

HISTORICAL ECOLOGY OF THE TEXAS HILL COUNTRY

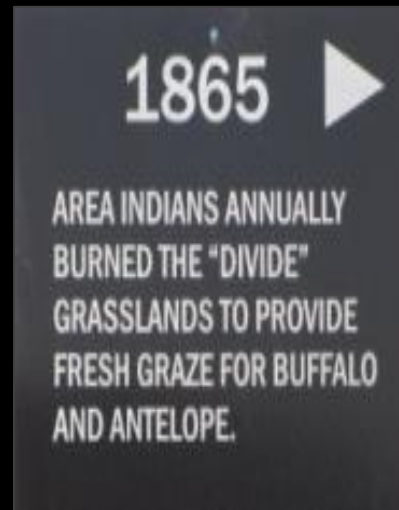
Historical Perspectives of
Vegetation Communities:

~1700-1900

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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 Colorado River in 1857, he described the Hill Country of Central Texas as "vast region, on which the live-oak trees stand alone or in picturesque groups near and far upon the green sward, which rolls in long waves . . . The first settlers found the landscape covered with little timber other than the ancient cypress trees and some scattered, sturdy oaks growing upon carpet of lush grasses and herbs.

But present-day patterns of vegetation in the Texas Hill Country 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 escaped the ravines and canyons to which it was restricted in the past. Cedar now colonize and persist in what were formerly pasture dotted with live oak and hickberry.

Ranchers are aware of the cedar invasion that is gradually taking over Hill Country. Many are apprehensive, knowing that cedar lowers the quality of pastures for deer and livestock. These animals use cedar for food only under the most severe conditions, preferring to browse on oaks and other hardwood species that cedar can shade out as it takes over. Although hand-chopping and chaining with bulldozers are used to control its spread, high labor costs make those methods too expensive for complete control. Meanwhile, the spread of cedar continues.

Three questions commonly asked

have been measured every year since establishment. Some of the trees are located on badly overgrazed round-up pastures, which have been removed in 1994. Pastures were established in 1954 before cedar brakes had colonized. Information on cedar brakes had been collected for more than 60 years. Informative changes have been observed in one year. One remarkable observation is that the



Example of Using Historic Accounts to Justify Management Practices

"...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."

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

Prehistoric Records

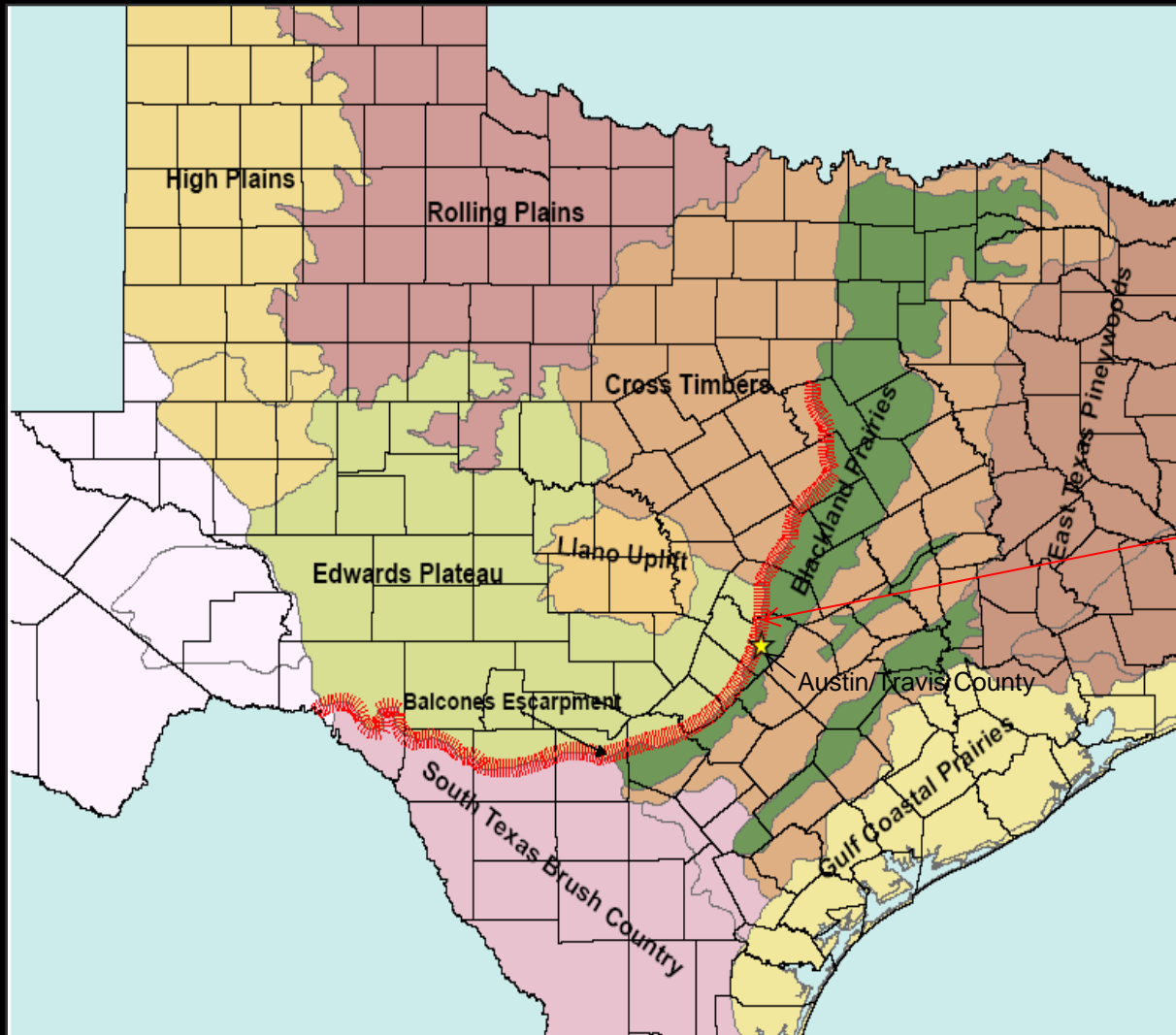


Sketch (unknown artist) of Friesenhahn Cave from the Bulletin of the Texas Memorial Museum (1961)

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

Spatial Context for Historic Accounts

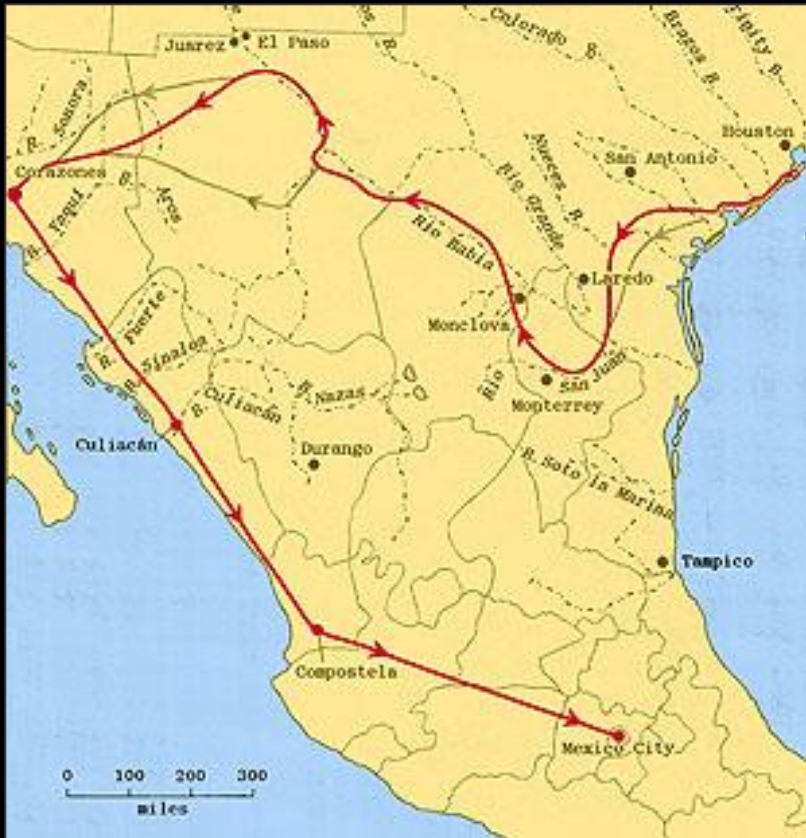
Major Ecological Regions



- 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



Cabeza de Vaca's route, adapted from Krieger (2002: Map 4)
<http://www.texasbeyondhistory.net/cabeza-cooking/index.html>

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

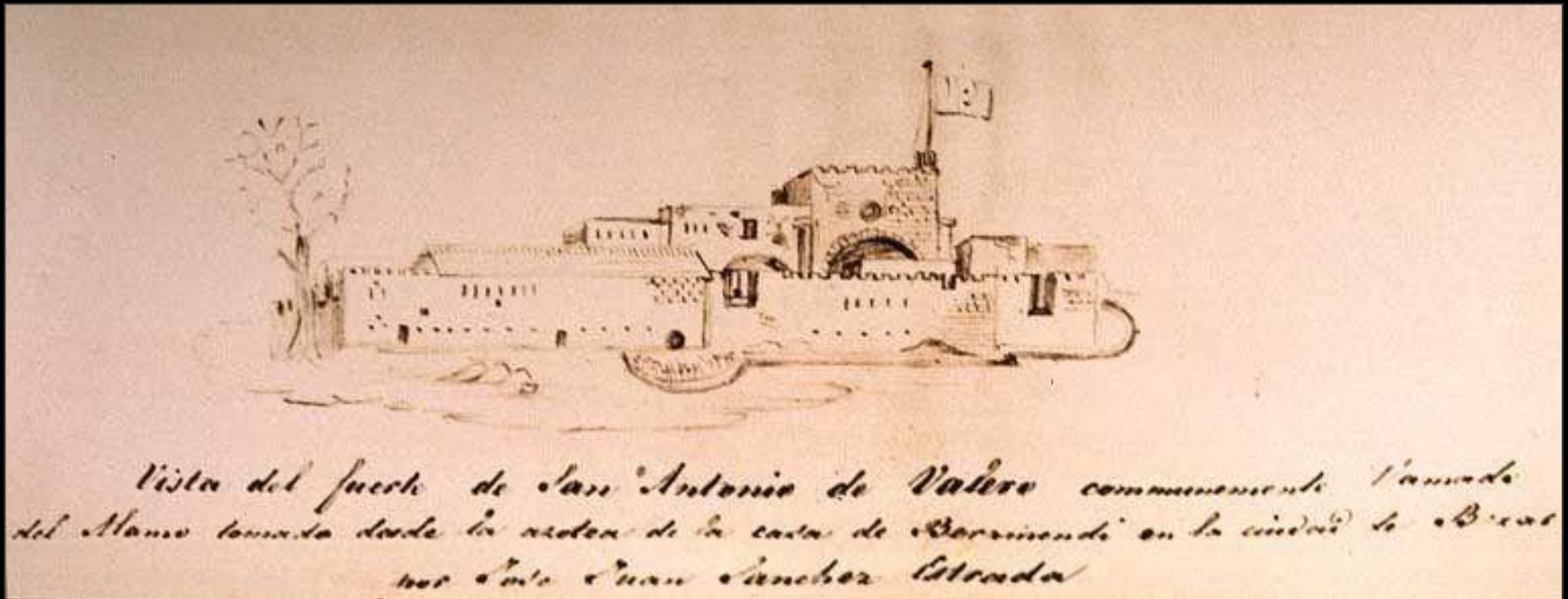


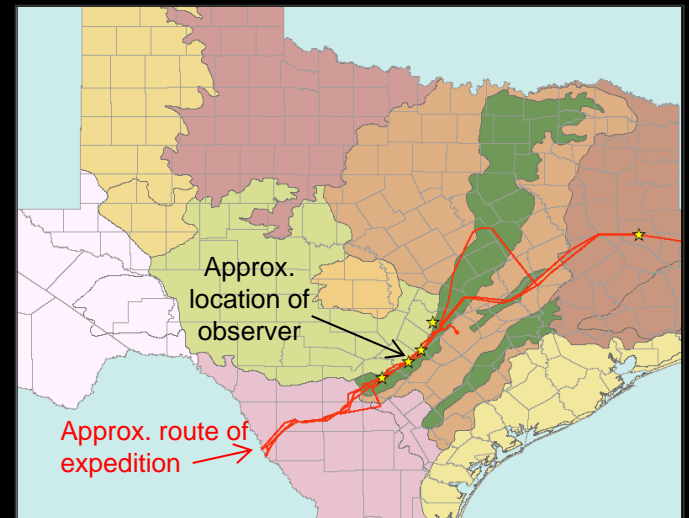
Image from Jean Louis Berlandier's Indians of Texas in 1830, Beinecke Rare Book and Manuscript Library



© Photo # CO2164, Austin History Center, Austin Public 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 [Escarpment], 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

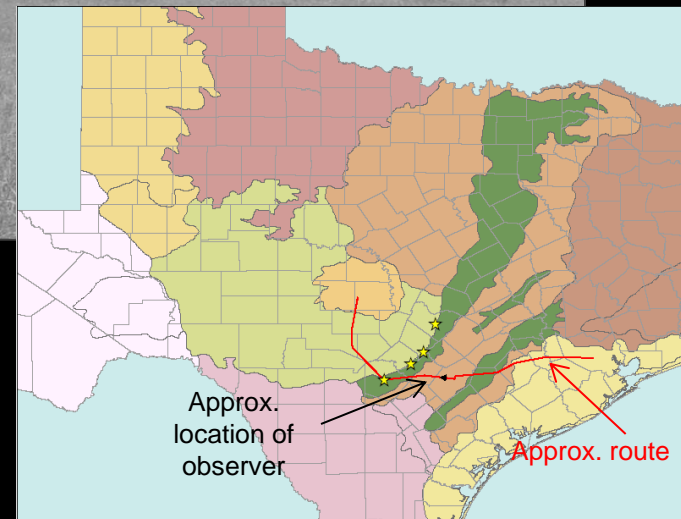
Major Historic Events: 1800-1850

- 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

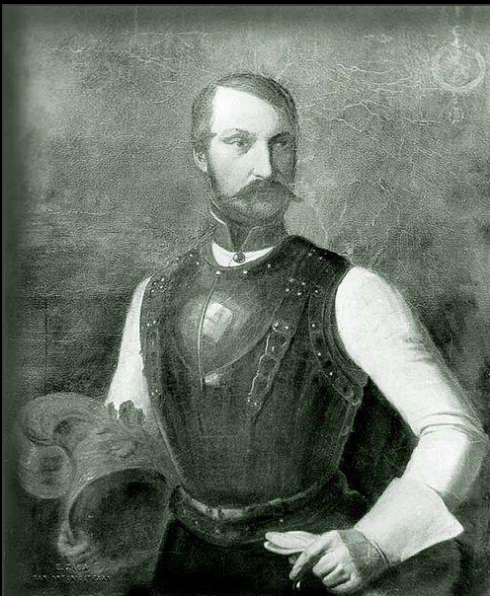


This account provides a good example of an observer reporting “grass as far as the eye can see.” It’s critical to note that he was describing the Blackland Prairie. We need to keep reading for his description of the Hill Country (here described as mile after mile of “dark boding forest”).



“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.”



Portrait (unknown artist) of
Prince Carl of Solms-Braunfels

“...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

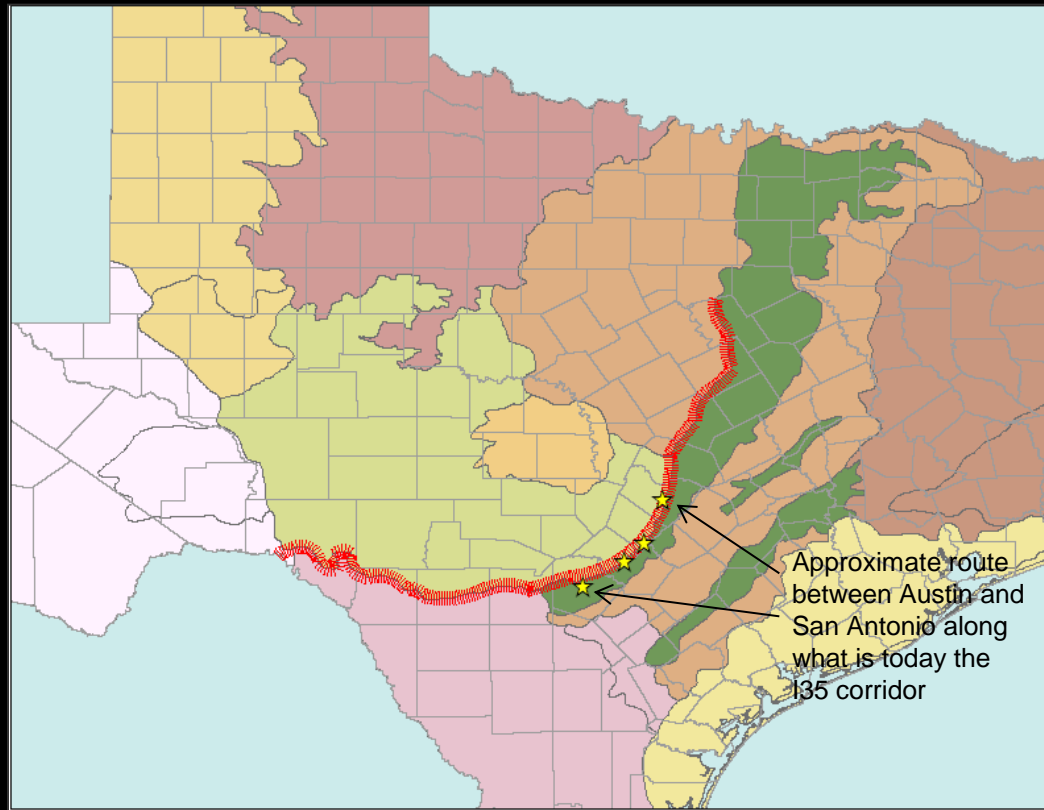
“The cedars here are not the stunted shrub-like plants found in the Northern States of the Union, but are stately trees with straight trunks, seldom more than twenty to twenty-five feet in height and one and one-half feet thick. They have a uniformly spreading crown....”

“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

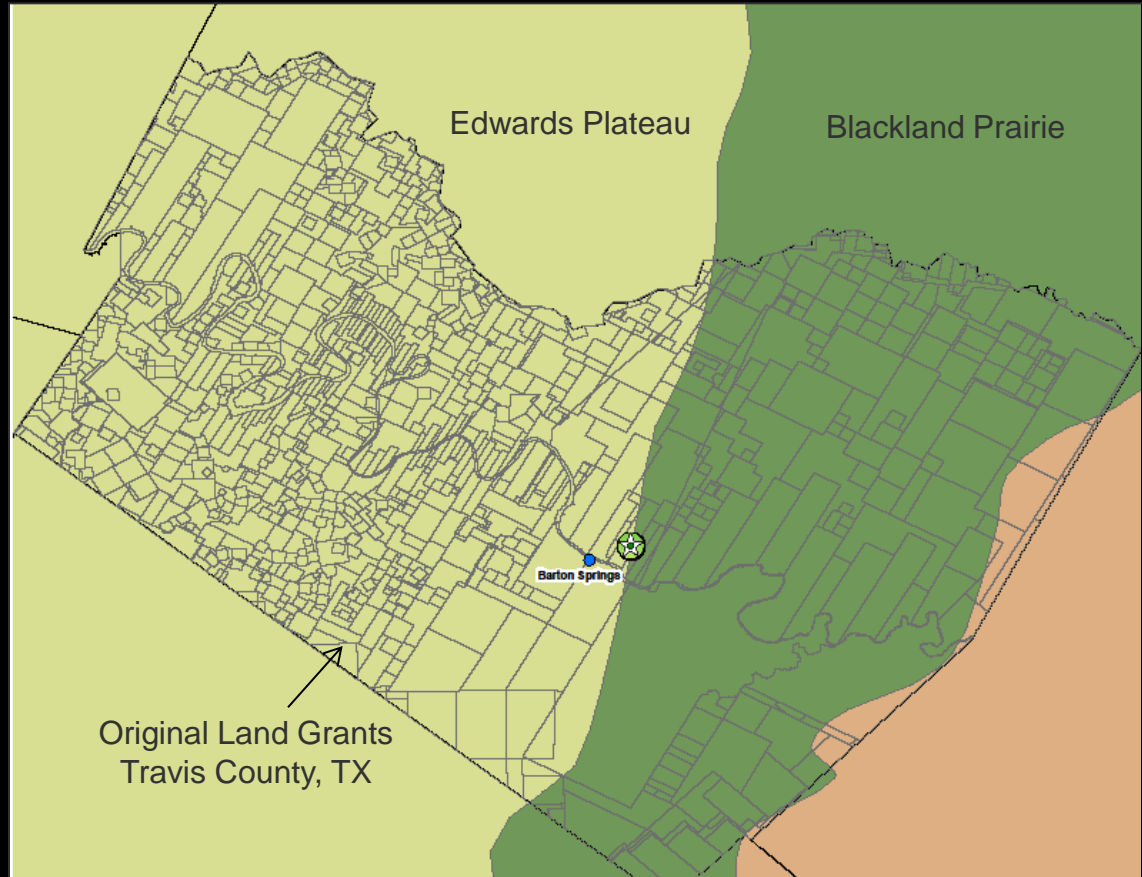
Survey for Wm Barton one Sale of Land situated on the west side of the Calcasieu River on Spring Creek being the quantity of land to which is entitled by virtue of a certificate to Wm Barton by the Board of Land Commissioners for the County of Bexar beginning at an elm at the mouth of the creek thence 1000 ft S 80° W thence 1000 ft E 20° N to a stake from which is a hackberry bearing N 87° E 100 ft one live oak thence N 75° E 100 ft to a stake from which is a cedar bearing N 70° E 100 ft one live oak thence S 70° E 100 ft a live oak creek 40 ft in width at 200 ft a cedar from which are two others one bearing N 60° E 100 ft the other N 70° E 100 ft where it intersects another line a spanish oak from which is a live oak bearing N 50° E 100 ft a cedar S 22° W 100 ft thence N 30° E with said cedars line 500 ft to the corner on Spring Creek thence N 60° E 500 ft to the beginning

*Containing 100 acres of arable land
Variation 11° East*

*Jas Barton, Surveyor
Barton Springs, Bexar Co.
1838*

*I do solemnly swear the foregoing survey was made since the opening of the same office in the year 1838
Jas Barton
April 6th 1838*

*I certify that Allan H. Holderman person came before me and in my office and acknowledged this foregoing under oath this 6 April 1838
Jas Barton
I certify that Allan H. Holderman person came before me and in my office and acknowledged this foregoing under oath this 6 April 1838
Jas Barton*

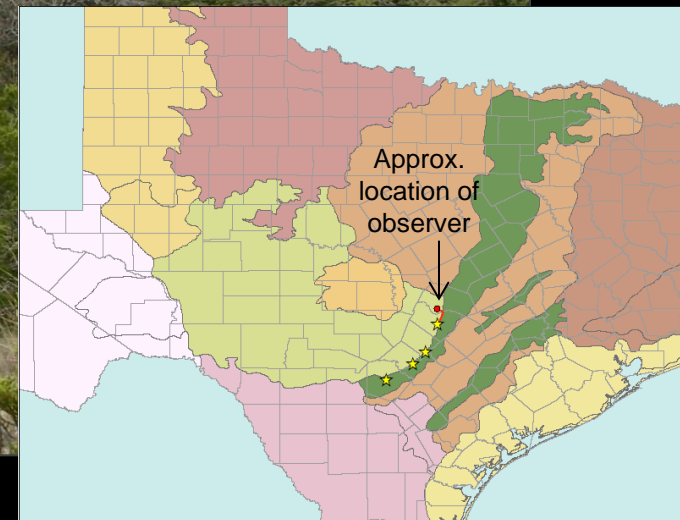


Field survey notes for William Barton's Property, 1838; recorded 1 elm, 1 hackberry, 5 cedars, 1 Spanish oak, and 1 live oak (“witness trees”) near Barton Springs

Major Historic Events: 1850-1900

1854	Two Indian reservations established in West-Central Texas	1883	UT Austin opens
1859	Indians on the Texas reservations moved to reservations in Oklahoma	1888	Completion of Texas State Capitol
1861-1865	Civil War	1889	Survey reports 25 bison remaining in the Texas panhandle
1868	First patent granted for barbed wire	1893	Completion of first Colorado River dam
1871	First train arrives in Austin	1894	Oil discovered in Texas
1872	Yellowstone established as first national park	1900	Last records of passenger pigeons in Texas. U.S. wild bison population drops to fewer than 40 animals.
1875	Last free band of Comanches surrenders and moves to Fort Sill Reservation in Oklahoma	>1900	Continued expansion of livestock industries on the Edwards Plateau
1878	Huston-Tillotson opens		

“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



Note artist's rendering of forest (textured) and prairie (flat)



Photo taken from Texas Capitol Dome shortly after it was built, looking southwest
© Photo #PICA19238, Austin History Center, Austin Public Library



“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

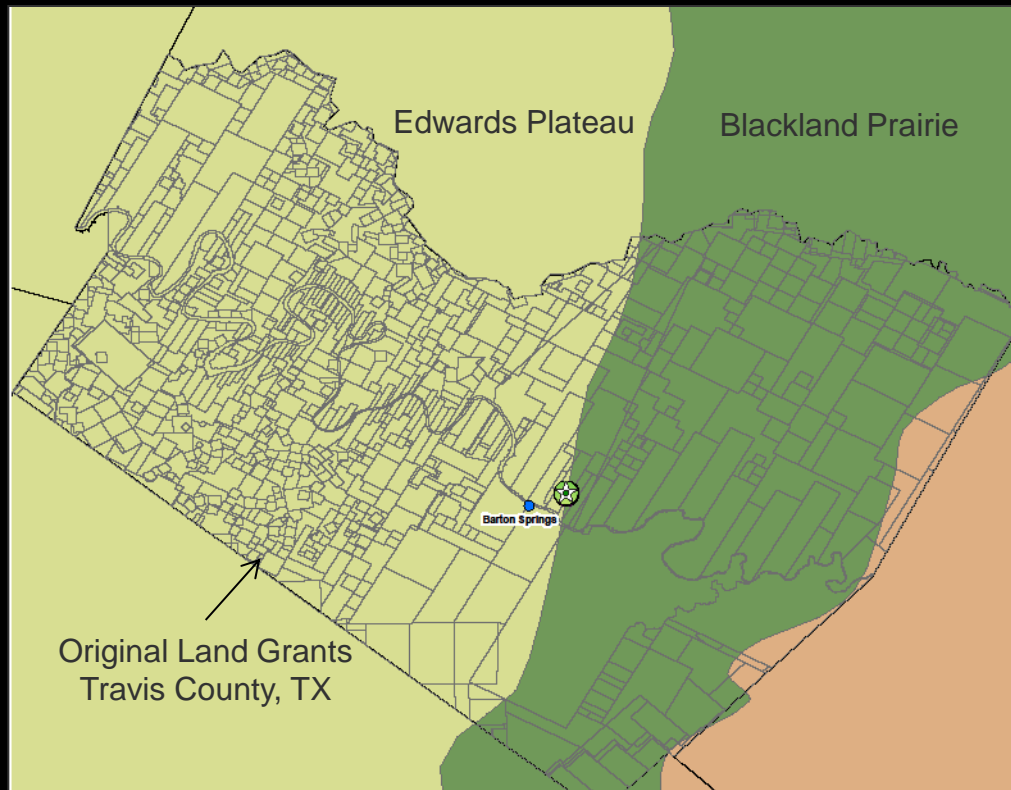
Compare the following accounts from Frederick Law Olmstead with those from the article at the beginning of this presentation:

Note artist's rendering of forest (textured) and prairie (flat)



“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

Bull Creek, near confluence with Colorado River, looking north/northwest (circa early 1900s)



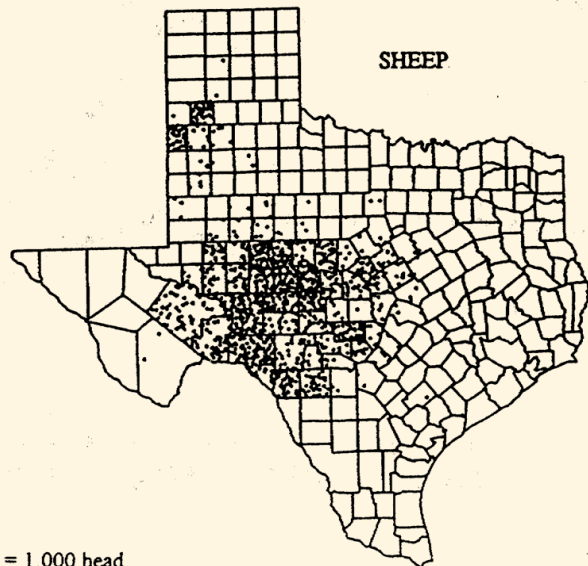
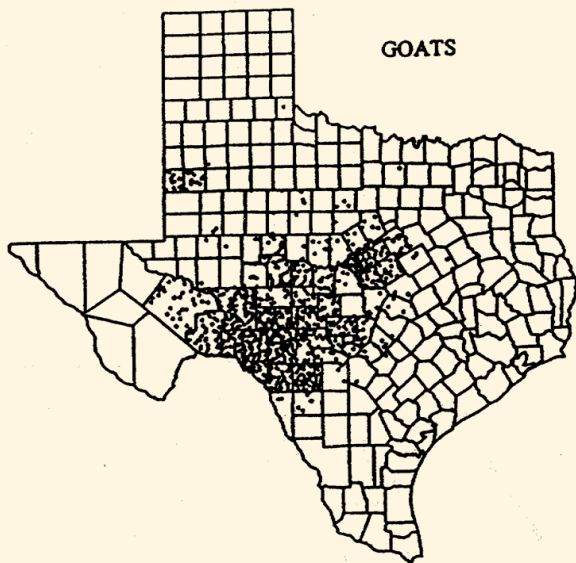
“...the mountains...are covered with cedar, and send clear crystal waters gushing from them....” –J. de Cordova, 1858

Cedar cabin on what is today RM 2222, looking west with Bull Creek in background (circa early 1900s)



© Photo #C02101, Austin History Center, Austin Public Library

“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



1 dot = 1,000 head

“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



Photo of Angora goat herd on what is today part of the Balcones Canyonlands Preserve
 © Photo #PICB12552, Austin History Center, Austin Public Library

Distribution of sheep and goats in Texas
 (Texas Crop and Livestock Reporting Service 1994)



© Austin History Center, Austin Public Library

“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



© Photo #PICA19726, Austin History Center, Austin Public Library

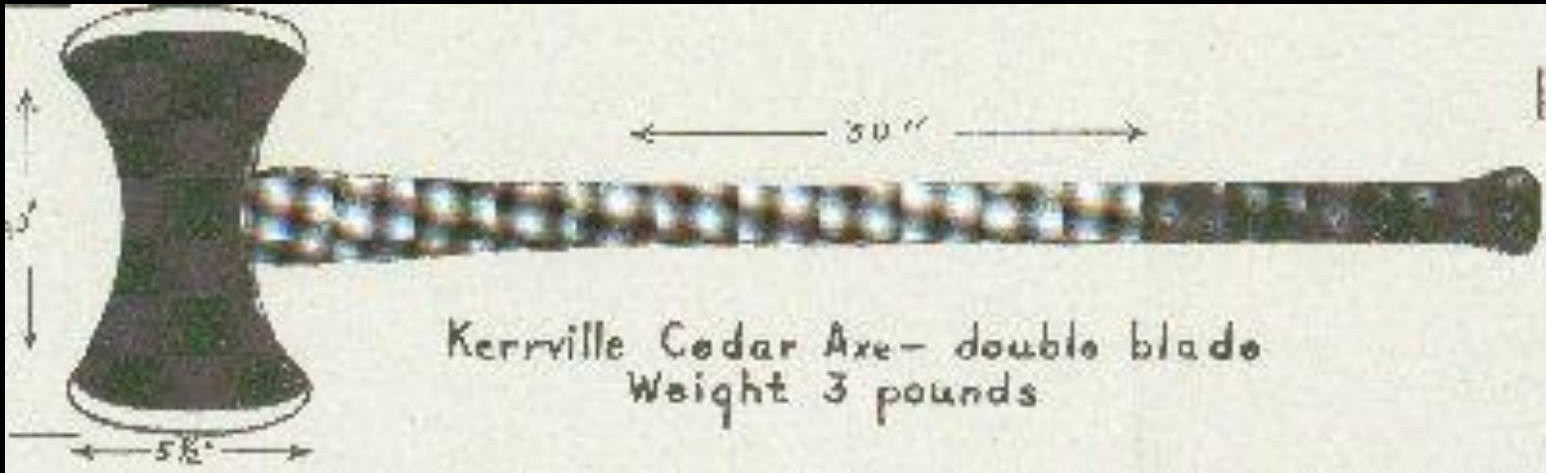
“The writer knows of no region in which any species of cedar is so uniformly abundant and dominant as is the mountain cedar in the limestone country of Texas. ... [Mountain cedar] is the most valuable tree of the semiarid hill country of Texas.” –W. Bray, 1904

“Cedar Chopper” Culture



“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



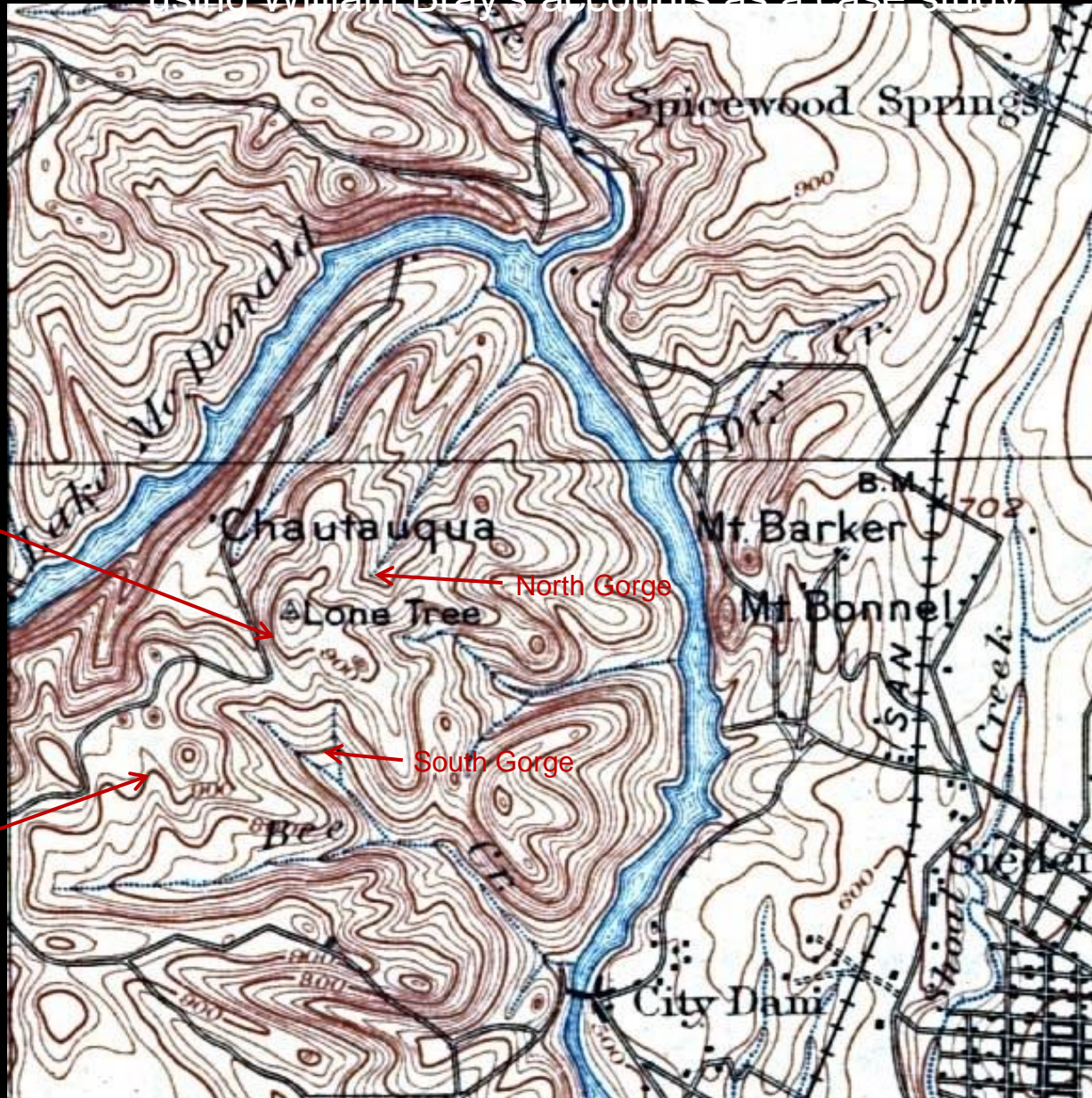
From Hollon (1946) with permission from Texas State Historical Association

“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

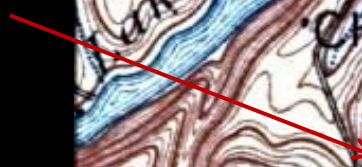
“A deplorable loss of cedar has taken place from brake fires. For half a century these have periodically occurred; areas which have not been burned over are the exception. Every old settler can tell of big fires which burned for days. In July, 1901, a very disastrous fire occurred near Marble Falls, 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



Lone
Tree Hill



North Gorge



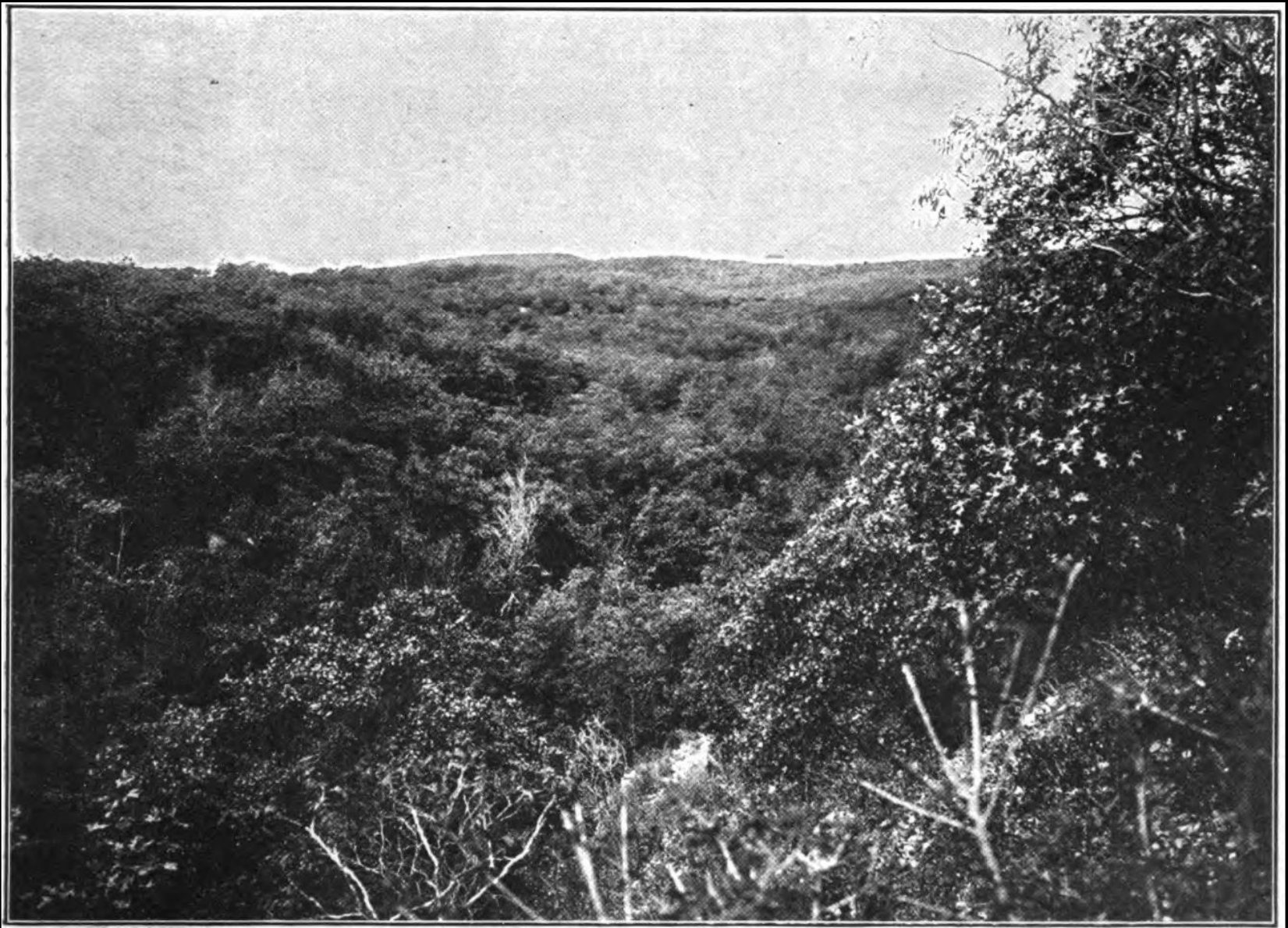
South Gorge



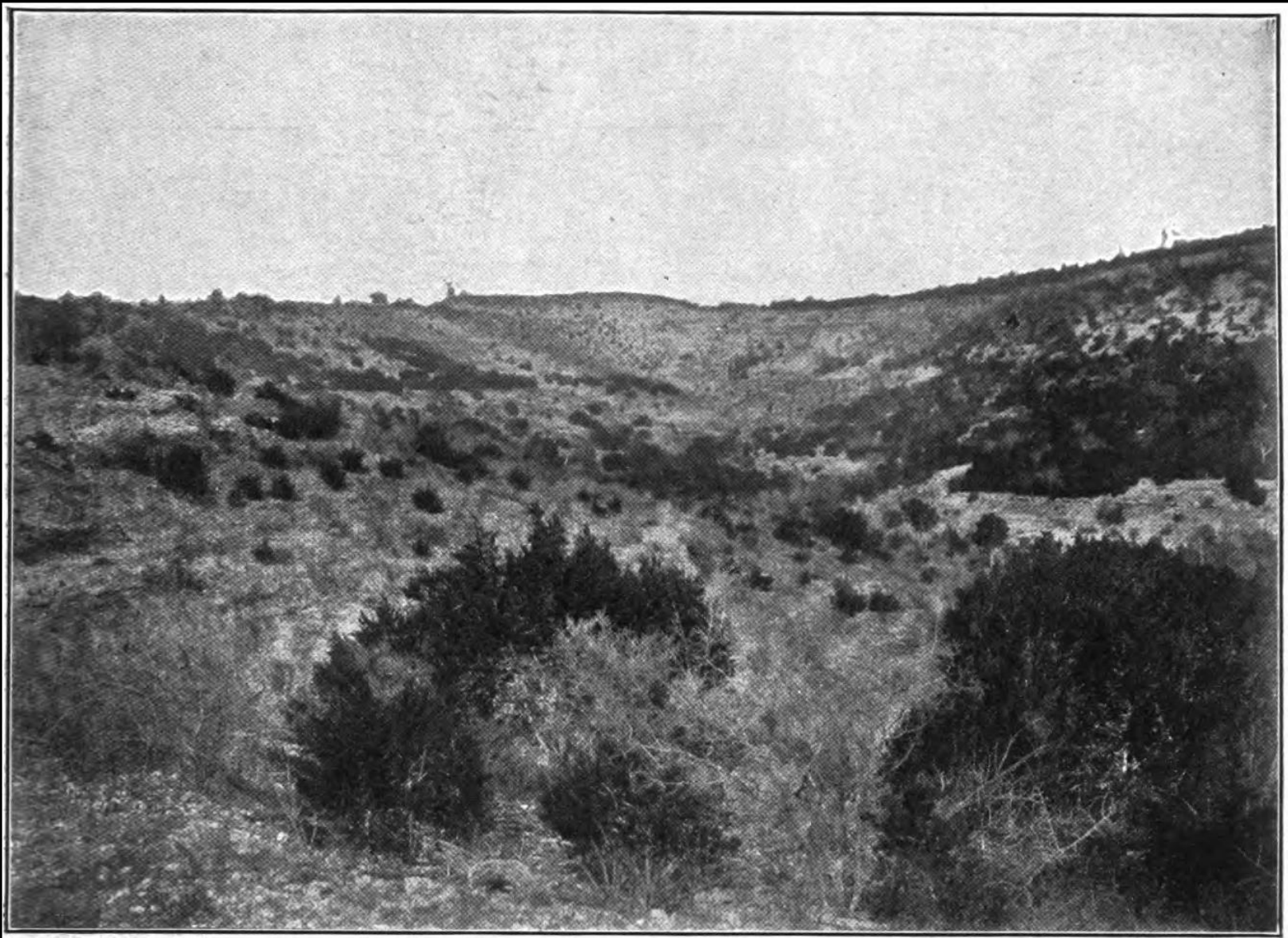
Wild Basin/
Vireo Preserve



Topo map,
Westbank
Peninsula,
circa 1895



“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).



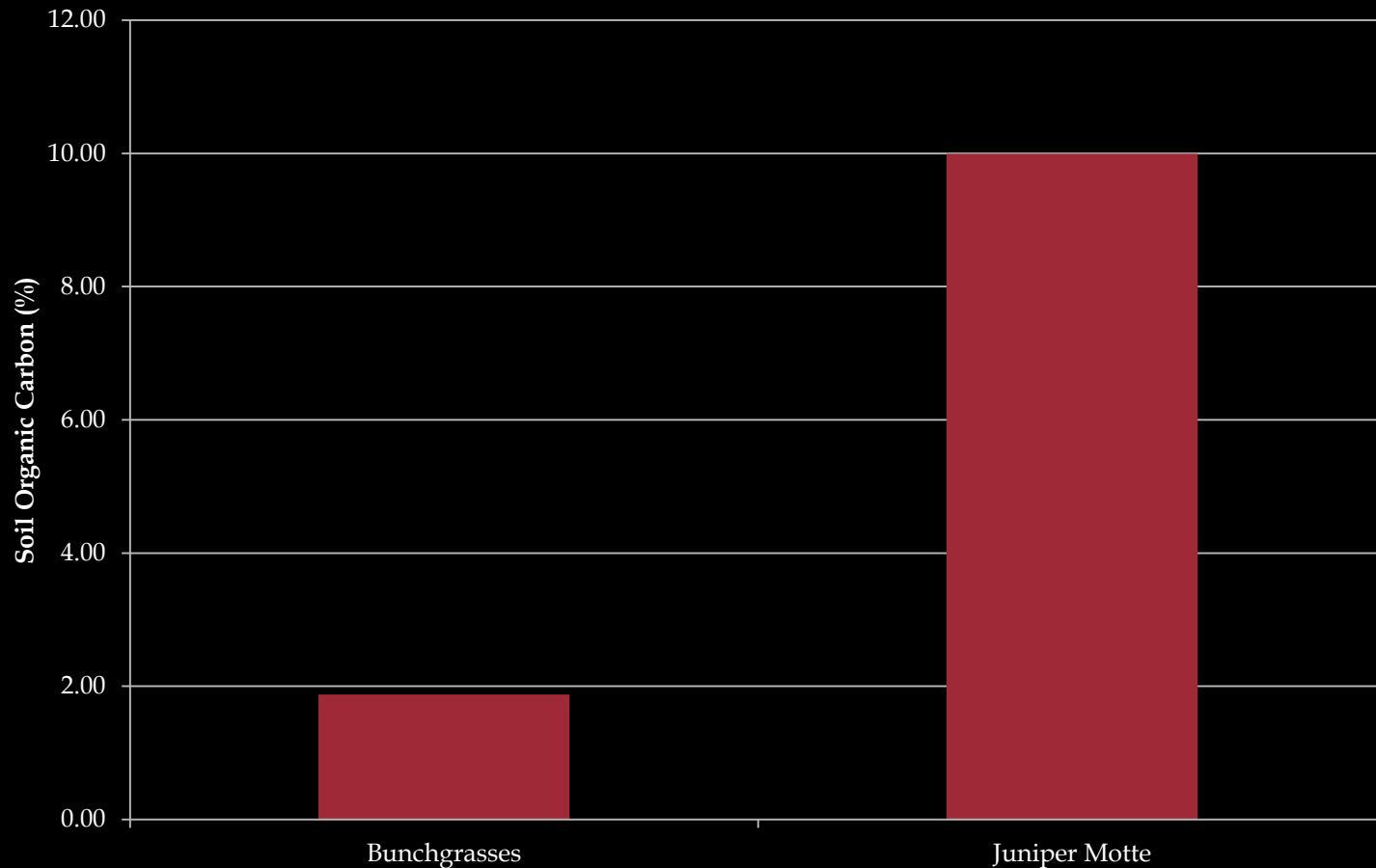
Close-up of typical vegetation from the eroded slope on the Vireo Preserve surrounded by bare caliche and bedrock. However, note the bunchgrasses and woody species under the juniper canopy.



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).

Soil Organic Carbon Vireo Preserve Balcones Canyonlands Preserve



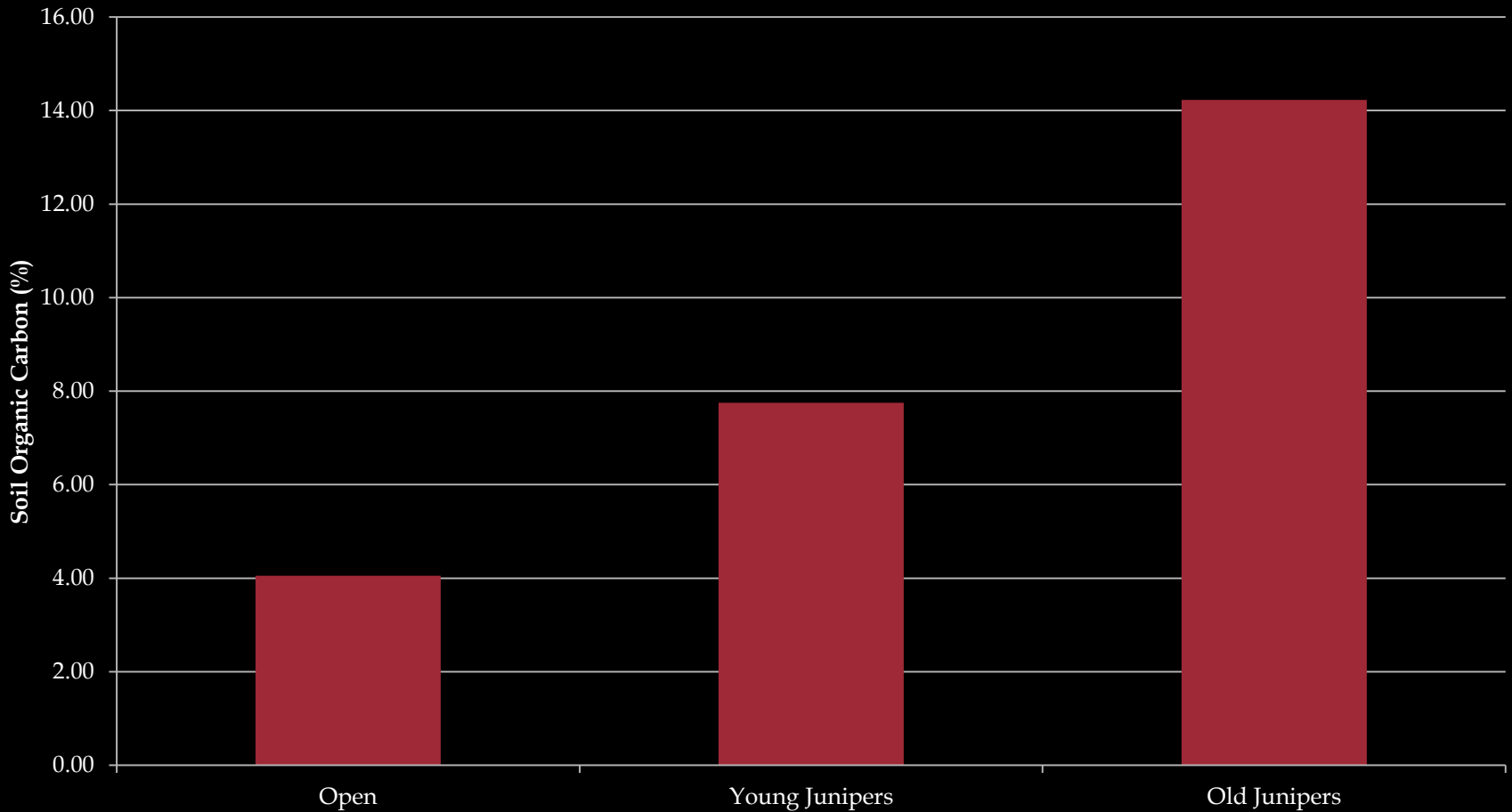
Soils under the juniper mottes have over 5 times the amount of organic carbon as the surrounding subsoils

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.

Soil Organic Carbon San Hamilton West Tract Balcones Canyonlands Preserve



Levels of soil organic carbon increase with increasing woodland stand age

Importance of History in Conservation & Management

“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



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Chapel Hill Herbarium

Ashe juniper was not formally described until 1930, by John Bucholz, and was named in honor of William Ashe

**William Willard Ashe
(1872-1932)**

1892-1905 – Forester, North Carolina Geological Survey

1905–1932 – U.S. Forest Service

1918-1924 - Secretary of the National Forest Reservation Commission



Any
Questions?

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