HISTORICAL ECOLOGY OF THE TEXAS HILL COUNTRY

Historical Perspectives of Vegetation Communities:
~1700-1900

Lisa O’Donnell
Senior Biologist
City of Austin
22 September 2016
Project History

- Work in progress
- Started in early 1990s
- Questioning popular assumptions, such as...
  - The Hill Country was originally dominated by grasslands that have been invaded by woodlands due to overgrazing/over-browsing and fire suppression
  - Native Americans burned on a regular basis
  - Ashe juniper is not native, invasive, etc.

Mural claiming Native Americans routinely set fires on the Edwards Plateau
Putting the Brakes on Cedar

When Frederick Law Olmstead crossed the Guadalupe River in 1857 he described the Hill Country of Central Texas as a "vast region on which the brooks wind about in pleasant groves and run into the broad sweep, which rolls in long waves... The first settlers found the landscape covered with little timber other than inclement oaks and some scattered, sturdy oaks growing upon patches of rocky ground and herbs.

But present-day patterns of vegetation in the Texas Hill Country have shifted from rolling hills clothed with tall grasses. One of the most striking differences in the landscape is the large area that now is covered with dense cedar brakes—extensive stands of tall shrubs and trees dominated by Ashe juniper, commonly known as cedar. This brush species has served as a barrier and canopy to water conservation in the past. Cedar has been used and planted by former residents of Texas, post oak and buckbrush.

Claims based on historic accounts, cite Frederick Law Olmstead (1857).
Historical ecology helps inform land management, including for endangered, threatened, and rare species and their ecosystems.
Project Outline

- Primary eye-witness accounts (>20)
  - Missionaries, prospectors, settlers, scientists, reporters
  - Frame of reference/context for accounts:
    - Major ecological regions
    - Major historic events
      - <1700
      - 1700-1800
      - 1800-1850
      - 1850-1900
- Other sources (historic maps, photos, buildings, original land grants/field survey notes, rare/endangered species habitat, land use histories)
- Importance of multiple accounts and cross-referencing
While the focus of this project is on eyewitness accounts, the presence of fossilized juniper pollen in Friesenhahn Cave in northern Bexar County provides evidence that juniper has been in the Hill Country for a very long time. – S. Hall and S. Valastro, 1995
Entered historic accounts into GIS database

Need to determine where each observer was with respect to the Balcones Escarpment – i.e., was the observer on the Blackland Prairie or in the Hill Country (hilly portions of the Edwards Plateau, Llano Uplift, and Cross Timbers)
Temporal Context for Historic Accounts

Major Historic Events: <1700

1528  Cabeza de Vaca shipwrecked off the Galveston coast, begins first known European exploration of interior Texas

>1528  Spanish explorers introduce horses, cattle, sheep, goats, hogs

>1600  Comanches and other Plains Indians acquire horses

No written accounts during this period, but several significant events will influence next century
Major Historic Events: 1700-1800

>1700  Comanches move south into Texas, displacing other tribes

1716-1789  Spain establishes networks of Catholic missions and presidios, including the Alamo in 1718

Image from Jean Louis Berlandier's Indians of Texas in 1830, Beinecke Rare Book and Manuscript Library
“…we…travelled upstream with a desire to ford [the Guadalupe River] or reach its source. We travelled about three leagues of very rugged land owing to the heavy woods and many rocks; and at the end of the three leagues two soldiers left for upstream to reconnoiter the land. They said that it could not be traveled because it is more wooded and contains more rocks….The woods consist of oaks and junipers….”

--Fray Francisco Céliz, 1719
“...going past the Balcones [Escarptment], we arrived at the river they call Alarcón [Guadalupe River]. This [travel] was an effort because of the many hills and rocks, the many arroyos formed by the hills, and some thickets that contain valuable cedar and oak timbers.” -- Bernardo de Miranda, 1756
Major Historic Events: 1800-1850

1810-1821  Mexican War for Independence

1835-1836  Texas Revolution
            First documented permanent European settlement in Austin
            The new Texas government begins issuing land grants to immigrants

1837      Village of Waterloo (present-day Austin) is founded
            William Barton settles at Barton Springs

1839      Mirabeau Lamar, second president of the Republic of Texas, relocates the capitol from Houston to Austin. Lamar launches an “exterminating war” of “total extinction” against Texas Indian tribes.

1845      Texas is incorporated into the United States
“Immediately before us appeared as an extensive lawn with a beautiful green sward, slightly tinged with the various flowers which decked its surface. Not a shrub or bush obstructed the monotony except the towering Live Oak. Further to the west appeared the skirting timber thickening the further it receded and rising gradually so that mile after mile of the dark boding forest rose to our view so that ones imagination or view would be extending to the intricacies of the forest in search for the curling smoke of the wigwam.” – W.J. Benedict, 1839

This account provides a good example of an observer reporting “grass as far as the eye can see.” It’s critical to note that he was describing the Blackland Prairie. We need to keep reading for his description of the Hill Country (here described as mile after mile of “dark boding forest”).
“On the left bank of Comal Creek there is well forested bottom land which extends to the cedar, oak, and elm covered cliffs which here already have considerable height. Beyond this there is a high ridge with summits here and there similar to our Black Forest.”

“From its confluence with the Comal Creek I, with four companions, attempted to reach the head spring. However, having covered only five miles after hours of chopping through underbrush and heavy forest, we had to return without success.”

“…I ascended the ridge on horseback, forcing a path through the heavy cedar thickets and using the outcropping ledges as steps. The view from the high ridge, behind which there is a plateau several miles wide, is enchanting. I rode three or four miles into this tableland without coming to its end.”

-- Prince Carl of Solms-Braunfels, 1845
“The cedars here are not the stunted shrub-like plants found in the Northern States of the Union, but are stately trees with straight trunks, seldom more than twenty to twenty-five feet in height and one and one-half feet thick. They have a uniformly spreading crown….”

“This cedar forest is a treasure to the colonists of New Braunfels, since the wood was preferred above all others on account of its durability when used in building houses and fences.”

– F. Roemer, 1849

Large Ashe juniper on Balcones Canyonlands Preserve, estimated to be several hundred years old
“The road [between New Braunfels and San Antonio] led us over an open, undulating prairie of great fertility. *A cedar-covered slope, similar to that at New Braunfels, was at our right for the first ten miles, which farther on flattened out into a low lying chain of hills.*” – F. Roemer, 1849

“The hills which extend all the way from Austin to New Braunfels, are covered with heavy timber.” – V. Bracht, 1849
Field survey notes and “witness trees” from original land grants

Field survey notes for William Barton’s Property, 1838; recorded 1 elm, 1 hackberry, 5 cedars, 1 Spanish oak, and 1 live oak (“witness trees”) near Barton Springs
## Major Historic Events: 1850-1900

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1854</td>
<td>Two Indian reservations established in West-Central Texas</td>
</tr>
<tr>
<td>1859</td>
<td>Indians on the Texas reservations moved to reservations in Oklahoma</td>
</tr>
<tr>
<td>1861-1865</td>
<td>Civil War</td>
</tr>
<tr>
<td>1868</td>
<td>First patent granted for barbed wire</td>
</tr>
<tr>
<td>1871</td>
<td>First train arrives in Austin</td>
</tr>
<tr>
<td>1872</td>
<td>Yellowstone established as first national park</td>
</tr>
<tr>
<td>1875</td>
<td>Last free band of Comanches surrenders and moves to Fort Sill Reservation in Oklahoma</td>
</tr>
<tr>
<td>1878</td>
<td>Huston-Tillotson opens</td>
</tr>
<tr>
<td>1883</td>
<td>UT Austin opens</td>
</tr>
<tr>
<td>1888</td>
<td>Completion of Texas State Capitol</td>
</tr>
<tr>
<td>1889</td>
<td>Survey reports 25 bison remaining in the Texas panhandle</td>
</tr>
<tr>
<td>1888</td>
<td>Completion of Texas State Capitol</td>
</tr>
<tr>
<td>1893</td>
<td>Completion of first Colorado River dam</td>
</tr>
<tr>
<td>1894</td>
<td>Oil discovered in Texas</td>
</tr>
<tr>
<td>1895</td>
<td>Oil discovered in Texas</td>
</tr>
<tr>
<td>1899</td>
<td>Oil discovered in Texas</td>
</tr>
<tr>
<td>1900</td>
<td>Last records of passenger pigeons in Texas. U.S. wild bison population drops to fewer than 40 animals.</td>
</tr>
<tr>
<td>&gt;1900</td>
<td>Continued expansion of livestock industries on the Edwards Plateau</td>
</tr>
</tbody>
</table>
“We rode [from Austin] to the Brushy Creek, 20 miles [near Cedar Park], and encamped for the night. Our road was for about 14 miles of the way over a rich rolling prairie and for about six miles through a heavy cedar brake. Cedar is the main reliance for rail timber in this section, the live oak being too gnarled for such purposes.”
-- A. S. Johnston, 1855
“I have visited Austin for the first time...The surrounding country is quite beautiful...dark, steep, cedar-covered mountains rise about five miles north of the city.” -- V. Bracht, 1849

“The country on [Barton] creek presents an extensive range of cedar hills and is much broken.” – J. De Cordova, 1858
"Beyond [San Marcos] our road approached closely the hill-range, which is made up of spurs coming down from mountains North. They are well wooded with cedar and live-oak."

"Behind us were the continuous wooded heights, with a thick screen of cedars; before us, very beautiful prairies...." – F.L. Olmstead, 1857
"Wild lands [in Travis County] may be purchased at very low rates. The cost of improvements is a serious item; but when a cedar fence is once put round a plantation it will need but little repair for many years. *With vast prairies, we have also cedar lands at intervals seldom exceeding five miles, and these can be purchased at a small price. The planter finds a cedar lot of indispensable value, from the abundant material for improvements with which it furnishes him.*" -- J. De Cordova, 1858

Our fences are chiefly made of cedar-rails, from the cedar-brake above Austin.
- S.J. Wood, 1861
“...the mountains...are covered with cedar, and send clear crystal waters gushing from them....” – J. de Cordova, 1858
“I am getting a little afraid the sheep will take the mountains in four or five years more…. Sheep is mighty hard on the range. You can tell a sheep range before you get in two or three miles of the house, for they keep the grass eaten off plum in the ground…. ” – E. Burrowes, 1860
“About one fourth of [Travis] county is mountainous or hilly, the land rather poor and rocky, but well watered, and some of it covered with cedar and others kinds of timber. It is well adapted to the raising of horses, cattle, sheep, and goats. The balance of the county is gently rolling prairie or level prairie and river-bottom….” -- S.J. Wood, 1861
“The cedar tie business has contributed largely to the growth and prosperity of the ‘Hill City’ in the last two years, more especially the last twelve months. A gentleman connected with the Central Railroad says that two hundred thousand cedar ties have been shipped from this city during the last two years, and when it is remembered that these ties bring from sixty to ninety cents each, the reader will readily comprehend the vastness of the revenue from this source….”

–Austin Daily Democratic Statesman, September 10, 1874
[Golden-cheeked Warblers] are nowhere abundant, and only to be met with in the thickest cedar brakes, and as these are fast being cut and burnt out, the bird will no doubt become still more rare.” – H.P. Attwater, 1892
“The writer knows of no region in which any species of cedar is so uniformly abundant and dominant as is the mountain cedar in the limestone country of Texas. … [Mountain cedar] is the most valuable tree of the semiarid hill country of Texas.” – W. Bray, 1904
“With the exception of cedar, the hill timber finds a market chiefly as fuel, of which enormous quantities are consumed….Cedar likewise is extensively consumed as fuel and in charcoal burning; but its great value lies in its yield of railway ties, poles, posts, sills, and innumerable other articles which utilize its great durability.”
–W. Bray, 1904
“The cedar eradication program was greatly accelerated as a result of the invention of a new type of axe ['Kerrville Cedar Axe'] especially suited for cutting cedar trees and cedar brush. The cedar axe is a product of the Hill Country in Texas, where armies of cedar choppers have been swinging away for over thirty years. It was invented partly by accident and partly because of a real need for a better tool to do the job.” –G. Hollon, 1946
“A deplorable loss of cedar has taken place from brake fires. For half a century these have periodically occurred; areas which have not been burned over are the exception. Every old settler can tell of big fires which burned for days. In July, 1901, a very disastrous fire occurred near Marble Falls, in which about 600 acres of valuable cedar were destroyed” -- W. Bray, 1904
Connecting history to present-day land management, using William Bray’s accounts as a case study.
“'North Gorge’ from Lone Tree Hill” described as having “almost impenetrable growth of cedar and mixed timber” and a “deep layer of rich soil.” -- William Bray 1904
"South Gorge’ at its head under Lone Tree Hill, near Austin” described as having been cleared of most of the woody vegetation and “denuded of soil down to the rock and adobe.” -- William Bray 1904
Bray (1904) compared the North Gorge and South Gorge photos to illustrate the effects of forests on soils and on the behavior of rainfall and runoff.

He made several points, including:

- Forests build soil
- Forests protect soil from erosion, keep it cool and moist
- Forest soils act as a sponge and promote recharge

He concluded: “For all these reasons, forests tend to conserve the water supply and to maintain full springs and an even flow of streams.”

William Bray believed the woodlands of the Edwards Plateau were critical to protecting water supplies downstream and advocated for their protection.
Photo of the Vireo Preserve (part of the Balcones Canyonlands Preserve), which is just south of “Lone Tree Hill.” This shows an example of eroded slopes with sparse vegetation over subsoil (“caliche”) and bedrock, similar to Bray’s “South Gorge” photo.
Close-up of the subsoil (caliche) from the eroded slope on the Vireo Preserve; the subsoil has a sparse cover of native bunchgrasses.
Close-up comparing the subsoil (right) with topsoil from under the forest canopy (left).
Close-up of typical vegetation from the eroded slope on the Vireo Preserve surrounded by bare caliche and bedrock. However, note the bunchgrasses and woody species under the juniper canopy.
Another example of bunchgrasses and woody species under the juniper canopy (juniper mottes).
• Given our knowledge of land use history, we are working to restore topsoils in areas within the Balcones Canyonlands Preserve where they have been lost due to erosion following land clearing.

• As part of our restoration efforts, we are collecting baseline data on soils.

• The following graph compares soil organic carbon from under the native bunchgrasses growing over the subsoil and from under the juniper mottes (shown in previous slides).
Soils under the juniper mottes have over 5 times the amount of organic carbon as the surrounding subsoils.
Why soil organic carbon is important (the following is drawn from NRCS webpages and other sources):

- Carbon is critical to soil function and productivity, and is a key component of and contributor to healthy soils.
- Soils high in organic matter can hold more water, which means they both capture and store more rainfall while reducing runoff and the resulting flooding.
- High carbon soils are less vulnerable to erosion and are more resistant to drought.
- They store and supply nutrients and so have better fertility and are less likely to lose nutrients through leaching.
- Soil management plays a critical role in whether the carbon remains in the soil or is released to the atmosphere.
The following slide shows soil organic carbon data for another tract within the Balcones Canyonlands Preserve (Sam Hamilton West).

The SHW tract is relatively flat and so still has about a foot of topsoil.

The area has been cleared several times in the past and includes open areas, young juniper woodlands, and a few old junipers.
Levels of soil organic carbon increase with increasing woodland stand age.
“A fundamental aspect of ecosystem restoration is learning how to rediscover the past and bring it forward into the present – to determine what needs to be restored, why it was lost, and how best to make it live again.” --D.E. Egan and E.A. Howell, 2001
Ashe juniper was not formally described until 1930, by John Buccholz, and was named in honor of William Ashe.
Any Questions?

© Gil Eckrich
Attwater, H.P. 1892. List of birds observed in the vicinity of San Antonio, Bexar County, Texas. The Auk 9(4):337-345.


Johnston, Albert Sidney.  1855.  With Albert Sidney Johnston in West Texas: Austin to Fort Chadbourne, March 1855.  Edited by Marilyn McAdams Sibley, in West Texas Historical Association Year Book (October, 1964).  West Texas Historical Association, Abilene, TX.


Wood, S.J. 1861. Travis County: the Texas Almanac for 1861, with statistics, historical and biographical sketches relating to Texas. W. & D. Richardson, Galveston, TX.