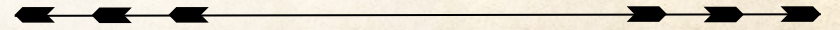




# MOUNTAIN CEDARS



## THE LIMESTONE JUNIPERS OF TEXAS

by Elizabeth McGreevy

Executive Director Project Bedrock and author of *Wanted! Mountain Cedars Dead and Alive*



# WHAT ARE MOUNTAIN CEDARS?

They are the juniper trees that ranchers call “invasive” and city people curse for cedar fever.

They not only consist of Ashe Juniper (*Juniperus ashei*), but also of the recently discovered Adams Juniper (*J. ovata*) and Ashe-Adams Juniper hybrids (*J. ashei* x *J. ovata*).

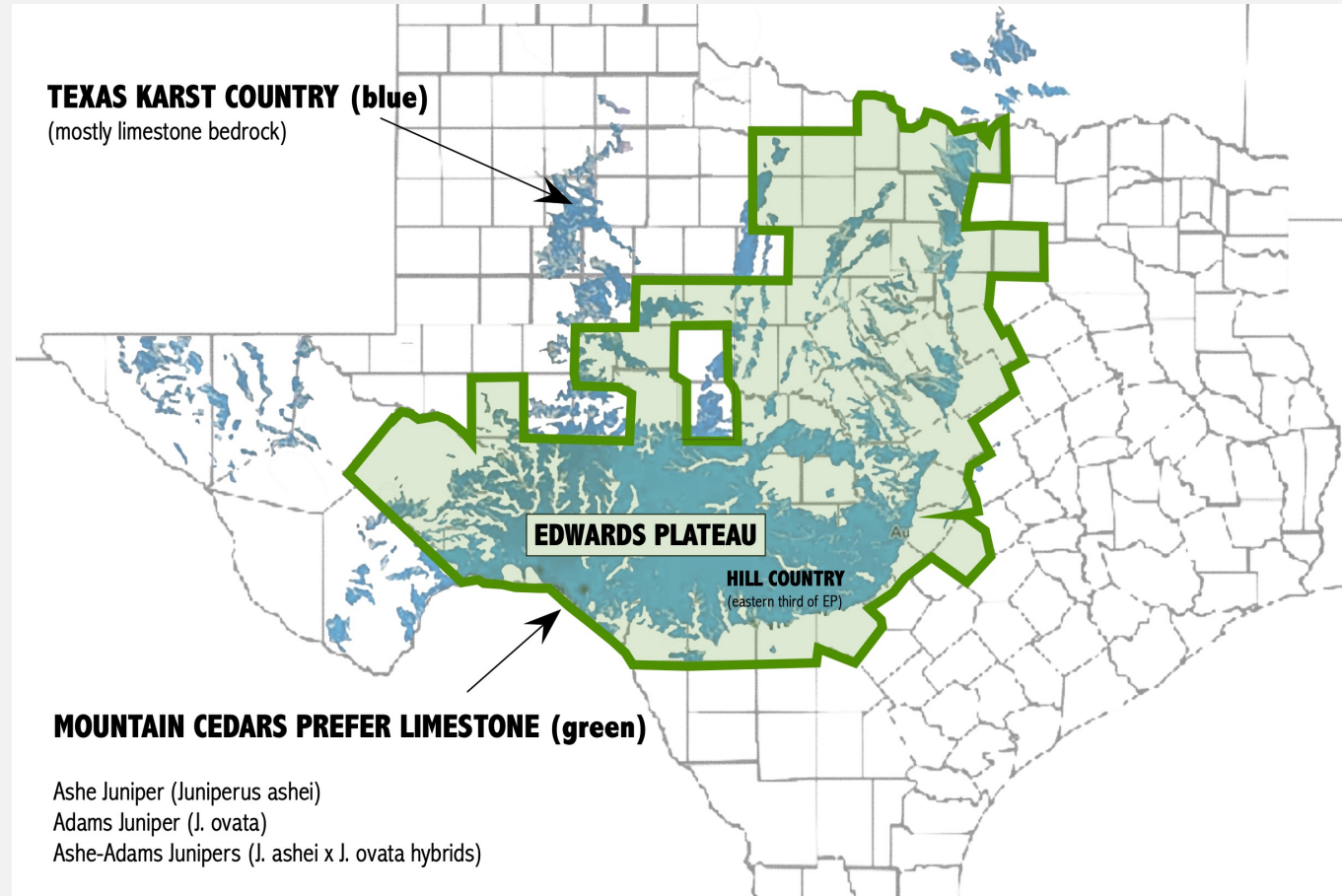




# MOUNTAIN CEDARS PREFER LIMESTONE-BASED SOILS

Limestone soils occur wherever there's subsurface limestone bedrock. These regions are called 'karst country.'

Red-berry Juniper (*J. pinchotti*) and the occasional Eastern Red Cedar (*J. virginiana*) also grow on limestone soils, but are more common on other types of soils. So they aren't true Mountain Cedars.





# WHAT IS KARST COUNTRY?

Karst country has bedrock (typically limestone) that easily dissolves to form a network of caves, sinkholes, springs, disappearing streams, and aquifers.

About 20 percent of Texas is karst country. The largest continuous area is the Edwards Plateau.





# KARST COUNTRY SOILS ARE A CHALLENGE

These soils are very shallow and take 10 to 40 times longer to rebuild than other soils.

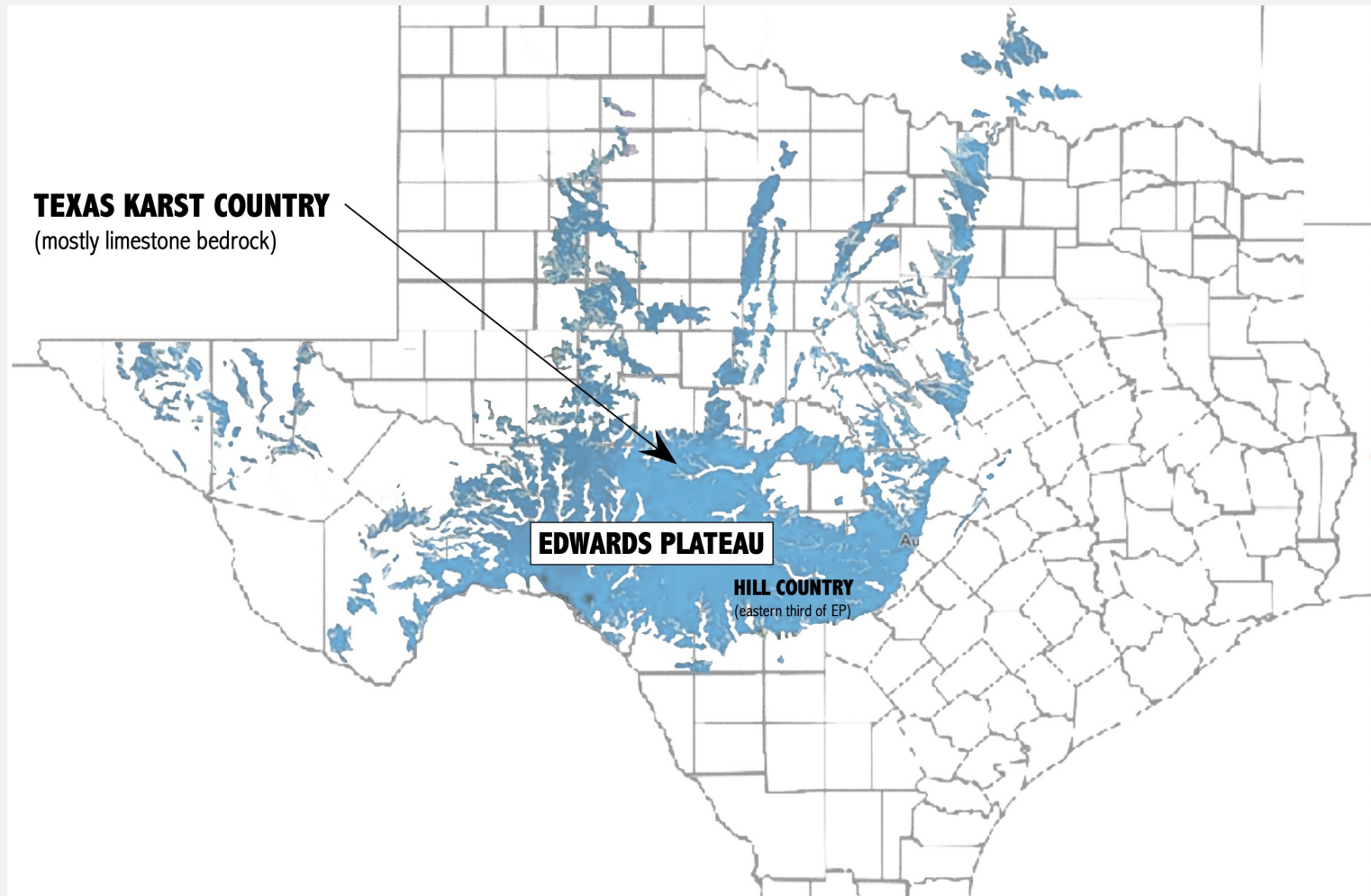
Since the region is prone to gully washer rains, karst country soils are much more vulnerable to erosion and degradation. For this reason, they must always be protected.





# POLL QUESTION

## DO YOU LIVE ON TEXAS KARST COUNTRY?





# KARST COUNTRY WAS NOT HISTORICALLY ALL GRASS

Before the 1900s, karst country in Texas was described as a patchy mosaic of different vegetation types.

The semi-arid, less-broken western Edwards Plateau was more open grassy prairie with trees and maintained by bison, dense grass cover, and occasional fires.





# EAST AND NORTH KARST COUNTRY HAD MORE TREES

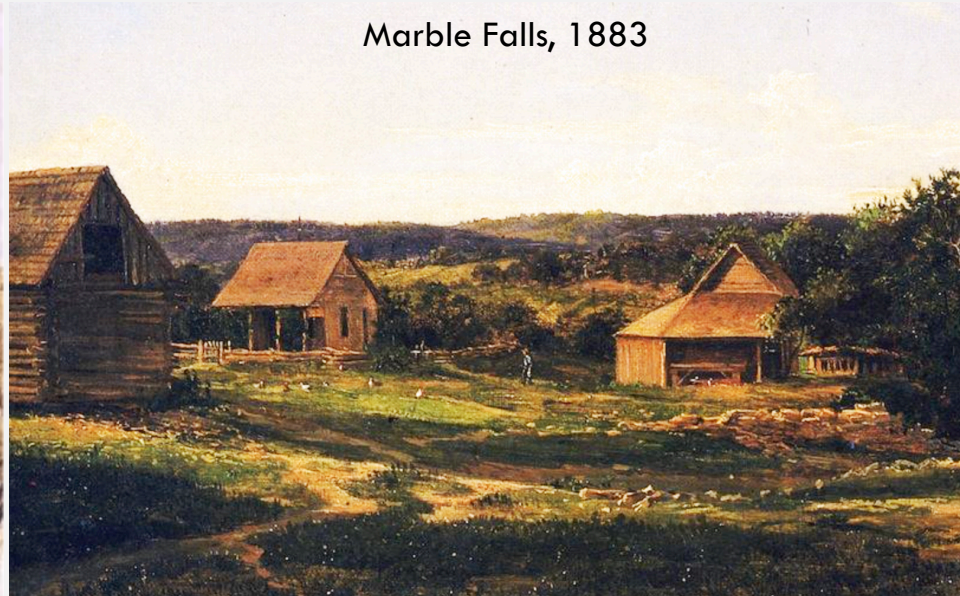
The broken, subhumid, eastern portion of the Edwards Plateau (the Hill Country) was about half well-wooded and half open grassy prairie. To the north through the Lampasas Cut Plains it was a more grassy prairie than wooded. The Balcones Escarpment was almost 100 percent wooded:

“Live oak, holly, many kinds of cactus . . . and the millions of cedar that cover the Comal hills like a mantle, preserve the pleasant picture of summer when the icy northerners sweep down on us.” -Viktor Bracht 1848

North of San Antonio, 1849



Marble Falls, 1883

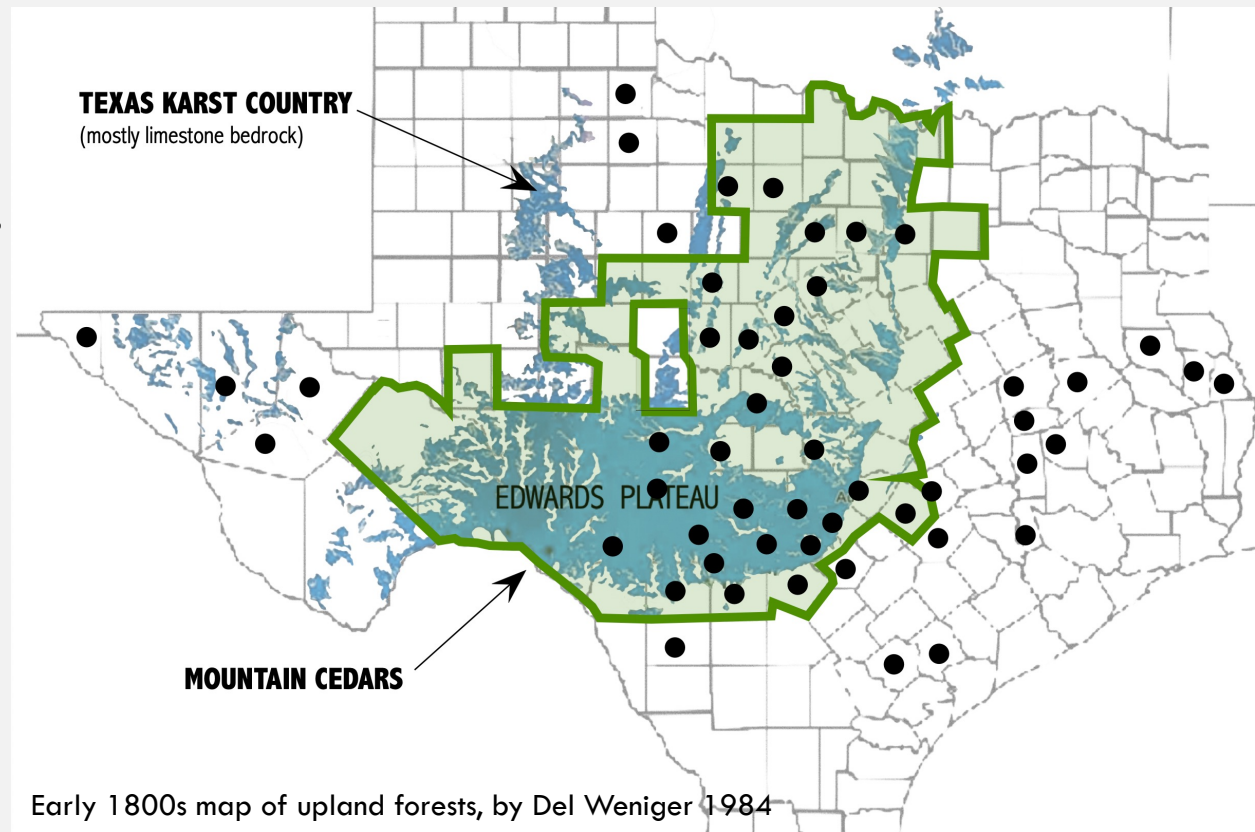


# KARST COUNTRY HAD MANY UPLAND FORESTS

The black dots represent counties where early-1800 Texas land surveys documented upland forests.

Explorers commonly reported upland Mountain Cedars:

“The soil is rich...mesquite prairie pretty fairly timbered up to the mountains, which are covered with cedar.” —Bandera County 1828





# MOUNTAIN CEDARS GREW OUTSIDE CANYONS

Mountain Cedars did not grow just inside canyons where they were protected from fires.

Many large Mountain Cedars can be found growing on exposed upland sites. These veteran Mountain Cedars were growing here before the Spanish arrived in the 1700s.



Mountain Cedar at the Shield Ranch: 300-500 years old



Veteran Mountain Cedar near Brownwood: 350-600 years old



# WHERE MOUNTAIN CEDARS GROW?

Mountain Cedars grew inside hillside forests, thickets, and oak shinneries AND along valleys, bluffs, ravines, and creeks in juniper-oak forests.

They also grew inside Live Oak mottes or alone in prairies.

Old-growth Juniper-Oak  
Bottomland Forest



Bushy thicket



Prairie Mountain Cedar



Hillside old-growth forest



# THEY GREW AS TREES WITH WELL-DEFINED TRUNKS



State champion Mountain Cedar



Regenerating old-growth cedar brake

These forests helped maintain healthy soils and spring flows. They provided a diverse habitat for numerous wildlife, including jaguars, black bears, passenger pigeons, and even migrating herds of bison.

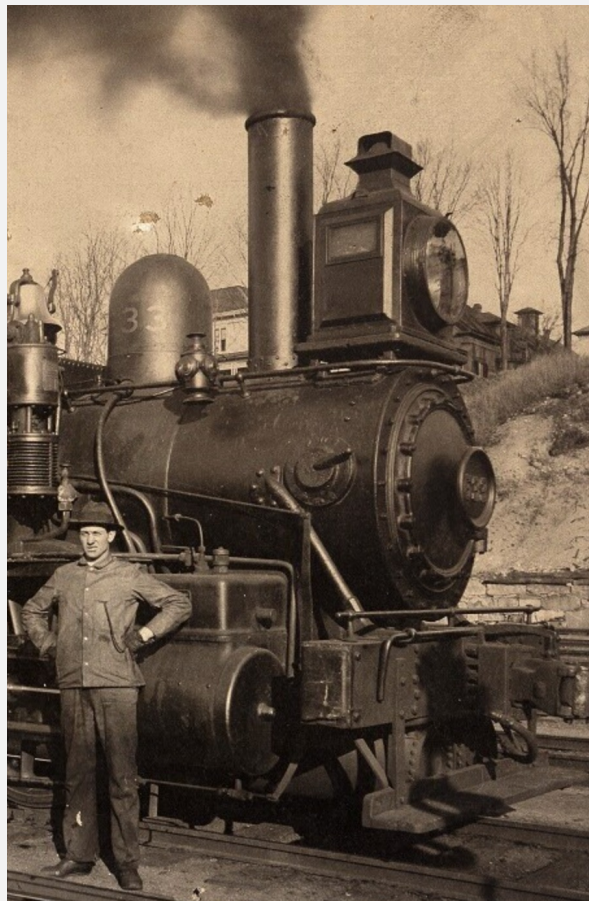


**THEY SELDOM GREW AS BUSHES**





# THEN EVERYTHING CHANGED





# MOUNTAIN CEDARS BECAME A COMMODITY

The Texas economy boomed as the region grew and new inventions were introduced.

Mountain Cedars proved to be valuable as a decay resistant and plentiful source for railroad ties, foundation piers, roof beams, telegraph poles, and fencing.

Railroad construction near Llano using Mountain Cedar ties,  
1881



Mountain Cedar barn, built 1852





# CLEARCUTTING & OVERGRAZING WAS COMMON

To keep up with the demand, juniper trees were clearcut by tens of thousands from 1860 to 1900. As demand for beef skyrocketed, ranges were overstocked, fenced-in, and overgrazed.

“Forests in this vicinity will soon be extirpated...the cedar brakes will soon be destroyed.” —Daily Democratic Statesman 1875





# THESE ACTIONS DEGRADED TEXAS KARST COUNTRY

We didn't realize how shallow the soils were and how long it would take for them to rebuild. Soon, soils degraded and eroded. Eventually, the original vegetation cover stopped regenerating.

"The land's fertility was a deception, that the soil was rich but shallow, sitting atop a bedrock of limestone." - Robert Caro, Path to Power





# NATURE TRIED TO COVER THE BARE LIMESTONE

On karst country, Mountain Cedar trees morphed into bushy thickets. They began to spread across Texas karst country in the early 1900s.





# WE DIDN'T REALIZE THE TREES WERE HELPING

At first they repopulated the hillsides and bottomlands. Then they began to spread into our rangelands. That's when people started to notice.

In 1939, *The Cattleman* ran an article that claimed the trees were killing grass and stealing water.





# SO THE WAR BEGAN

In the mid-1900s, vast amounts of Mountain Cedars and other woody brush were clearcut from Texas karst country. They were chained, burned, dozed, and sprayed.

It has been estimated the region lost an average of five inches of topsoil during that time.





# DECADES LATER, WE STILL HAVEN'T WON THE WAR

We've been blaming Mountain Cedars for the problems we caused.

We've supported a brush-centric approach instead of focusing on the real problem: degraded karst country soils.

We didn't realize these lands need to be managed differently than the rest of Texas AND that Mountain Cedars are part of the solution.





# POLL QUESTION

CAN GRASS RESTORE BETTER THAN MOUNTAIN CEDARS?





# POLL QUESTION

## CAN GRASS DO A BETTER JOB THAN MOUNTAIN CEDARS?



### ANSWER

No, because our soils are shallow.

Prairie grass roots are fibrous and dense. They are excellent at slowing overland and subsurface flows. But they cannot establish a good root system where shallow karst country soils are degraded.





# A SIDE-BY-SIDE COMPARISON



Grass on degraded karst country soils



Grass on healthy karst country soils

\*especially true if the land is being grazed improperly.



# MOUNTAIN CEDARS ARE PIONEERS, NOT INVASIVE

The bushy thickets provided the perfect pioneering cover. They are part of the solution to regenerate degraded karst country in Texas.

They spread fast and prolifically.  
They drop tons of organic debris year-round.  
They jumpstart soil fungi, and protect and shade the soil.  
They grow woody roots 10 to 25 feet down that can crack and dissolve limestone.





# THEY IMPROVE, NOT DEGRADE, SOIL





# THEY ENHANCE, NOT SUPPRESS, BIODIVERSITY

As nursery trees, their lower branches protect newly emerging native plants.

They enhance wildlife habitat diversity over time. They provide shelter and an important source of winter carbs (fruits) for our native wildlife.

The shredding bark of older Mountain Cedars provides excellent material for ALL native nest-builders (not just Golden-cheeked Warblers). So it's important to have multiple older Mountain Cedars.





# THEY CO-EXIST WITH, NOT CHOKE, OAK TREES



The average water use of all trees, including Plateau Live Oaks and Mountain Cedars, is about the same.

When you measure water use tree-by-tree, one Mountain Cedar might use 33 gallons of water per day (Owens 1996) but then another one, same size and 100 yards away, might use 1-6 gallons of water per day (Dugas 1995).

Established trees use water from different levels (Plateau Live Oaks 50-60 feet down; Mountain Cedars 15-20 feet down). They've been growing side-by-side for 1000s of years.

Studies have revealed that Limestone Durand Oaks need Mountain Cedars to jumpstart soil microbes before they can start growing.



# THEY INTERCEPT THE SAME RAIN AS DENSE GRASS

Dense cover of Mountain Cedars intercepts an average of 40% of rains. A dense cover of Little Bluestem and Indian Grass intercepts an average of 44%.

Dense cover is ideal because it reduces erosion, flooding, improves soil health, and increases how much rain soaks into the ground.





# BUT MOST STUDIES COMPARED IT TO SPARSE GRASS

Sparse grass cover on degraded soils intercepts only 10-20% of rains.

But since sparse cover causes more erosion, surface runoff, and downslope flooding and moves lands towards rocky desertification, is that what we really want?



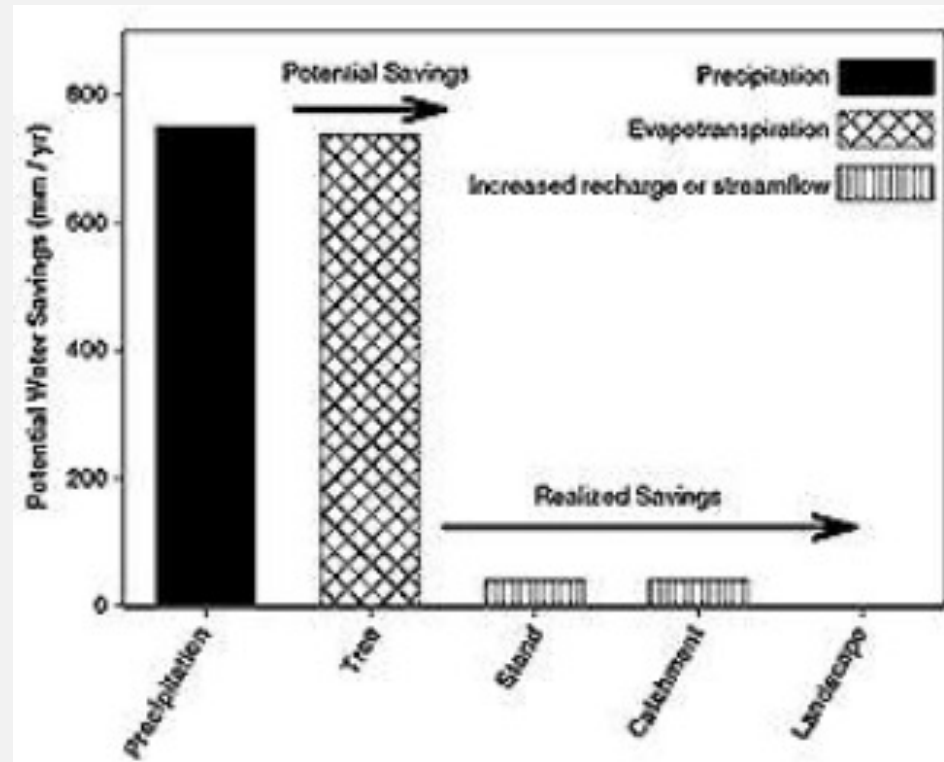


# STUDIES PROMOTED MATH, NOT FIELD RESULTS

Calculated estimates predicted that clearing Mountain Cedars would dramatically increase spring flows. But in-field clearcutting results were significantly less.

The same results would happen if you cleared any vegetation, including live oaks.

Why do so many karst country landowners report more spring flows after clearing Mountain Cedars? Because the thickets increased how much rain soaks into the ground (infiltration)—remove the trees, and you get 100% of rains soaking into better soil. Three to five years later, these savings go away as the exposed soil compacts and new vegetation starts growing. Clearing for springs is NOT sustainable.





# JUNIPERS ON LIMESTONE ENHANCE GROUNDWATERS

Throughout the Edwards Plateau, studies reveal pioneer juniper thickets increase how much rain soaks into the ground. They do this by activating soil microbes and enhancing soil health and by increasing limestone porosity through physical root action and excreting carbonic action through deeper root tips.

Studies by Dr. Brad Wilcox at Texas A&M proved that since the 1940s, where pioneer thickets have spread across the eastern Edwards Plateau, river levels have increased.

Karst country studies around the world repeatedly conclude that dense continuous vegetation cover allows more water and carbon to soak into the ground and dissolve more limestone to increase groundwaters.





# SO WHAT CAN WE DO?



Stop managing karst country like the rest of Texas.

Stop focusing on a tree species—and see the bigger picture and think outside the box.

We can start by protecting all remaining old-growth forests and prairies (such as with conservation easements). They are resilient and valuable as green infrastructure and wildlife habitat.

We can incorporate nature-based solutions to create more resilient and longer lasting results. Many of these solutions can take time to see results, so we need to also overcome the urge for instantaneous gratification.

We need to learn to work with pioneer thickets of Mountain Cedars or mimic what they are doing to regenerate Texas karst country.



# THE OBJECTIVES OF THE PIONEER THICKETS

COVER BARE LIMESTONE SOILS

SLOW DOWN OVERLAND FLOWS

BOOST SOIL HEALTH





# GET BARE LIMESTONE SOILS COVERED

If Mountain Cedars have been cleared and the limestone soils are exposed, get it covered fast. One way is to use shredded mulch (1-2 inches deep is best for new growth) on hillsides or pasture cropping on lower, flatter areas with somewhat deeper soils.





# KEEP LIMESTONE SOILS COVERED

Always maintain a continuous canopy cover inside dense woodlands and forests. Regenerating and old-growth forest may include doghair-regrowth and stick cedars (single trunks) that are a normal part of forest regeneration. These should only be thinned as needed and never cleared.

Dog-hair regrowth is growing where it should

Single  
trunks





# KEEP LIMESTONE SOILS COVERED

To work with pioneer thickets you need to assess soil health, slope, and emerging native vegetation. The goal is to determine if a pioneer thicket has regenerated soil health, the appropriate amounts of clearing based on slope and habitat needs, and to determine what emerging vegetation needs to be protected. Project Bedrock is working on a pocket guide with videos to guide the decision-making process.



Cut slash was left on ground to protect the soil, however too much was cleared at once.



# SLOW DOWN OVERLAND FLOWS

Slowing the water reduces erosion and downslope flooding. It also allows more rain to soak into the ground to enhance soil biology, keeps plants more hydrated to reduce fire risk, and increase groundwaters.





# BOOST SOIL HEALTH

We may not be able to speed up the soil building process, but we can improve soil health.

Mountain Cedars do this by increasing organic matter in the soil, shading the soil to reduce evaporation, bringing up deeper waters, and activating soil microbes.

We can do this by using holistic planning, adaptive grazing, and multiple species to properly manage livestock. Or we can mimic this process using mowing, compost sprays, and biochar to enhance soils to support more grass cover.





# WE NEED TO LET MOUNTAIN CEDARS DO THEIR JOB

...and we need to find ways to speed up and mimic the work they're doing





# GOT QUESTIONS?



## PROJECT BEDROCK

Providing solutions to regenerate Texas karst country

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