THE GREAT OUTDOORS

CU Maurice River members listen attentively to Mark Demitroff as he describes periglacial features on the Maurice River Bluffs preserve. Photo: Joan Lawrence-Rhoads

Reading the Landscape

A Walk within The Nature Conservancy's Bluffs Preserve offers telltale signs of its frosty, periglacial past.

By J. Morton Galetto, CU Maurice River

On March 15, I was fortunate enough to participate in a CU Maurice River walk led by Mark Demitroff, on The Nature Conservancy's (TNC's) Bluff Preserve in Millville. Located just south of center-city Millville on the west bank of the Maurice River, this site is one of TNC's most visited parcels. Possibly you've been there, but it is my hope that by sharing some of Mark's esoteric facts you might consider those concepts when you return - or visit for the first time.

The Nature Conservancy provides excellent mapping and marking of the bluff trails. Source: TNC website also posted at parking lot kiosk. White dots show the course of the CU Walk as described in this article.

Answering the question "Who is Mark Demitroff?" can lead to a complicated response. He has lived a life of intellect with a grand diversity of interests, many of which are centered, as an old-fashioned geographer, on the Pinelands. His pursuits lie at the intersection of cultural, environmental, and natural histories. An adjunct professor in

the Geology Department at Stockton University, Demitroff twice served on the board of the U.S. Permafrost Association, and sits as a board member of Stockton's South Jersey Culture & History Center.

Demitroff's expertise is periglacial geomorphology—the study of non-glacial processes in cold areas past and present. He focuses on ice age environments, when deep seasonal frost and past permafrost profoundly affected South Jersey's land surface. He has authored and co-authored numerous journal publications on cold-climate, frost cracks, permafrost thaw, wind-etched stones, and ancient dune fields, mostly borne of the cold, dry, and windy conditions during the Late Pleistocene era particularly in the New Jersey Pine Barrens.

Mark's book, *Soggy Ground: A Geography of Pine Barrens Wetlands,* discusses how to interpret the wetlands of the Pine Barrens through land-surface processes. The book's promotional description reads, "Little-known ice age landforms provide critical habitat for plants and animals. Places like spungs, cripples, blue holes, and savannahs are woven together in a geographic tapestry of interactions between nature and society. People here have exploited these wetlands for millennia, features that now slowly fade from memory and place."

Our walk began by looking at ventifacts: desert gravels that have been shaped by wind-driven sand or dust-laden ice crystals. These geologic time-travelers have surface features that can be analyzed for clues into the distant past. Mark showed us small stones that would have been polished and etched by strong winds across frozen ground—the polar desert-like landscape that prevailed when the continental ice sheet came closest to southern New Jersey. He explained how the surface of a single grain of sand can analyzed to disclose the frigid temperatures that it was exposed to in the past, the timing of grain wind transportation, and when that grain thawed as permafrost waned. All of these are data used to build climate models. Working with colleagues nationally and worldwide, he unlocked the paleoenvironmental secrets held by deceptively complex Cumberland County quartz grains. Currently, Mark is collaborating with Canadian, Polish, and US research institutions on ice age dunes systems, ancient river channels, past permafrost in the Appalachian Mountains, and prehistoric frost cracks preserved in the Devonian rock record.

To make inferences and proper assumptions about a past landscape by looking at what is present currently, one must know the full history of a location. In the case of the

Maurice River Bluffs, knowing that sand mining took place on the site is important to knowing the former topography dating back over 12-million years ago. Mark sees beyond the present disturbed state to formulate how it was formed and to understand its past nature.

Early miners first sought sugar-sand silica for glassworks from the banks of the Maurice River. Well-sorted clean loose grains of windblown sand would have been deposited in a blanket that filled old valleys and depressions carved into the bank. Excavations were labor intensive, being hand-dug. Mining at the time would have been selective and conducted in a more surgical fashion than present day machine-based operations, hence the patchwork nature of the Bluff's diggings. In the mid-1800s workers' tools were shovels, pick-axes, and mule-drawn wagons—not large diesel-fueled excavators.

Pettinos Sand Co. circa 1900 mined the Maurice River Bluffs preserve via wagon. Photo: Joann and Dale Wettstein, Steelman Photo

Sand was loaded and barged at wharfs on what is now The Nature Conservancy Maurice River Bluffs Preserve. Photo: Joann and Dale Wettstein, Steelman Photo

Today's LiDar (short for "light detection and ranging") mapping tools allow scientists like Mark to view the remaining carved landscape of hills and valleys that apparently trapped windswept sands. There is much to learn. The Bluff's resultant topography offers further proof of Mark's long-held belief that our local landscape was frequently frozen and thawed while being scoured by cold, dry katabatic winds (a wind that blows downslope due to gravity pulling denser, cooler air from higher elevations to lower elevations) that flowed off a nearby continental ice sheet. LiDar is a laser technology that maps the Earth's topographical surface from above, using airplanes, drones, and satellites. You may be familiar with its being used to discover the vast empire of the Mayans it provides a degree of clarity which allows the trained eye to see the outlines of ancient cities and village foundations in Central America.

Armed with these images and a plethora of other scientific evidence, geomorphologists like Mark can determine that although the Laurentide Ice Sheet (starting 2.5 million years ago) stopped north of our region about 51 times – with the last advance halting near present day Exit 11 on the NJ Turnpike, our region is indeed shaped by a glacial past. Periglacial processes are potent—albeit poorly understood—geomorphic agents that

ravaged our landscape. The Laurentide Ice Sheet at its maximum was 30 percent larger than its present-day counterpart in Antarctica! In its full extent it was one to two miles thick. At the glacial maximum, sea level here was 433 feet lower than today.

We visited the old stone Ferguson Farm house and our geologist guide asked us where the large stones came from. My first guess was Pennsylvania, but Mark explained that some stones used in local construction were actually ballast stones from European ships. In fact, ports in Philadelphia often acquired cobblestones for streets when ballast stones were off-loaded and replaced with cargo. We phoned octogenarian Richard Weatherby, whose grandfather owned the house after Ferguson. Richard said he was told that they were indeed New York State ballast stones, offloaded and exchanged for sand on the return trip. These were valued commodities at either end of a trade deal. As early as the 1790s, Maurice River glass sand was barged to the Pitkin Glass Works near Hartford, Connecticut.

Ferguson house in 1974; by then, the house was Weatherby's. CU file photo provided by Billie Giberson Moloney

Weatherby farm, former Ferguson farmhouse. Collection: Joann and Dale Wettstein, Steelman Photo.

Mark discussed the Charles Hartman maps that date the Thomas Ferguson house as being extant in 1859, and, one could suppose, earlier. I've perused Hartman's maps for years and they provide insight into our past. Charles S. Hartman was a Cumberland County antiquarian and land speculator who amassed maps from deeds and put together at least a dozen composite maps still appreciated and referred to by local historians. These are available on the West Jersey History Project's website

(http://www.westjerseyhistory.org/surveys/Hartman/index.shtml).

Mark asked if we had been to Tuskee Run. None of us knew it by the name he used so we replied "No." The Hartman maps point it out as the creek "Tuskee Run" on Map 3 along with the Ferguson Farm dwelling, and many of us had crossed it numerous times on the Red Trail or even on Buckshutem Rd.

Soon we would find ourselves crossing the dell, which was filled with tussocks and relic savannah habitat; yes, it is a 'tussocky' Tuskee Run. This valley is a periglacial basin, a sparsely wooded wetland hollow or small valley. Chapter 5 of *Soggy Ground* (Demitroff 2024: 101–124) is devoted to cripple dynamics. The South Jersey vernacular for a dell is 'cripple,' from the Low Dutch 'kreupel.' There we were asked to sing "The Farmer in the Dell" and, later, "Alouette."

"The Farmer in the Dell," is evidently a courtship song and game of German origins. And I assume that the purpose was for us to remember that we were standing in a dell and that we had indeed used the term ourselves as children!

Holly trees and songs about labor led to a discussion about the French-Canadian work

song “Alouette” and birdlime, a sticky substance used in various parts of the world to capture birds. In Europe, holly tree bark was harvested and boiled to make this product. It was applied to window sills to capture birds that were ultimately plucked and eaten. The work song takes a distasteful laborious task and sweetens the chore. The origins of the song are debated, but it is often theorized that since it arose during a period of subsistence hunting, it may have been sung while preparing fowl for a meal. Translated, it essentially means “lark, nice lark—I’ll pluck you,” mentioning the discarding of beak, head, eyes, wings, feet until ultimately the entire body is properly prepared for cooking.

In the dell, numerous softball-sized growths disfigured two large red maples’ trunks whose crowns were stunted. I asked Mark for his thoughts about these abundant growths, to which he replied without hesitation, “*Agrobacterium tumefaciens*.” The possible causes included fungi, bacteria, insects, genetic mutation, or physical injury. We commonly call these burls, tumors, or galls. The swelling takes place when cells divide more rapidly than normal, causing an excessive enlargement. The most common bacterial gall is crown gall or *Agrobacterium tumefaciens*.

Gall-riddled red maples in the Tuskee Run Dell at the Maurice River Bluffs Preserve. Photo: J. Morton Galetto.

In "*Agrobacterium tumefaciens*" the University of Connecticut Home & Garden Education Center describes the process like this: *"The bacteria, upon attaching to the plant cell walls, send DNA that causes*

production of plant growth hormones into the plant cell where it is incorporated into the plant cell chromosome. Affected cells begin to multiply at an uncontrolled rate, resulting in visible tumors within 2-4 weeks. More than 600 plants are susceptible to crown gall." The gall doesn't generally harm the tree but often stunts it.

We followed the Red Trail up the hill to where it meets a dirt road and makes a hard right. This is the road that leads to the silo foundations of the former Cargill Granary. Here we came to what possibly was a cubby hole. The approximate 14-feet square depression would have been made by a collier or charcoal maker. During the 1800s or as late as the early 1900s these men made coal by burning a teepee of limbs covered in dirt around a triangular wooden chimney and central green stick called a "fagin," thus charring the wood and dehydrating it in a low-oxygen environment. Once the moisture was removed this resulted in a very light wood product. The cubby was used as a root cellar for the tiny—often portable—abode above it, in which the collier lived while preparing coal (see J.G. Wilson source below). Coal was still being produced in the 1940s, and the last personal operation, in Buena, New Jersey, was fired for the final time in 1999 on Old Landis Avenue, east of Vineland.

Multiple-trunk trees, evident around the cubby, are further evidence of charcoaling, since cutting of trees at the base often results in new growth of coppice wood. Mark explained that the newly-sprouting trees on stump sites were used for "hoop poles," or barrel hoops: yes, the hoops that hold barrels' staves together. A wooden hoop, as opposed to the metal ones associated with wine and whiskey barrels, was advantageous for highly corrosive materials such as pickles and other brined products. Mark described our region as the capital of wooden hoop-pole making.

We made our way east on the Red Trail to its confluence with the White Trail and the Maurice River. Here we learned about the formation of bluffs on the colder side of the river and the role of permafrost in their creation. The river's entire drainage basin would have been permafrost. But when the sun rose over the water, the west bank would only have been exposed to the cooler morning sun while the warmer afternoon sun would have heated the east side, and for a longer period. The thawed side would erode more quickly, so that the Maurice River's west bank remained higher (because it remained more frozen) than the east side, which melted like an ice cream cake in the hot afternoon sun.

I’m continually amazed by the quality of the CU Maurice River’s guided walks. The intertwining of history, culture, and our natural landscape is defined by all of the components. Nature’s frozen impact on the landscape has endurance, be it good or bad, and there is always a story to be told while rambling in the Pines!

Sources

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