

# North Carolina Sandhills Conservation Partnership

## Quarterly Meeting Minutes

### *“Sandhills Subterranean”*

1:00-4:45 PM, Wednesday, December 7, 2022

➤ Welcome & land acknowledgement

- As we gather to discuss stewardship and conservation of the Sandhills, it is important to acknowledge the original inhabitants and stewards of these lands. Many still live here today, including the Tuscarora, Coharee and the remnants of several other tribes forcibly removed from their lands which then coalesced as the Lumbee tribe. These tribes are still present and active in our communities, and that fact challenges us to think creatively about how we can better involve them in our work. We pay our respects to these past, present, and emerging leaders who have been custodians of this land for many years. We also welcome them to become a part of our partnership as we form conservation strategies going forward.

➤ Steering Committee Attendance

Present:

Pete Edmonds (chair)

John Hammond

Jeff Marcus

Steely Russell

Clyde Sorenson

Tim McFayden

Fort Bragg – Training

USFWS

TNC

Three Rivers Land Trust

NCSU/SEI

NCWRC

Other attendees:

Sarah Hecoeks (TNC/USFWS), Alan Schultz (Fort Bragg – Wildlife), Alicia Jackson (), Alyssa Young (UNC Greensboro), Andy Van Lanen (SEI), Brady Beck (NCWRC), Clyde Sorenson (NCSU/SEI), Dallas Shoemaker (NCWRC), Dave Heins (Fort Bragg - ), David Mattocks (NCWRC), Debbie Crane (TNC), Erick Rietschier (TNC), Jake Comer (Quail Forever), Jeff Beane (NCMNS), Jeff Marcus (TNC), Jesse Wimberley (Sandhills PBA), Jessie Jordan (NC State Parks), Jessie Schillaci (Fort Bragg - ESB), Jimmy Dodson (NC State Parks), John Ann Shearer (USFWS), John Hammond (USFWS), Josh Junot (Bonnie Doone), Juan Cervera (NC State Parks), Julian Wilson (NCFS), Lauren Pharr (NCSU/SEI/NCWRC), Kacy Cook (NCWRC), Lisa Kelly (UNC Pembroke), Mike Martin (NCWRC), Nathan Shepard (NCNHP), Pete Edmonds (Fort Bragg - Training), Phil Doerr (Retired: NCSU/SEI), Rex Badgett (NCDOT), Rhonda Sturgill (TNC), Saubhagya Silwal (Salem College), Steely Russell (TRLT), Susan Miller (USFS), Tim McFayden (NCWRC), Wendy Dunaway (Public Works/Bonnie Doone), Zach Hardwick (PWC/Bonnie Doone)

Total attendees: **39**

➤ Partner updates: highlights from 2022 & projects for the new year

- Debbie Crane: Got longleaf whole system featured in TNC magazine. Started project with indigenous people through Preserve History Project. Looking forward to building on that project and reconstituting the communications committee to be more useful in the coming years.

- Jake Comer: Many landowners who applied for NRCS cost-share found out that they were funded over the last couple months, so starting on some of those projects (fire breaks installed).
- Jeff Marcus: Proud of hiring a top-notch ORISE Fellow. Accomplished monitoring of Bachman's sparrows across the SE NC to determine effectiveness of management funded by NFWF, and ecological pine-raking study. Looking forward to Joint Chiefs Initiative to expand management into the Uwharries and restore LL where it's been extirpated, as well as climate resilience project that will help add capacity to TNC fire program & fund research.
- Jesse Wimberley: Sandhills got lots of shout-outs this year—hosted the Fire Council meeting and showcased a lot of work. Started dialogue with native communities. Expanded Joint Chiefs to landscape-scale.
- Jessie Jordan: New burn coordinator on staff housed out of Weymouth Woods. Successful past few weeks of seed collection.
- John Hammond: Glad to have someone helping out with Safe Harbor program in the Sandhills.
- John Ann Shearer: Continuation of NC Longleaf Honor Roll which has been a positive way to connect with and highlight landowners for restoration. Jesse Wimberley attended Partnerscapes (group about public and private partnerships) and presented history of the Sandhills which reached and inspired many people.
- Kacy Cook: Proud of Sandhills to Uwharries restoration project and all of the conservation partners she gets to work with. Green Growth Toolbox now has demonstrated success stories; for example, a large development in Charlotte (>1000 acres) used the GGT recommendations during design process which was a product of GGT training of the consulting firm. Because of this, the development will be certified wildlife-friendly.
- Lauren Pharr: Shout-out to Jeff & Sandhills team for securing REPI challenge funding, and to Jesse Wimberley & the SPBA for organizing a successful tree-planting event at Hoke Community Forest.
- Lisa Kelly: Shout-out to UNC Pembroke for originating as a school exclusively for native Americans.
- Mike Martin: Proud of development of new techniques for release of head-started metamorphic gopher frogs at Block T Pond where we are attempting to establish a new population. In the past this has been difficult due to predation by fire ants, so new method of making a hole in the ground for each released frog has shown success.
- Pete Edmonds: Past year of successful training of all 4 units and accomplishments of external partners to ensure we have a training area that presents challenging and realistic conditions to soldiers.
- Phil Doerr: Proud to see that the long-term RCW studies that began in the 70's are still ongoing and that young, fresh talent are involved in this work.
- Rhonda Sturgill: Closed on 2 protection projects this fall, 2 more in the next year, and several more in the pipeline.
- Steely Russell: Recent TRLT acquisition of 172-acre property along Deep River.
- Susan Miller: Provided US Capitol Christmas tree this year ("Ruby" from Pisgah NF). Excited about Joint Chiefs project-- new crew on the ground making

progress thinning and burning, NRCS working with funding landowners.

Uwharries NF: new partnership coordinator coming on in February, hired a second archaeologist last month, promoted two people in fire and recreation & will bring on 2 new others, new botanist position will be posted soon which will provide botany support to Uwharries & Croatan, and new bioscience tech.

- Tim McFayden: Marked ~450 acres of older longleaf that will be thinned (old pinestraw production site) and planted with warm season grasses. ~120 acres of loblolly clearcut that will be planted with LL. Burn season coming up, and WRC will have an online dashboard that will be open to the public to see which blocks are being burned on what game lands and will be updated daily.
- Julian Wilson: Rangeland LL accomplishments are looking good. NC LL Storymap is up on nclongleaf.org and Sandhills are well-represented.
- Wendy Dunaway: Currently in negotiations to purchase 2 small parcels adjoining Bonnie Doone.
- Dave Heins: RCW population on Bragg is rather robust, just had 1<sup>st</sup> of 4 timber sales to support development of new training range, so now in process of relocating affected clusters which will take place over next 6 weeks.

➤ New funding opportunities discussion

- Many new funding sources available: NFWF (potentially up to ~\$17 million, meeting on Jan 5 to hear short- and long-term partner goals), DoD OLDCC for climate resilience on bases and surrounding communities, Inflation Reduction Act, etc.
  - One issue here is that there is a lot of uncertainty on how to get the money and how exactly it will flow through federal agencies.
- What are the needs? Let's dream & think big:
  - As always, priority at Bragg is close the gap and buffer the installation. Management in next year will be focused in W side of FB where it's been neglected and has gotten very overgrown due to fire suppression, so is no longer useable for training.
  - Landowners in Gap are becoming more engaged in restoration so could use more targeted funding
  - One of the biggest blockages to completing TNC & TRLT protection projects is lack of capacity, and waiting on feedback from partner agencies throughout process. This constraint would be best alleviated with more full-time staff.
  - How can we establish an endowment that would provide stewardship capacity in perpetuity? We keep acquiring more properties, but not necessarily our capacity to manage those lands, in part due to impermanent funding sources.
  - Need a way to work with landowners who don't have timber to qualify for a commercial thinning, but need to remove fuels to get fire on the ground. By the time NRCS funding is awarded, the fire season is often wrapping up, so lining up our funding sources in time is also something we need to make more seamless on private lands. Jessie Birkhead of Conservation

Corps could potentially accomplish some of these needs. Private contractors are also a good way to accomplish this.

- Increasing prescribed burn capacity (via training) is also one way we can increase the number of quality people available for burns
- When these needs arise, we need to share. Often when requests for proposals come about, it's too late. We need to be at the ready to spend money wisely (which of course requires more capacity).

➤ Working Group updates

**RCW Recovery** (Jessie Schillaci, Brady Beck & Andy Van Lanen):

- Fort Bragg update:
  - 553 current managed clusters; 547 are active. Area of tightly connected clusters in SW corners will be affected by the MPTR; will be cleared either partially or entirely. Some mitigation was made by creating cavities for relocation. Between 2002-2009, we had >2% growth rate. Rate is still increasing in 2022 but has slowed. As clusters become denser on the landscape, it's likely that the population will reach carrying capacity and eventually plateau. The population is still a major source of budding and pioneering into base which is improving in quality.
  - Clusters on private lands adjacent to base: ~37, which is an increase of 3 groups from last year. FB is a source for these lands.
- NCWRC update:
  - # of nests in artificial cavities has decreased since 2014, when WRC stopped installing as many as before. Simultaneously, nesting in natural cavities increased, partially due to forest stands ageing and improving in quality, but also due to less artificial cavities being available.
  - Almost 250 nestlings banded; ~175 fledged. 210 total RCW groups (128 in 2000, 150 in 2010). Surrounding private lands in Moore remain steady. 1 new pioneer group on Calloway. 4 new groups on W FB. 21 groups on Camp Mackall.
  - Still documenting a spread in avian keratin disorder malformation, which has spread more into SGL. Majority of cases on W FB.

**Land Protection** (Rhonda Sturgill):

- TNC closed on BLATCO (34.82 acres), soon will close on Caddell, both of which will go to SGL. Closed on Creed CE (199 acres) right in Gap and adjoins McCain tract; pine straw raking does occur but it is low impact via lifting rather than raking. Hoping to close on another couple hundred acres in a CE next year.

**Resource Management** (Jessie Jordan):

- No updates.

**Communications** (Debbie Crane, Jeff Marcus, Jesse Wimberley):

- New website for partnership (ncscp.org)
- Fire in the Pines event was a hit (~2000 people attended)
- We have access to Andrew Kornylak professional photos from Sandhills
- Call for participation in communications committee; email Debbie if interested
- Shout-out to State Parks who did a fantastic Halloween-themed nature walk at Weymouth Woods. Thousands of kids attended.
- Party for the Pine: April 22<sup>nd</sup>
- Successful tree-planting event at Hoke Community Forest

**Reserve Design** (Sarah Hecoeks):

- No updates.

- Introduction (Sarah Hecoeks, TNC/USFWS)
  - We know a lot more about forest ecosystems above ground than we do below, even though the underground ecosystem is just as important. The fine root systems of trees are responsible for 75% of forest biomass production. Most of a forest's carbon storage and sequestration, essential for mitigating climate change, occurs underground. 50% of animal biodiversity is found underground, and these species provide many important services such as water purification and decomposition.
  
- Legume-rhizobia symbiosis as a tool to enhance restoration success – *Alyssa Young, UNC Greensboro*
  - Alyssa is a PhD candidate in the Biology Department at UNC Greensboro. She is interested in how longleaf pine savanna understory plant communities may respond to global change and how symbiotic relationships can enhance restoration.
  - Soil microorganisms drive decomposition, plant growth, biogeochemical processes, nutrient cycling
  - Atmospheric N is not available to plants, so N-fixing soil bacteria convert it to a form that plants can use. Many plants have formed symbioses with these bacteria (rhizobia) that live in root nodules developed by host plant. Plant uptakes the ammonia (converted N) and produces sugars for the bacteria.
  - Some legumes are generalists, some are specialists. Some rhizobia are more efficient at fixing N than others. The symbiosis increases yield in soybeans
  - Degraded LLP are low in N; also recently burned LLP have lost N through fire. Legumes can overcome this by fixing extra N and creating a “zone of influence” that increases N in surrounding soil, available to other plants
    - One study in GA found that N-fixing by legumes following fire was low relative to other legume-containing systems, which could indicate underperformance in LL system
      - Can this symbiosis be enhanced for restoration? Especially when soil communities have been altered and depleted?
  - Dissertation took place in SGL. Collected 10 individuals from 4 species & 3 sites (120 individuals total) varying across growth habit
    - Collected abiotic & biotic variables to identify predictors of N-fixation. Conducted Acetylene Reduction Assays (put nodules in incubation chamber during which rhizobia would convert acetylene to ethylene)
      - Amount of ethylene produced = rate of N-fixation
  - Found that N-fixation varied across species. *Lespedeza hirta* fixed the most:
    - Greater soil N, legume aboveground biomass, & nodule weight/plant were positive predictors of N-fix rate
    - Proximity to *Aristida stricta* was negatively associated with N-fix
  - Waiting to sequence rhizobia DNA to determine which strains are most associated with N-fix
  - Question from Jeff Marcus: LLP is adapted to nutrient-poor soil, which is part of reason why we don't have big invasive spp problems. Would adding more N to system be negative to natives & positive to invasives (e.g. wiregrass negatively assoc w/ N-fix legumes)?
    - This would really only be used in systems greatly depleted below natural levels of available N, that are further depleted by fire.
    - We need a baseline for natural/normal levels of available N in LLP

- Question from Jimmy Dodson: Have you looked at the soil N levels on these same sites pre & post fire? I ask b/c there is a wide range of reported N loss with fire, but sandhills are already lower in quantity, in addition to the factor of available vs unavailable N complicating the scenario.
  - No, although some sites had been burned more recently than others. Both total N and available N were lower in the sites that were more recently burned and some legume species were forming more nodules at those sites than others (probably compensating for low soil N).
  
- Effects of fire on soil microbial community function in longleaf pine ecosystems – *Kevin Robertson, Tall Timbers Research Station*
  - Kevin is the Fire Ecology Research Scientist at Tall Timbers Research Station. His background is in plant ecology, but he researches a wide range of topics relating to fire ecology and fire science mostly in Coastal Plain ecosystems.
  - Endo- and ectomycorrhizal soil fungi play many roles in ecosystems, both positively and negatively affecting plants
  - While wildfires can cause soil sterilization, frequent maintained fires can indirectly affect soil communities
  - Ecosystem services project in FL: looking at effects of time since agricultural abandonment coupled with frequent fire to restore LLP communities
    - Row crop ag compared with different points in chrono-sequence:
      - Pine savanna restoration that began 5-15, 15-30, 30-50, 50-75, and 75-100 years ago
      - Native pine savanna (never plowed)
      - Pasture
      - Pine plantation
      - Fire-excluded/unmanaged hardwood forest
  - Findings:
    - Frequent fire in longleaf pine communities has little direct effect on soil fungal communities
    - Frequent fire regimes and their effects on vegetation and environment appear to have strong effects on soil fungal communities
    - Frequent fire regimes drive post agricultural succession of plants and fungi toward native pine conditions, with some limitations
    - Succession with frequent fire transitions from more pathogens to more symbiotic fungi
    - Native pine fungal communities are mostly a subset of disturbed fungal communities, with some indicator species for native conditions
    - Individual fires in longleaf pine communities do not strongly effect soil fungal biomass, but they do temporarily shift fungal community composition, especially reduction of saprobes
    - Frequent fires decrease rates of microbial decomposition and soil respiration, which appears to be a mechanism for increased soil carbon relative to unburned forests
    - The mechanism is not known, but could include changes chemical inputs to soil, changes in the physical environment, and reduction of plant root exudates
  - Question from Alan Schultz: How can you know when a fire is/will have impacts on soil community?

- All has to do with soil heating. With long period of fire exclusion, there will be duff accumulation that increases soil heating at surface but still might not be terribly deep aside from at base of pines, which can have a big effect by killing roots.
  - Question from Jeff Marcus: Do you have data to indicate whether the increased soil carbon after burning offsets the carbon released with fire? i.e. can controlled burning be neutral or beneficial for atmospheric carbon as opposed to a problem?
    - Yes, apparently frequent burning is a net plus, or at worst neutral, for increasing soil C. So, given this fact and that the perennial vegetation recovers completely between burns, frequent burning in these systems is not a concern in terms of net C release to the atmosphere.
- The ecology of invasive fire ants in natural wetlands of North Carolina – *Lisa Kelly, UNC Pembroke*
  - Lisa is a professor of ecology in the Department of Biology at UNC Pembroke. She has studied invasive fire ants in protected North Carolina wetlands since 2008, mentoring undergraduate researchers in studies involving ecological distributions, colony social form, and plant food diets.
  - Red imported fire ant (*Solenopsis invicta*) ecology
    - Tied to human disturbance/soil disturbance, highly mobile, large colony size, superior competitor, generalist consumer, aggressive, ubiquitous, prefers open sunny areas and wet sandy soils, ecosystem engineer
    - Outnumbers native ant spp where they occur, likely due to periodic flooding of preferred areas which are less frequently occupied by natives
    - Builds aboveground mound, from which tunnels may reach the water table. The mound is a solar incubator and accelerates brood development. Different microbial community enriched in Actinobacteria rich in anti-fungal compounds that may provide protection against infection. Mound is mix of different soil horizons
    - Fire ants spend most of time underground; only fraction of workers forage aboveground. Opportunistic feeders. Workers have sugar-rich liquid diet; queen needs protein
    - Colony social form:
      - Monogyne: small densities, territorial, long-distance dispersal, fat queens, wetland interior. Polygyne: exact opposite
  - Colony (mound) densities
    - Belt transects done in intact wetlands of NC (Hamby's Bay, Green Swamp, Robeson Co. Oak Savanna, 17 Frog Pond, Pretty Pond, and others in Pender & Brunswick counties)
      - Antioch Bay 2013 (dry) to 2017 (flooded): colony numbers plummeted and social form shifted. Monogyne dominance shifted to polygyne dominance
        - During flooding, ants nested on raised structures and rafted on water. Note from Mike Martin re fire ant rafts: he has found them after flooding hurricanes in the fall as late as the following spring still floating.
  - Management options
    - Mechanical: not good b/c causes soil disturbance. Be wary of hot-water treatment of mounds for this reason

- Chemical (bait & contact poison). Works initially but not in long-term. All studies show that fire ants reinvade quickly
    - Biological (living organisms- parasites, parasitoid). Best long-term solution. Available now: 2 pathogens & 6 spp of parasitoid flies
    - Recommendation for multiple strategies & invasive spp task force
      - Comment from Jeff Marcus: ~1 decade ago the Partnership supported an invasive species task force with a full time person and seasonal help and they surveyed and treated invasive species (mostly plants) on multiple partner properties. Might be time to revive that group.
  - Question from Debbie Crane: When fire ants colonize a new place, how long does it take them to build a mound?
    - Several months to a year.
- Herps in the basement: Subterranean ecology of Sandhills herpetofauna – *Jeff Beane, NC Museum of Natural Sciences*
- Jeff is the Herpetology Collection Manager for the NCMNS, where he has been employed since 1985, and during which he has spent many years studying the herpetofauna of the Sandhills region. He has friends in low places and has learned to look beneath the surface of things.
  - Incredibly high herp diversity in sandhills, and many of them spend most of their life underground. Why?
    - Protection from predators, freezing temps, extreme heat
    - Food
    - Reproduction (protection for eggs & young)
    - Niche partitioning
  - Eastern spadefoots bury themselves by digging with keratinized spade on foot
  - Carolina gopher frogs are unusual for a ranid, as most are very aquatic. Gopher frogs spend much of life in uplands in burrows (frequently stump holes, and the same one year after year, travelling 0.5-3.5km to reach it). They clear a pad outside stump hole to feed at.
  - Bufonids & narrow-mouthed toad spend hot dry months buried in soil and leaf litter
  - Mole salamanders (*Ambystoma* spp) adults live whole lives terrestrially in mammal burrows, root channels, travelling 1 mile or more to reach breeding site on rainy nights. These massive distances make their underground refugia extremely important
  - Even very aquatic salamanders (e.g. sirens) spend time buried underground. Eft stage of newts very frequently underground, a stage which can last 1-8 years.
  - Southern hognose snake digs own burrows into soft sandy soil. Telemetered *H. simus* found underground 70% of time during active season of April-Oct, and in the same spot for >1 month (1 adult female for >48 days)
  - Northern pine snake spends a lot of time above ground and can even climb trees, but digs burrows and spends a lot of time underground as well, mainly for breeding events. Females excavate long tunnel with nest chamber at end (8-16” below surface), a process which may take >1 week typically in July. Many snakes can lay in rotten logs or other enclosed spaces, but pine snakes need soil chambers. Eggs are size of chicken eggs and have high hatch success rate
  - Worm snakes, scarlet & coral snakes are fairly fossorial
  - Eastern hognose snake spends more time aboveground than southern but digs equally as well



- Even mud & rainbow snakes, which are highly aquatic, have been found underground in plowed fields far from water
- Even the rest of the snakes that are semi-aquatic or just spend more time on the surface (4 Nerodius spp, queen snake, ribbon snake) spend the winter underground in a hole in the bank of a stream or sometimes far away from a stream (mammal burrow, etc)
- Rough green snake will occasionally winter in a hollow of a tree, but more often found underground
- Rat snake, which does a huge amount of climbing of trees and often lives inside hollow trees, spends winter below frost line. Eastern king snake & coachwhip too
- Scarlet king snake has a unique niche, spending a lot of time underneath bark on dead pines or rotten logs, but spends winter below surface
- Pine snakes & coachwhip often share hibernacula
  - Once found a corn snake, 3 pygmy rattlers & a coachwhip all hibernating in one winter burrow
  - Coachwhips and racers are snake predators, so it's baffling that a pygmy rattlesnake would share hibernaculum with them
  - Perhaps snakes follow the scent of each other to identify hibernacula
- Burrowing engineers that create holes for herps: Both mole spp, cotton rats, pine voles, Sandhills crayfish (burrowers when bays are dry), red & gray foxes, coyotes
- Most fossorial of Sandhills lizards is eastern glass lizard. 3 skink spp spend a lot of time on surface or under litter but will lay eggs underneath sheltering objects or underground in root channels and will guard the eggs till they hatch
- Ground skink, fence lizard & 6-lined race runner abandon their eggs but lay the clutches underground
- Green anole buries eggs in soil. They only lay 1 egg at a time and lay them throughout the summer in different places
- 6-lined race runner likes temps at ~110 deg F so when it gets much below that they are buried in the ground where other animals can find them and dig them out, otherwise they would never be able to catch them
- Most turtles are aquatic or semi-aquatic. They typically bask a lot. In winter they are buried underground at the bottom of ponds, breathing through their skin & cloacas. They all lay eggs underground. Nestlings stay in chamber through winter, living off yolk sac
- Spotted turtle spends a lot of time underground in summer; even better chance of seeing them aboveground in winter
- Chicken turtle & eastern mud turtle leave pond in fall and bury themselves just below the soil surface on sandy ridge, probably to avoid predation in winter when raccoons would easily find them in a dry bay
- Chicken turtle can spend more time on land than water, but will be found in terrestrial refugia in all months except December
  - 3 telemetered turtles spent 1 year or more (of consecutive days) in terrestrial refugia (1 subadult female spent >674 days!)
  - Once found a red-bellied snake underneath a turtle, which reflects how long the turtle had been sitting there; this had been during a drought
- Ag fields are death traps for herps, which are often disced or plowed 2x/year