



Horseshoe Ranch Adaptive Restoration and Community Stewardship Project

A Year in Review...

Trees are growing and science is happening! Research work began this past August in the experimental Cottonwood Garden at Horseshoe Ranch. Northern Arizona University in collaboration with scientists from Desert Botanical Garden, ASU and others began a 5-year research project. The garden is one of three sites in a regional-scale research project to investigate the impacts of climate change and exotic species invasions on riparian ecosystems in the southwest. Researchers intend to use findings to develop adaptive restoration strategies that address riparian management uncertainties, such as how to prepare and mitigate for climate change, exotic species, and tamarisk leaf beetles.

Here are a few of the interesting highlights regarding the field research and status of the garden:

Fall of 2014, a total of 4,096 Cottonwood trees from the Colorado River Watershed were planted in a 3 acre portion of fallow cropland at the Ranch. We hosted a volunteer workday to help NAU plant ~ 1,000 of the total trees. We had several college students from ASU and SCC out to help us! The trees were planted in a block design for research purposes and individual populations are marked with signs.

- Tree sources range from Keams Canyon (Navajo lands) to Mexico border (San Luis) including the Agua Fria River; elevations between 5500'-Sea level
- 16 populations and 12 genotypes from each population
- Each block has 64 trees
- Each population has 4 blocks (256 trees)
- Each genotype is replicated 21 times
- There was very low mortality after initial plantings; <10%

Researchers are field sampling a series of plant physiology measures. Field measurements are being collected at 3 replicate project sites (Yuma, Horseshoe and Utah Canyonlands) and include:

- Plant growth
- Plant survivorship
- Soil C, N, K, Na, Mg, pH
- Phenology: Budset and leaf nutrient resorption
- Plant water stress
- Plant stomatal conductance (using a leaf porometer); vapor pressure deficit and plant water potential (using a pressure chamber)
- Collection of leaves for future chemistry and leaf morphology analyses

Project Construction and Maintenance:

- NAU Installed a weather station (above ground) in the garden
- AGFD and NAU have collaborated on installation and maintenance of the garden watering infrastructure
- NAU manages a significant abundance of weeds using manual removal methods

Other Project related Monitoring Activities:

- AGFD initiated a partnership with Audubon Arizona's River Pathways Program (<http://az.audubon.org/river-pathways-program>) to bring high school youth to the Ranch to

conduct photo point monitoring and measure native riparian tree and shrub densities and structure along the Agua Fria River on the Ranch. We are hopeful to continue the partnership yearly.

- AGFD is monitoring water use rates for garden irrigation
- AGFD is monitoring fluctuations in water table levels within the immediate vicinity of the garden
- AGFD began measuring surface flows, when present, along the Agua Fria River downstream of the garden to monitor seasonal surface flow variability; and AGFD measured Agua Fria River channel morphology to establish a baseline from which we can monitor changes in the future

The Future...The Experimental Cottonwood Garden represents Phase I of the adaptive restoration project. There is a possibility that the garden will become a long-term restoration research site. In the future, we hope to implement Phase II and focus on removal of invasive Tamarisk and restoration/enhancement of native riparian trees and shrubs within the Agua Fria River channel on the Ranch.

Experimental Garden Photo Points:

AGFD initiated photo point monitoring Fall 2014 after the trees were planted. Photo points will be replicated annually at the end of the growing season (fall) to photographically document the growth of the cottonwood trees. See what changed between October 2014 and 2015 below!



Photo 1 – Indian Creek side of the Garden looking west 2014



Photo 2 – Agua Fria side of the Garden looking south 2014



Photo 2 – Indian Creek side of the Garden looking west 2015



Photo 2 – Agua Fria side of the Garden looking south 2015