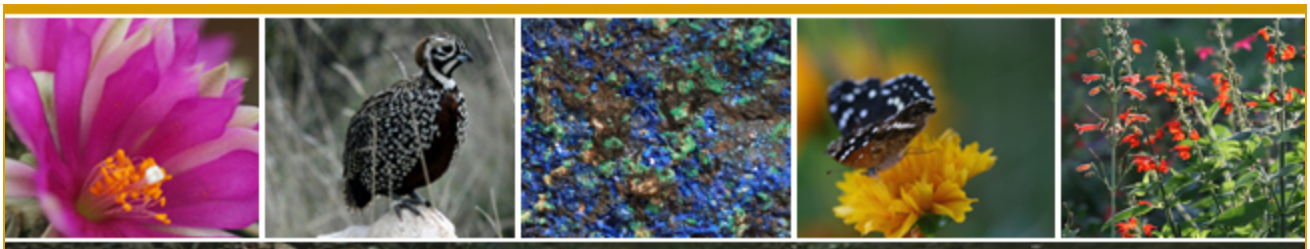

News from the Chihuahuan Desert Research Institute

The Desert NewsFlash

June 2020

Photo of tree cholla (Cylindropuntia imbricata) by Mary Beadleston

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Coronavirus Update from CDRI

Like most of you, the past few months we've been studiously reading about the coronavirus outbreak, trying to learn as much as possible regarding the virus. We're

still reading and still learning.

Since February, the facts on the ground have rapidly unfolded. One month ago we were unsure about our next plan of action. We had created a “preserve and optimize our assets” plan that would see us through to the end of the year. As we thought about the hoped for phase of reopening with public safety being paramount, we had a "bold" idea to pencil in a reopen date of August 1. Less than a week later, the August 1st reopen date moved to mid-July. And, less than a week after that, we landed on a reopen date of June 15.

At the time, a reopen date of June 15th felt a little optimistic, in light of all that might be required. We've worked out the details, step by step, sharing the plan with the Board of Directors and with our risk management advisors and insurance carriers, with our colleagues in the nature center industry, sharing the plan with the team, and we are confident we've got the essential elements in place.

Although it seems easy enough just to open our front gates, there's a lot more to planning and keeping our visitors and the team safe. Just ordering supplies and waiting on deliveries has been a hurdle, given wait times and delayed fulfillment. We landed on several waiting lists over a month ago - waiting for an infrared thermometer, face masks, half-gallon bottles of hand sanitizer, paper towels, face coverings and a window speaker system. At this printing, our paper towels and face coverings are still on backorder. And, we just received our window microphone/speaker which our host camper Dave Boner expertly installed. You'd almost think every business in the U.S. (actually in the world) was also ordering the same or similar supplies to get their reopening underway!

We've made a few changes to our procedures which are detailed in the next article. We've created some pretty terrific, original signs -- like the one that reminds visitors to remember to stay six feet from others. We hope that by adhering to our policy of wearing a face covering and practicing social distancing that our visitors will be reminded even after they've left CDRI to practice thoughtful measures to help stop the spread of the coronavirus.

The truth of the matter is we've missed you. June 15th can't get here soon enough! You, your family and your friends meaningfully add to the energy and life of your Nature Center. It's better place with you present.

We're looking forward to welcoming you back starting June 15. Please direct comments or questions to lgordon@cdri.org.

See you soon!

Chihuahuan Desert Nature Center

& Botanical Gardens

Reopens Monday, June 15

Our priority is your health & safety. These procedures minimize physical contact & follow "best practice" protocols. Thank you for visiting and for your compliance.

Phase 1 Reopening:

- **Purchase your e-ticket** at www.cdri.org. (Tickets cannot be sold onsite.)
- **Bring your e-ticket** on your phone or **printed ticket** to the admissions window at the Powell Visitor Center.
- **A "group" arrives in the same car, and is limited to 5 people.**
- **Maintain 6 feet social distancing.**
- **Face coverings are required** (3 years +) when:
  - others are within 6 feet, or
  - in enclosed areas (Mining Exhibit, Cactus Greenhouse) if others are present.
- **Access is open to the following:** *(Please take a free site map.)*
  - Trails
  - Botanical Gardens
  - Cactus Greenhouse
  - Bird Blind
  - Mining Exhibit
- **Access is currently closed to:**
  - Powell Visitor Center
  - Gift Shop
  - Restrooms
- **Wear sturdy, closed toe shoes, hat and sunscreen**.
- **Bring plenty of water**; a walking stick is helpful.

Yes, Even Clean Energy Has Limits

Edited & submitted by Rick Herrman

This summary is drawn from a September 2019, article appearing in *Foreign Policy* magazine, authored by Jason Hickel, an anthropologist, author, and a fellow of the Royal Society of Arts. Twitter: @jasonhickel. We encourage you to subscribe to the magazine, and/or review the entire article online for the more

complete picture. https://foreignpolicy.com/2019/09/06/the-path-to-clean-energy-will-be-very-dirty-climate-change-renewables/

If you follow our monthly newsletter, you know we love sharing developments at your Nature Center, including programs, events, noteworthy initiatives and the like. We also attempt to summarize an article, or two, in an attempt to provide you information on a wide range of nature based topics. We know many of you, depending on your time and interest, dive more deeply, and for many, a general awareness is sufficient.

Strong winds blow sand at a wind farm in the Coachella Valley on May 6, 2019 in Palm Springs, California. Photo by Mario Tama / Getty Images.

Remember when (4 months ago) the topic of climate change was covered extensively by the media and scientific communities? Of course, news regarding the global pandemic and its vast impact on nations, economies, and societal behaviors has dominated. Ironically, the slowdown in economic activity has reduced carbon emissions, but it's safe to assume, global warming continues, and news regarding the initiatives concerning renewable energy will return to its much needed position of importance.

We believe regaining a focus on climate change, which is widely viewed as a global existential threat, is necessary and welcomed. However, we found Mr. Hickel's article of interest for reminding us that transitioning to renewable energy, while critical, does not ensure a utopia of "green growth" free of

concern or consideration. If that strikes the reader as heresy for a nature center to express, please allow us to explain.

The phrase "clean energy" normally conjures images of sunshine and breezy winds. Obviously, sunshine and wind are clean, renewable, and provided "for free" by nature. That said, the required infrastructure to capture the intrinsic energy is not "clean" or free of environmental consideration. Fact is, the transition to renewable energy will require a meaningful increase in the extraction of metals and rare-earth minerals, accompanied by ecological and social costs.

Reality is, to truly create a sustainable path, we need a rapid transition to renewables because we simply cannot continue to grow our energy use at existing rates. No energy is innocent. **The only truly clean energy is less energy.**

In 2017, the World Bank released a report that offered a comprehensive and somewhat holistic perspective to this issue of "renewable does not equal free." The report models the increase in mineral extraction required to build solar and wind generation capacity to produce an annual output of about 7 terawatts of electricity by 2050, a production level to power roughly half of the global economy. By simply doubling the World Bank figures, we can estimate what's required to achieve zero carbon emissions—and the results are staggering: 34 million metric tons of copper (18M currently), 40 million tons of lead (12M currently), 50 million tons of zinc (13.5M currently), 162 million tons of aluminum (63M currently), and no less than 4.8 billion tons of iron (48M currently).

Additional demands on extraction levels include: neodymium—an essential element in wind turbines—extraction will need to rise by between 35-200 percent over current levels. Likewise, for silver's critical use in solar panels, estimates range from 38-105 percent increases in annual volume. Demand for indium, also essential to solar technology, will more than triple and could end up skyrocketing by over 900 percent.

The above demands relate to energy capture, but we also require batteries for power storage for use at night and on less windy days. Estimates for storage suggest 40 million tons of lithium—an eye-watering 2,700 percent increase over current levels of extraction.

That's just for electricity to power our homes, offices and factories, comprising ~20% of total energy demand. What about transportation? In 2019, a group

of leading British scientists submitted a letter to the U.K. Committee on Climate Change outlining their concerns about the ecological impact of electric cars. They agree, of course, that we need to phase out the use of combustion engines. But they pointed out that unless consumption habits change, replacing the world's projected fleet of 2 billion vehicles is going to require an explosive increase in mining: global annual extraction of neodymium and dysprosium will go up by another 70 percent; annual extraction of copper will need to more than double; and, cobalt will need to increase by a factor of almost four—all for the entire period from now to 2050.

The concern is less about depleting the earth's mineral reserves--although that may indeed become a concern—but rather the concern of the impact of extraction. Mining has become one of the biggest single drivers of deforestation, ecosystem collapse, and biodiversity loss around the world. Ecologists estimate that even at present rates of global material use, we are overshooting sustainable levels by 82 percent.

For example, Mexico is home to the Peñasquito mine, one of the biggest silver mines in the world. Covering nearly 40 square miles, the operation is staggering in its scale: a sprawling open-pit complex ripped into the mountains, flanked by two waste dumps each a mile long, and a tailings dam full of toxic sludge held back by a wall that's 7 miles around and as high as a 50-story skyscraper. This mine will produce 11,000 tons of silver in 10 years before its reserves, the biggest in the world, are gone. Think about the remnants.

To transition the global economy to renewables (given today's technologies and efficiencies), we need to commission up to 130 more mines on the scale of Peñasquito. Just for silver.

Lithium is another ecological nightmare, in that 500,000 gallons of water are used to produce a single ton, creating issues even at present levels of extraction. In the Andes, where most of the world's lithium is located, mining companies are literally draining the water tables and leaving farmers without irrigation sources, resulting in abandoned properties and loss of livelihoods. Meanwhile, chemical leaks from lithium mines have poisoned rivers from Chile to Argentina, Nevada to Tibet, killing off whole freshwater ecosystems. The lithium boom has barely even started, and it's already an environmental crisis.

And all of this is just to power the existing global economy and population while converting to renewable sources. Add growth projections in demand and these issues become even more extreme.

A quick lesson in geography and the world's major mineral reserves reveals that most of the key materials for the renewable energy transition are located in the global south. Parts of South America, Africa, and Asia will likely become the target of a new scramble for resources, and some countries may become victims of new forms of colonization. A high level history lesson reveals violent upheavals in the 17th and 18th centuries in South America in the hunt for gold and silver. In the 19th century, it was land for cotton and sugar plantations in the Caribbean. In the 20th century, it was diamonds from South Africa, cobalt from Congo, and oil from the Middle East. It's not a reach to imagine that the scramble for renewables might produce similar aggression.

Absent thoughtful, conservation based guidelines and oversights, clean energy firms could become as destructive as fossil fuel companies—buying off politicians, trashing ecosystems, lobbying against environmental regulations, and even provoking violent conflict.

Perhaps nuclear power will help us get around these problems—and logically it seems to have a place as part of the mix? But we all understand that nuclear comes with its own constraints, including: a) the permitting related time frames to get new power plants up and running, and b) the challenges of storing "spent" waste. We have fewer than 30 years to achieve zero emissions by 2050, which limits the "pie size" realistically attainable from nuclear, even if its environmental challenges can be addressed. Even given longer term time horizons, best estimates are that nuclear can't be scaled beyond about 1 terawatt. Clearly, it appears the vast majority of our renewable energy will come from solar and wind.

These realities are not to suggest that we shouldn't pursue a rapid transition to renewable energy. We absolutely must and do so urgently. But if we're after a greener, more sustainable economy, we need to abandon the fantasy that we can carry on growing energy demand at existing usage rates without expanding a separate set of environmental issues.

Globally, we know that poorer countries still need to increase their energy use in order to meet basic needs as their middle classes develop. But richer countries, fortunately, do not. ***In high-income nations, the transition to green energy needs to be accompanied by a planned reduction of aggregate energy use.***

How might this be accomplished? Given that the majority of our energy is used to power the extraction and production of material goods, the Intergovernmental Panel on Climate Change suggests that high-income nations

reduce their material throughput—legislating longer product life spans and rights to repair, banning planned obsolescence and our throwaway mindsets, shifting from private cars to public transportation, while scaling down socially unnecessary industries and wasteful luxury consumption like the arms trade, SUVs, and excessively large homes, to name but a few steps.

Reducing energy demand not only enables a faster transition of renewables, but also ensures that the transition mitigates and manages new waves of environmental destruction. Any national or international push to advance a more rapid transition to renewable energy, must include awareness of these factors, provided it strives to be socially just and ecologically coherent.

Remember being reminded to, "Turn off the light when you leave the room," and to "Adjust the thermostat to save energy" ? The mindfulness of finding ways to lower energy consumption is, in reality, a terrific way to craft a "win-win": lowering your electric cost, and helping reduce the demand for expanded sources for renewable energy production, as we strive toward the goal of being 100% renewable.

Most of you know that CDRI, having two large solar arrays (one installed in 2013, and one in 2019, with the generous assistance of Green Mountain Energy's Sun Club), is very nearly a 100% renewable energy enterprise. Next time you visit, be sure to review our free literature regarding our system and its applicability to your own residential, and/or business requirements.

Thanks to each of you for being concerned conservationists, and supporters of the natural world.

Above left: The solar array installed October 2013, provides power for the Powell Visitor Center. **Above right:** The solar array over the Maintenance Building, completed May 2019, provides power to the Cactus Greenhouse and well pump.

The Cactus Sale Continues

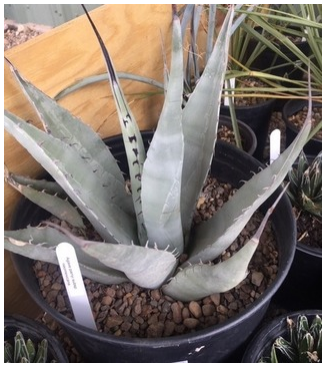
Last month in the **May 2020 *Desert NewsFlash***, we told you about small cacti we had for sale. These were remaining from our Cactus & Succulent Sale fundraiser which we had to cut short in March, due to our temporary closure. We're happy to report that we had several readers contact us for their 10 or more cacti. We filled their orders, then met our buyers at the front gate where we loaded the cacti into their vehicles and answered any questions they might have. To each of those buyers, we say, "Thank you for supporting the CDRI Nature Center!"

For June 2020, we're featuring our remaining large plants for sale. You can either pick them up (front porch pick up) or we'll happily plant them in the Botanical Garden if you would like to donate your purchase to the CDRI Botanical Gardens. Pictures of the large cacti are shown below this article.

We are shouting out a BIG thank you to **Jim Martinez**, landscape designer, Vice-President of CDRI's Board of Directors and Marfa resident. Jim, and some of his family members, donated $1,000 to CDRI to go toward purchasing large cacti and succulents from the Cactus Sale. These will be planted in the Desert Specialty Garden inside the Botanical Gardens, along with four beautiful Queen Victoria agave (*Agave reginae-victoria*) which will be planted in front of the Powell Visitor Center. Thank you for your generosity and support, Jim!

To fill your order and to schedule a convenient pick up time, please email programs@cdri.org, Subject: Cactus Sale.

We still have several small cacti left! Please contact us at programs@cdri.org, Subject: Cactus Sale for a complete listing if you're interested in purchasing small cacti. For small cacti we are requiring a minimum purchase of ten (10) plants.



Agave havardiana $20 (2)

Agave reginae-victoria "Compacta" $30 (14)

Echinocereus triglochidiatus $40 (3)

Agave bracteosa $15 (2)

Nolina lindheimeriana $40 (1)

Yucca rupicola $20 (3)

Membership Update

Last month, we made a plea for y'all to renew your CDRI memberships as a show of support for your Nature Center. We want to thank all of you who answered that request. You are an amazing group, and we couldn't be more grateful or humbled by the show of support we received. Our members are the backbone of this organization - and we thank you!

Garden Notes

by Seth Hamby, CDRI Head Gardener

Part 1: Garden Side Notes

In last month's Garden Notes entitled "Pteridophytes: Ferns and Fern-like Plants of the Trans-Pecos Region," I stated that the sporophyte generation of the Pteridophyte lifecycle was sexually reproductive. This is incorrect. It is actually the gametophyte generation that reproduces sexually, and I will explain why in a moment. A couple hours after the Desert News Flash was emailed out to everyone, I was skimming through my article, and to my horror, realized my mistake. Since it's not practical to send out a correction email, I had to wait an entire month to make the correction. Those of you who know me personally know that I'm a little bit of a Type A personality, so it was an especially long month.

The fern life cycle is pretty unusual and sometimes difficult to wrap one's head around. Let's start with the typical sporophyte fern that we are all familiar with. If you've ever examined the underside of a fern, there may have been strange, often rusty looking circles. You may have thought the plant was sick or had a fungal infection. However, these circles, called sori, are part of the plant and house its spores. When the spores are released, they can travel a great distance from the parent plant. When they finally settle, and conditions are right, the spore grows into the gametophyte, also called the prothallus. The gametophyte is haploid, which means it has only one set of chromosomes. Think of the human gametes (sperm and egg), each gamete contains half the information it takes to create a new and unique person. The gametophyte often has both male and female structures, called the antheridium and archegonium, respectively, where sperm and eggs are produced. When the gametophyte gets wet, the sperm swims to fertilize the egg. After fertilization, the diploid sporophyte (1 set of chromosomes from each parent) grows up to be the quintessential fern we all know and love.

Part 2: Lichens: Animal, Vegetable, or Alien?

When people discover the Chihuahuan Desert they are sometimes surprised to find lichens growing in the desert! Some of the most obvious and ubiquitous lichens of the Chihuahuan Desert are saxicolous, meaning they occur on rocks. These creatures can range in color from black, to gray, to bright orange and neon chartreuse.

In the right microclimates, many terricolous, or soil-living lichens, can be found. And, wherever trees occur in the desert, especially at higher elevations, lignicolous (bare wood) and corticolous (bark) lichens can be found.

There are even muscicolous lichens that live on moss, and lichenicolous lichens that live on other lichens! Lichens occur in virtually all types of environments, from desert to tundra and forest to prairie. They attach themselves to trees, rocks, soil, and even concrete and asphalt.

Technically, lichen are fungi that live symbiotically with algae and/or cyanobacteria. These photosynthetic "photobionts" live within the elongated cells of the fungus, called hyphae. The fungus (mycobiont) breaks down the substrate (rock, tree, soil) to feed the photobiont, while the photobiont produces sugars for the fungus. It was recently discovered that many lichens also have a complex community of internal symbiotic bacteria, but this relationship is not yet well understood.

The body of a lichen is called a thallus. Most lichens have dense layers of fungal hyphae in the upper layer (upper cortex) with a layer of photosynthetic algae directly underneath. Below the algal layer is a loosely-packed layer of fungal hyphae called the medulla, followed by another densely packed layer of fungal cells called the lower cortex, and finally, most lichen have a rhizine which is used to connect to, and extract nutrients from, the substrate. The basic components of the thallus are highly variable among species and some may be completely absent.

A myriad of thallus types exists within the lichenized fungi. Foliose lichen can be branching and leaf-like, or have rounded lobes. Crustose lichens often have a continuous thallus that is tightly fixed to the substrate making it look like paint

on a rock or branch. Leprose lichen are also crustose, however they lack the upper and lower fungal cortices and resemble fuzz or fine powder. Endolithic lichens are also crustose and are simply algal cells with fungal hyphae that grow into the pores within limestone or granite and look like a stain rather than a paint smudge. Squamulose lichen appear foliose to the untrained eye but are actually scale-like instead of leaf-like. Fruticose lichens have a three dimensional growth habit and are often the largest, most obvious type.

Lichens are classified taxonomically by their mycobiont, which is the fungal aspect of these composite organisms. For centuries the fungal kingdom has been lumped in with the plant kingdom, causing a bit of confusion as to what fungi actually are. In fact, fungi are more closely related to humans than they are to plants. Genetic evidence shows that all fungi are descended from one common ancestor that evolved about 600 million years ago. Lichen fossil evidence has been found in formations that are at least 400 million years old, suggesting that they were already a vital part of the ecosystem even then. There was a time in Earth's history (the Late Silurian to the Late Devonian), approximately 420-370 mya, that giant 24-foot-tall mushrooms known as *Prototaxites* dominated the landscape. Can you imagine that instead of forests we had giant mushrooms?

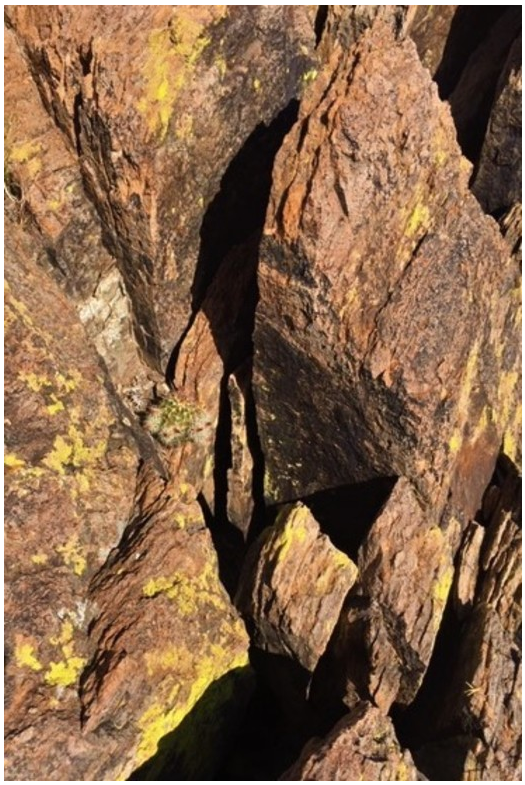
Okay, back to the subject at hand. Lichen fungi can be either phyla Basidiomycetes or phyla Ascomycetes. Because two different phyla of fungi can be found in lichens, it is thought that the "lichenization" of fungi evolved at least two separate times in evolutionary history leading to the roughly 20,000 species of lichen known today. The main differentiation between the two phyla of lichenized fungi is that the Basidiomycete-based lichens produce external spores on microscopic stalks, while the Ascomycete-based lichens produce spores in microscopic sacs.

So why is lichen important? Why should we care? Lichens are what are known as pioneer species. Any time we have events such as fires, landslides, glacial retreats, and volcanic eruptions, lichens are the first group of species to colonize the area. Lichens make it possible for all other life to exist in an area because they break down the parent materials, releasing nutrients, fixing nitrogen (cyanobacteria), and creating soil for plants, which are the basis for entire ecosystems to form.

Lichen are critical for sustaining reindeer and elk populations. The pharmaceutical industry is currently investigating the efficacy of various lichen compounds as antivirals, antimicrobials, antioxidants, antigenics, anti-inflammatories, and anti-cancer agents.

The long lifespan and predictable growth rate of many lichen species can be used to date historic events. Because lichens are particularly susceptible to changes in temperature, humidity, and pollution, they are used as indicators to predict and show the effects of climate change as well as to gauge air quality. Lichens are especially important for increasing our biological understanding, especially as it relates to symbiotic relationships and species interactions. We could certainly stand to learn a little about cooperation right now.

I hope you have enjoyed this brief introduction to lichens. I trust it has inspired you to delve a little deeper into the subject. Now you will be on the lookout for lichens everywhere you go, cultivating a deep appreciation for the thankless conglomeration of tiny creatures that do so much for us. I look forward to welcoming you all back to the nature center very soon!

Images of lichens growing on rocks on the Clayton's Overlook Trail.

Best of Luck, Patrick!

We're sad to see **Patrick Anderson**, CDRI's Programs & Events Coordinator,

leave CDRI, but we're happy for his future which looks very bright. Patrick arrived in the area as his wife, Barbara, started Graduate School at SRSU two years ago. Congratulations to Barbara for completing her studies and earning her M.S.!

Patrick came to CDRI with a B.S. in Biology from the University of Massachusetts with an emphasis in small mammal studies. During his tenure at the Nature Center, Patrick scheduled programs and helped coordinate the logistics for our large school groups. He created some great posters, kept our volunteers informed of upcoming volunteer opportunities and events, and he maintained CDRI's website, Facebook page, and the Desert NewsFlash.

Patrick and Barbara are moving to California where Patrick will begin graduate school at Cal Poly, San Luis Obispo. He will continue with his studies in Biology, where he will be researching the San Joaquin Valley antelope ground squirrel.

We'll miss Patrick, Barbara, their talented dog Champ, and Zeus, the cat, who also came out to the Nature Center for a hike with the family - on a leash - of course.

Best of luck to Patrick and Barbara as they head out on another of life's adventures!

New Bench in Honor of Thomas Blake Younger

As a celebration of life, we want to share with our readers that we have added a new bench at the top of Clayton's Overlook. The bench is in honor of **Thomas Blake Younger (1971 - 2020)**. With an immense outpouring of friendship, love and respect for the **Younger family** from their vast network of friends from across Texas, we wish to acknowledge those donors and again say, "Thank you" for their donations to CDRI in memory of Tom.

While we share our heartfelt sympathy with the Younger family for their loss of a beloved husband, stepfather, brother and son, we hope, for each of them and for all who venture to the top of Clayton's Overlook, that as you enjoy a moment to reflect on the landscape and the natural world in front of you, that it brings a smile to your face as you give a nod to Thomas Blake Younger for a life well lived.



From

"the best rural Nature Center in Texas,"

we hope you enjoy nothing but blue skies from now on!

Thank you for your support.

We're looking forward to welcoming you back on June 15!

CDRI Nature Center & Botanical Gardens

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432.364.2499

www.cdri.org