



Restoration

Just what do you mean by that?

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Photo by Emily Bishop

The Riverby Ranch is on the Red River in Fannin County, Texas. Native vegetation is Post Oak savannah. Wheat and soybean fields are being restored to native tallgrass prairie grasses and forbs.

Restoration—what does it mean? Dictionaries help us with familiar definitions, and professional societies of restoration ecologists include impressive declarations in their mission statements. E.O. Wilson, a luminary in the ecological world, appealed to it in his 1992 prophecy saying, “The next century will, I believe, be the era of restoration ecology.”

Ecologists write papers with titles like “Restoration through reassembly: plant

traits and invasion resistance.” With the word reassembly, some think that this endeavor is intended to “fix something,” to “put it back together.” For us, though, the whole idea of restoration is nuanced with distinctions that blur what seems so clear to others.

For example, Notre Dame de Paris, a cathedral that is the pride of France and a place of worship since the 11th century, burned in April 2019. In just three

hours, the roof was all but destroyed and its spire—recognized worldwide—shattered to the floor. Immediately came loud calls to restore Notre Dame...but to what?

This glorious structure had been ravaged by fires more than once since its completion, and what burned was not what was completed in 1260, but rather what was that medieval structure plus all that had been added to it, modified and extended, over the next 600 years.

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It's far from clear what "restoring Notre Dame" means.

In contrast, restoring a Renaissance painting seems straightforward: when experts look at Michelangelo Merisi da Caravaggio's "The Adoration of the Shepherds," they can see what the artist accomplished with his delicate brush—those clasped hands, those intent faces leaning forward—and all of this can be restored to the original by careful removal of aged varnish.

Fannin County, Texas, shares the Red River with our Oklahoma neighbors, and on a farm-ranch operation that extends over hundreds of acres, Post Oak savannah is interspersed with wheat and soybean fields that have been cultivated for decades. Here, CKWRI and Texas Native Seeds are engaged in a program of tallgrass prairie restoration.

There's that word again: it seems to mean many things for Notre Dame's spire and timbered roof, perhaps just one thing for Caravaggio's masterpieces. What does restoration mean for Riverby Ranch?

A rich source of information resides in "Ecological Site Descriptions" that have been developed by the Natural Resources Conservation Service (NRCS). Detailed descriptions of climate and soil can be found for most locations in the U.S. This database includes accounts of historic vegetation, what are called "reference communities."

Reference communities are our best attempts to describe plant communities at the time of European immigration and settlement—and they represent a valiant effort by the NRCS to provide us with exactly what the name implies: a reference point, a starting point, for *this* place here, for *this* soil, and under *this* climate—*this* is what originally grew.

For many of us who read papers about "assembly rules," this might mean that we simply need to reassemble the historic plant community: just put it back to-

CKWRI's and TNS's research at Riverby Ranch is being generously supported by RES and the North Texas Municipal Water District. Riverby Ranch is a 17,000-acre ecological mitigation project associated with the North Texas Municipal Lake Project.

Photo by Tyler Wayland



The CKWRI research team planted 250 acres with monocultures and mixtures of 30 varieties of commercially available tallgrass prairie grasses in more than 600 research plots on Riverby Ranch, Fannin County, Texas. Photo by Tyler Wayland.

Photo by Brianna Slothower



Canada wildrye emerged in late autumn from research plots that were seeded in September 2019 at Riverby Ranch, Fannin County, Texas. This photo shows a seedling with its seminal roots still attached to the seed.



Photo by Tyler Wayland



Coastal Plains Little Bluestem (left center foreground) and Lavaca Canada Wildrye (center midground) are adapted to silt loam soils in northern Fannin County, Texas.

Photo by Emily Bishop



This photo shows a row of Coastal Plains little bluestem plants in a sampling quadrat at Riverby Ranch, Fannin County, Texas, in August 2020. Also present in the photo are mare's tail and chickweed.

gether. Regrettably, for our study area as well as many others in Texas, details are lacking. The reference plant community is painted, ecologically-speaking, with broad strokes. Whereas we know that the “big four”—big bluestem, little bluestem, Indiangrass and switchgrass—dominated the landscape, many other species created a diverse prairie: other grasses like wildrye and gamagrass, and a rich assortment of forbs, both ephemeral and long-lived, clothed these prairies before cultivation.

The nearest pristine tallgrass prairie is 20 miles distant, tucked away in pockets as small as 100 acres, where soil lays undisturbed and plant composition fluctuates in dynamic equilibrium with the prevailing climate. But do these remnants resemble what graced our native landscapes prior to settlement?

How do we go about reassembling this tallgrass prairie? This is not like peering beneath the accumulated varnish on a 400-year-old canvas. Nor is it like replacing timbers in a cathedral.



Photo by Emily Bishop



Sideoats grama in full flower at Riverby Ranch, Fannin County, Texas.



The original framework of this plant community, like Notre Dame over the centuries, has changed over time: it has been burned by wildfires, it has suffered prolonged droughts. And what about the list of component species?

Big bluestem is...well, it's the name of a plant. But big bluestem is much more than that because of something ecologists call "ecotypic variation." Research by Calvin McMillan on tallgrass prairie grass ecotypes 50 years ago has been extended by many ecologists since then. Big bluestem, found throughout the Great Plains, is dominant in mesic prairies but also grows in drier grasslands; it can be found in pinyon-juniper woodlands in eastern New Mexico and in coastal South Texas prairies.

Ecologists have long recognized that plants exhibit "local adaptation" to prevailing growing conditions: big bluestem in Fannin County is not the same big bluestem in South Texas. Little bluestem, too—all the prairie grasses—display ecotypic variation in structure, physiology,

establishment and growth traits. This variation—only partially understood—is just one of the keys to restoration success.

What is desperately needed is a catalogue of plants that will grow well here and in similar areas. Our initial approach to tallgrass prairie restoration, then, is to take a very close look at 30 commercial seed varieties of common tallgrass prairie grasses.

We have seeded hundreds of research plots with monocultures of grasses that historically characterized these sites. We are monitoring plant density in more than a thousand permanently located quadrats with the hopes that what we learn will become first few pages of this catalogue.

But there's so much more to a prairie. These plant communities are rich in many senses. Rich in species means many different species. And so we are evaluating performance of these varieties in mixtures to assess how they interact with each other.

Rich means rich in soil microbial communities that are intimately related to the

aboveground plant community. Here, our knowledge is scant. We know from our previous research with tanglehead invasion in the Coastal Sand Sheet that soil microbial communities are different in plant communities dominated by native plants and in communities invaded by tanglehead. It seems obvious that long-time cultivation in Fannin County has had lasting impacts on soil microbes and so the question begs to be asked: "How do soil microbial communities change after a field has been taken out of cultivation and seeded with grasses and forbs? How long do these changes take?"

Our fieldwork documenting plant density at Riverby Ranch involved many days on our hands and knees. Texas is home to more than 290 species of ants, and our work afforded us the opportunity to get reacquainted (sometimes painfully so) with more than a few of these delicate but ferocious insects.

A kaleidoscope of butterflies flanked us as we walked through head-high mare's tail, clouds of grasshoppers everywhere. Red-winged blackbirds flitted by in the late afternoon. The lament of cicadas serenaded us as the stars came out. What species of wildlife and what kinds of insects will we find here as these fields progress through successional stages of plant establishment? Only time will tell.

Whether for a farm field, a retired fracking pond, an energy pipeline, or a pasture invaded by invasive grasses, the overall goal of restoration is the same even if individual settings pose unique challenges. And surely, restoration is more than reassembly, because reassembly implies that we know the pieces of the puzzle, that we understand how they fit together. To claim that we know this for many of our Texas landscapes would be hubris. But to claim that this is our goal—to better understand how the pieces of the world around us fit together—is to reaffirm our own mission statement at CKWRI.

We ardently believe that our native landscapes can be as durable and majestic as the cathedral of Notre Dame and as rich and delicate as the brush strokes on Caravaggio's masterpieces. And just as worthy of restoration. 🌱

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