Rehydration, Water Quality Enhancement, & Reforestation Projects On the Balcones Canyonlands Preserve

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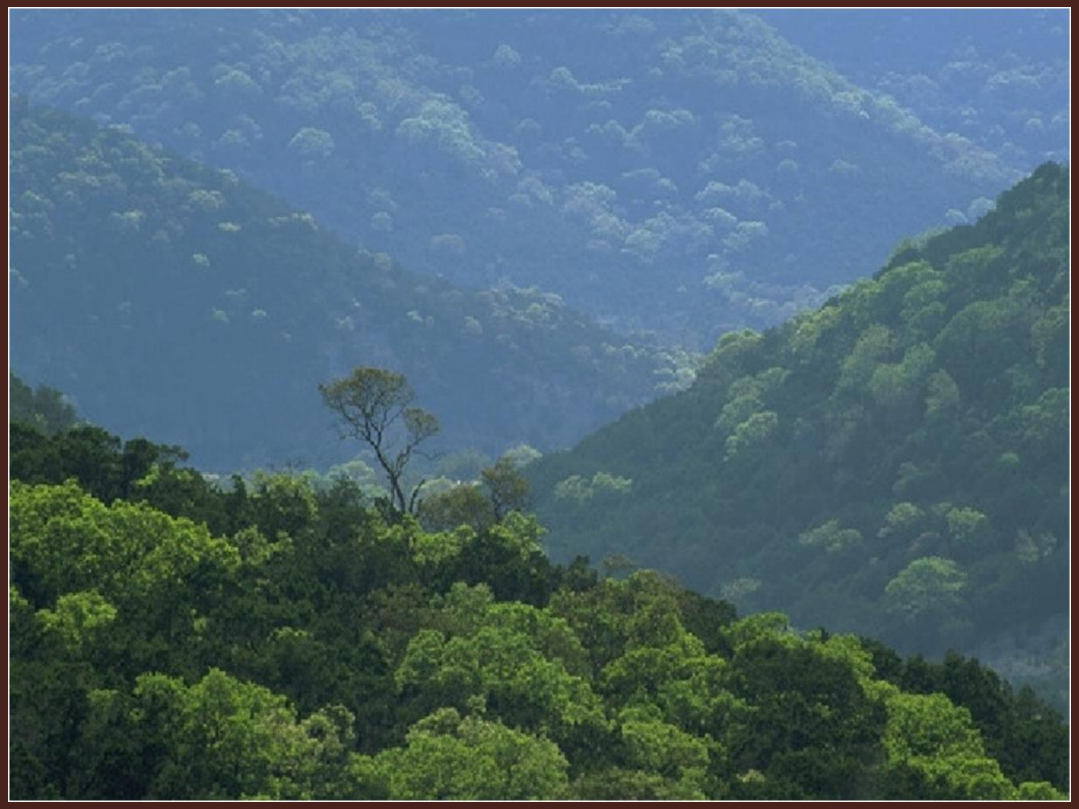
BCCP Permit Requirements

A minimum of 30,428 acres in western Travis county must be protected and managed as endangered species habitat

At least 2,000 acres must be managed to protect existing and create additional Black-capped Vireo habitat (focus on areas not currently suitable for Vireos or Warblers)

The remaining 28,428 acres must be managed to protect existing and restore additional Golden-cheeked Warbler habitat



Typical Golden-cheeked Warbler Habitat

Golden-cheeked Warbler & Black-capped Vireo Tier II Land Management Plans


Photo by John Ingram

Management for the Warbler includes promoting regeneration of oak-juniper woodlands in areas that have been previously cleared, thinned, or burned.

Management for both species includes revegetation efforts to improve habitat and reduce habitat fragmentation.


Photo by John Ingram

BCP Forest/Woodland Restoration Goals

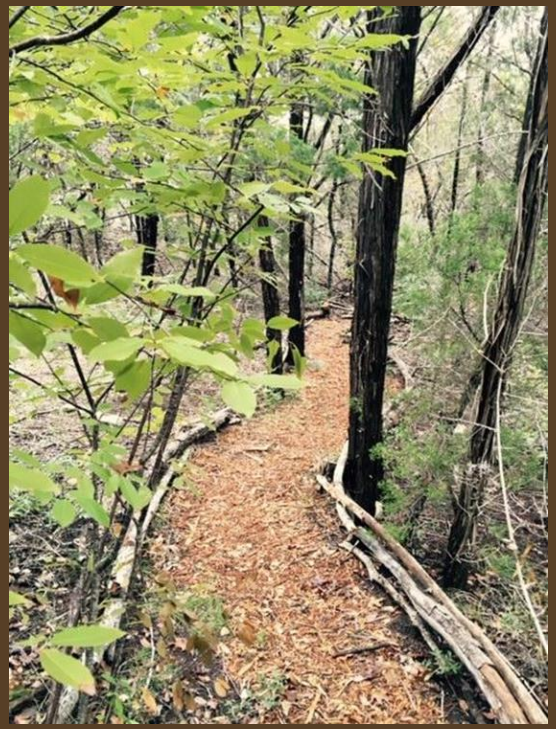
PROTECT - Prime Habitat

ENHANCE - Systems that are recovering

RESTORE - Degraded systems

Identifying Ecosystem Conditions & How To Help

Prime



Recovering

Degraded

How Do We Restore Degraded Landscapes?

Summer Soil Temperatures

Open Caliche

120 degrees

Forest Canopy

86 degrees

air temperature = 104 degrees

Restoring Connections

The goal in working with degraded ecosystems is to identify and stabilize eroding sites that are not improving over time.

These can be small or large patches that are not currently habitat for permitted species.

Restoration is designed to begin the road to a regenerative, resilient system. In these patches we control erosion, build soil biology, and plant/seed to provide a species-rich, diverse connection to mature habitat.

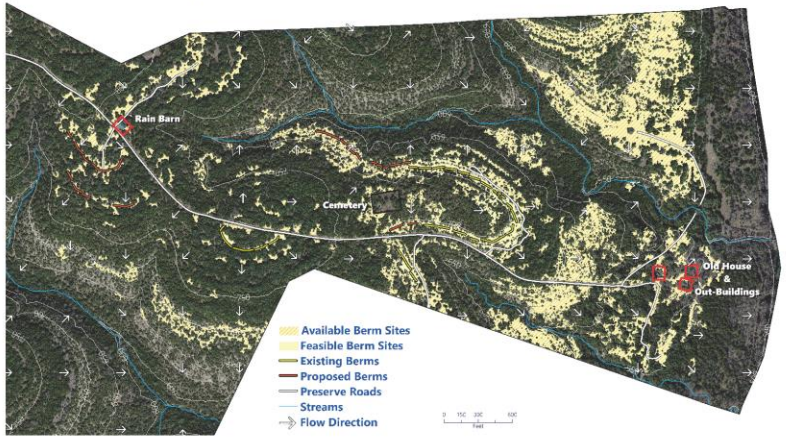
Recovery of Degraded Landscapes

- Assess soil condition: compaction, structure, depth, drainage, erosion, organic matter
- Assess species diversity
- Assess amount and accumulation of biomass
- Assess slope and aspect
- Research land use history
- Design a restoration plan

JJT Rehydration Berm Suitability Analysis

Suitable berm locations and general drainage patterns on the JJT Balcones Canyonland Preserve

Detailed Site Map



1940 Aerial Imagery

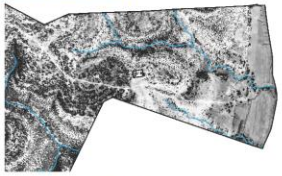


Table 1: Berm Suitability Inputs

Input	Data Source	Suitability	Weight
Slope	TNRIS 2021 DEM	0-5°: High, 5-15°: Mid, >15°: Low	20%
Aspect	TNRIS 2021 DEM	NE: High, NW&SE: Mid, SW: Low	20%
Stream*	COA 2022 Creek Centerlines	0'-50': Low, 50'-100': Mid, >100': High	20%
Vegetation	TNRIS 2021 Lidar	Little/No Veg: High, All else: Low	40%

*Distance from a stream

Table 2: Berm Suitability Results

JJT Preserve	1,731 Acres
Suitable Berm Sites	201 Acres
Feasible Berm Sites	52 Acres
Available Berm Sites	47 Acres
Existing Berms	2,600 LF
Proposed Berms	1,940 LF

Table 3: Watershed Analysis Results

Watershed	Num of Subbasins	Drainage Area (Acres)	Total Stream Length (Miles)
Honey Creek	45	1620	10.87
Harrison Hollow	31	1450	6.02
Lake Austin 1	9	515	3.35
Lake Austin 2	9	384	2.29

Methods & Results

Purpose

The City of Austin (COA or City) Wildland Conservation Division manages the JJT Balcones Canyonland Preserve in western Travis County, Texas. Their mission is to protect and reestablish habitat for several endangered species and species of concern. See the 1940 Aerial Image for historical conditions on the preserve. They are currently considering land management strategies for the preserve. One of the goals is to rehydrate the land by building 2-3 foot high earthen berms that capture rainwater runoff and allow it to gradually soak into the soil. Trees and other native plants are then planted on the berms to prevent erosion and start the reforestation process. There are 25 existing berms, adding up to approximately 2,600 linear feet (LF), and the City wants to add more. The JJT Rehydration Berm Suitability Analysis has identified potential new berm sites, runoff flow patterns, and watersheds on the preserve.

Berm Suitability Analysis

The suitability analysis determined the best locations for new rehydration berms. The City prefers the new berms to be located on gentle slopes no steeper than 18 degrees that face the northeast, have little or no vegetation, and are not within 50 feet of a stream. For the foreseeable future, the berms also need to be located within reach of the only rain barn on the property, so new plants can be watered regularly.

For the suitability analysis I standardized existing criteria into raster datasets with 2'x2' cell size and a NAD 1983 State Plane Texas Central FIPS 4203 (US Feet) coordinate system. Then, using the Suitability Modeler in ArcGIS Pro, I transformed the cell values into a common 1 - 10 suitability scale (1 = low, 10 = high). I gave each transformed criteria a weight and ran the suitability model to get the resulting Berm Suitability Index. See Table 1 for suitability input data. The Berm Suitability Map below (bottom left) displays the resulting suitability indices.

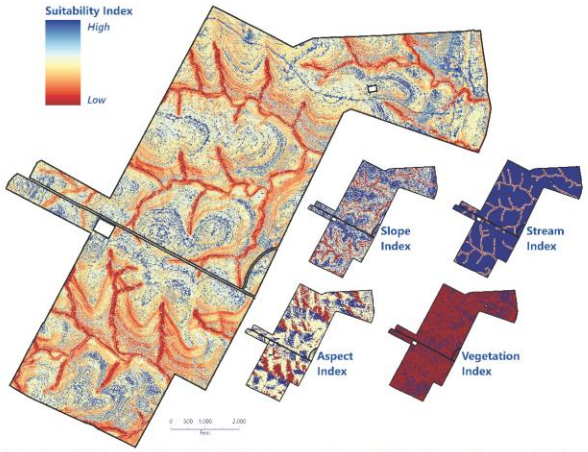
Then, I converted cell values with a berm suitability value greater than 7 into a polygon feature class, clipped it to the preserve boundary, and kept only the areas greater than 1,000 sf (the area needed to construct 1 berm). The resulting 200 acres of suitable berm sites are depicted in green on the Overall Site Map (bottom right). Next, I selected only the suitable berm sites located within 500 feet of the rain barn or within 1,000 feet of the main preserve road and downslope of the rain barn. The resulting 52 acres of feasible berm sites are depicted on the Detailed Site Map (top left). Approximately 5 acres are occupied by existing berms, so there are roughly 47 acres of available berm sites on the preserve. Lastly, I digitized 1,940 LF of proposed berms in the most conveniently located areas. Table 2 summarized the suitability analysis results.

Watershed Analysis

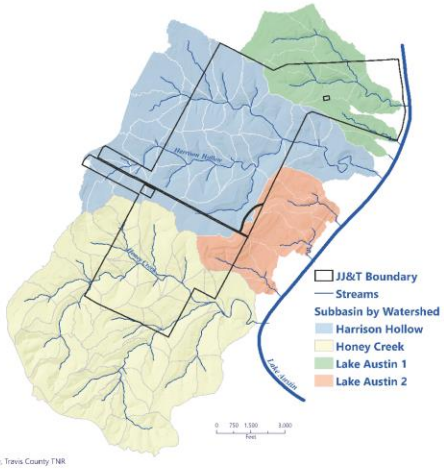
The watershed analysis determined general drainage patterns on the preserve, including flow directions and subbasins. I used the Texas Natural Resource Information System (TNRIS) 2021 Digital Elevation Model (DEM) and the Hydrology tools in ArcGIS Pro to create flow direction and flow accumulation raster datasets with 2'x2' cell size. Then, I used the raster calculator to create a stream raster dataset that includes only flow accumulation values over 250,000. Next, I generated stream links and watershed raster datasets. For display and calculation purposes, I converted the watershed and stream links raster datasets into polygon and line feature classes, respectively. See the resulting subbasins and streams in the Watershed Analysis map (bottom middle) and the watershed calculation results in Table 3.

Finally, I resampled the flow direction raster dataset into 500'x500' cells, then converted that to a point feature class. Using the flow direction value, I symbolized the points with directional arrows to represent the flow direction across the preserve. See the flow direction arrows in the Detailed Site Map (top left).

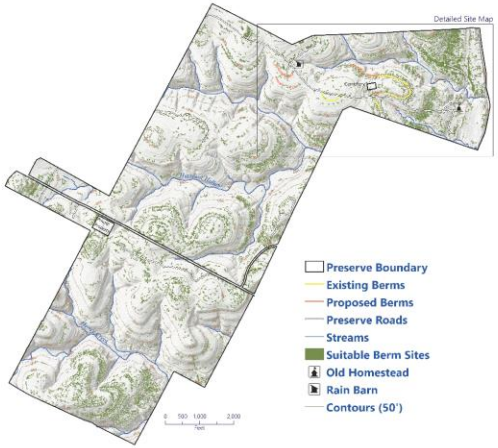
Berm Suitability Analysis



Watershed Analysis



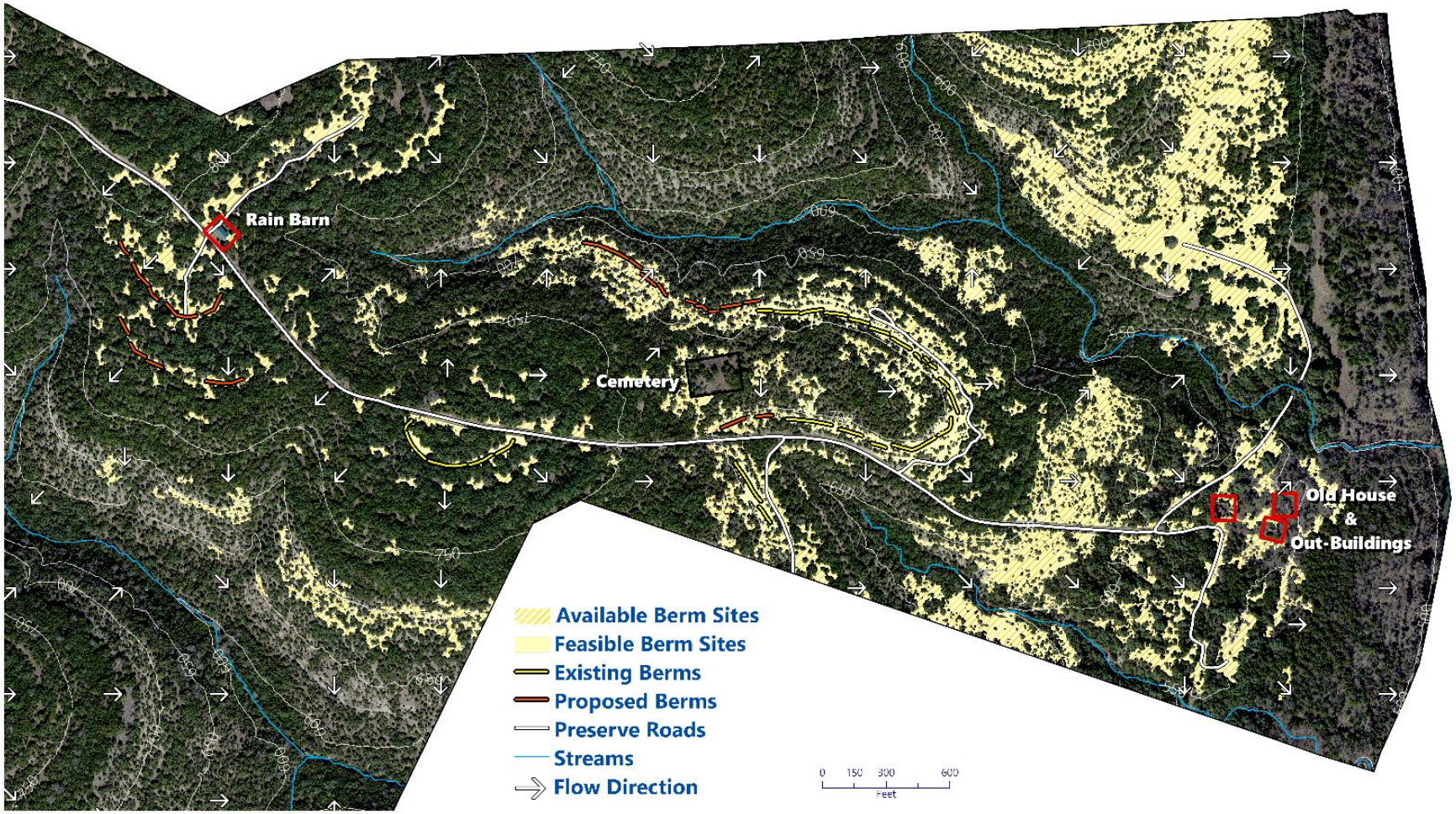
Overall Site Map



Poster and Maps by Beth Richter on July 26, 2022 for ACC GISC 2164. DEM, Lidar, Hypsography, 2021 Imagery, TNRIS; Creek Centerlines, 1940 Imagery, City of Austin; Preserve Boundary, Travis County TNR

Poster by Beth Richter

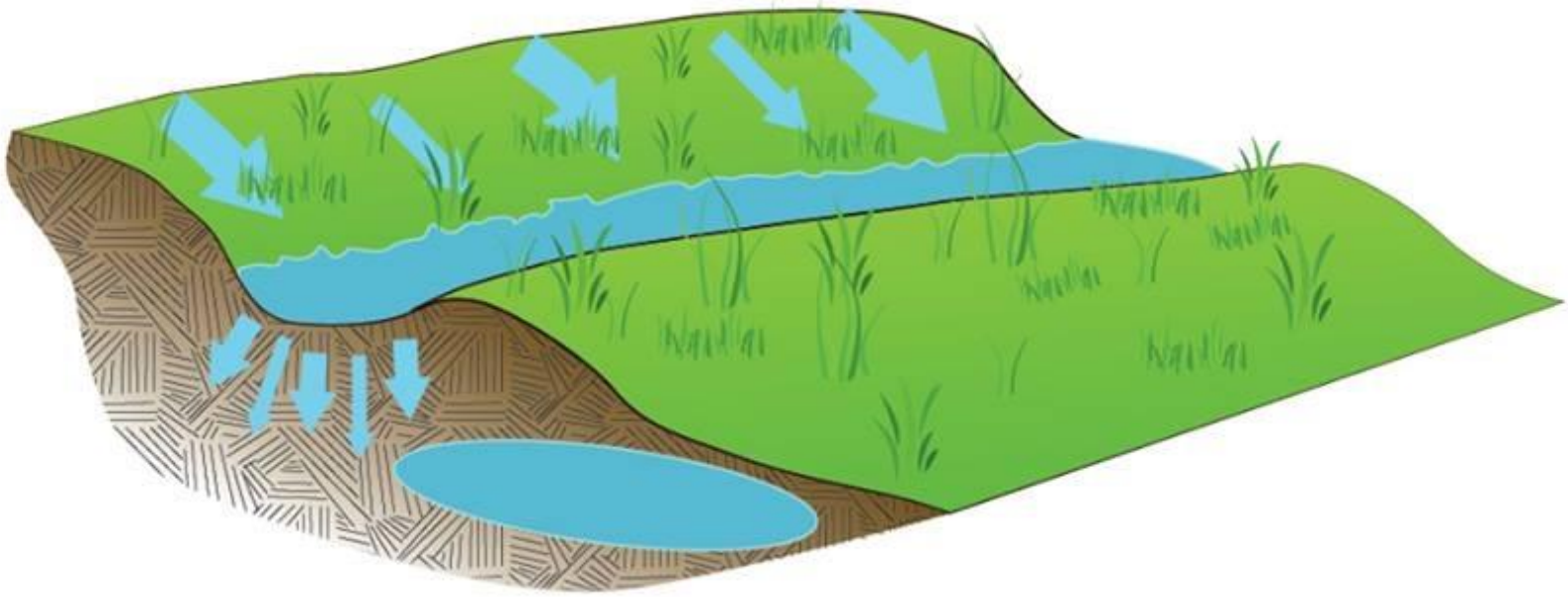
Detailed Site Map



Map by Beth Richter

Restoration (Seeding) Sites on JJT Tract

Using berms and swales to rehydrate dry hillsides and “jump-start” the reforestation process



“bioswale”, terrace, conservation trench, etc.

Bioswale Construction at the Vireo Preserve October 2019

Using a laser level to align bioswales on contour

Digging the Bioswales

Planting trees on the berms and mulching the berms and swales

- Spring 2020

- September 2020

Bioswale
Vireo Preserve
July 2021

Bioswale Plume

Adjacent area next to the bioswale

2.5 year old bioswale

JJT Half-mile Bioswale Project

January 2021

June 2021

JJT
“crescent bioswale”
installed on old road

Hand-dug Bioswales

February 2016

August 2016

One Rock Berms
Vireo Preserve

- Erosion of topsoil following clearcutting and fire
- West-facing dry slope
- Rocks on contour about 3-feet wide and one rock high to capture and slow water runoff
- Sheet mulching to build organic matter
- Legume and sumac tree planting
- Heavy seeding of grasses, forbs, and woody plants to help build and stabilize soil

Terraces/Bioswales: an ancient and global method used to promote reforestation

Loess Plateau, China before (1995) and after (2009) -- Ecosystem Restoration Camps

India – Paani Water Cup

Eritrea, Africa – WOCAT SLM Technologies

Tips for Building Soil Biology

- Protect existing woodlands/forests
- Capture, spread, and sink water
- Ramial wood/fungus
- Sheet mulching/compost
- High diversity of fauna & appropriate plant cover
- Seed, Seed, Seed
- Plant, Plant, Plant
- Protect young vegetation
- No exposed ground
- Minimal disturbance of soil/compaction issues
- Protect soil from erosion

Importance of the Soil Carbon Sponge

- Captures and stores more rainfall while reducing runoff and the resulting flooding.
- Less vulnerable to erosion and more resistant to drought.
- Stores and supplies nutrients, increasing fertility.

Topsoil from under old Ashe juniper canopy

Using native mushrooms (turkey tail) to break down invasive woody plants and build soil

Ligustrum Inoculation

8 Months

Ligustrum Inoculation

24 Months

Austin CCC Restoration Training at the Vireo Preserve

Promoting Plant Diversity at All Levels – Compositional, Structural, Functional

- Canopy
- Low trees
- Shrubs
- Herbaceous
- Ground cover
- Vertical layer
- Fungal

An Abundance of Food

A University of Delaware study found that it took 5,000-9,000 insects to raise one brood of chickadees.

Photo: Doug Tallamy


Photo: Gary Sertich

Community Collaboration

Austin Civilian Conservation Corps

Northern Arizona Univ.

Mycorrhiza Project

TreeFolks

Master Naturalist Chapters

Boy Scout Eagle Projects

Many Volunteers!!

Habitat Restoration Takes a Community of Volunteers!

Building Community

The goal of our restoration work is to share best practices and build a community of trained volunteers to help us enhance and restore functional ecosystems from the ground up.

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