Fremont Cottonwood demographics and regeneration along the Verde Wild and Scenic River

# Abstract

The watershed upstream from the Verde Wild and Scenic River drains central Arizona and the Verde River from its headwaters to terminus at the Salt River is the state’s longest remaining perennial river. Fremont cottonwoods (*Populus fremontii)* are a dominant riparian tree species in the Southwest and are important habitat for native wildlife, highly dependent upon river hydrology and are a included as one of the Outstandingly Remarkable Values in the 1984 amendment to the 1964 Wild Scenic River Act. Fremont cottonwood health and demographics along the Verde River are understudied. This study uses seedling plots established after 2023 winter floods and dendrochronology to monitor regeneration and to quantify tree age and growth. Fremont cottonwoods along the Verde River are young, with the mean age being 24 years old. They continue to add biomass at an above average rate and their growth is significantly impacted by summer temperatures and river flows. Seedlings from the 2023 cohort continue to grow rapidly and their survival is governed by a diverse set of environmental conditions.

# Introduction and Background

**Verde River Overview**

The Verde River is in central Arizona and its watershed drains over 16 thousand square kilometers. Elevations range from over 3650 m ASL in the San Francisco Peaks to about 400 m ASL at its confluence with the Salt River. The upper reaches of the watershed are largely ephemeral, consisting of the Chino Valley and Big Chino Wash. Perennial flow begins at a series of springs near Paulden, AZ. The river flows through an isolated area until it reaches Cottonwood, Arizona. The river flows then flows through the towns of Cottonwood and Camp Verde, Arizona before it reaches its Wild and Scenic (W&S) designation at Beasley River Access Point (BRAP). Along this reach the Verde River gains volume from a string of canyons with perennial tributaries. These include Sycamore, Wet Beaver, Oak, and West Clear creeks. These perennial tributaries get large portions of their base flow from springs discharging from the regional aquifers (Ecological Implications of Verde River Flows, 2008).

**Riparian Forest Overview**

Riparian forests in Arizona are disproportionately important to the landscape despite their relatively small geographic area. Riparian forests in Arizona cover only about 0.4% of the land surface area yet support more biodiversity and ecosystem functions than surrounding upland habitat (Ffolliott et al. 2004). In Arizona, 80 percent of all vertebrate species complete a part of their lifecycle in riparian areas (Hubbard, 1977). Riparian forests support and enhance terrestrial and aquatic habitat, filter upland sediment and nutrients, store water and recharge aquifers and stabilize stream banks among many other functions (Schultz et al. 2009).

Fremont cottonwood *(Populus fremontii*) and Goodding’s willow (*Salix gooddingii*) are major components of riparian forests along the Verde River. Other important woody riparian plants include Arizona sycamore (*Platanus wrightii)*, Arizona Ash (*Fraxinus veluntina)*, seep willow (*Baccharis salicifolia*)*,* coyote willow *(Salix exigua)* and sedges (*Carex).* Tree diversity is low in Verde River riparian forests with Goodding’s willow and Fremont cottonwood being the dominant species. However, age class structure is usually very diverse. Stands of Fremont cottonwood and Goodding’s willow often occur in spatially separate, but same age cohorts with younger stands closer to the active channel and older stands extending up to 200 meters away (Stromberg, 1993).

## Methods

### Field Site

* 2023 floods

### Seedling Plots

* Plot method

10 monitoring plots were established at two W&S sites. River reaches were walked in Fall 2023 to identify seedlings that had survived most of their first growing season. If regeneration was found and able to be surveyed, a metal pin was pounded into the ground. We determined a radius to encompass all or most of the seedlings. An Arrow100 GNSS (Quebec, Canada) was used to record the coordinates of the seedlings to less than 0.60 meters. We measured seedling heights with a ruler or measuring tape to the nearest centimeter and the diameters near the ground were measured with calipers to the nearest millimeter within the determined radius. These data were recorded along with a site ID and brief description of the environmental setting.

If a regeneration area was too large or there were too many seedlings to feasibly measure, the area was subsampled. First the area containing the cottonwood seedling was mapped using the GNSS. After the polygon was created and the area determined to the nearest square meter, a one square meter hoop was used to create subsample areas. This hoop was placed in representative areas within the plot. The seedlings within the hoop were then measured and recorded. The goal was to sample 15-30% of the total area containing seedlings.

Light

Light intensity was taken with a Li-COR LI-1500 Light Sensor Logger (Lincoln, NE). The pyranometer sensor was placed in the or near the plot and allowed to acclimate. Then, a reading was taken every minute for 5 minutes. These readings were then averaged to get an average W m-2 value at each plot.

Herbaceous

Herbaceous competition was estimated using the Braun-Blanquet 6 step scale (Braun-Blanquet 1964). Plants within the plots and rooted at the same elevation as the cottonwood seedlings were considered.

Soil

Soil samples were taken inside the seedling plots using a trowel. Soil samples are from the first few inches of the soil horizon where the cottonwoods originally germinated. The soil samples will then be sieved to get the soil texture in which seedlings germinated.

Samples were then dried in an oven for 6 hours at 70 degrees Celsius. The samples were ten sieved to

### Dendrochronology

* How were cores taken
* How were cores prepared
* How were cores measured
* Analysis

## Results

## Discussion