

ECOLOGICAL SUSTAINABILITY ANALYSIS OF THE CORONADO NF: DESCRIBING THE ECOLOGICAL NICHE OF THE FOREST FOR WATER AND RIPARIAN RESOURCES

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The Coronado National Forest (the Forest) is made up of a group of mountain ranges known as the Sky Islands in Southeastern Arizona. These mountain ranges provide an interesting function for the water resources of the area. This paper describes the water quantity and quality ecological niche of the Forest at several different scales in order to evaluate the contributions to ecological sustainability that may occur at those scales.

SUBBASINS AND WATERSHEDS

This analysis extends beyond the boundaries of the Forest in order to understand the environmental context of the Forest and the opportunities and limitations of the Forest to contribute to the sustainability of ecological systems. National direction recommends using the subbasins, watersheds, and subwatersheds developed by the National Hydrographic Dataset. (NHD, 1999)

The Forest is contained within nine subwatersheds and 51 watersheds. Subwatersheds have not been developed to date. The subbasins are listed in Table 1, and displayed on a map in Figure 1.

WATER QUANTITY

Water quantity available in the subbasins, watersheds, and subwatersheds as surface water is affected by a variety of factors including:

- Precipitation – most available water is directly responsive to precipitation events.
- Interception – some precipitation does not reach ground surface to become surface water but is intercepted by plant canopy and litter.

- Evapotranspiration – vegetation converts precipitation into water vapor, but is highly variable for different vegetation types and densities
- Infiltration – precipitation that infiltrates into the soil generally does not become available as surface water in Southeastern Arizona. In isolated locations there is an excess of water in the soil that emerges as surface at springs or seeps, or in perennial streams where the water table intercepts the stream bottom.
- Soil Water Storage – water stored at the end of the growing season, often leaving the watershed more responsive to subsequent precipitation events.

The data represented in Figures 3 and 4 represents runoff – often stormflow, but generally any water that is not intercepted, evapotranspired, infiltrated, or stored and makes its way down a watercourse on the surface. The wide variety of precipitation, topography, and vegetation communities found at every level of analysis makes estimating runoff difficult. Few stream gages record runoff in this area, and those that do represent water yield at points generally downstream from large water uses such as farming communities and municipalities, or high in watersheds representing areas smaller than subwatersheds (Daly et al, 2003).

Perennial water is scarce. A total of 458.51 miles (NHD modified) are found in these watersheds. In the watersheds that have perennial water, the Coronado National Forest contains a large share of the miles of perennial water compared to representation of acreage in those

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Table 1 Subbasins that Contain the Coronado National Forest

Hydrologic Unit Code	Subbasin Name	Subbasin Area (mi ²)	USFS Area (mi ²)
15040003	Animas Valley. Arizona, New Mexico.	2221.4	41.6
15040005	Upper Gila-San Carlos Reservoir. Arizona.	2784.1	246.6
15040006	San Simon. Arizona, New Mexico.	2241.8	283.1
15050201	Willcox Playa. Arizona.	1678.7	275.4
15050202	Upper San Pedro. Arizona.	1797.2	253.2
15050203	Lower San Pedro. Arizona.	1985.7	365.6
15050301	Upper Santa Cruz. Arizona.	2209.1	690.9
15050302	Rillito. Arizona.	929.3	278.1
15050304	Brawley Wash. Arizona.	1389.9	44.0
15080200	Rio De La Concepcion. Arizona.	135.0	99.2
15080301	Whitewater Draw. Arizona.	1188.1	124.9
15080302	San Bernadino Valley. Arizona, New Mexico.	427.5	47.5
15080303	Cloverdale. New Mexico.	135.1	28.0

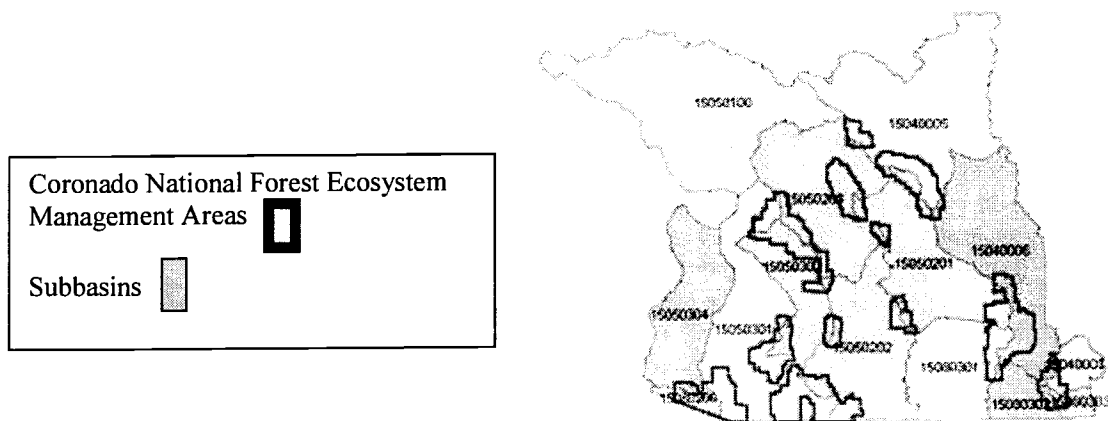


Figure 1. Subbasins that Contain the Coronado National Forest

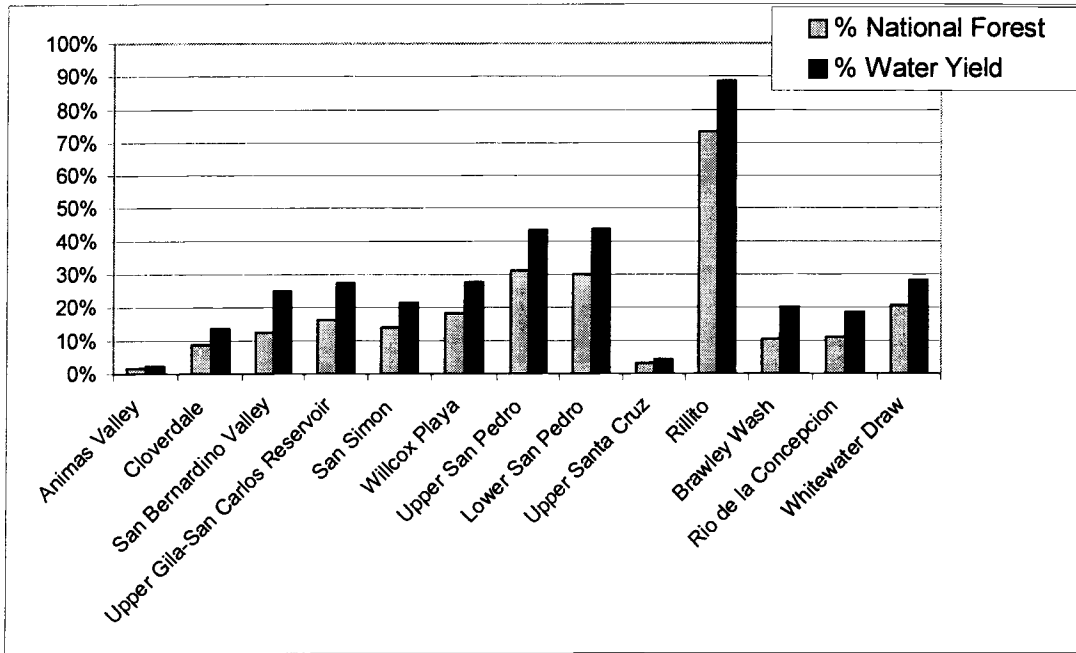


Figure 3. Comparison of Percent Total Water Yield from the National Forest to Percent of the Watershed that is National Forest.

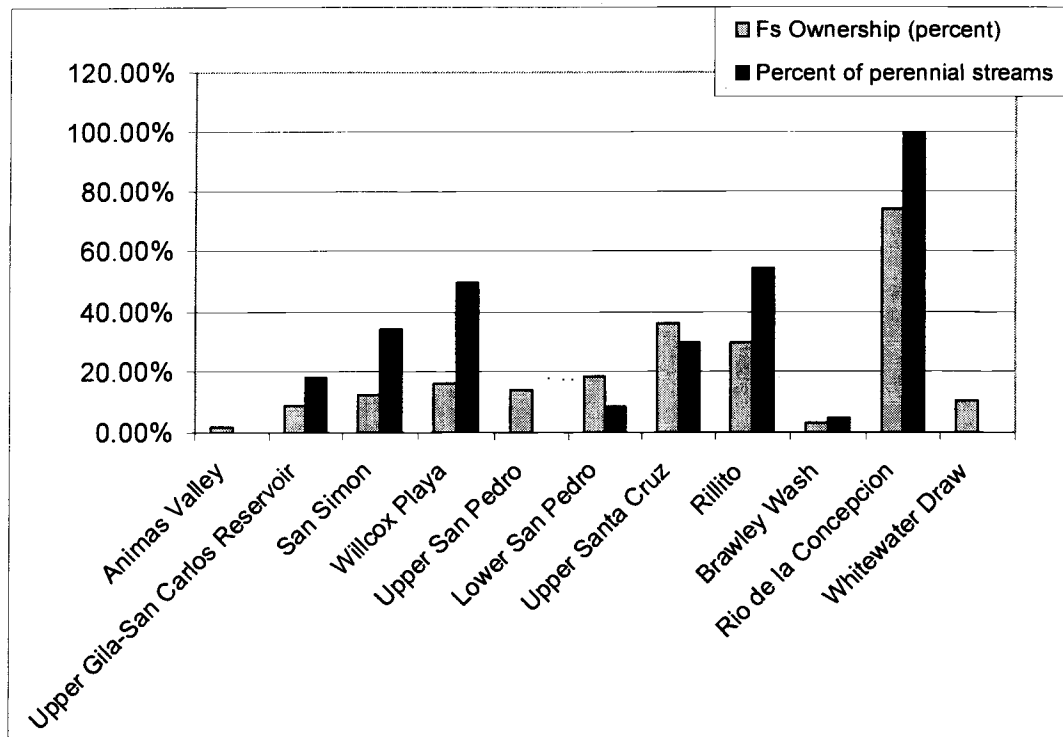


Figure 4. Comparison of Percent Perennial Water on National Forest to Percent of the Watershed that is National Forest.

watersheds. The fact that the Forest is made up of sky islands that receive the majority of the precipitation within these watersheds, coupled with the generally shallow soils and bedrock near the surface explain most of this.

WATER QUALITY

Surface water quality flow is affected by hydrologic function, which is the ability of soil to capture, hold and release water, and by direct additions of pollution from a point source, or from landscape accumulations of pollutants (non-point source). The States of Arizona and New Mexico have conducted water quality assessments and reported on them as required by the Clean Water Act. Assessment at Subbasin or Watershed level is not appropriate, because all data is presented at the stream reach level. Figure 2. displays the streams that have been monitored in Arizona in the Subbasins of the Coronado National Forest.

Arizona

The general classifications used for surface water quality by the Arizona Department of Environmental Quality (ADEQ) are “attaining” and “impaired” for all uses specified, and “not attaining” or “not assessed”. Presently, water quality has not been assessed within much of the Forest. However, down stream, off the national forest, water quality has been assessed by ADEQ. According to the 2004 ADEQ draft report “Status of Water Quality in Arizona: The Integrated 305(b) Assessment and 303(d) Listings Report” (ADEQ 2004), some reaches within and downstream of the Forest have been determined to be impaired and not meeting the state standards for uses specified for that water body.

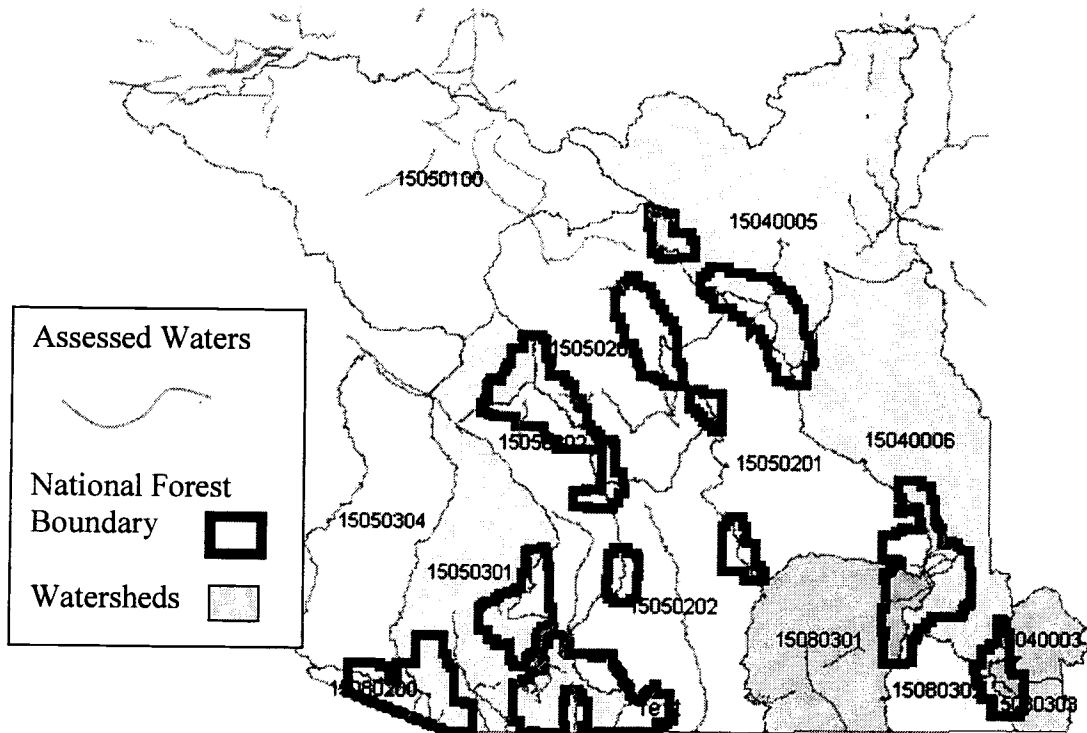


Figure 2. Assessed Waters within the Subbasins within which the Coronado National Forest is located.

The Categories are defined as follows: Category 1: Attaining All Uses – All designated uses assessed as “attaining” Category 2: Attaining Some Uses – At least one designated use assessed as “attaining” and all other uses assessed as “inconclusive” Category 3: Inconclusive – All designated uses are “inconclusive” (by default, any surface water not assessed due to lack of credible data is actually included in this category) Category 4: Not attaining – At least one designated use is “not attaining,” and no designated use is “impaired” Category 5: Impaired – At least one designated use was assessed as “impaired”

A total of one stream and two lakes on the Forest are “impaired”. In addition, five streams and two lakes are “not attaining” because they have Total Maximum Daily Load (TMDL) plans in process. Off Forest, several other streams are listed.

Cave Creek, which drains the Chiricahua Mountains, is listed as impaired due to selenium.

Rose Canyon Lake in the Rillito subbasin, identified as impaired because it is eutrophic after two major wildfires in the watershed and a large amount of burned organic matter eroded into it.

Parker Canyon Lake in the Upper Santa Cruz subbasin is listed as impaired due to mercury content in the lake sediments and a fish advisory.

Alum Gulch, Harshaw Creek, Cox Gulch, Humboldt Canyon and Three R Canyon are listed as not attaining in the Patagonia Mountain area due to zinc, cadmium, and copper.

Arivaca Lake in the Brawley Wash subbasin has a TMDL approved plan for improving the mercury content in the lake sediments. The source of mercury is thought to be atmospheric and from natural levels within the soil of the watershed.

Peña Blanca Lake in the Upper Santa Cruz subbasin has a TMDL approved plan for improving the mercury content in the lake sediments. The source of mercury is thought to be atmospheric and from natural levels within the soil of the watershed.

New Mexico

No waters within or immediately downstream from the Forest in New Mexico have been identified as not meeting standards.

THE RIPARIAN ECOLOGICAL NICHE OF THE FOREST

The riparian ecological niche of the Forest is presented at several different scales in order to evaluate the contributions to ecological sustainability that may occur at those scales. At the watershed scale, the Forest accounts for a very small percentage of total riparian area. This is due to the large rivers including the Gila River, San Pedro River, and Santa Cruz River supporting riparian communities in the valleys, but not represented on the Forest. All riparian areas on the Forest are on small tributary streams to these large rivers. Figure 5 represents the acreage of riparian areas within the watersheds both on and off the Forest.

Vegetation

The Arizona Game and Fish Department (AGFD) developed a riparian area map in 1994 that includes all lands within these subbasins (AGFD, 1994). In addition, The Coronado National Forest has conducted riparian area data collection and monitoring on National Forest System Lands since 1984. Table 2 displays the vegetation types mapped by the AGFD and the Forest.

The “Strand” and “Agriculture” types are mapped on the Forest in small quantities, and could be mismapped.

Channel Morphology

Data collected since 1998 on the Coronado National Forest has included channel morphology information. No similar data collection is known for areas off the Forest.

Entrenchment Ratio

Entrenchment Ratio is the width of the flood-prone area to the surface width of the bankfull channel (Rosgen, 1996). Entrenchment ratios less than 1.2 are generally thought of as incised systems, or gullies. Entrenchment Ratio on all stream types that have mapped riparian areas on the Forest are expected to range from 1.4 to 4.9.

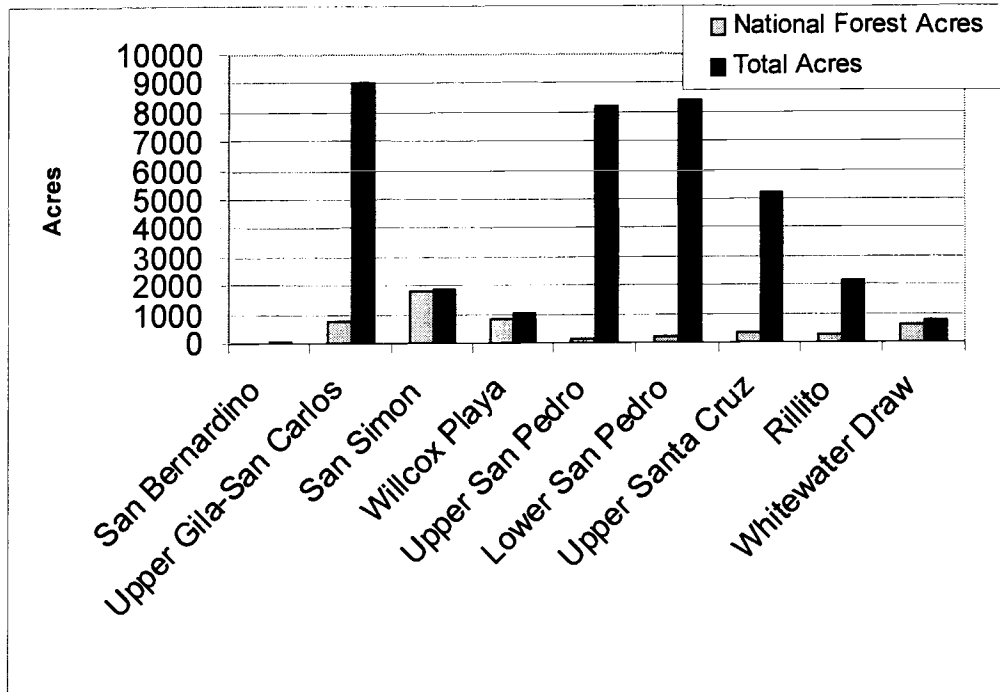


Figure 5. Comparison of Riparian Acres on Forest to the total in the Watersheds.

Table 2. Vegetation Type Approximate Equivalents.

AGFD Vegetation type	Coronado National Forest Vegetation Type
Agriculture	Not Represented
Cottonwood Willow	Deciduous Riparian
Marsh	Not Represented
Mixed Broadleaf	Evergreen Riparian
Tamarisk	Not Represented
Conifer-Oak	Coniferous Riparian
Flood-Scoured	Not Represented
Mesquite	Dry Desert Riparian
Strand	Not Represented

Width to Depth Ratio

Width to depth ratio is the bankfull channel width divided by mean depth of the bankfull channel (Rosgen, 1996). Width to depth ratios on all stream types that have mapped riparian areas on the Forest are expected to range from 12 to 90.

SUBBASINS OF THE CORONADO NATIONAL FOREST

Its twelve "Sky Islands", not the subbasins, define the major ecological niche of the Forest. These mountain ranges rise above the desert floor throughout southern Arizona and southwestern New Mexico, dividing the land into the subbasins and watersheds. Riparian areas represent only 0.6% of the land area within these subbasins, and only 0.3% of the land area on the Forest. Several subbasins contain no mapped riparian areas, and others contain mapped riparian areas only outside Forest lands. However the Forest contains the majority of all riparian areas mapped in the San Simon, Wilcox Playa, and Whitewater Draw subbasins. These subbasins are unique among those with riparian areas mapped in that the off-Forest lands do not include major rivers such as the San Pedro, Santa Cruz, and Gila Rivers.

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