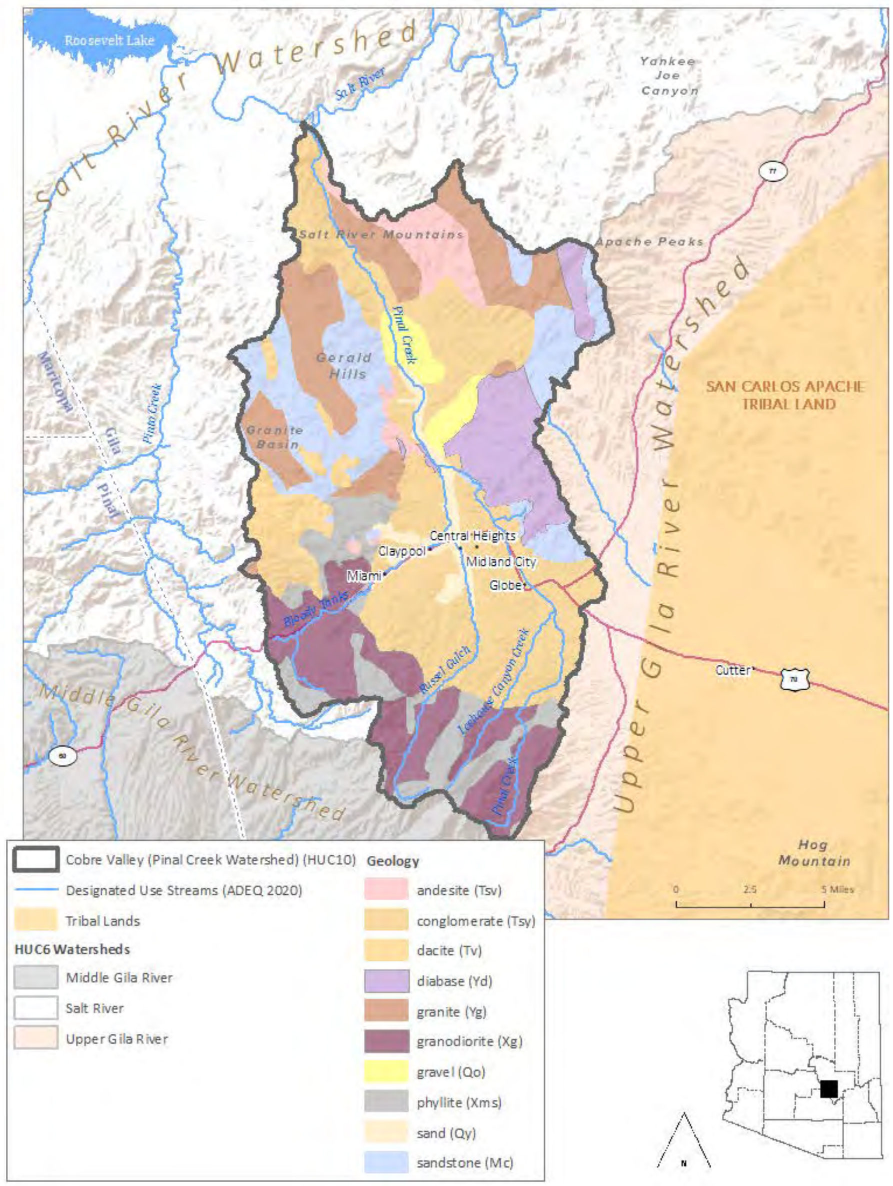

Figure 7. Geology of the Cobre Valley

Table 1. Dominant Geologic Formations in PInal Creek Watershed (AZGS 2020)

Geologic Formation	% Watershed	Abbreviation	Description
Conglomerate	33%	Tsy	Moderately to strongly consolidated conglomerate and sandstone deposited in basins during and after late Tertiary faulting. Includes lesser amounts of mudstone, siltstone, limestone, and gypsum. These deposits are generally light gray or tan. They commonly form high rounded hills and ridges in modern basins and form prominent bluffs locally. Deposits of this unit are widely exposed in the dissected ba-sins of southeastern and central Arizona.
Diabase	8%	Yd	Dark gray to black sills (intrusions mostly parallel to bedding) in strata of the Apache Group and irregular to sheet-like in-trusions in other rocks. Present in east-central and south-eastern Arizona. Some sills are more than 100 m thick. Expo-sures are extensive north of Globe.
Dacite	5%	Tv	Lava, tuff, fine-grained intrusive rock, and diverse pyroclastic rocks. These compositionally variable volcanic rocks include basalt, andesite, dacite, and rhyolite. Thick felsic volcanic sequences form prominent cliffs and range fronts in the Black (Mohave County), Superstition, Kofa, Eagletail, Galiuro, and Chiricahua Mountains. This unit includes regionally extensive ashflow tuffs, such as the Peach Springs tuff of northwestern Arizona and the Apache Leap tuff east of Phoenix. Most volcanic rocks are 20-30 Ma in southeast-ern Arizona and 15 to 25 Ma in central and western Arizona, but this unit includes some late Eocene rocks near the New Mexico border in east-central Arizona.
Sandstone	12%	Mc	Brown to dark gray sandstone grades upward into green and gray shale, overlain by light to medium gray or tan limestone and dolostone. This unit includes the Tapeats Sandstone, Bright Angel Shale, Muav Limestone, Temple Butte Formation and Redwall Limestone in northern Arizona, and the Bolsa Quartzite, Abrigo Formation, Martin Formation, and Escabrosa Limestone in southern Arizona. These rocks record intermittent sea-level rise and inundation in early Paleo-zoic time.
Sand	1%	Qy	Unconsolidated deposits associated with modern fluvial sys-tems. This unit consists primarily of fine-grained, well-sorted sediment on alluvial plains, but also includes gravelly channel, terrace, and alluvial fan deposits on middle and upper piedmonts.
Gravel	1%	Qo	Coarse relict alluvial fan deposits that form rounded ridges or flat, isolated surfaces that are moderately to deeply incised by streams. These deposits are generally topographically high and have undergone substantial erosion. Deposits are moderately to strongly consolidated, and commonly contain coarser grained sediment than younger deposits in the same area.
Phyllite	12%	Xms	Metasedimentary rocks, mostly derived from sandstone and shale, with minor conglomerate and carbonate rock. Includes quartz-rich, mostly non-volcanic Pinal Schist in south eastern Arizona and variably volcanic-lithic sedimentary rocks in the Yavapai and Tonto Basin supergroups in central Arizona.
Granodiorite	9%	Xg	Wide variety of granitic rocks, including granite, granodiorite, tonalite, quartz diorite, diorite, and gabbro. These rocks commonly are characterized by steep, northeast-striking foliation.
Andesite	3%	Tsv	Sequences of diverse volcanic rocks with abundant interbedded sedimentary rocks.
Granite	16%	Y	Mostly porphyritic biotite granite with large microcline phenocrysts, with local fine-grained border phases and aplite. Associated pegmatite and quartz veins are rare. This unit forms large plutons, including the Oracle Granite, Ruin Granite, granite in the Pinnacle Peak - Carefree area northeast of Phoenix, and several bodies west of Prescott.

SURFACE WATER

Little surface water is available for local use in the Cobre Valley. Streams in this watershed are mostly ephemeral, occurring only in response to precipitation events. Pinal Creek is the watershed's primary surface water body, which flows northward through mining zones and local communities to arrive at the Salt River upstream of Roosevelt Lake. The Pinal Creek catchment area is constrained by the Pinal Mountains to the south, Apache Peaks to the northeast, and Globe Hills to the east. The watershed is composed of seven subwatersheds as part of the greater Upper Salt River Watershed. Small tributary canyons (Six-shooter Canyon, Icehouse Canyon, Kellner Canyon) make up the headwaters of the system in the south, with additional source waters entering the system further north from Nugget Wash, Negro Wash, and Wood Springs Wash. Major tributaries of Pinal Creek include Bloody Tanks Wash and Russell Gulch, which join to form Miami Wash. Precipitation events in the southern portion of the basin create a perennial stream that emerges in the north end of the channel where bedrock impinges on the alluvial aquifer and forces groundwater to the surface. The perennial flow is present in the northern 3.41 miles of the watershed (Table 2, Figure 8).

The Clean Water Act and associated rules require Arizona to identify how waterbodies are used – referred to as "designated uses." Surface water quality standards are then associated to designated use(s) for a waterbody. A waterbody that does not meet standards for a designated use is considered "impaired" and a Total Maximum Daily Load (TMDL) or watershed plan is developed to identify necessary managment actions. Arizona Department of Environmental Quality (ADEQ) records designated uses for 65.3 miles of waterways (ephemeral and perennial streams) in the Cobre Valley (Table 2). Designated uses are assigned as outlined in the Arizona Administrative Code. ADEQ also conducts a public review process for any changes to standards or designated uses during the Triennial Review, as required by the Clean Water Act.

Table 2. Designated Use Waterbodies in the PInal Creek Watershed (ADEQ 2020)

Name	Stream length (mi)	AWW: Aquatic and Wildlife (Warm Water)	AWE: Aquatic and Wildlife (Ephe-meral)	AWEDW: Aquatic and Wildlife (Effluent Depen-dent Water)	FC: Fish Con-sumption	FBC: Full-Body Contact	PBC: Partial-Body Contact	AGL: Agri-cultural Livestock Watering
Bloody Tanks Wash	1.9		Y				Y	Y
Bloody Tanks Wash	6.2		Y				Y	
Copper Springs Creek	2.7	Y			Y	Y		
Pinal Creek	6.4		Y				Y	Y
Pinal Creek	4.4	Y				Y		
Pinal Creek	2.4	Y			Y	Y		
Russell Gulch	12.2		Y				Y	
Miami Wash	2.5		Y				Y	
Pinal Creek	13.5		Y				Y	Y
Icehouse Canyon Creek	7.6	Y			Y	Y		
Pinal Creek	2.3			Y			Y	
Pinal Creek	1.8			Y			Y	
Unnamed (receives Globe WWTP)	1.4			Y			Y	
Total	65.3	4	6	3	3	4	9	3

Globe-Miami is listed under the Water Quality Assurance Revolving Fund (WQARF) Program Registry maintained and regulated by ADEQ. The WQARF program supports ADEQ in identifying, prioritizing, assessing and resolving the threat of contaminated soil and groundwater sites in the state. Based on the type of contamination, the contamination's location and the number of people that may be affected, a registry site's score can reach a maximum of 120. The Globe-Miami WQARF site covers approximately 37 square miles and has a score of 97 (Figure 8).

The WQARF site includes:

- City of Globe, Town of Miami, and the surrounding communities,
- BHP and Freeport-McMoRan Inc. (FMI) mining properties,
- Drainages and underlying aquifers of Miami Wash, Bloody Tanks Wash, Russell Gulch and Pinal Creek,
- Entire Pinal Creek floodplain from the Old Dominion Mine to the Salt River, and
- Portions of the communities underlain by contaminated groundwater.

The contaminants of concern include aluminum, iron, manganese, copper, cobalt, nickel, zinc, cadmium, sulfate, acidity and dissolved solids, plus arsenic, lead, copper, cadmium, manganese, nickel and zinc in localized soil and stream sediment. Local mining companies have completed investigations and conducted remedial actions including source control since 1988. These entities have also conducted a well replacement program for contaminated private and public supply wells. The PCG conducted groundwater extraction and treatment from the alluvial and regional aquifers since 1988 and continuing today.

FMI's Pinal Creek Project (PCP) is the sole owner and operator of the Pinal Creek groundwater remediation systems and responsible for the Groundwater Remedial Action Plan described in the 1998 Consent Decree. The PCP remains responsible for source control, groundwater remediation, and groundwater monitoring. To speed up aquifer restoration, groundwater remedy optimization pilot tests have been conducted near the contamination source area in Bloody Tanks Wash. This treated water is then recharged into the aquifer downstream in the Pinal Creek, resulting in the only perennial stream reach of the Pinal Creek (Figure 8).

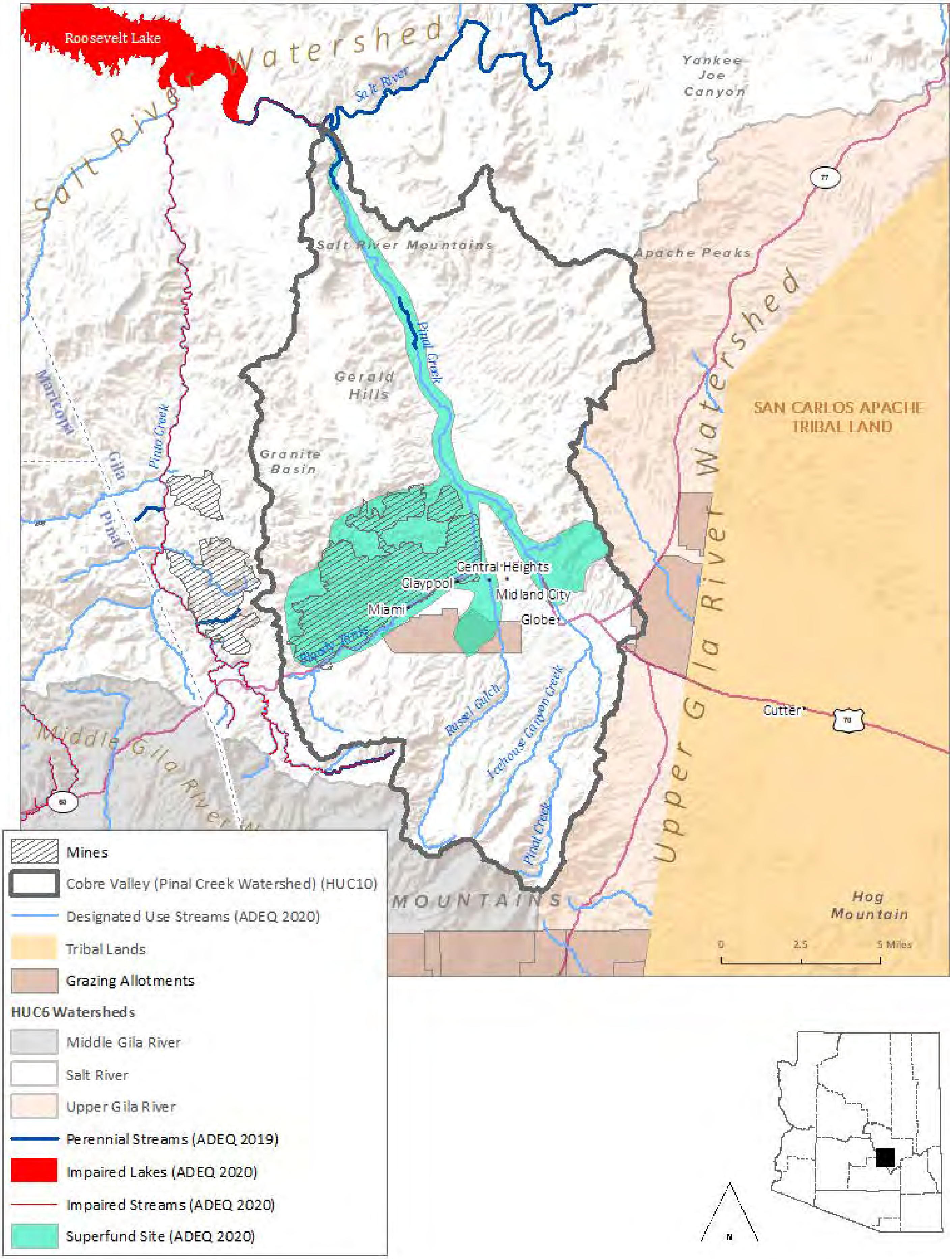

Figure 8. Designated Waterbodies and Impaired Waterbodies (ADEQ 2020)

BIOTIC COMMUNITIES

The health of ecosystems rests on the productive capacity of the soil, water, and climate, along with their interaction, to support all biota. Biomes, or biotic communities, are characterized by their distinctive vegetation. Meanwhile, an ecosystem refers to the interaction among both biotic and abiotic organisms living together in a particular environment. The status of natural ecosystems depends on the health of the species (or combinations of species) to tolerate a limited range of conditions (chemical, physical, and biological). Understanding what biotic communities are present and how they interact with their environment is essential to developing effective watershed management approaches and promoting long-term ecosystem health.

Cobre Valley's biotic communities include diverse and interconnected species and their complex relationships with their associated ecosystems. Associations are based on biologic communities, the limits of moisture and temperature regimes, and the evolutionary origins of the plants and animals present. Extended drought and changing temperature and precipitation patterns may cause shifts in the location of biotic communities, which can impact the benefits that they provide. For example, as average temperatures increase, some plant communities must shift to higher elevations to survive. This can influence the associated fire risk, affecting the wildlife habitats dependent on them. Cobre Valley biotic communities include Interior Chapparal, Semidesert Grassland, Upland Sonoran Desert Scrub, Petran Montane Conifer Forest, Madrean Evergreen Woodland, California Chapparal, and Great Basin Conifer Woodland (Table 3, Figure 9). The two most prevalent biotic communities in Cobre Valley are Interior Chapparal (49 percent) and Semidesert Grassland (24 percent).

Table 3. Dominant Biotic Communities in Pinal Creek Watershed (Brown & Lowe 1980)

Biotic Community	% Watershed	% Arizona
Semidesert Grassland	24.5%	25.4%
Great Basin Conifer Woodland	1.0%	11.0%
Petran Montane Conifer Forest	6.4%	7.5%
Upland Sonoran Desert Scrub	14.3%	18.2%
Interior Chapparal	49.2%	5.7%
Madrean Evergreen Woodland	3.2%	13.5%
California Chapparal	1.47%	<1%

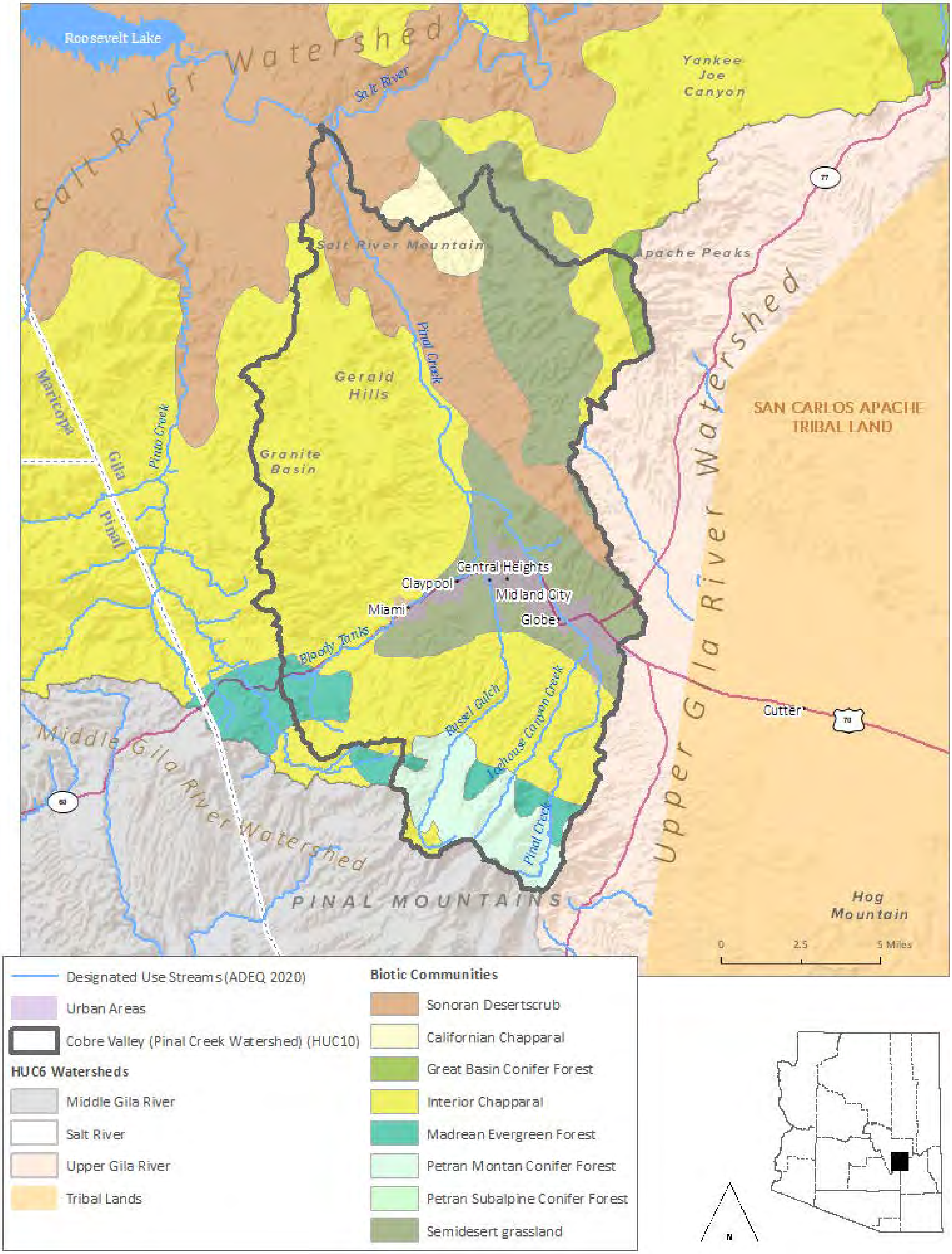

Figure 9. Biotic Communities of the Cobre Valley (Brown & Lowe 1980)

Ecosystem Reference Conditions

For an ecosystem to be healthy, it must possess the long-term capacity for renewal in terms of ecological productivity, diversity, and complexity. Climate variability and natural disturbances may cause short-term disruptions to ecosystem health, but changes outside of historic bounds threaten long-term consequences. One of the first steps in managing the landscape to enhance and preserve these capacities is to stratify the landscape into meaningful units. Ecosystem Response Units (ERUs) facilitate landscape analyses and planning by defining historic or "reference conditions" to consider in selecting land management approaches and evaluation of current health. The ERUs dataset is provided by the USDA Forest Service Region 3. To an extent, the ERUs refine biotic communities as defined by Brown and Lowe (Table 3, Figure 9), but they are not a one-to-one match and provide opportunities to draw comparisons between the two stratification systems.

The ERUs integrate site potential (soil physical and chemical properties, geology, geomorphology, aspect, slope, climate variables, and geographic location) and fire regime (historic and contemporary), along with impacts from neighboring ecological communities and seral stages, to create a framework representing all major ecosystem types in the planning area (Table 4, Figures 10-11). The ERUs are hierarchical categorized by major terrestrial systems (e.g. forest, woodland, shrubland, grassland, riparian, etc.). The dominant ERU in the Pinal Creek watershed is the Semi-Desert Grasslands at 40.1 percent, which is much greater than the 24.5 percent identified by Browne & Lowe. This ERU may have over 10 percent shrub cover historically but less than 10 percent tree cover (Wahlberg et al. 2014). Desert shrub species can be common in this ERU, so the boundary between Semi-Desert Grasslands and desert communities requires greater evaluation to distinguish.

Ecological Response Unit = Site Potential + Historic Disturbance Regime

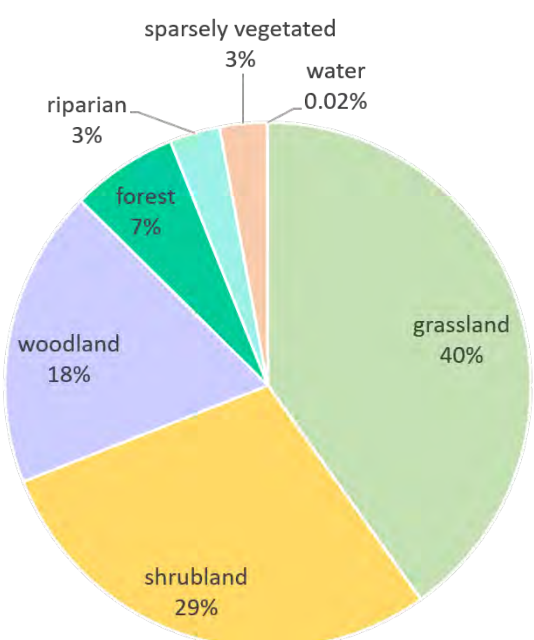

Figure 10. Terrestrial System Types Found in Cobre Valley (USDA 2021)

Table 4. Reference Conditions (USDA 2021)

System Type and Ecological Response Units (ERUs)	Area (acres)	Percent (%)
forest - Mixed Conifer w/ Aspen	2,500	2.0%
forest - Ponderosa Pine - Evergreen Oak	5,874	4.6%
grassland - Semi-Desert Grassland	51,262	40.1%
human / other - Sparsely Vegetated	3,740	2.9%
human / other - Water	28	0.02%
riparian - Arizona Walnut	11	0.01%
riparian - Desert Willow	516	0.4%
riparian - Fremont Cottonwood - Oak	137	0.1%
riparian - Fremont Cottonwood / Shrub	3,091	2.4%
riparian - Sycamore - Fremont Cottonwood	54	0.04%
riparian / wetland - Fremont Cottonwood / Shrub	140	0.1%
shrubland - Interior Chaparral	34,055	26.7%
shrubland - Mojave-Sonoran Desert Scrub	2,892	2.3%
woodland - Juniper Grass	8,906	7.0%
woodland - Madrean Encinal Woodland	620	0.5%
woodland - Madrean Pinyon-Oak Woodland	82	0.07%
woodland - PJ Evergreen Shrub	13,271	10.4%
woodland - PJ Grass	587	0.5%

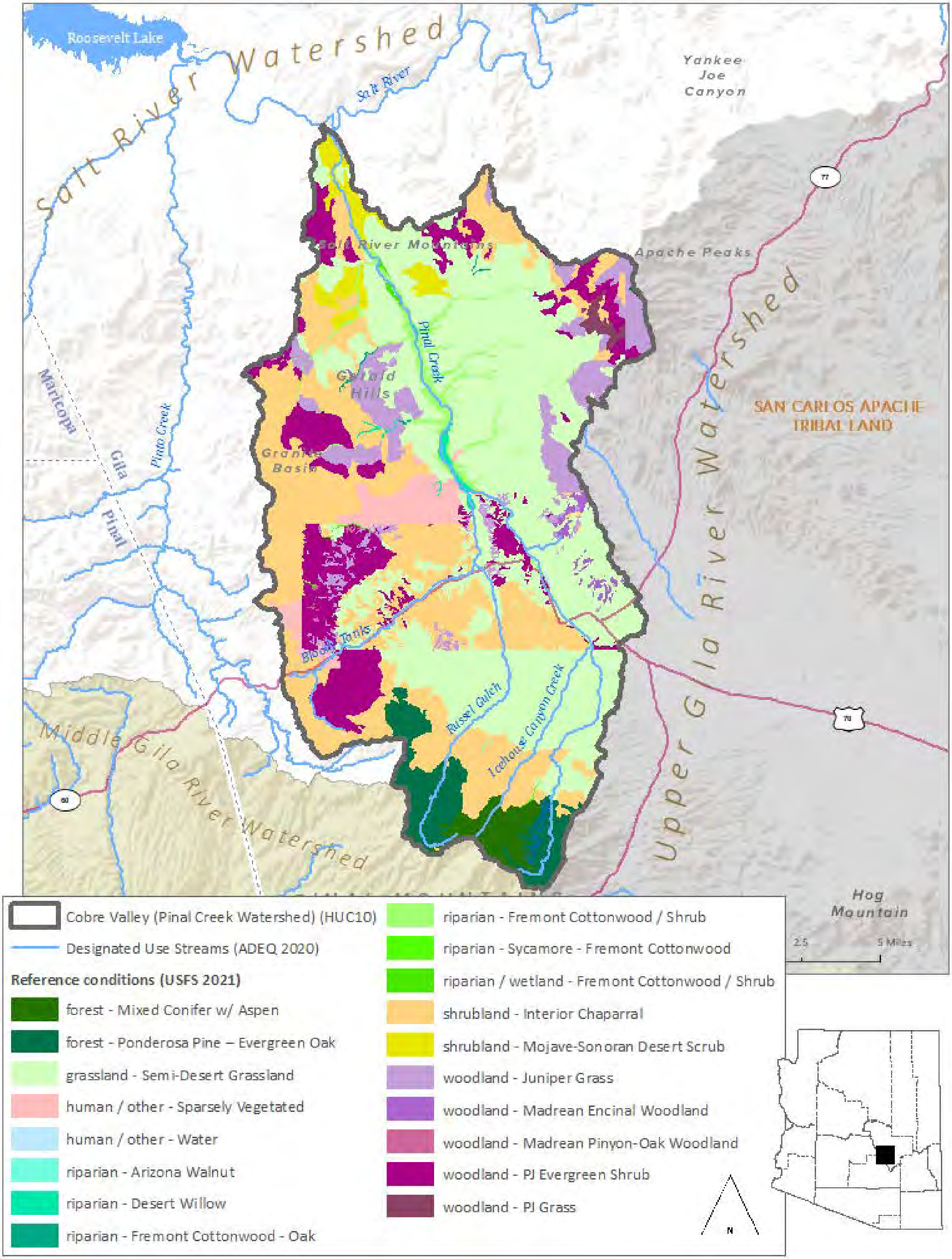

Figure 11. Reference Conditions Based on Ecological Response Units (USFS 2021)

Land Cover Change

Humans can have various impacts on their ecosystems, including land conversion through heavy industrial use, forest harvesting, suppression of natural fire cycles and floods, degradation through incompatible uses, atmospheric pollutants, and the introduction of non-native species. In turn, these factors influence natural processes and ultimately ecosystem-dependent plant and animal species. Monitoring and research are essential to understand our ecosystems and develop appropriate management strategies that promote healthy, productive, and sustainable watersheds.

Abundant native vegetation not only signifies a prospering ecosystem but also the quality of life for the people populating that region. Observing land cover change over time can indicate trends and the degree of landscape preservation, restoration, or degradation. The National Land Cover Database (NLCD) from the Multi-Resolution Land Characteristics Consortium provides consistent land cover information in 30-meter resolution to gain an overview of the important trends and changes in the land cover patterns.

The geospatial analysis of land cover change between 2001 and 2016 in the Cobre Valley indicated a shift in grasslands/herbaceous land cover to shrub/scrub and a loss of 67 percent grasslands/herbaceous cover in that period (Table 5, Figure 12). While reference conditions identify shrub/scrub as a dominant ecological unit, grasslands historically covered more of the watershed and are continuing to diminish. These findings support the trend of woody plant encroachment that is prevalent throughout the American southwest and in grassland ecosystems worldwide. Proliferation of woody plants alter grasslands plant communities and ecosystem processes (Andersen & Steidl 2019). For instance, woody plant encroachment can accelerate rates of wind and water erosion and decrease richness of plant species (Andersen & Steidl 2019).

One of the biggest threats to grasslands worldwide is encroachment by woody plants, driven by a complex and interacting set of factors (Andersen & Steidl 2019). Some of these driving factors include changes in land use, climate, fire frequency and intensity, concentrations of atmospheric CO2, among others (Archer et al. 2017). Grasslands are one of the most endangered ecosystems in the world, primarily due to land use changes (Andersen & Steidl 2019). The decline of grasslands has encouraged preservation efforts, which can provide direction to the Cobre Valley. However, even the grasslands that remain and are protected are threatened by non-native vegetation and other changes that compromise their ecological function.

Other NLCD Science Research Products indicate that the perimeters of many of Cobre Valley's forests, directly within the watershed or neighboring watersheds, are spectrally transitioning shrub. These transitions will be examined in greater detail in later chapters of this report, which will also seek to correct change miscalculations. NLCD is certainly not 100 percent accurate, so any misclassification errors can be transferred to analysis results.

Table 5. Land Cover Change Analysis, 2001-2016 (NLCD)

Landcover type	2001 area (acres)	2016 area (acres)	Change in acres	% Change
Open water	187	183	-4	-1.9%
Developed, open space	2,220	2,300	+81	+3.6%
Developed, low intensity	2,064	2,100	+36	+1.7%
Developed, medium intensity	891	929	+38	+4.2%
Developed, high intensity	211	235	+24	+11.4%
Barren land (rock/sand/clay)	5,734	5,706	-28	-0.5%
Evergreen forest	16,757	16,169	-589	-3.5%
Shrub/scrub	97,602	99,412	+1810	+1.9%
Grasslands/herbaceous	2,030	663	-1367	-67.3%
Woody wetlands	208	206	-2	-1.1%
Emergent herbaceous wetlands	2	3	1	+50.0%

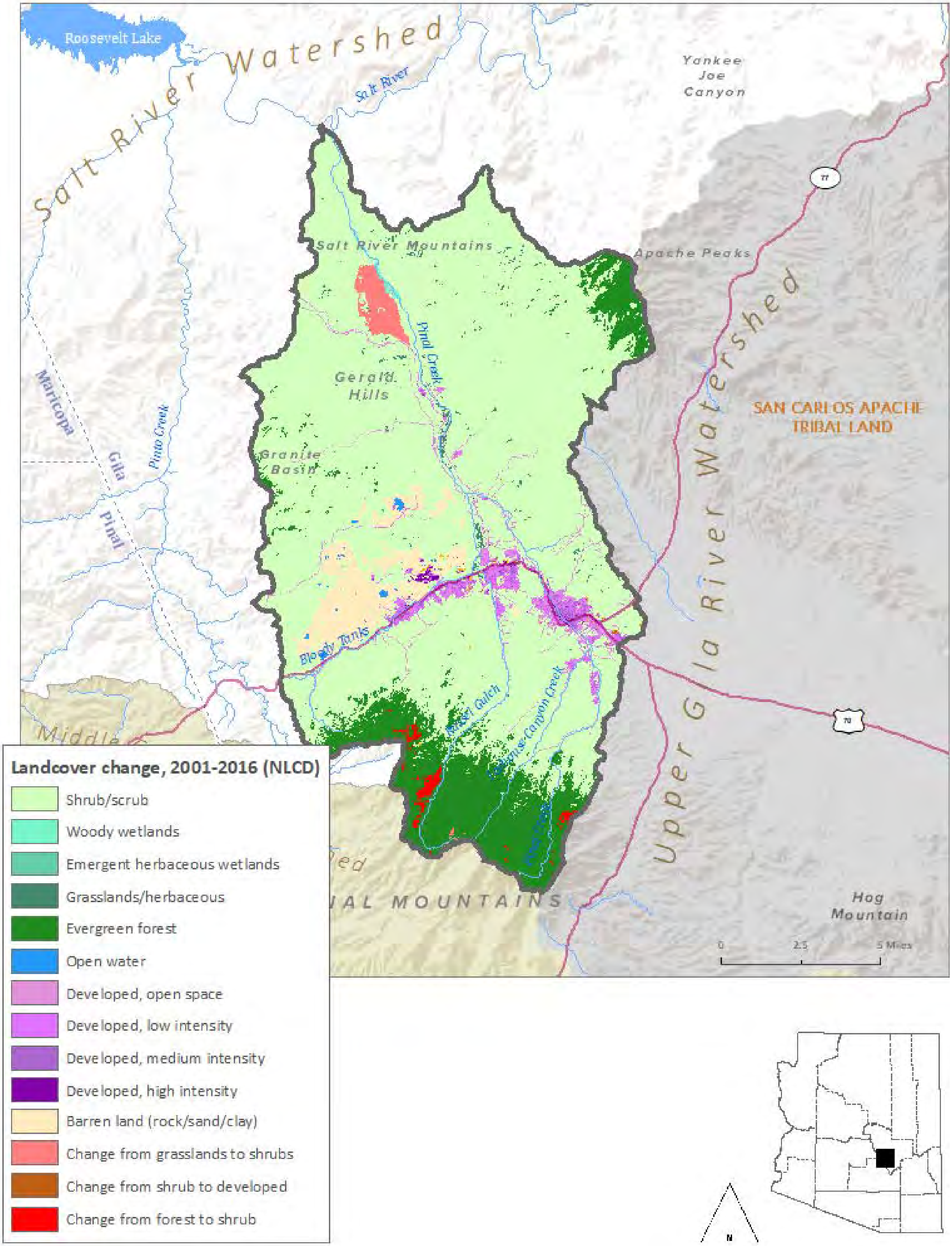

Figure 12. Land Cover Change in the Cobre Valley, 2001-2016 (NLCD)

BENEFITS GAINED FROM ECOSYSTEM SERVICES

The study of ecosystem services is centered around developing a framework to understand and value the vast diversity of benefits humans derive from their ecosystem. These benefits are both direct and indirect. Direct benefits include examples such as lumber harvested from a forest, clean water for drinking, or the enjoyment one gets from hiking. Indirect services include soil communities that provide nutrients that support rangeland health or a forest's role in erosion control. Indeed, as research into ecosystem services continues to develop, the more we appreciate the many ways we are reliant on the many functions of our ecosystem.

Understanding the value of ecosystem services is essential for natural resource managers or policy makers to make informed decisions about actions or policies that influence ecosystems or how society interacts with the environment. An economic valuation of ecosystem services is one method, of many, for natural resources managers to evaluate the relative impact of their land use decisions. Economic valuations divide ecosystem services into use and non-use values: 1) use values support people's own consumption (e.g. clean water and recreation); 2) non-use values result from the regulatory or supporting ecological processes that contribute to the ecosystem functions that provide tangible human benefits (e.g. healthy forest communities provide erosion control during and after storm events).

CULTURAL VALUE OF ECOSYSTEM SERVICES

Beyond the direct economic value of rangelands, there are deeply rooted cultural values tied to rangelands. In Cobre Valley, and indeed, communities throughout the West, rangelands play an important role in rural community identity and history. These values, while difficult to estimate monetarily, are important benefits provided by rangeland ecosystems.

RANGELANDS

Rangelands in Arizona are lands where the native vegetation is predominantly grasses, grass-like plants, forbs and small shrubs, and dispersed trees and woodlands. Management of these lands typically involve grazing by cattle or wildlife and some extractive industries such as mining or timber. Rangelands provide many ecosystems services of value to Cobre Valley in addition to the direct economic value derived from ranching.

Rangeland ecosystem services also include the regulating processes of the land itself, such as nutrient cycling in the soils, carbon sequestration, and erosion control, and cultural services which are highly valued by communities rooted in a long and rich history of ranching. However steep slopes can contribute to erodiblity (Figure 13). These slopes make land even more vulnerable to water erosion. Mismanaged pasture can contribute substantially to water quality degradation due to soil erosion and sediment transport to nearby water bodies.

The economic value of rangelands is often viewed in terms of the direct services the land provides, e.g. the value of the forage or number of cattle supported on the land. More recently, however, research into rangeland ecosystem services show a shift in stakeholder value from these provisioning services to regulating and cultural ecosystem services (Yahdjian, et al., 2015). According to the literature, this shift is at least partially driven by the diversity of stakeholders with competing values tied to the range (Yahdjian et al. 2015).

The Cobre Valley watershed consists of a patchwork of land ownership (Figure 5). The majority of the land within the watershed is managed by the US Forest Service (USFS), followed by private lands, Bureau of Land Management (BLM), and Arizona State Trust land. The San Carlos Apache Tribe has major land and water holdings upstream of the Cobre Valley. USFS, BLM, and State Trust land are all leased to fulfil their mixed-use management mandates for grazing, mining, and recreation. Because of these many, and at times competing, land use interests, watershed planning can be challenging. What is clear, however, is the importance of rangeland health to the communities that rely on them. With only 4% of the land in Gila County privately owned, managing rangeland ecosystem services is integral to the regional economy (UArizona Cooperative Extension).

In addition to the direct benefits gained by grazing, effective management of pastureland is critical because of the high potential of surface water contamination due to sediment and manure nutrient runoff. Producers who manage livestock on pasture usually consider the impact of their operation on water quality. Producers can reduce soil erosion and the delivery of nutrients and sediment to surface waters by focusing their management on avoiding overgrazing and nutrient problems caused by manure.

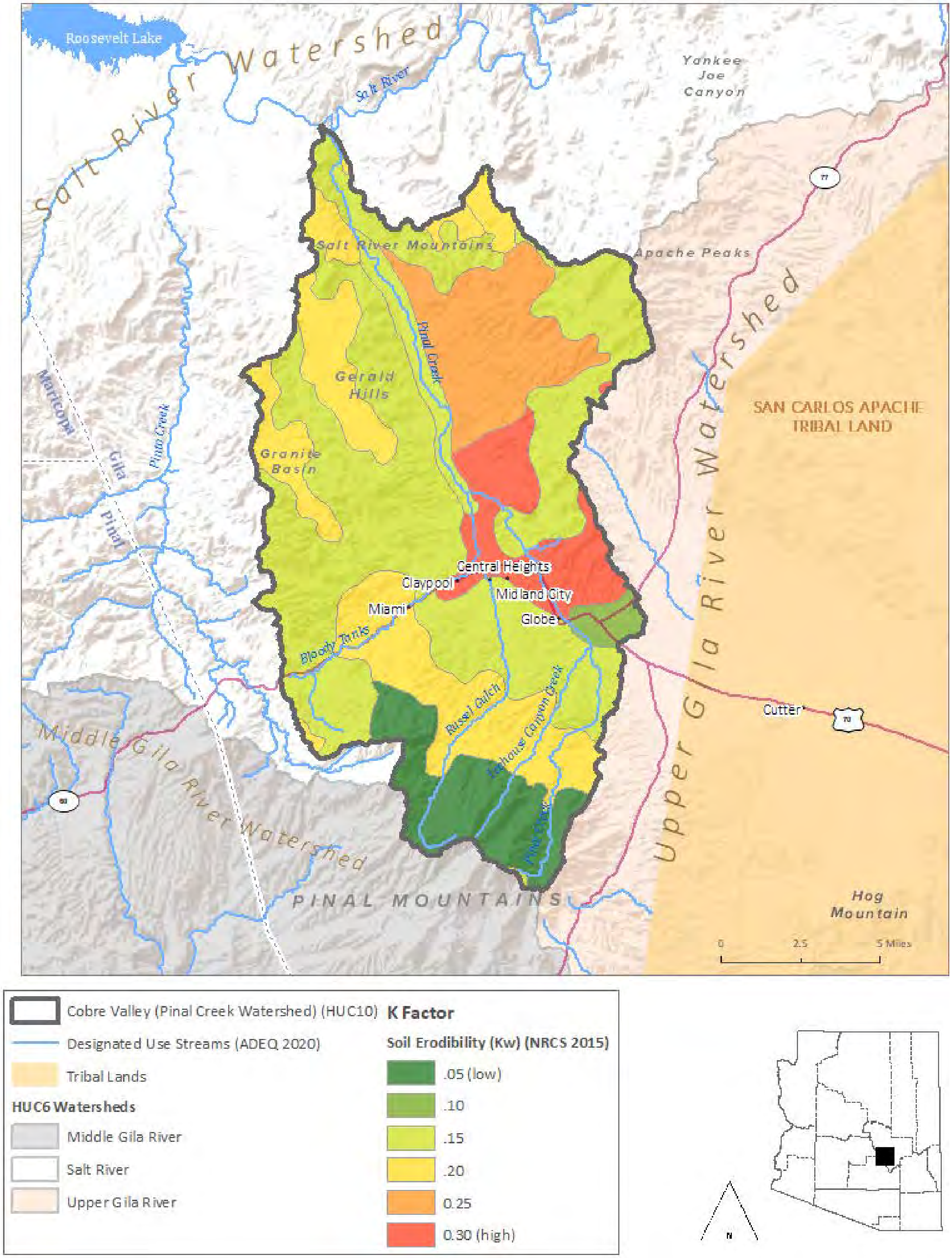

Figure 13. Soil Erodibility in the Cobre Valley (NRCS 2015)

RECREATION AND TRAILS

We derive real value from the enjoyment of activities such as hiking, biking, fishing, boating, or simply appreciating the natural beauty of a landscape. As a direct benefit provided by the ecosystem, recreation is at the same time easily understood and difficult to evaluate. Market valuations do not adequately capture the value of recreation, as there are few direct market transactions associated with recreation (e.g. a fee paid to visit a park). One method often used to evaluate the value of recreation or other non-market goods is the travel cost method (TCM). The TCM of analyzing the value of an activity measures an individual's willingness to pay for access to a particular site, in terms of time spent and direct travel costs (Duval et al. 2020). This method is particularly useful in assigning a value to trail or other site-specific recreation.

In early 2020, the University of Arizona Cooperative Extension and Department of Agricultural and Resource Economics published a report detailing research into the economic value of trail access in Arizona. The reports several findings that are significant to the evaluation of recreational ecosystem services in Cobre Valley. Using data from a survey of individuals from across the state, the study estimated the value of both non-motorized and motorized trail use using the travel cost method (Duval et al., 2020). The study found that in 2019, state residents used both motorized and non-motorized trails an estimated 103.2 million times, with non-motorized trail users averaging 27 visits in the year and 16 for motorized trail users (Duval et al. 2020). Furthermore, the study estimated the economic value of trail use to be $13.5 billion per year, which translates to a per visit value between $90-259 for both non-motorized and motorized trail use (Duval et al. 2020).

RURAL RECREATION DRIVEN BY METROPOLITAN USERS

Nearly 70% of trail use in Gila County comes from users visiting from Maricopa County.

Another significant finding of this study was that respondents overwhelmingly indicated (77 and 80 percent for non-motorized and motorized trail users, respectively) that access to trails for both non-motorized and motorized use is an important factor in deciding where to live (Duval, et al., 2020). Even individuals who did not use any trails in the study year responded that access to trail use was an important driver of where they decide to visit (Duval, et al., 2020).

The 2020 report demonstrates the significant economic value of trail-based recreation throughout Arizona. County by county analysis, also included in the report, show that the bulk (~69 percent) of trail use in Gila Country is driven by trail users from Maricopa County, highlighting the significant draw the county has for recreation tourism (Duval, et al., 2020). While the report did not estimate trail use value at the county level, synthesizing the total economic contribution in Arizona and the relative popularity of trail use in Gila County, one might conclude that trails in Gila County provide a significant economic benefit.

Trail use is just one way to estimate the economic value of recreation, however. In 2019, Audubon Arizona published "The Economic Contributions of Water-related Outdoor Recreation in Arizona." This report estimated the economic contributes of recreation on or along waterways in Arizona (Audubon 2019). Through analyzing a set of statewide surveys and recreation studies, the Audubon report estimates that in 2018, water-related recreation generated $13.5 billion in economic output, contributed $7.1 billion to Arizona's GDP, and supported 114,000 jobs (Audubon 2019). This study estimated recreation participation and spending and reports estimates at the county level. In Gila County, the study estimated an economic contribution of $387 million in economic output supporting 3400 jobs, and generating $130 million in wages (Audubon 2019). It should be emphasized that this report measured the economic value of water-based recreation, which in Gila County predominantly includes activities around Fossil and Christopher Creeks and Lake Roosevelt. The relevance to the Cobre Valley, however, is still salient. As was the case with the University of Arizona trails study, this report demonstrates the often-overlooked economic value of recreation as an economic driver.

Together, these two recreation studies provide examples of how the ecosystem service of recreation can be evaluated to inform decision-making. The significant economic value derived from recreation may be impacted by changes to the natural landscape, whether they change due to climate or human land use change. The Cobre Valley currently has at least 42 miles of hiking trails in the watershed and plans to expand and connect trail systems in the area (Figure 14). Many more miles of motorized trails exist as well.

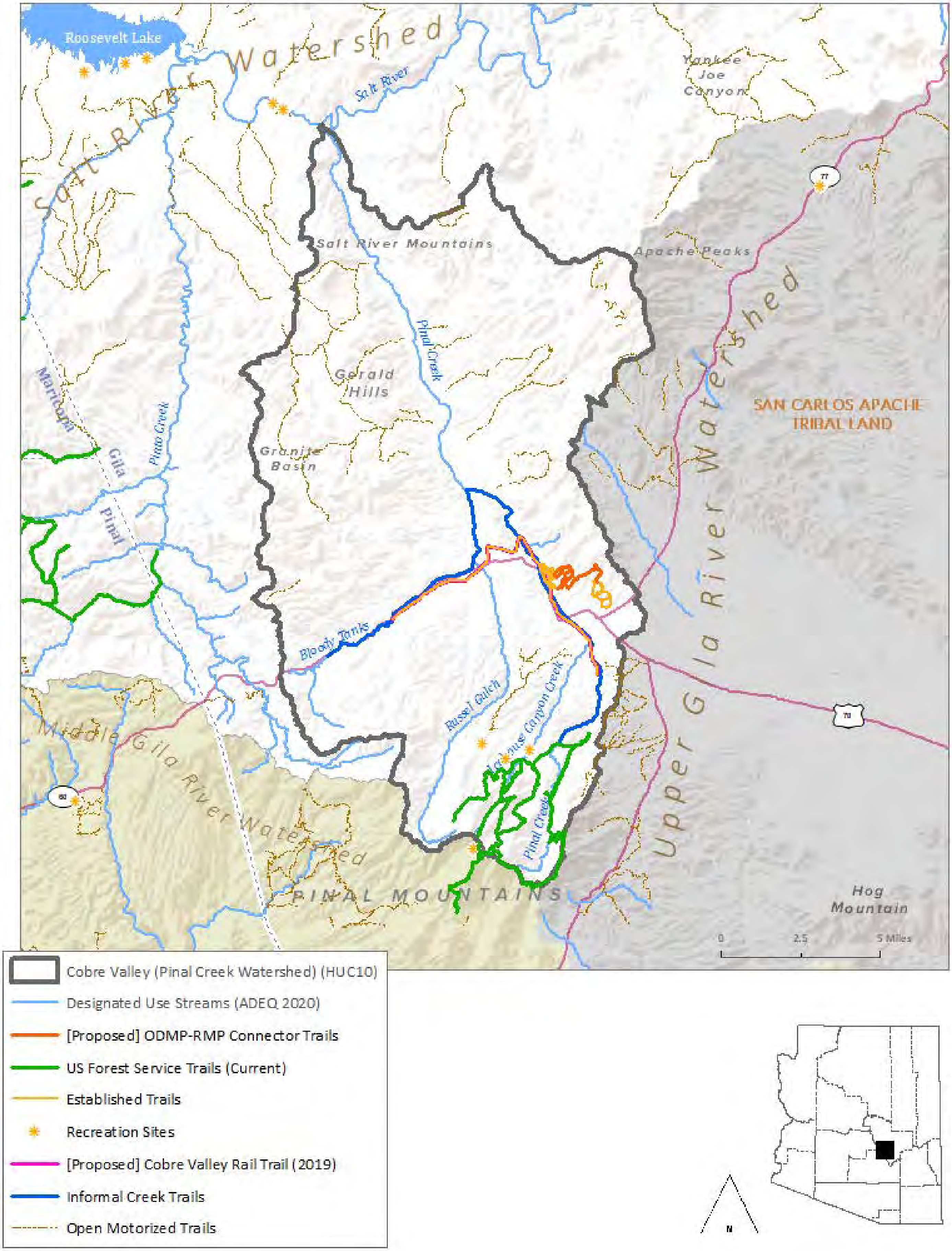

Figure 14. Current and Proposed Trails in the Cobre Valley

SPECIES HABITAT AND WILDLIFE LINKAGES

Arizona's growing communities and economy present challenges to maintaining natural ecosystems and wildlife populations that constitute a valuable part of the state's wealth. Cobre Valley is an important focal point with nearly half of the watershed (97 square miles out of 200) identified by state or federal agencies and conservation organizations as critical habitat, wildlife linkages, or sensitive biological lands.

The Pinal Creek Watershed contains over 60 square miles of critical habitat designated for the conservation of the Mexican Spotted Owl, primarily in the Pinal Mountains in the southern part of the watershed (Figure 15). The watershed is also home to a small proportion of critical habitat for the Southwestern Willow Flycatcher in the northern tip of the watershed that connects with the Salt River. These areas were designated by the US Fish & Wildlife Service (USFWS), the federal agency that must consider areas of habitat believed to be essential the species' conservation when proposed for listing as endangered or threatened under the Endangered Species Act (ESA). Those areas may be proposed for designation as "critical habitat." The term critical habitat describes a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and may require special management and protection. The critical habitat designation may include an area that is not currently occupied by the species but that will be needed for its recovery. An area is designated as "critical habitat" after USFWS publishes a proposed Federal regulation in the Federal Register and receives and considers public comments on the proposal. The ESA requires federal agencies to consult with USFWS on action they carry out, provide funding for, or authorize to ensure the project will not destroy or adversly modify critical habitat. The riparian area along the perennial stretch of Pinal Creek downstream of Globe-Miami is proposed as yellow-billed cuckoo habitat and has not been finalized as of February 10, 2021.

The watershed is also the terminus of three different wildlife linkages (Figure 15). Roads, building developments, railways, and other corridors can remove habitat and "create barriers that isolate wildlife populations and disrupt ecological functions such as gene flow, predator-prey interactions, and migration" (ADOT 2006). Wildlife linkages identify areas of species movement and connectivity, as well as indicate the need to preserve or restore habitat connectivity with physical design and local protection. The Nature Conservancy (TNC) also includes parts of the watershed as "Natural Infrastructure" based on a 2008 study. The study used 12 datasets to map sensitive biological lands and waters (i.e. areas supporting core habitat or providing corridors for wildlife) and open space plans (i.e. areas with existing or proposed designation for outdoor recreational use as identified by counties, municipalities, and community open space plans).

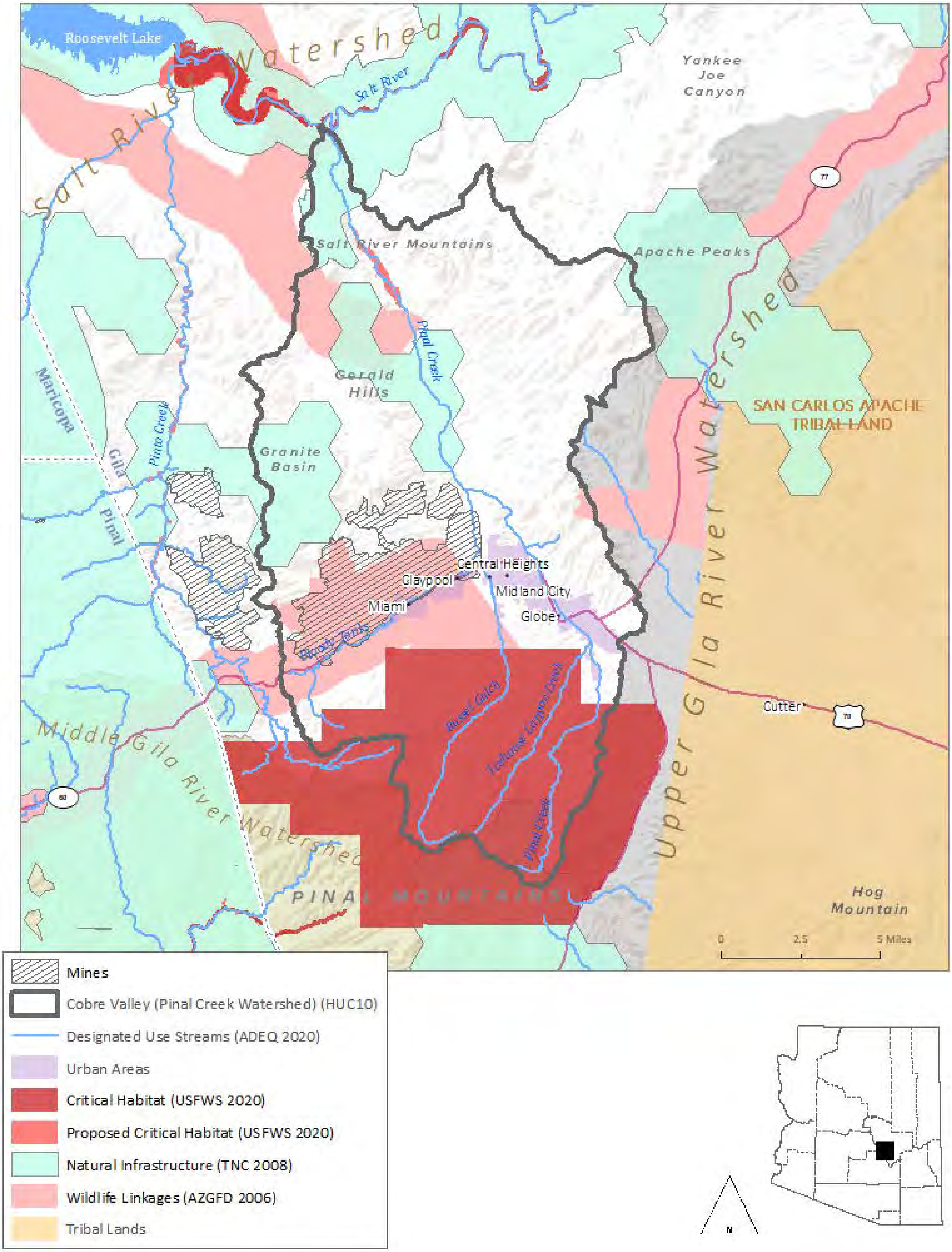

Figure 15. Critical Habitat, Wildlife Linkages, and Natural Infrastructure in Cobre Valley

TREE CANOPY COVER

As a grassland and shrub-dominated ecosystem, the Pinal Creek watershed's riparian forests (found along waterways) and uplands forests (found at higher elevations) are key assets to the local communities and animal species. The densest concentration (above 50 percent) of tree canopy cover are found at higher elevations, such as the Pinal Mountains (Figure 16). These forests provide important benefits such as heat mitigation and carbon sequestration in the Cobre Valley. Carbon sequestration, or carbon uptake by trees, in Cobre Valley is estimated at 140 metric kilotons annually in trees in the Cobre Valley, which is a service valued overall at $20 million dollars (i-Tree Canopy). Clearly the greatest concentrations of tree canopy do not align with the greatest concentration of impervious areas, where daytime and nighttime temperatures tend to be higher. An assessment of the daytime cooling effect of tree canopy cover in Phoenix showed that a one percent increase in tree canopy cover reduced air temperature by 0.14 °C (or 0.25 °F) (Middel et al. 2015). The same study indicated that an increase in tree canopy cover from 10 to 25 percent yielded an air temperature reduction of up to 2.0 °C (or 3.6 °F). Along with heat mitigation benefits, trees also have multi-dimensional services by increasing soil moisture retention and providing erosion control, along with other benefits.

Urban tree canopy in Arizona can be a significant factor for quality of life. The trees and vegetation that exist in developed areas where impervious hardscape surfaces prevail. Many times, urban forests are located on private land, but also include public parks, street trees, community gardens, riparian areas, and washes. Especially as annual temperatures increase throughout the state, Arizona communities have recognized the value and benefits of trees and urban tree canopy. In a 2015 assessment of the Globe-Miami urban areas, tree canopy was estimated at 4.8 percent – 139 acres of canopy cover out of the 2900 acres assessed (AZDFFM 2015)(Table 6). By way of comparison, the City of Phoenix estimated a 12.4 percent canopy cover in 2015 and City of Tucson estimated their canopy cover at 8 percent in 2019. Phoenix and Tucson have both adopted goals to reach 25 percent and 20 percent canopy cover respectively by 2030. Local community members may ask the following questions to take initial steps toward enhancing urban tree canopy cover:

- What might be a target percent urban tree cover?
- Where is it socially desirable to plant trees?
- Where is it financially efficient to plant trees?

Table 6. Cobre Valley Urban Tree Canopy (AZDFFM 2015)

Canopy cover area	Analysis area source	Acres of analysis area	Estimated Acres of Urban Tree Canopy	Football field equivalent
Globe	ADOA incorporated area x Census Urbanized Area intersection	2,412.3	114.6	127.1
Miami	ADOA incorporated area x Census Urbanized Area intersection	490.4	23.3	25.9

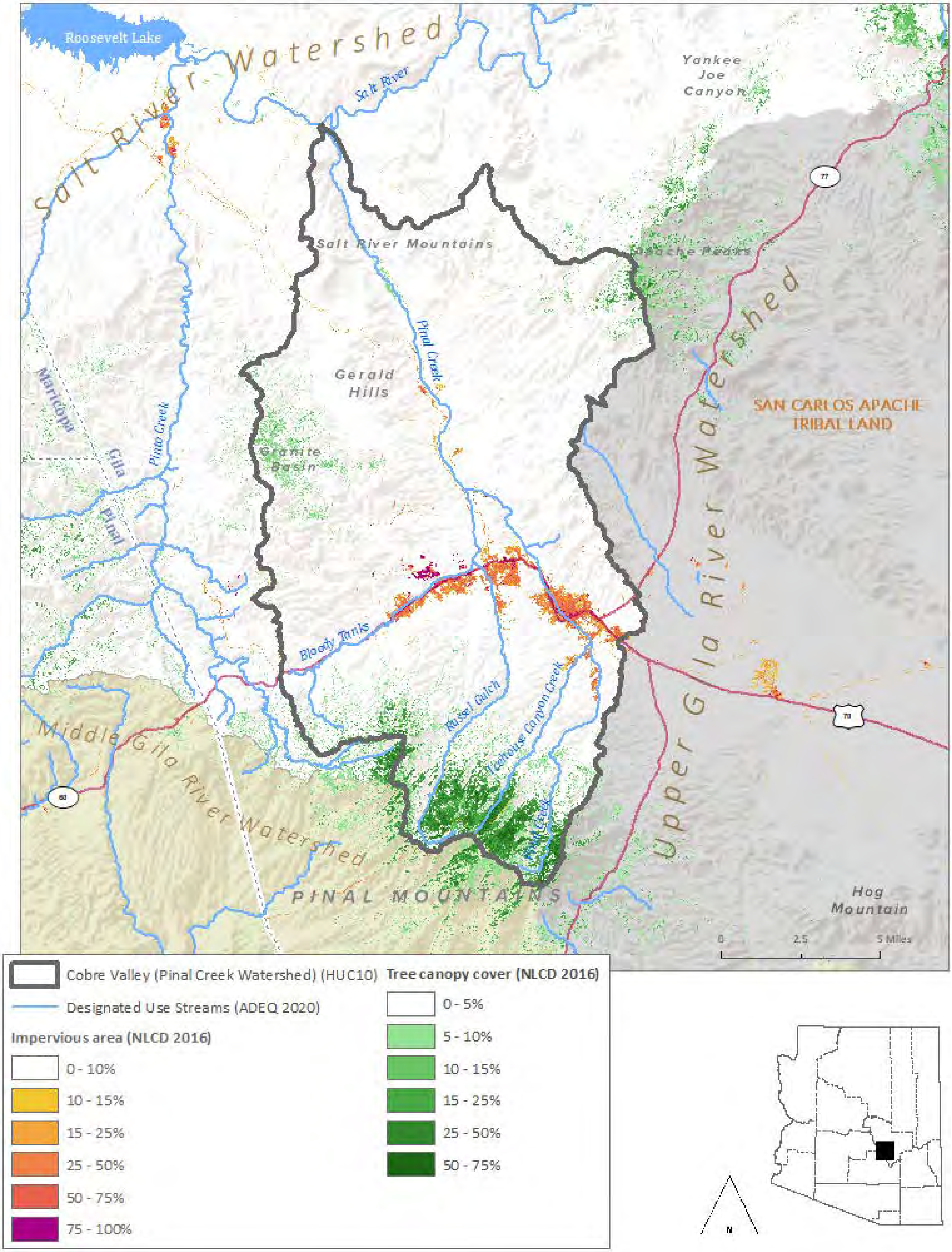

Figure 16. Impervious Surface Area and Tree Canopy Cover in the Cobre Valley (NLCD 2016)

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APPENDIX 1. INVENTORY OF RELEVANT LOCAL POLICIES

FEDERAL POLICIES	
National Environmental Policy Act (NEPA)	The NEPA implements an environmental review process required for federal actions, which can include watershed projects developed in coordination with federal agencies, with federal funding, requiring a federal permit, or involving potential impacts to federally protected species.
	The NEPA process may require the preparation of an Environmental Impact Statement (EIS), or Environmental Assessment (EA), or the action may qualify under a Categorical Exemption (CE). The University of Arizona James E. Rogers College of Law Natural Resource Use and Managment Clinic collaboratively produced a NEPA Handbook for Ranchers, a useful resource for watershed planning efforts.
Clean Water Act (CWA)	The CWA establishes the regulatory framework governing surface water quality and discharges into water of the United States (WOTUS). A 2020 EPA/USACE Rule redefined WOTUS, likely limiting the jurisdiction of CWA regulations on the intermittent waterways in Cobre Valley such as Pinal and Pinto Creeks.
	Section 404 regulations the discharge of dredged or fill materials into WOTUS; applicability of Section 404 and other CWA permitting requirements hinge upon the definition and application of the updated WOTUS rule.
	Projects that require a Section 404 permitting are subject to the NEPA process and may require careful coordination between multiple federal and state agencies including USFS, BLM, EPA, USACE, ADEQ, ADWR, and or ADOT. A useful resource for understanding the Section 404 process can be accessed here*. *The linked resource was produced in 2018 so does not reflect the recent changes to WOTUS definitions.
Endangered Species Act (ESA)	Riparian areas throughout Gila County and Cobre Valley support a variety of endangered species. Projects that impact these ecosystems may require USFWS permitting to comply with regulations under the ESA. As of January, 2021, there are 27 species of animal and one plant known or believed to occur in Gila County listed under the ESA, including Mexican Spotted Owl and Mexican Grey Wolf. USFWS map of critical habitat in Cobre Valley designated under the ESA.
US Forest Service - Draft Tonto National Forest Management Plan (2019)	The Draft Tonto National Forest Managemetn Plan identifies key ecosystem services to be considered in the management of the forest: water for consumption; water for recreation; habitat for hunting, fishing, and watchable wildlife; sustainable and productive rangelands; and cultural heritage.
	Chapter 2 (Pp. 19-126) details forest wide plan directions regarding recreation (Pp. 21), rangelands (Pp. 38), cultural and historic resources (Pp. 42), forestry (Pp. 48), scenery (52), lands and access (59), vegetation and ecological response units (64), riparian ecological response units (97), fire (101), watersheds and water resources (105), riparian areas (110), invasive species (118), and soils (121).
Bureau of Land Management Lower Sonoran Decision Area: Resource Management Plan (2012)	The Lower Sonora Decision Area is situated in Southern Arizona, extending south from Phoenix to the Mexican border, west to the border of Yuma county, and a small portion extends east to include a portion of Gila county including the towns of Miami and Globe.

STATE POLICIES	
Arizona Department of Water Resources (ADWR)	Established by the Groundwater Managment Act in 1980, ADWR regulates water both surface and groundwater resources thorughout the state. Cobre Valley is not within an Active Management Area; therefore, landowners may pump groundwater without restriction as long as it is for a reasonable and beneficial use (subject to the federal reserved water rights doctrine).
	The University of Arizona James E. Rogers College of Law Natural Resource Use and Management Clinic partnered with the WRRC to prepare an overview of water rights adjudication, groundwater management, and potential Clean Water Act jurisdiction as they relate to rights and activities in the Cobre Valley. Access the memo here.
Arizona Department of Water Quality (ADEQ)	The ADEQ administers both state and delegated federal environmental policies, including the Water Quality Assurance Revolving Fund (WQARF), and both surface and groundwater monitoring, among other regulations established under the Clean Water Act.
ADEQ Nonpoint Source 5-Year Managemnt Plan (2020)	This plan updates the state's strategic plan for meeting the water quality regulations imposed by the Clean Water Act. The Plan can be used to allign community watershed projects to existing state and federal water quality activities.

LOCAL POLICIES	
Gila County Comprehensive Master Plan	Chapter 2 - Land Use Elements, specifically land use goal 2: "a high level of community quality with a lean, safe, and healthy environment that provies multiple-use opportunities for both residents and non-residents." Relevant policy objectives include 2.0-2.4.
Gila County Land Use and Resource Policy Plan (LURPP) (2010)	Federal and State agencies are obligated under both state and federal law to coordinate agency planning and decision making with the county regarding land and natural resource management actions. Relevant sections I-XIV.
	Sections II, IV, and V are policy statements that specifically call for the preservation of healthy ecosystems, habitats, watersheds, and water resources, among other relevant ecosystem services. The LURPP can be used to help align community watershed projects to local policy or planning priorities.
Gila County Subdivision Reguations	Section 500.03 is potentially relevant to alligning projects to local regulations or design priorities – "the subdivider shall make every effort to preserve the site's natural features such as trees, water courses, historical and archaeological sites and similar community assets, which when preserved, will add attractiveness and value to the property and community."
City of Globe 2035 Plan	City of Globe Community Vision statement "....the creation of an economically diverse, vibrant, environmentally conscious, attractive community integrated within the historic framework of our western mining, ranching, and regional government heritage. With expanded business and job opportunities and new living options for residents, redevelopment and preservation will re-connect the neighborhoods to the Cobre Valley's rich environmental context..."
	Economic Development Goal 2 focuses on tourism and identifies local and regional recreation as a key driver. Economic Development Goal 5 focuses on infrastructure development including efforts to protect public health and the environment through water, wastewater, and stormwater management.
	Section 2.3 outlines the water resources element of the city's plan. The entire section is relevant to watershed planning efforts. Water resource goals include adequate and sustainable supply, improved water quality, and an emphasis on water conservation.

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