Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

by Nan Gray

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Compiled by Nan Gray

Cover: Looking south to Sinking Creek Mountain from the high quarry on Pine Top anticline. Craig's Creek enters from the distant left side of the photograph, John's Creek from the distant right and Meadow Creek tumbles down the Sinking Creek Mountain in the middle right of the photo. High silica, friable Rocky Gap Sandstone and more recent water-borne deposits are mined northeast of New Castle, Virginia at Castle Sands Company Quarry by Titan America (photo by author). Several braided, mosaic water-borne deposits, red and reddish-brown clay rich lenses, bedrock and independent lithologies of large competent rock units and single grain sorted friable sandstone of minimal competence are in the picture above.

Copies of this Guidebook may be obtained by contacting the author

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FERC Docket # CP16-10 Regarding rare and endangered species near the route of Mountain Valley Pipeline: more endangered species are in these unique landscapes, but here are a few that would be impacted by the construction of a pipeline. This area should be designated as a National do-not-construct zone due to the findings of select water, soil and geology properties investigated in this report, and the animals that live here.

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Nan Gray, Soil Scientist

Executive Summary: 1) Wilderness and undisturbed areas enhance the physical stability of an environment to be able to tolerate more rainfall and disperse water more slowly, lessening erosion, lessening infilling of sediments and decreasing the risks of water contamination by decreasing erosion and mass wasting 2) Influences of population pressure will continue to effect erosion into all damplands, wet lands and intermittently wet lands unless adequate buffers such as "No-Build-Zones" are created 3) Geologic Power will change a stable landscape and the Saltville Fault is still active (as of 2011) 4) Periglacial influences are considered here to extend to the Sinking Creek Valley as one long periglacial lake, during the last ice age – which affects our water now 5) Siliceous fragipans and Calcareous fragipans (here) impact water movement through the soil profile 6) Episodic migration of alluvial and saturated debris flow material is presented 7) Steep mountain slopes erode for many reasons 8) John's Creek Valley and Craig's Creek Valley have evidence of weakly cemented, deep, sorted, thixotropic, peri-fragic, episodic, epi-migrating deposits that may have ice-dam, peri-glacial periodicity 9) Humans need clean fresh water 10) If ever there was a finger to protect, it is the finger of the Sinking Creek Valley of Craig County, Virginia and all of the surrounding mountains of the Great Eastern Continental Divide 11) Sinking Creek Valley stores cool, clean, fresh, free-flowing, natural water, underground, free; there are more miles of the Great Eastern Continental Divide source water in Craig County than any other county in the Commonwealth of Virginia. Our common wealth is fresh water. 12) Protect the Source waters that are still clean. 13) Consider this region a "NO-BUILD-ZONE" buffer due to the high risk of damaging clean water here. 14) Several rare and endangered soils exist here and animals live in the area of this report, including the James Spinymussel, many fish, amphibians, bats, worms and crayfish. 15) This area is a migratory bird flyway.

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Purpose and Site Descriptions

The purpose of this field excursion is to showcase the variety of ecosystems, explore the soils and surface processes and their relationships to landscape evolution in this part of the World. We begin the story with where our area of interest is now in the Appalachian Mountains. The Sinking Creek Anticline and surrounding area of Craig County are near a pivot point (west of a radial shear zone) in the Valley and Ridge Province of southwest Virgijnia. The deep old rocks are broken sedimentary Cambrian to Silurian-Devonian age and are exposed here. The metamorphic rocks of the Blue Ridge Province lie farther to the east and the Appalachian Plateau is to the west of the Valley and Ridge Province. Notice the gradient flow and land extension eastsoutheast to the Chesapeake Bay and Atlantic Ocean. Notice the land extension to the west, where the water flows, ultimately, to the Gulf of Mexico (Figure 1). Our mountainous watershed study areas are at this part of the Great Eastern Continental Divide, in beautiful Craig County, Virginia, United States of America.

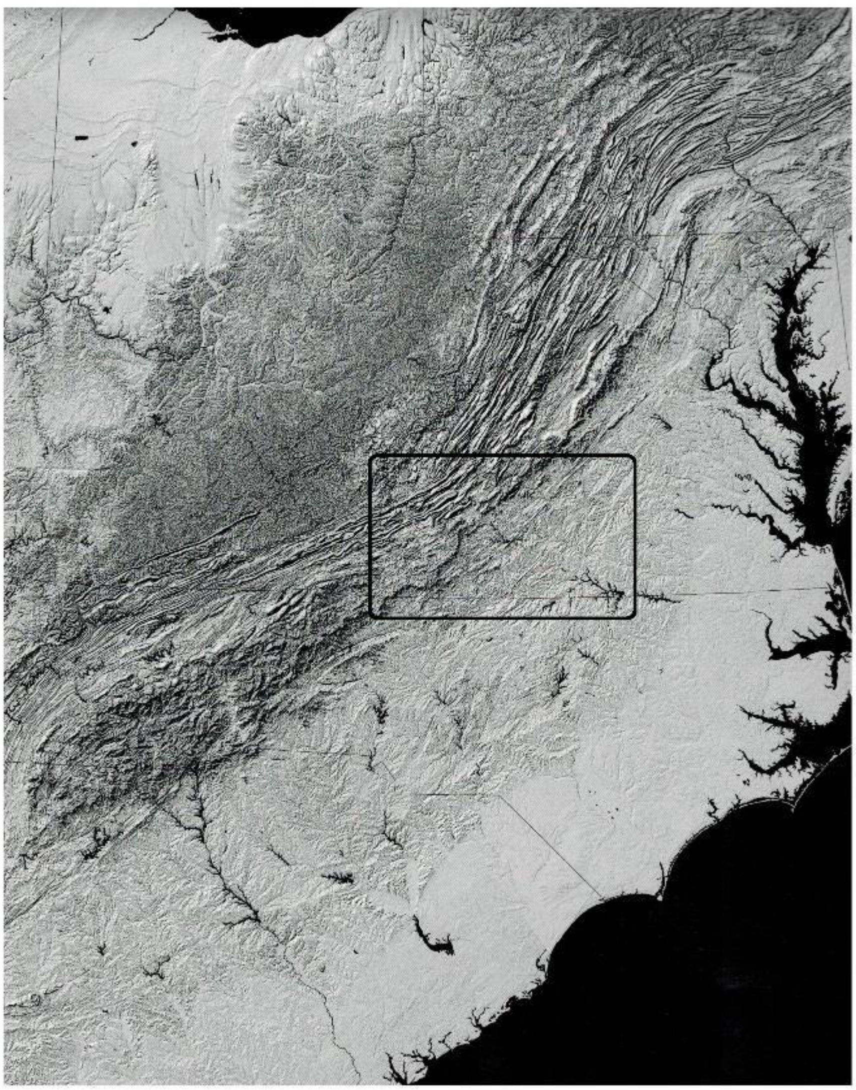

Figure 1. The Appalachian Mountains of eastern United States of America. (Morin, 2006). Inset shows Sinking Creek Mountain anticline in middle northwest corner. The folds and faults of Sinking Creek Valley in Craig County, Virginia are easily traced by the high ridgelines that define the Great Eastern Continental Divide of waters that flow to the east or to the west. Craig County has more miles of source water watershed devoted to the Great Eastern Continental Divide than any other county in the Commonwealth. The water divide's long loop of the Sinking Creek Valley extends into Giles County. To the west, it borders John's Creek Mountain and Potts Mountain; to the east, the continental divide of water follows Brush Mountain of Montgomery and Roanoke Counties, Virginia.

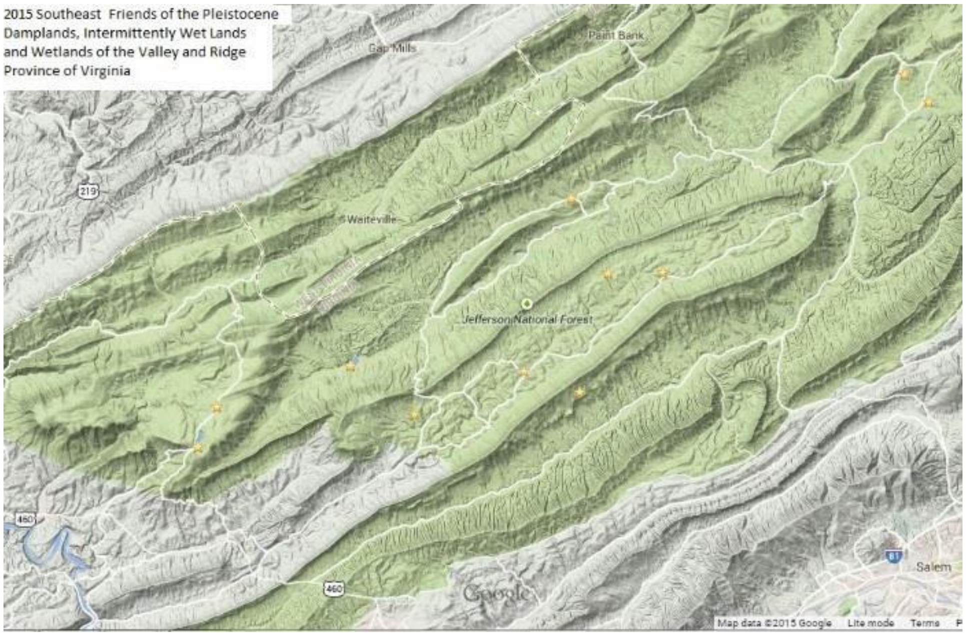

Figure 2. Sinking Creek Mountain (east side of anticline loop) of Craig County in the Valley and Ridge Province of the Appalachian Mountains of southwest Virginia (Google Map, 2015). The general topography and transect stars (yellow) shape of the basis of the water story in this region.

Sinking Creek Valley of Craig County is a folded, breached anticline with a northeast-southwest trending axis that lies in the southern section to the Valley and Ridge Province (Figure 2). This broad, raised valley has an intermediate climate between the higher, colder land of Mountain Lake (west) and the lower elevation, warmer Craig's Creek Valley to the east and New Castle to the north. The western ridge of the breached anticline is named John's Creek Mountain and the creek to the west of that is John's Creek of John's Creek Valley. The western end of John's Creek Valley is narrow and V-shaped, which Mills (1988) considered filled with finer, smaller rock material than what is deposited in a broad valley. The eastern ridge of the broad valley is Sinking Creek Mountain. We shall consider the long axis transect and an east-west transect from Huckleberry Knob to Mountain Lake.

The two western most stars are Mountain Lake and the Mountain Lake Biological Station where periglacial features of evidence were presented in the 1989 SEFOP. The highest point in this area is approximately 4363 feet. Mountain Lake is 3875 feet above sea level. The two northeast stars of Figure 2, are Castle Sands Company Quarry and Virginia Mineral Springs at the lowest elevations on our tour, and flowing away to the east.

Geology

Introduction

The Sinking Creek Valley is a unique geologic feature, one of two raised valleys in this province. The other perched valley is Burke's Garden in Tazewell County, Virginia. Burke's Garden shares many karstic and wetland features with Sinking Creek Valley.

The termination of the Saltville Fault is in the Sinking Creek Anticline, where down faulting has left a wall hanging and tipped the shoulder of the landform down to a toe that reaches for New Castle; or, a fingertip pointing to another, smaller anticline northeast of New Castle. The smaller anticline, broken but unbreached, underlies sand worth digging.

Hard sandstones armor and cap the mountain ridges. Remnants of those sandstones compose the alluvial fans in John's Creek and what we shall see in the lowlands' quarry. To the east, Craig's Creek Valley has large sandstone blocks that slid over sandstone and shale. The fluvial and alluvial deposits are reworked in Craig's

Creek. Craig's Creek has enough force to move downstream boulders weighing more than 8 tons, just outside of New Castle. They are rounded Devonian and Silurian shale and sandstone boulders. Shale beds are exposed in the creek.

Cambrian and Ordovician limestone valley exposed has grown clay as it has weathered over time (250+ million years). So we shall go from clay size to sand size to giant, rock-block slides on this transect, as we look through a "vertical" window of this anticline.

The Saltville Fault is one of the major structures of the Valley and Ridge Belt as a whole. Sinking Creek Valley is a southwesterly dipping anticline, eroded to the Cambrian formations. The fault runs all the way down the Sinking Creek Valley to Saltville, Virginia and extends to Alabama. Generally, the Saltville Fault juxtaposes the Cambrian Honaker Dolomite in the hanging wall against Devonian and Mississippian units of the Greendale Syncline in the footwall block (Webb et al, 2008).

The outside of the anticline consists of Silurian and Devonian age rocks that may be overlain by younger erosion deposits. The Pulaski Fault runs along Craig's Creek just east of Sinking Creek Mountain. We shall see ancient, giant rock-block slides on this side of the mountain. The Appalachian Trail is approximately 300 feet from the "knobs" we shall visit.

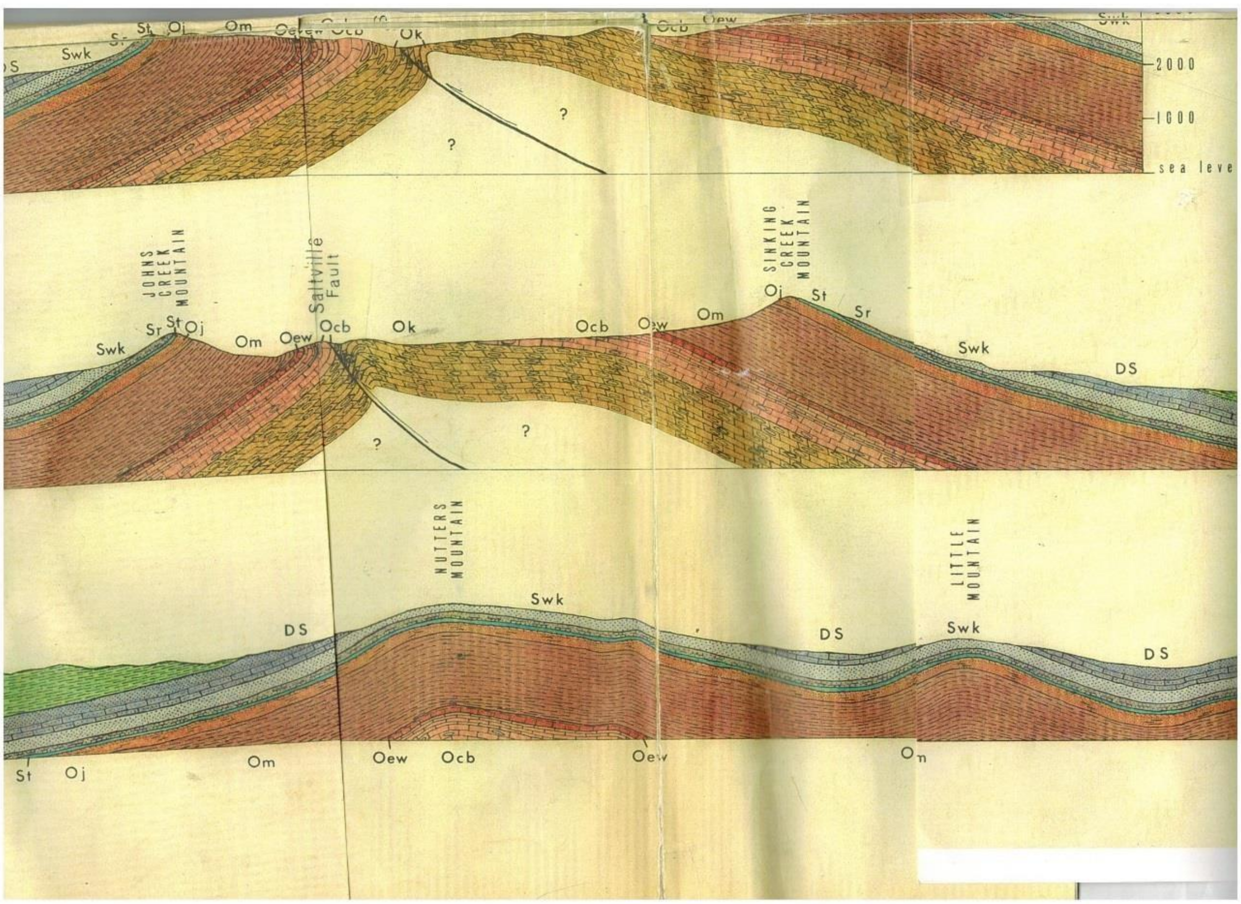

Figure 3. The anticlines of New Castle Area, Craig County, Virginia (Bregman, 1967) general geology, where Ds=Devonian Shale (Millboro and Needmore), DS=DevonianSilurian formations (Ridgely sandstone, Tonoloway limestone), Swk=(Keefer-Wills Creek sandstone, Sr=Rose Hill formation, St=Tuscarora Sandstone,

Oj=Juniata formation, Om=Martinsburg/Reedsville formation, Oew= Eggleston formation, Ocb=Lincolnshire, Elway limestone, Ok=(upper) Knox dolomite; O= Ordovician (510+-435 my), S= Silurian (435-405 my), D= Devonian (405-350 my)

Importance

Vastly different ages of exposed rock, created in various environments, sometimes mixed together or scalped away to someplace else and re-lithified, allow concentrations and depletions of minerals, water and nutrients to occur in this area of Virginia; everything connected by younger events and deposits. We know land changes up and down and sideways. Geologic Power can be matched by man and done so incrementally; however, the landscapes all require geologic time to stabilize internally. Geologic equilibrium is tentative, and so while we are waiting, let us enjoy some beauty and good water.

The location and orientation of Craig County's watersheds allow the water to be filtered by wilderness, trees and soils and channeled through our geology of karst, shales and episodic deposits of eroded sandstone from the upland. Craig County has unique, natural wetlands due to the local geology. The entire Sinking Creek Valley is karstic and stores water in addition to being a tributary to the New River (lower left corner of Figure 2). The area outside of the Sinking Creek Valley is underlain with shales, some of which outcrop or can be seen in road cuts. The soils and rocks shed from the mountains reveal a number of different environments and climates. Our soils and current climate are excellent for cultivation of asparagus and many other foods of plants and animals.

Here are distinct ecosystems, each with its own diverse biotic (soils, flora and fauna) and abiotic (rock) characteristics. This whole area contains a mixed deciduous, temperate peri-rainforest. Happy Hollow, alone, hosts native dogwood, hickory (shagbark and pignut), oak (northern red, scarlet, white), pine (Virginia and white), black locust (Robinia pseudoacacia) maples, hemlocks and walnuts, cherries, hawthorn, beech, elm, ash, tulip trees and sassafrass. Mountain Lake, and in the highest elevations nearby, have spruce and hemlock. Craig's Creek is drier, warmer and more acidic environment than the limestone Sinking Creek Valley. John's Creek has the Endangered James Spinymussel (*Pleurobema collina*), whose dependence on good, clean water is limited living on Earth to here.

This evolution of landforms and landscapes is significant today because the intermittent nature of relative stability means that humans may build dwellings or other permanent structures in terrestrial environments that change with hydrological, seismical or collapse phenomena, such as what is evident in the watersheds of this study.

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Base camp:

Route 662 in Craig County is also called Happy Hollow Rd. The creek is mapped as "Little Creek". Silver Lining Farm Coordinates
37º 22' 23.079"N
80º 23' 38.997"W

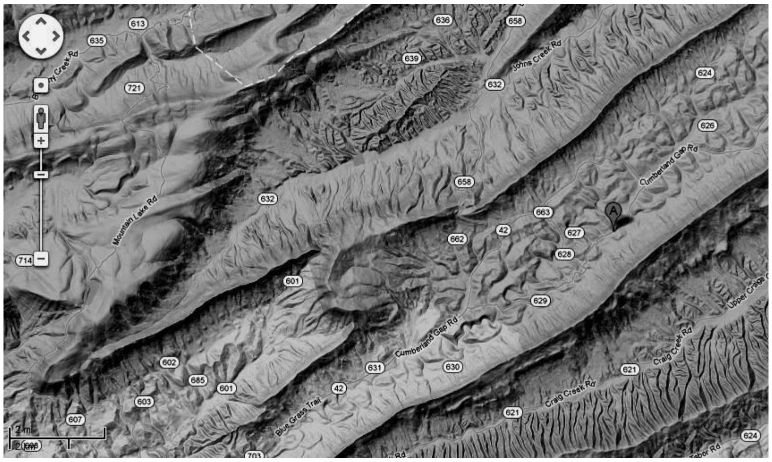


Figure 4. Google map of local roads we shall travel in Craig, Giles and Montgomery Counties, Virginia (Google Map, 2015). Rt. 662 is west of the "A" placemark. Where the map has 662 is where we begin, at Silver Lining Farm

General story of Holocene field excursion sites

DAY 1 STOP 1: Base Camp

Silver Lining Farm contains well drained, deep and shallow soils derived from transported soils and pockets of residuum soils, held mostly in places where it did not erode. The soils are primarily loamy to silty loam in the upper horizons and grade to more clay in lower horizons. Soils are naturally high in calcium and magnesium from limestone and dolostone bedrock. The soils are Loamy to Clayey, mixed, mesic Typic Paleudults and cousins. Being a natural system and having anthropic influences the diversity of soils in this part of the World match the diversity of flora and fauna and abiotic geology. Even then, rock becomes soil, soil weathers physically and chemically to nourish all biotic, until it rests again in the soil.

Indian arrowheads of the Archaic age (9,000-3,000 years ago) work their way to the garden soil surface periodically. This field would have provided shelter and water and the hills above would have offered good lookout points for early people passing through the area on hunting expeditions. Sinking Creek Valley is a raised valley, prone to colder climate than the surrounding land. It was a great hunting ground, lush with many animals who might eat you during the last Ice Age, so Native Americans did not linger to build, but passed through the area. But people here would have been interacting and communicating with nearby Indian Tribes. Later, this land was hunting grounds for Cherokee and Monacan Tribes with an occasional raiding party of the Shawnee passing through this area (Eckhart, 2001). The first white settlers came, stayed here (what is now Craig County) and recorded their deeds in the 1750's.

The French and Indian Wars (1756-1763) pitted the expansion of the settlers against the Indians and their French backers. The Cumberland Gap Rd. (Route 42) was the front of the settler territory, to the west, wilderness and Indian Territory. Cumberland Gap Rd. was the main road to get to Cumberland Gap, Virginia-Tennessee. Ms. Olga Smith's house was built in the 1770's and has window slits in the basement (which would have been the whole house then) to ward off the Indians attacks. They shot guns through the window slits. We pass by the Cumberland Gap Rd. house on our tour. Several farms were given to soldiers or their families who served King George III, for which he awarded land grants in the 1770's (Johnston, et al, 2011)

The Happy Hollow is documented by oral and written family histories of Civil War Union General Averell and more than 2,000 troops retreating westward from Montgomery County (east of us) across Sinking Creek Mountain to Sinking Creek Valley, up Happy Hollow, across John's Creek Mountain and Potts Mountain on west to West Virginia. The creeks were swollen with rain. The retreating Yankees stopped here to rest a few hours, long enough for the local folks to call this Yankee Meadow. The farmhouse next door was used as a field hospital. The family who lived there put their daughter to bed as being sick. The daughter hid the jewelry and hams in bed with her (Johnston et al, 2010). Another neighbor was told by Grandparents that the Yankee solders showed good manners by asking permission before taking something, whether it was food or animals

(Huffman, personal communication). The name Happy Hollow is primarily used, but Yankee Meadow is known here, as well.

Happy Hollow has been Happy Hollow for a long time. The James Echols Tannery tanyard of Happy Hollow began operation in the 1880's. It had a pond covering part of where our garden is now. The pond was drained by the 1940's (Jonhston, personal communication). Soil cores taken during construction of an irrigation system revealed waterlogged soils of blue-green color. Soil analyses of our garden show soils to be high in calcium and magnesium with a neutral pH.

Climate

The temperate climate of the region brings relatively cool summers and mild winters to the area.
The winds through the region generally blow from the west/northwest at an average of 8-10 miles per hour. Yearly rainfall ranges in New Castle from 35" to 50" of rain/liquid precipitation and Happy Hollow of Sinking Creek Valley receives between 32" to 71" per year of liquid precipitation. Rainfall can come in high intensity short duration rains that amount to five inches of precipitation in 24 hours in New Castle. Orogenic effects bring us rain when a neighbor up the valley is in a rain shadow, and gets none.

Climate characteristics effect soils and are used in the taxonomy of soils. Our soils are mostly udic moisture regimes (Keys to Soil Taxonomy, 2014). Silver Lining Farm hosts a Virginia Department of Environmental Quality and U.S.G.S. State Observation Well (SOW 232) which measures water table fluctuations. Data collected thus far is shown in Figure 5. Our agreement to host the SOW 232 for 100 years will yield more data with time.

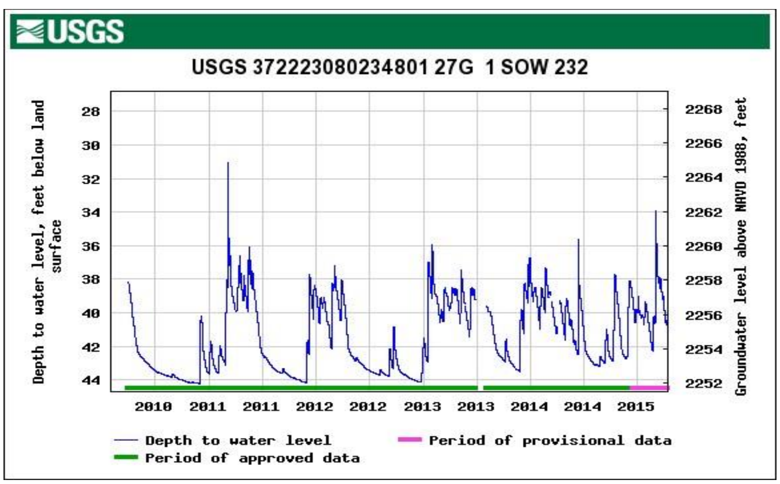


Figure 5. Water table fluctuations of SOW 232 from installation to April 2015. Low points on the graph were recorded during the period July to January. Note the water table has been higher longer in the recent past (USGS SOW 232, 2015).

SOW 232 Craig County, Virginia
Hydrologic Unit Code 05050002
Latitude 37°22'23.34", Longitude 80°23'47.99" NAD83 Land-surface elevation 2,296 feet above NAVD88
The depth of the well is 152 feet below land surface.
The depth of the hole is 160 feet below land surface.
This well is completed in the Valley and Ridge aquifers (N500VLYRDG) national aquifer.
This well is completed in the Knox Dolomite (367KNOX) local aquifer.

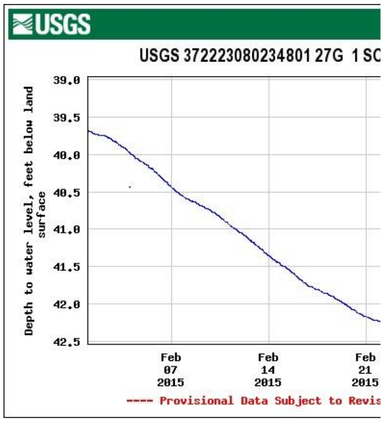


Figure 6a. Ice Umbrellas on the rocks in Little Creek were evidence of a higher (1") water level before temperatures dropped to below zero 19-21 February 2015. The SOW 232 watertable depression occurred as ice formed around the edges of the spring that emerges downhill of SOW 232. Little Creek, that flows past the rock outcrops along the lower Happy Hollow Rd. froze over in February 2015 and flowed at full bank when melt began on the 22nd of February 2015. The shows the short response time between SOW 232, our spring and surface water.

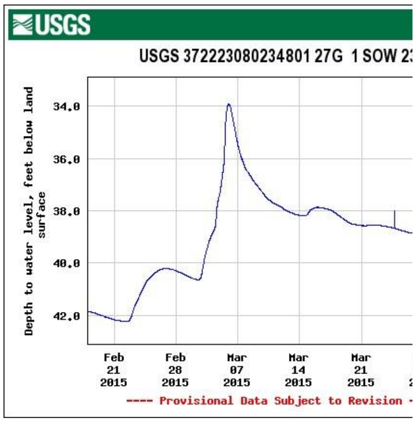


Figure 6b. This spike of 6 March 2015 shows the instrument's response to water table rise as a surge of water: snow melt and 1.1 inches of rain that day, enter the well (USGS SOW 232, 2015). In the other watershed of Meadow Creek, the turlough of Meadow Creek flooded on 5 & 6 March 2015.

However, summers can be extremely hot and dry, causing drought to occur. When the rain returns in the fall (often as a result of a tropical depression or storm in the vicinity) flooding may occur in low-lying areas of the County because of poor soil permeability, desiccated soil pores and natural compaction of colluvial and alluvial soils or rapid water rise in a confined (by rock) system. New Castle is situated in a debris flow/ alluvial fan position and is underlain by shales and sandstone. Dense, cemented fragic soils are common. Flash flood streams leave polished rocks. Fluctuating water tables in karst land may leave dry creek beds, that only flow surface water after all voids and caverns are flooded below the stream bed.

Temperatures in Craig County remain fairly mild year-round, with an average annual maximum temperature ranging in the low to mid 60s and the average minimum temperature ranging in the low to mid 40^{o} F, fitting the mesic temperature conditions.

The Earthquake of 23 August 2011, centered in Louisa County, Virginia, was felt at the same time in New Castle as in Happy Hollow in the Sinking Creek Valley. The underlying geology carried the seismic wave down the Saltville Fault along Happy Hollow Rd. and under Buck Hill. Our house is on "Buck Hill", which is a remnant of resistant limestone bedrock, mantled by deep residuum. The earthquake cracked our rock walls in several places (displacement approximately 1 inch). I watched cobwebs and items on my window sill giggle as the seismic wave passed. The Earthquake did not shake the roots of John's Creek Mountain. No sign of the earthquake was present in the SOW 232 water table fluctuation data. A feature of an earthquake is evidence of an abrupt up-down water spike in the well. The SOW 232 is situated on the John's Creek Mountain side of Happy Hollow Rd. The bedrock of Buck Hill is exposed at the road and is another candidate site for a collapsed valley floor of the karst periglacial lake.

Finer material in deposits also vibrated and karst collapse happened at the John Price farm. We shall visit the recent sinkhole development of the valley's sinkhole plain.

Why would we live here amid all of this danger: These dangers are not complicated by large, linear, man-made disturbances such as permanent structures involving the construction and aftermath of pipelines.

Mining

In the past, Oriskany iron ore was produced by underground and surface mining in northeastern Craig County. The iron ore was used primarily in local iron ore furnaces. Mining operations for iron ore ceased about 1925. Manganese deposits occur at several locations and have been mined in the vicinity of Simmonsville, New Castle, Paint Bank and on Sinking Creek Mountain southwest of New Castle. Limestone and dolomite have been quarried near New Castle, Simmonsville and Huffman for road stone and other uses. Samples of clay and shale from selected localities in the County have been tested and found to be potentially suitable for brick, tile, drain tile, pottery and lightweight aggregate. Sandstone in the County offers a potential source of construction and industrial stone (Caldwell, 1995, Sweet, 1985). The Castle Sand Quarry northeast of New Castle is an active sand mining operation. It is on our tour.

Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service completed the *Soil Survey for Craig County, Virginia* in 2011.

The soils in a survey area occur in an orderly pattern that is related to the geology, organisms and natural vegetation, relief, climate and time. It is important to know geology to understand what is happening in the soil. Soils of New Castle and surrounding areas are largely deposits from another time, although more recent deposits from Craig's Creek, John's Creek and Meadow Creek are as recent as this last Tuesday. Evidence of flash floods in the form of very large boulder movement by the three main Creeks around New Castle further suggests the waters ability to remove all of the finer material, too. The shaly soils around New Castle are shallow over shale or are deposits. The geology of underlying sandstone may also influence the soils by transmitting water in a sand-karstic solution channel or solution channel of siliceous fragic nature to a larger stream. There are beautiful, small beaches of sand in the slipoff slopes along all of the mountain streams. Native fish use the gravel bars and ledges in the streams where exposed rock structure controls the water flow and its deposits.

Large colluvial material of shale or sandstone that moved, shattered, split into slabs of big rock, and moved a little more also trap mountain slope soil creep in zones of accumulation. Wetland soils, in an area too small for a large scale map, form in debris that does not drain. Spring Peepers and other amphibians trill for mates, almost year round in these mountain forest wetlands. The V-shaped valley of upper John's Creek has pockets of sorted sandy alluvium braided in a deposit on a drained wetland with quicksand. Shale bedrock outcrops in John's Creek and some of the lower slopes. Large sandstone knobs hold big rocks and some deep sandy soils higher on the slopes. The valley becomes split by Seven Mile Mountain and broadens near Craig Healing Springs, as it approaches New Castle.

Sinking Creek Valley deposits are reworked colluvium of sandstone and limestone, or calcareous Ordovician shale. Trilobites and shells have been found in the limy shales on Rt. 624, Little Mountain Road, past the Blueberry Farm. Deep paleosol soils form from limestone where disturbance has been minimal. Limestone rock weathered to clay generates expansive smectitic clays (shrink swell clay) and larger particles of sand and silt. The entire Sinking Creek Valley contains clay with high shrink-swell potential. Some of the paleosols have been covered/buried by younger deposits. The hillside well-drained soils on Buck Hill range in thickness from 0 inches to 15+ feet deep over light bluish-grey limestone. Lenses of the limestone have small, oval lenses of medium dark grey chert. The soils are loamy with increasing clay with depth. Black Manganese concretions and and soft masses are redoximorphic features from a fluctuating water table that stain the clay horizons deeper than six feet. These redoximorphic features formed at a time when the water table was high enough to reach these soils, or engulfed them.

Soils developed on mountain foot slopes found in Sinking Creek Valley formed in colluvium and alluvium of large rock slabs of Tuscarora and Juniata Sandstone or weathered Ordovician calcareous dolostone/limestone bedrock. The chemical weathering of neutral to basic limestone against acid sandstone dissolves into the ground water the softer minerals in the rocks or allows soils to grow as a weathering rind of the rock. Water affects the voids in the limestone to enlarge and connect over time as the water table fluctuates. Natural flushing and infilling of the porous bedrock happens as water supply increases and solution channels open and close, or collapse completely, closing underground flow of water. The backup of water or rerouting of water may replace air filled chambers in the bedrock caves, or surface as a karst intermittent lake or estival (waterreversible sinkhole). Water can be heard flowing under the large sandstone rocks along the flank of Sinking Creek Mountain near the Great Eastern Continental Divide. Large springs on the flank of Sinking Creek Mountain produce millions of clean, clear water every day. Some of the most productive springs lie in the path of a proposed utility corridor, PF15-3.

The soils formed in transported material (colluvium) from the ridge tops have higher sand contents and the soils formed in limestone have more clay. The soils formed in shale have a higher silt content and may be shallower than the soils formed in colluvium of either sandstone or limestone. Stream deposits contain sandstone, shale and limestone.

Craig County has six of the twelve Soil Orders: Mollisols, Inceptisols, Entosols, Alfisols, Spodosols and Ultisols.

Approximately 79% of the County's population relies on well water (1990 Census). Most wells in Craig County's mountainous areas are less than 300 feet deep and generally yield five to twenty gallons per minute. In the Potts Mountain area dry holes have been drilled as deep as 250 feet. Wells in the valleys are generally less than 200 feet deep and yield less than 40 gallons per minute. One of the deepest and most productive wells in the County penetrates shale and limestone at the Paint Bank Fish Hatchery. This well is 400 feet deep and was test pumped for 24 hours at 323 gallons per minute with only 89 feet of drawdown. All but five gallons per minute were obtained from calcareous shale at depths of between 300 and 400 feet. Artesian wells located near Route 311 have also been located and found to produce 1200-1300 gallons per minute. Sinking Creek Valley has a well 500 feet deep with 5-6 gallons/minute recharging its well. Some wells hit caverns that swallow well drilling equipment.

STOP 2: Maywood Wetland Mosaic

Maywood Wetland Mosaic is a wetland in a karst lake flood plain (west of the curve at Maywood). The area was a road-crew prison camp in the 1950's for a few years. Maywood School (east of the curve) was an active school until the 1970's, but the school site was known in 1887 as Fairview Academy (Johnston, et al, 2011). The stereo-pair aerial photograph below shows many straight line fractures that lead to Sinking Creek (Figures 7, 8, 9). Notice the old, abandoned stream meander, now high up on the hillside near the tree line. The farmer who farms that land occasionally finds chunks of concrete of old building foundations and walkways in the floodplain. The ground was compacted by the camp activities and extra water added by the roads adds to the flooding of this area during high rainfall years. Three hurricanes (Frances, Ivan and Jeanne) in September of 2004 left the area completely flooded five feet deep for several days. The soils are mapped by NRCS as drier than they actually are. The year round water table is less than 6 inches below the surface in the majority of the floodplain, creating a mosaic of wetlands with corresponding vegetation. This is another karst intermittent lake under the right conditions in our current climate. The area that floods extends to the south and past the dairy farm to the north, but the easy view of the land prevents us from seeing how big the floodplain, intermittent karst lake really is.

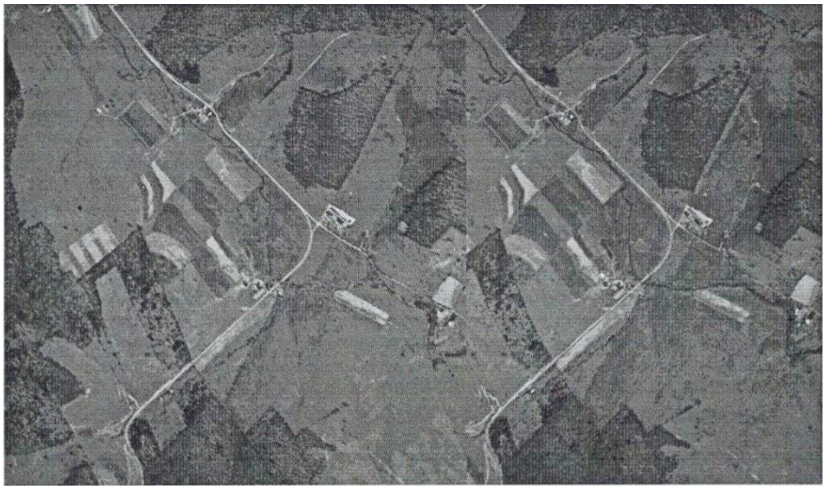


Figure 7 . Stereo-pair aerial photographs of Maywood. Notice the straight fracture the road follows. The intersection of fractures, low flood plain and continuous surface water here of Sinking Creek has created a mosaic of wetlands with drier land (Photo from DMME files).

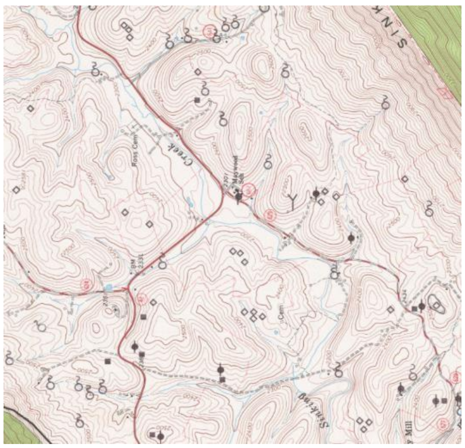


Figure 8. The flow of Sinking Creek is intersected by a fracture and another creek at Maywood. Water flows to the southeast corner of this map (Craig County Water Resources Inventory, 1992).

Figure 9. Sinking Creek on right looking south on Route 42, Cumberland Gap Rd. The road turns to the right, west. The area is called Maywood and is a mosaic of wetlands and drier land, in Craig County (photo by author). This area flooded in 2004 to form an intermittent lake.

Drive by: Heading northeast on Rt. 42, Olga Smith family's house on left. Spring house is nearby.

STOP 3: Sinking Creek Store and John Price's recent sinkholes

Acid sandstone rubble blanket the mountain sides and approach the valley floor limestone soils and bedrock. The contact pits one chemistry against the other; the limestone dissolves slowly with the acid rain and acid sandstone contributions to the local groundwater. The limestone becomes cracked and cavernous out of sight. Sinkholes form where the overlying mat of vegetation, soils and rock become too weak to hold the weight, and the whole mess falls into the crack or cavity or fluctuating groundwater table. Usually the instigator is a water seep or underground stream meandering through the large blocks of sandstone rubble below the surface. The resultant landscape is called a sinkhole plain. Last ice age periglacial (and earlier) influences would also freeze water seeped into cracks and voids and cause additional physical deterioration of rock structure. Mr. Price has some sinkholes that opened recently, not long after the 2011 earthquake mentioned on this tour.

Drive by: Sign for Great Eastern Continental Divide

There is a sign near the Great Eastern Continental Divide where the watershed divide crosses Route 42, Cumberland Gap Rd., just west of New Castle. There is no surface water at the valley floor along Sinking Creek Mountain from the Great Eastern Continental Divide to the Big Spring (on right) across from the fish hatchery (on Rt. 42). The water sinks upgradient and rises out of the ground at the Big Spring, joins Meadow Creek and heads to the Atlantic Ocean.

Sinking Creek flows from the Great Eastern Continental Divide in Sinking Creek Valley in Craig County to the New River in Giles County. The high point on Sinking Creek Mountain marks the divide for three major creeks: Craig's Creek, Sinking Creek and Meadow Creek. While Craig's Creek and Meadow Creek flow to the James River and into the Chesapeake Bay and Atlantic Ocean, only Sinking Creek flows to the New River and on to the Gulf of Mexico. Johns Creek, Potts Creek, and Barbour's Creek also all flow to the James River.

STOP 4: Meadow Creek Turlough/Polje

Meadow Creek Turlough/Polje floods when conditions are right, frozen cold with high rainfall or sudden snow melt generates more water than what can pass through the sinkhole drain. The outlet cave is approximately 1 mile down gradient and can eject a forceful discharge for a short duration time (usually less than a week). The 1833 map and In and Around Craig County (1997) list and discuss the "sinks" and "rises" of these karst features.

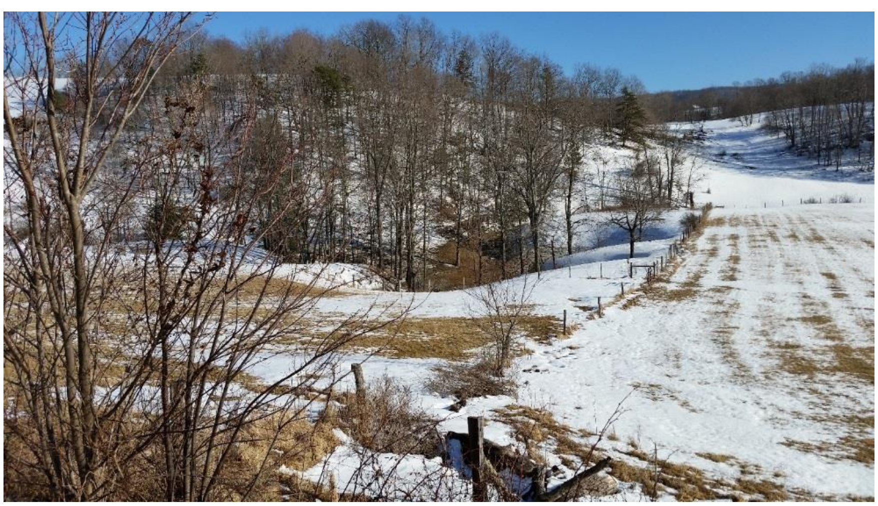


Figure 10. Collapsed sinkhole sink drains water flowing to the north through Meadow Creek watershed. Some winters the drain is too small to pass the water fast enough, and water backs up three miles upgradient from this point, forming an intermittent lake, Meadow Creek Turlough. (photo by author, 2015).

The intermittent lake that forms when the karstic sink drain gets plugged may be flooded for more than a month or less than a week. This is the drain of the Meadow Creek Turlough/Polje with water approximately 12 feet deep at the drain hole, Figure 10.

A polje is a large, commonly flat-floored, closed depression in a karst area, of equivocal origin and a turlough is a seasonal lake, up to 5 km^2 in area, found in glacially influenced karst terrain, which fills and empties through springs and sinkholes (Keary 1996). Meadow Creek Polje now and Meadow Creek Turlough 10,000 years ago. Cavities in the limestone bedrock are enlarged through chemical and physical weathering. This area was certainly influenced by periglacial cold, melt and heaving. Notice the collapsed valley floor across the turlough, where the rock is exposed in the high wall (Figure 11). Evidence of periglacial cold at Mountain Lake and Huckleberry Knob and Meadow Creek Turlough indicate that Sinking Creek Valley, with its abundant water, would have been a connected, frozen, periglacial lake during the last ice age, and at other periglacial times as well. That is, Sinking Creek Valley would have been one long continuous periglacial lake, before this end of the valley collapsed, changing the watershed divide.

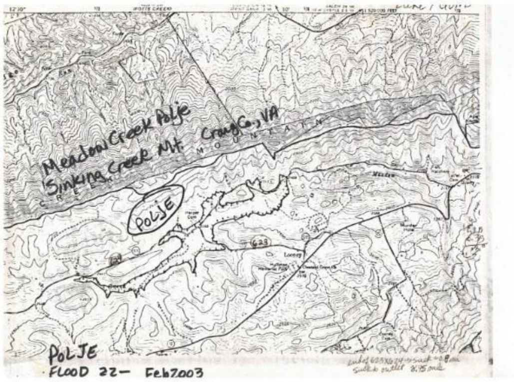
Figure 11. Left photo, Meadow Creek Turlough/Polje partially flooded March 2015 (photo by author).

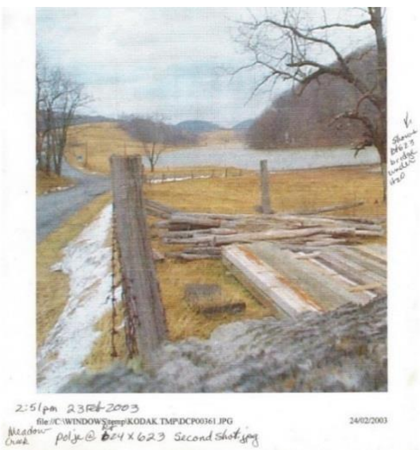
Figure 12. Right photo, Meadow Creek Turlough/Polje dry March 2003 (photo by author).

Figure 13. Meadow Creek Turlough/Polje outlined on topographic map (USGS Looney, VA Quardrangle, 1963). John's Creek Mountain is the ridge closest to the Meadow Creek intermittent lake feature. Route 623 intersects Route 624 at the broadest part of the intermittent lake.

Figure 14. The Meadow Creek Turlough/Polje flooded in February 2003 looking north from Route 624 X 623. Route 623 is flooded to the right of photo.

The area of Rt 624 and Rt 623 was called Moccasin Hollow long ago.





Release of lake melt water and physical weathering collapsed karstic rock, dropping the surface down, which changed water flows of the Sinking Creek Valley at the Great Eastern Continental Watershed Divide. Meadow Creek flows toward New Castle, Craig's Creek to the James River, Chesapeake Bay and on to the Atlantic Ocean. The rest of Sinking Creek Valley water flows to the New River. The Sinking Creek Valley hydrology changes at the hinge of this karstic collapse (Figure 2, note where north tip of Sinking Creek Valley hinges and drops to the east). Erosion by outpouring of glacial lakes removes overburden material (Posnansky, 1945) and exposes effects of the freeze/thaw cycles such as tilted slabs of rock (Mills, 1998).

It is proposed by the author that one long periglacial lake, snapped in two would become two periglacial lakes, with evidence on each side of the watershed divide in the landform of Sinking Creek Valley. Maywood is part of the periglacial lake that extended north up Sinking Creek beyond Bethel Church Rd, Route 626 and south on down the valley to Newport. Ice or rock dams of the periglacial lake would have blocked the flow of water, filled and frozen at least once, to the highest elevation possible. Excess valley water overflowed its confining rims to assist erosion. Dam breaks during ice melt would have released enough energy to move large rocks and empty the valley of loosened finer material quickly. Cavitation erosion is erosion caused by turbulent flow of meltwater at high velocity over rough bedrock under a glacier. The periglacial lake did not have the weight and force to grind as much material as a large thick glacier would. Some of the surface features of Sinking Creek Valley look like a drained lake with troughs around small islands of bigger loose rocks or resistant bedrock holding residual soils. Colluvium and alluvium derived soil deposits cover the rest of the valley floor. Other sections of the glaciated Ridge and Valley province in Pennsylvania (Potter, 2001 SEFOP) also exhibit vernal pools oriented with karst features caused by cavitation and debris flow deposits.

This evolution of landform and landscape is significant today because the intermittent nature of these lakes means that humans may attempt to build dwellings or other permanent structures in terrestrial environments that change with hydrological, seismical (Posnansky, 1945) or collapse phenomena, such as what is evident here in the watersheds of this study field excursion. The proximity of the surface soil and water with the water in karst rock of a long broad mountain valley lake also means that a lot of water has been stored in the rock and that it could fill above the surface again. The other meaning of the proximity of the subsurface water with the surface water (through karst channels and along rock faces) is that subsurface water becomes surface water and may become exposed to contaminants that would taint the stored clean, potable, cool water if it becomes underground water again.

Drive by: Leaving Meadow Creek by Rt 623 to travel Rt 42, Cumberland Gap Rd, to the left to New Castle, we come to hairpin turns to get us down the steep nose of the Sinking Creek Anticline. Notice the fish hatchery on the left, fed by the Big Spring on the right. There is a limestone quarry near the fish hatchery on the same side of the road as Big Spring. The Big Spring is the "rises" from the water that "sinks" upgradient from here to about where the sign for the Great Eastern Continental Divide sits.

Drive by: Upsections of rock plunging down to New Castle are visible in the roadcut along the nose of Sinking Creek Mountain/Sinking Creek Anticline. Tuscarora (whitish) and Rose Hill (dusky red) and Keffer (whitish) sandstones lean into the hillside at the roadcut. The complimentary sections of rock can been seen across the cascading waters of Meadow Creek. See the limited soil development and colluvium colors from the different parent material rocks along the whole soil and rock profile as we descend into New Castle (Figure 3). The view of New Castle and its fans will be seen from the overlook ahead.

STOP 5: New Castle Overlook

Figure 15. Overlook on Rt 42, Cumberland Gap Rd. New Castle lies in a plain of alluvial deposits and old oceanic deposits, underlain by sandstones and shales. Castle Sand Plant in distant left of photo (photo by author, 2015). New Castle is covered by several debris flows and alluvial fans, notice snow catchments along Craig's Creek and Virginia Mineral Springs, and beyond Castle Sand Quarry. John's Creek, Meadow Creek and Craig's Creek all flow to this area, leave deposits and carry on to the Atlantic Ocean.

STOP 6: Castle Sands Quarry and Titan Mid-Atlantic Aggregates (Titan America)

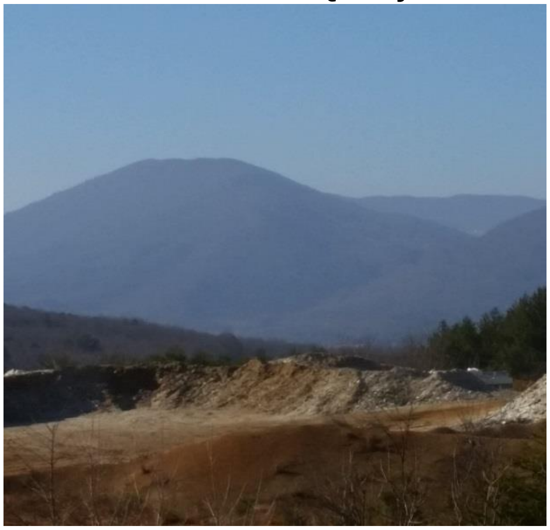


Figure 16. Castle Sands Company Quarry looking south, toward Rt 42 overlook. White material in right foreground is waste high silica siding to be reworked into new siding and other high silica sand products (photo by author, 2015).

Sinking Creek Mountain is approximately four miles distant in this photograph.

Figure 17. Looking south to Sinking Creek Mountain from the high quarry on Pine Top anticline. Craig's Creek enters from the distant left side of the photograph, John's Creek from the distant right and Meadow Creek tumbles down the Sinking Creek Mountain in the middle right of the photo. High silica, friable Rocky Gap Sandstone and more recent water-borne deposits are mined northeast of New Castle, Virginia at Castle Sands Company Quarry by Titan America (photo by author). Several braided, mosaic water-borne deposits, red and reddish-brown clay rich lenses, bedrock and independent lithologies of large competent rock units and single grain sorted friable sandstone of minimal competence are in the picture above.

Figure 18. This is the quarry rock being mined in the south view in above photo. It is considered Rocky Gap (Ridgley) Sandstone (Froehling & Robertson, 1990). Ridgley sandstone in photo is quite friable (photo by author, 2015).

Figure 19. Cobbles and other sorted, rounded stones deposited in distinct layers as evidence of alluvial and fluvial deposits at the Castle Sands Quarry (photo by author, 2015).

Figure 20. Banded black manganese oxides or iron oxides laid down in water borne deposit over more competent rock. See structure in bottom of photograph (close up photo by author, 2015).

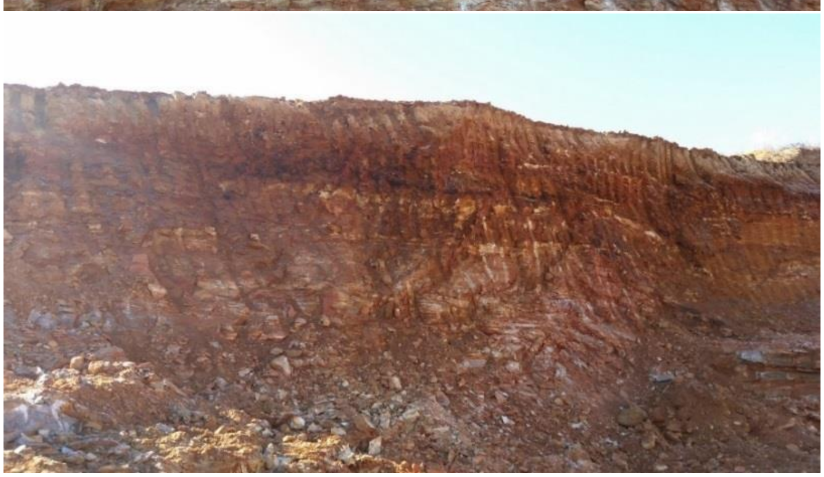


Figure 21. Level deposits show corresponding high watermarks on the arch of the little anticline in the quarry. This view is of the long side of the anticline and shows a profile 30 feet tall, the arch of the anticline is at the north end of the quarry (photo by author, 2015).

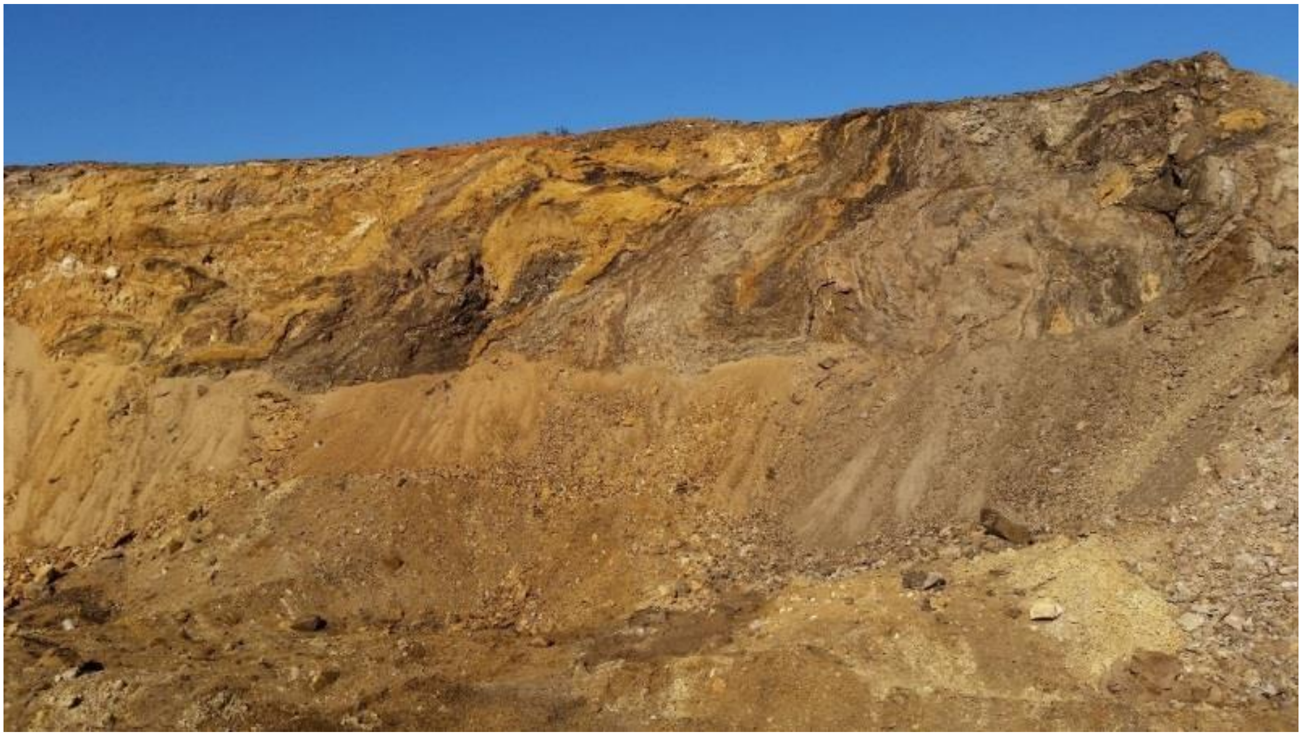


Figure 22. West wall of Castle Sands Company Quarry (mined by Titan America) showing rip-up and deposit of alluvial fan. Material is friable and somewhat sorted. Black material shows concentration of coating around a “ball” of rip-up rock. The rip-up rock has weak single grain structure but is pulverized and held in place by the matrix of yellowish brown material (slightly shaly, platy) (photo by author, 2015)

Drive by: Virginia Mineral Springs

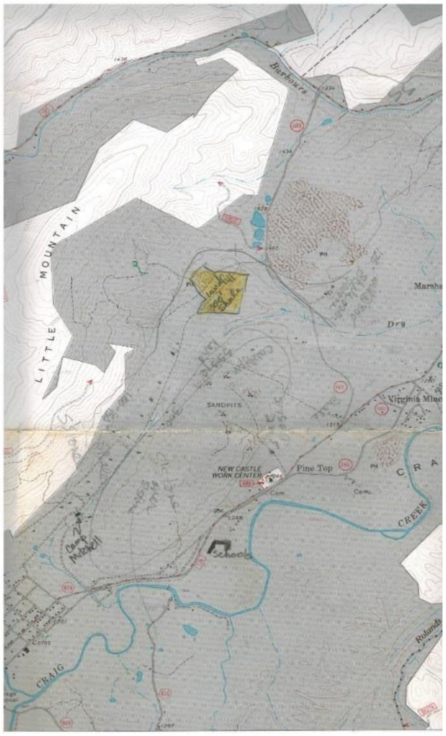


Figure 23. New Castle, Castle Sands Quarry and Virginia Mineral Springs locations (USGS 1:24000 New Castle, VA, 1979). New Castle to lower left, Castle Sands Company upper middle and Virginia Mineral Springs in middle right of figure.

A railroad spur went to New Castle past the Virginia Mineral Springs in the early 1900's. Train passengers could stay at the resort and take health in any one of the seven distinct mineral waters from springs that rose near or on the property (Caldwell, 1995)

Soils here have a perched water table due to a rather thick siliceous fragipan with iron and manganese oxide indurations. Water also flows through channels in the fragipans.

Figure 24. Stereo pair aerial photograph of Castle Sands Quarry and Virginia Mineral Springs locations (DMME, 1963). New Castle to lower left, Castle Sands Company upper middle and Virginia Mineral Springs in upper right of figure.

STOP 7: Huckleberry Knob

Southeast of the Sinking Creek Mountain ridge, on the Craig Creek side of the mountain, are ancient, giant, rock block slides of Keefer sandstone over Rose Hill sandstone. These lie mainly in the George Washington Jefferson National Forest. The geomorphology (SEFOP, 1989) of the slides and the resultant flora and soil formations have been a topic for scientists of all degrees. This is protected land and is not to be disturbed nor the plants, animals, rocks or soils of any species to be taken.

Figure 25. View of east side Sinking Creek Mountain, Craig County, Virginia (photo by author). Knobs are found at several places in Appalachian Mountains, although these are the “type location” specimens that brought recognition to vernal pools nestled in their sagponds.

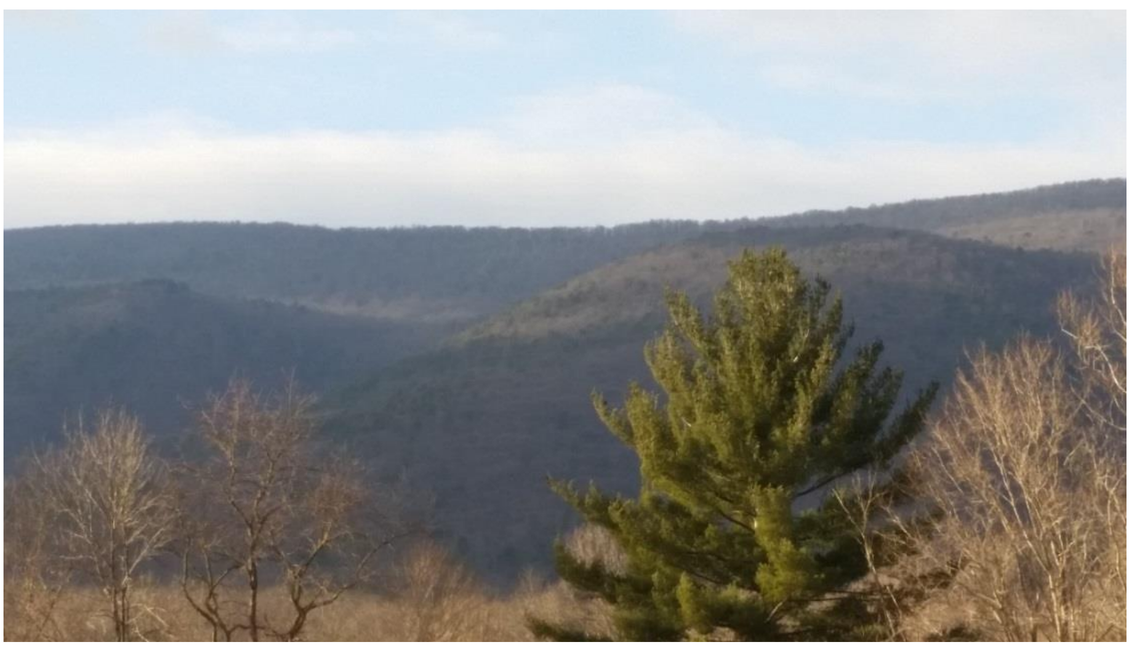


Figure 26. Close up view of knobs, east side Sinking Creek Mountain, Craig County, Virginia (photo by author),

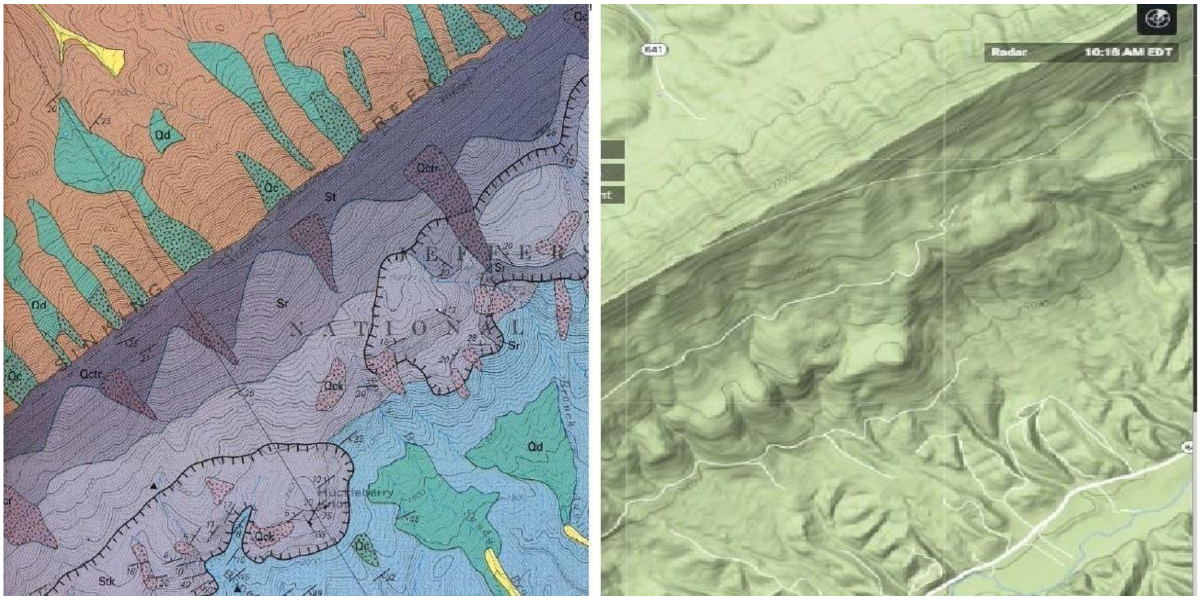


Figure 27. Huckleberry Knob as shown on left by Shultz (1986) and Google Map (2015).

Figure 28. O and A horizons of Huckleberry Knob soil sampled (photo by author with permission by Forest Service, 2015) and acid loving plants: laurel, rhododendron, red oak, chestnut oak, pine (pitch, Virginia, bull) moss, lichen. Soil pH ranges between 4.5 and 5.5.

Geomorphology of the knob: Ice wedges formed between slabs of Keefer sandstone during the last ice age which allowed big slabs of rock to slip on Rose Hill sandstone (Schultz, 1986, Schultz, et al,1989), forming steep slopes at the scarps and slopes that gently hold water and plant debris behind the giant rock blocks after they came to rest. Repeated additions of plant and slope material overlapped, blocked and sealed drainage outlets. Soils in this water holding landform contain pollens of plants that died more than 10,000 years ago and which no longer exist here. Ferrell (1989) described sampling 16 feet deep in a sagpond. Her descriptions fit hydric soil conditions and intermittent vernal pools. The 2002 VAPSS field excursion found a Spodosol remnant that had formed long ago but that no longer possesses the hydrology currently to maintain the moisture. Vernal pools contain ephemeral water and biota. Amphibians sing Spring time songs all throughout this field excursion study area.

The Great Eastern Continental Divide follows to the head of Craig's Creek at elevation 2200 feet at Rt. 460 and

Giles County route 621 and flows to the Chesapeake Bay. The drainage across the road is Poverty Creek, (Pandapas Pond) flows to the New River. Stream capture happens when a shorter distance steeper gradient eats away at resistant rock until it cuts into another drainageway and routes the headwaters to the steeper gradient side. Over time, the headward eroding stream becomes a longer, shallower gradient that erodes more slowly.

Sinking Creek Mountain and John's Creek Mountain are the same Great Eastern Continental Divide that continues between Poverty Creek and Craig's Creek and the watershed divide continues west to Salt Pond Mountain and Potts Mountain.

TABLE 1 Relevant Elevations

Place	Elevation
Sinking Creek Mountain high	3670 ft
Rt 42 at valley floor GECD sign* Craig's	2704 ft
Creek Valley floor at	
Rt 621 X Rt 460	2200 ft
Meadow Creek Turlough	
Rt 623 X Rt 624	2365 ft
Sinking Creek at Newport	
Rt 42 X Rt 460	1880 ft
Huckleberry Knob	2440 ft
Silver Lining Farm SOW 232	2296 ft
Mountain Lake	3875 ft
John's Creek Valley floor	1980 ft
John's Creek Mountain high*	3470 ft

*Great Eastern Continental Divide, GECD

Day 2

Drive by: Mountain Lake periglacial rock break and heave (SEFOP, 1989) (Figure 29).

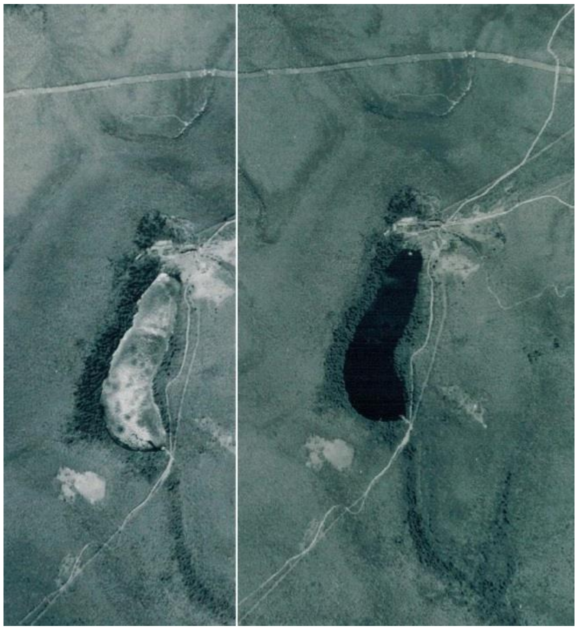


Figure 29. Mountain Lake stereopair aerial photographs (DMME files 1963) put into perspective the relief around Mountain Lake, elevation 3875 feet above sea level.

Mountain Lake is surrounded by large slabs of Juniata and Tuscarora sandstone tipped on edge by ice long ago. High water marks are visible when the lake waters are low. Mountain Lake would have frozen into a glacial/peri-glacial lake during the last ice age.

STOP 1: Mountain Lake Biological Station

Mountain Lake Biological Station Spruce Bog sphagnum moss associations and NEON Project

NEON Project: National Ecological Observation Network has stations set up across U.S.A. to monitor climate change. We shall visit the one at Mountain Lake Biological Station. This NEON station and Mountain Lake Biological Station lie adjacent to a protected Wilderness Area.

Drive by: Crest of John’s Creek Mountain

John's Creek Valley floor 1980 ft above sea level
John's Creek Mountain high* 3470 ft elevation

*Great Eastern Continental Divide, GECD

Notice large sandstone slabs of rock on-edge, peri-glacial boulder streams, chevrons of broken shaly sandstone in road cuts and where the rock units truncate to another rock unit. Hard Juniata Sandstone lies to the Sinking Creek Valley side or hard Tuscarora Sandstone (John’s Creek Valley side) cap the mountain, with dusky red Rose Hill sandstone down section, then whiter Keefer sandstone. Large rock blocks of Keefer Sandstone slid down this side of the anticline, too, but not as far. Notice the very large size of the “free” rocks, that loiter on the hillside. Boucher (personal communication, 2015) told me that the Giles County side of the crest had one foot of snow this Winter that stayed and didn’t melt as soon as the valley snows. Mr. Boucher said the snows were two feet deep in John's Creek, on the other side of the crest, and it lingered, too. This demonstrates the cold aspect of the slopes as well as orogenic effects and microclimates in this region.

STOP 2: John's Creek episodic deposits

The Norfolk and Western Branch rail line extended to Potts Mountain Valley at Waiteville to haul out of the region's iron ore and timber in the early 1900's. Forests were cut extensively. Severe erosion took place. Remnants of trees more than 200 years old are few now and exist mostly along property borders.

John's Creek infill shows repeated episodic storage and release of sands and colluvial material from narrow "pinch" of fold to broader valley floor where sorted, landslide-suspended material is deposited. Evidence of sorting in soil horizons is inferred as water filled catchments upslope, possibly blocked/dammed by rocks or trees, allowed debris flow slurries to settle large material out of suspension, before incremental release of catchment's contents onto the valley floor. As rainfall and stream power increase, and storage points are hydrated enough to migrate downgradient, they do. Some of these "incremental fans" overlap or incise earlier deposits and eventually get reworked into the streams, where the sediments are then considered alluvial material. Taylor (2009) described overlapping alluvial and debris flow deposits of sandstone landscapes in the Appalachian Mountains.

Figure 30. Part of upper John's Creek drainage (Craig County Water Resources Inventory, 1992 with USGS Waiteville Quadrangle, 1965).

The head of the John's Creek watershed marks the Great Eastern Continental Divide on John's Creek Mountain and Salt Pond Mountain. The water and debris flows migrate from John's Creek to New Castle where it joins Craig's Creek, to the James River and onto the Chesapeake Bay and Atlantic Ocean. The other side of the GECD flows water to the New River, north and west.

John's Creek, Oregon Creek and Dick's Creek have water control structures (dams) built in the 1970's to cope with high rainfall and flooding events. These "built" ponds and dams reduce the gradient of the creeks between the natural, colluvial/alluvial catchments in the valley floor. Settling areas get larger, water spreads out as the soils allow it to and the sponge of water and sediment become bigger and deeper. Forested side slopes contribute less soil, rocks and vegetation to Craig's Creek. Mass wasting of this area to any degree can expect to have a residency time in a catchment in this valley, unless there is a really big rainfall event or dam break, before it gets to New Castle.

Given the seismic thrombing of the Earthquake of 2011 felt in Happy Hollow, but not recorded by SOW232 on the John's Creek Mountain side of Happy Hollow, there is a likelihood that wet, sandy sediments could be influenced by an Earthquake, especially during water saturated seasons. Wet, sandy soils giggled will act like quicksand, flow and dewater. This sets up good conditions to form a fragipan, and in this valley, it would likely be siliceous cementation that would occur. The thixotropic nature of these sediments allows them to both hold a lot of very deep water and dry into a dense fragipan (or several) near the surface. Water coming off the mountain slopes still has to go somewhere. Several Elders of John's Creek talk about playing baseball in the field during dry seasons because the land became swampy after big rains. Trenches were dug to drain water out of flat lying fields that were farmed because it was too wet, sometimes even during dry spells.

The water also rises from below the sponge of soil in the catchment. Any hardpan that may have formed acts like a barrier. The water may flow in a channel of polished clean, clear sand grains, sandwiched between barriers or surface as free flowing water refreshed with air. John's Creek has weakly cemented soils that can go through both a wet and a dry phase where the potential fragic properties are morphologically masked. The critical threshold of an irreversible hard fragipan has not happened, yet.

Considering these soils as reversible weakly cemented, flowing sand lobes and gravel lobes, migrating from catchment to catchment, with thixotropic tendencies, John's Creek is a very good candidate for another gush of sand to be delivered to New Castle. It is a time dependent, critical load bearing, shear thinning, agitating event of good size, that would make the sediment storage catchments release the contents, again. Debris fans influenced by sandstone landscapes have been described by Taylor (2009) and Taylor and Kite (2006), and resemble some of what we see in John's Creek Valley where fans may lie dormant for a long time.

Soil Map—Craig County, Virginia, Giles County, Virginia, and Jefferson National Forest, Virginia (soil units map)
Natural Resources
Conservation Service
Web Soil Survey
National Cooperative Soil Survey
3/19/2015
Page 1 of 5
4137100 4137800 4138500 4139200 4139900 4140600 4141300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84 0
1000 2000 4000 6000
Feet
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Map Scale: 1:30,800 if printed on A landscape (11" x 8.5") sheet.

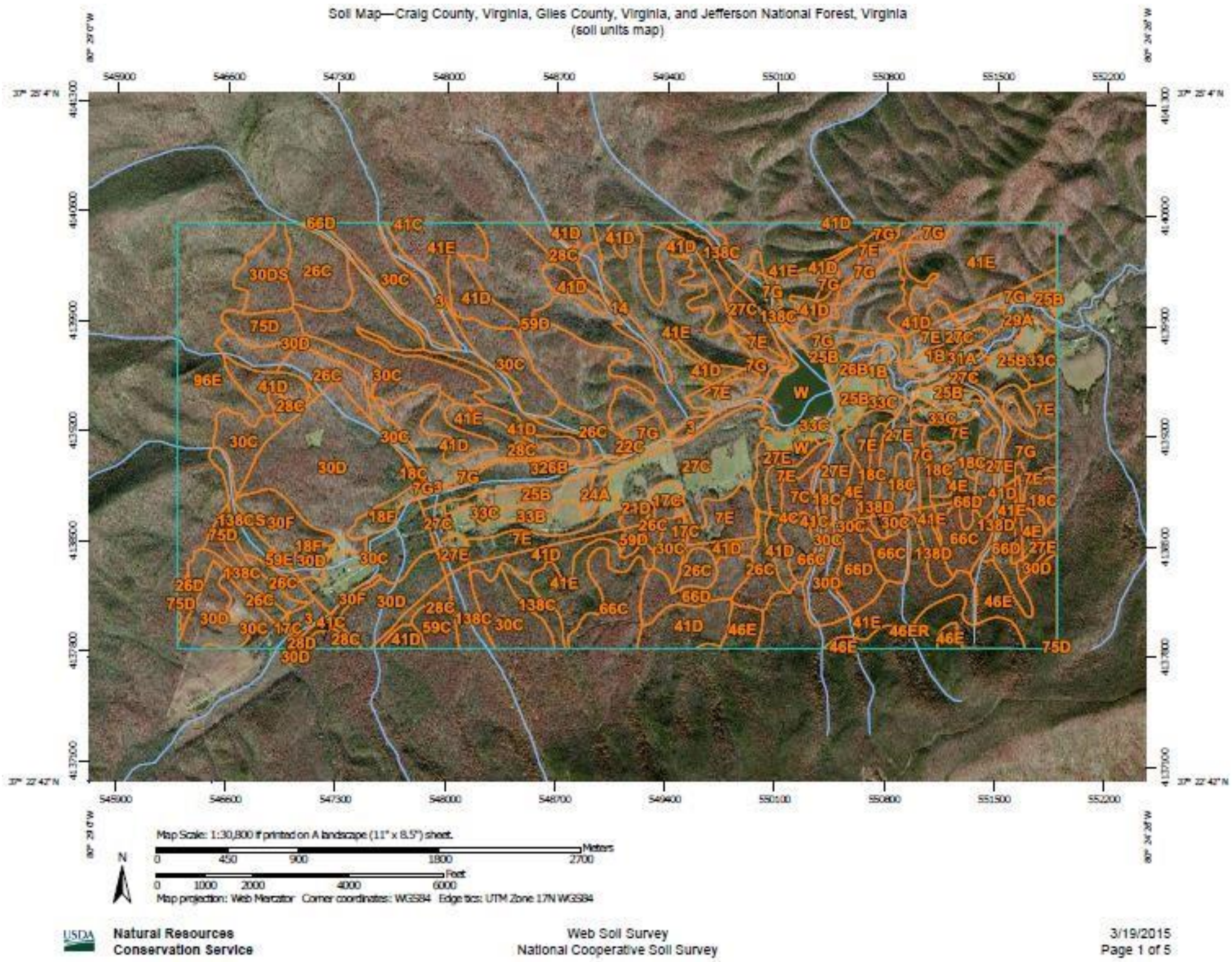

Figure 31. Soil map units in John's Creek Valley along upper John's Creek, Craig County, Virginia (websoilsurvey, 2015). The soils map shows lobes of finer soils and gravelly soils where the reworking of soils and rocks from upslope get deposited. The author found layers of sorted grains in the broader floodplain of John's Creek.

Table 2 Map Unit Legend for John's Creek soils

Map Unit Legend

Craig County, Virginia (VA045)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1B	Alonzville loam, 3 to 8 percent slopes, rarely flooded	16.9	0.4%
4C	Ballegap fine sandy loam, 8 to 15 percent slopes, very stony	1.4	0.0%
4E	Ballegap fine sandy loam, 15 to 35 percent slopes, very stony	26.0	0.7%
7C	Berks-Weikert complex, 8 to 15 percent slopes	13.4	0.4%
7E	Berks-Weikert complex, 15 to 35 percent slopes	177.4	4.7%
7G	Berks-Weikert complex, 35 to 70 percent slopes	142.3	3.8%
17C	Escatawba loam, 8 to 15 percent slopes	10.4	0.3%
18C	Escatawba loam, 8 to 15 percent slopes, very stony	64.7	1.7%
21D	Gilpin silt loam, 15 to 25 percent slopes	4.3	0.1%
22C	Jefferson cobbly loam, 8 to 15 percent slopes	1.3	0.0%
24A	Maurertown silt loam, 0 to 3 percent slopes, rarely flooded	5.9	0.2%
25B	Nicelytown silt loam, 3 to 8 percent slopes	77.7	2.1%
26B	Ogles very stony loam, 0 to 5 percent slopes, frequently flooded	68.7	1.8%
27C	Oriskany gravelly fine sandy loam, 8 to 15 percent slopes, extremely stony	142.0	3.8%
27E	Oriskany gravelly fine sandy loam, 15 to 35 percent slopes, extremely stony	87.9	2.3%
29A	Philo fine sandy loam, 0 to 3 percent slopes, occasionally flooded	20.1	0.5%
31A	Pope fine sandy loam, 0 to 3 percent slopes, frequently flooded	7.1	0.2%
33B	Shelocta silt loam, 3 to 8 percent slopes	38.0	1.0%
33C	Shelocta silt loam, 8 to 15 percent slopes	52.7	1.4%
W	Water	45.8	1.2%

Craig County, Virginia (VA045)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Subtotals for Soil Survey Area		1,004.0	26.7%
Totals for Area of Interest		3,765.5	100.0%

Giles County, Virginia (VA071)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
18F	Gilpin very stony silt loam, 30 to 65 percent slopes	19.6	0.5%
30C	Nolichucky very stony sandy loam, 7 to 15 percent slopes	80.7	2.1%
30D	Nolichucky very stony sandy loam, 15 to 30 percent slopes	234.0	6.2%
30F	Nolichucky very stony sandy loam, 30 to 65 percent slopes	37.9	1.0%
Subtotals for Soil Survey Area		372.1	9.9%
Totals for Area of Interest		3,765.5	100.0%

Jefferson National Forest, Virginia (VA606)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Craigsville cobbly sandy loam, 0 to 5 percent slopes, frequently flooded	55.5	1.5%
14	Botetourt loam, 0 to 5 percent slopes, rarely flooded	20.9	0.6%
17C	Sherando very cobbly sandy loam, 3 to 15 percent slopes	1.6	0.0%
26C	Jefferson loam, 3 to 15 percent slopes	145.8	3.9%
26D	Jefferson loam, 15 to 35 percent slopes	6.9	0.2%
28C	Shelocta channery silt loam, 3 to 15 percent slopes	41.8	1.1%
28D	Shelocta channery silt loam, 15 to 35 percent slopes	0.9	0.0%
30C	Laidig cobbly fine sandy loam, 3 to 15 percent slopes	283.8	7.5%
30D	Laidig cobbly fine sandy loam, 15 to 35 percent slopes	65.3	1.7%
30DS	Laidig cobbly fine sandy loam, 15 to 35 percent slopes, extremely stony	34.5	0.9%
41C	Berks-Weikert complex, 3 to 15 percent slopes	6.6	0.2%
41D	Berks-Weikert complex, 15 to 35 percent slopes	264.7	7.0%
41E	Berks-Weikert complex, 35 to 60 percent slopes	686.6	18.2%

Soil Map—Craig County, Virginia, Giles County, Virginia, and Jefferson National Forest, Virginia — soil units map

Jefferson National Forest, Virginia (VA606)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
46E	Dekalb cobbly sandy loam, 35 to 60 percent slopes, very stony	68.9	1.8%
46ER	Dekalb-Rock outcrop complex, 35 to 60 percent slopes, extremely stony	46.8	1.2%
59C	Gilpin channery silt loam, 3 to 15 percent slopes	15.7	0.4%
59D	Gilpin channery silt loam, 15 to 35 percent slopes	127.4	3.4%
59E	Gilpin channery silt loam, 35 to 60 percent slopes	1.4	0.0%
66C	Bailegap sandy loam, 3 to 15 percent slopes	106.9	2.8%
66D	Bailegap sandy loam, 15 to 35 percent slopes	70.9	1.9%
75D	Lily gravelly sandy loam, 15 to 35 percent slopes	33.0	0.9%
96E	Dekalb-Dekalb, shallow complex, 35 to 60 percent slopes, very stony	182.0	4.8%
138C	Oriskany very cobbly sandy loam, 3 to 15 percent slopes, very stony	76.9	2.0%
138CS	Oriskany very cobbly sandy loam, 3 to 15 percent slopes, rubbly	20.1	0.5%
138D	Oriskany very cobbly sandy loam, 15 to 35 percent slopes, very stony	24.4	0.6%
Subtotals for Soil Survey Area		**2,389.4**	**63.5%**
Totals for Area of Interest		**3,765.5**	**100.0%**

USDA Natural Resources Conservation Service — Web Soil Survey, National Cooperative Soil Survey — 3/19/2015, Page 5 of 5

NRCS Soil Survey staff can map soil units larger than five (5) acres. Soils can vary within five acres and so, for ease, the dominant soil characteristics are mapped. The whereabouts of the gravelly or coarser or finer descriptions indicate how far lobes of sediment travelled when they flowed in a debris or alluvial fan. Heavy and unsorted rocks fall out of solution/turbid water early and finer grains get sorted and settle as the water can no longer carry them. Sometimes episodes overlap and built raised lenses or dam islands, that then later trap the next muddy waters. We saw this at the Castle Sands Company Quarry, lithified.

The author described soils in the upper floodplain of John's Creek and called it Nicelytown Series:

Fine-loamy, siliceous, semiactive, mesic Aquic Paleudults

Soil Description of John's Creek floodplain soil:
Craig County Tax map number 91-A-9
Upper John's Creek, floodplain
Pit 1 Nicelytown Series: Fine-loamy, siliceous, semiactive, mesic Aquic Paleudults, not quite fragic enough to call it fragic (Moomaw Series)

Ap 0-9"; yellowish brown (10YR5/4) silt loam, medium moderate subangular blocky structure; friable, slightly sticky, slightly plastic; many medium roots; many medium tubular pores; krotavina (animal burrows); clear sand grains; 50 minutes per inch percolation rate; <5% small stones or rocks; clear smooth boundary to

Bw1 9-19"; reddish yellow (7.5RY6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; weak (siliceous) sand bridging; 70 min/in perc rate; >35% sorted gravels; pale greys showing as pit dries; clear smooth boundary to

Bw2 19-24"; reddish yellow (7.5YR6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; weak siliceous sand bridging; slightly denser than above 75 min/in perc rate; >35% sorted gravels; clear smooth boundary to

C1 24-27"; brownish yellow (10YR6/6) gravelly silt loam; fine to medium weak to moderate subangular angular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; few fine tubular pores; krotavina; siliceous silt coatings, possibly fragic when dry; slightly denser than above 85 min/in perc rate; >60% sorted gravels; many medium and thick black manganese precipitations/concretions/ concentrations and many medium black manganese stains; clear smooth boundary to

C2 27-32"; brownish yellow (10YR6/6) gravelly silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; 100+ min/in perc rate; > 60% sorted gravels and channers;

C3 32-40"; yellowish brown (10YR5/6) gravelly silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; cemented; 110+ min/in perc rate; > 60% sorted gravels and channers;

IIC 40-54+"; light grey (10YR7/2) silt loam; massive and rock controlled structures; friable, slightly sticky, slightly plastic; no roots; no pores; 120+ min/in perc rate; less gravel than above 20% gravels and channers; many medium and thick black manganese precipitations/concretions/ concentrations and many medium black manganese stains

These soils were moist at the time I described them and they passed water slowly. These are probably reversibly fragic: that is, dry they become quite hard; moist, they look innocent; and wet, the soils become a sponge. Sponge soils can have a slow slump, constant positive water pressure, exposed water. These soils have been trenched to dry the soils for farming. Oxigenated water flowing through sandy soils and these soils becomes polished clean. The only place on Earth that the endangered James Spinymussel lives is in this headwater area, sponge soils, of John's Creek, Oregon Creek, Dick's Creek of Craig County, Virginia.

Conclusions:

Mr. Jay Larimore with the National Oceanic and Atmospheric Administration presented conclusions of climate variability through time and showed a map indicating regional moisture and temperature regimes now and modelled expectations of the future 100 years (Larimore, 2009). Several considerations he made were:

Conclusions of Mr. Larimore:

1) The intensity of storms and drought will increase with time
2) For part of that time, the area of our tour will have more precipitation, primarily as rain.
3) High intensity rainstorms erode soils at a greater rate than low intensity rainstorms
4) It can be expected that more erosion will take place over the next 100 years.
5) Vegetation holds soil in place. Wilderness areas are a stable environment that can tolerate more rainfall and disperse water more slowly, lessening erosion
6) Influences of population pressure will continue to enhance erosion

Furthermore, the conclusions of this Author are:

7) Given that the deposits we have seen almost all show large scale catastrophic slope movement at times of episodic high rainfall, it can be expected that more erosion will take place over the next 100 years.
8) Wilderness and undisturbed areas enhance the physical stability of an environment to be able to tolerate more rainfall and disperse water more slowly, lessening erosion, lessening infilling of sediments and decreasing the risks of water contamination by decreasing erosion and mass wasting
9) Influences of population pressure will continue to effect erosion into all damplands, wet lands and intermittently wet lands unless adequate buffers such as “No-Build-Zones” are created
10) Geologic Power will change a stable landscape and the Saltville Fault is still active (as of 2011)
11) Periglacial influences were presented in the 1989 SEFOP excursion and are considered here to extend to the Sinking Creek Valley periglacial lake and the Meadow Creek Turlough as one long periglacial lake
12) Sinking Creek Valley has calcareous colluvium, calcareous residuum and calcareous fragipans
13) Siliceous fragipans formed in siliceous colluvium surrounding the Sinking Creek anticline
14) Siliceous fragipans and Calcareous fragipans both impact water movement through the soil profile
15) Weakly cemented fragipans may also rewet to act and look like non-cemented soils, peri-fragic
16) Episodic migration of alluvial and saturated debris flow material sorts the bed load
17) Steep mountain slopes erode for many reasons
18) John’s Creek Mountain and Sinking Creek Mountain ridges have steep slopes to headwater springs
19) John’s Creek Valley has evidence of weakly cemented, deep, sorted, thixotropic, peri-fragic, episodic, epi-migrating deposits that may have ice-dam, peri-glacial periodicity
20) Craig’s Creek side of Sinking Creek Mountain also has evidence of weakly cemented, deep, sorted, thixotropic, peri-fragic, episodic, epi-migrating deposits that may include peri-glacial periodicity
21) Humans need clean water
22) Humans can enjoy clean water between episodes of geologic unrest
23) James Spinymussels need clean water
24) Humans and James Spinymussel can co-exist in Oregon Creek, Dick’s Creek and John’s Creek Valley watershed
25) If ever there was a finger to protect, it is the finger of the Sinking Creek Valley of Craig County and all of the surrounding mountains of the Great Eastern Continental Divide.

Conclusions, continued:

26) The raised valley of Sinking Creek and upper John’s Creek gets cold and stays cold longer than the valleys at lower elevations. Sub-zero temperatures, ice wedging and heaving still happen here, above

ground and below ground. Water storage is underground, in sand grains to karst to big slab rocks of sandstone. This has been the purpose the this year's Southeast Friends of the Pleistocene Field Excursion, to show you uncommon, limited availability, natural, endangered landscapes and landforms, water cycling, fantastic geology and soils in a beautiful clean cold wet land experience.

27) Humans can protect the clean water

28) Sinking Creek Valley stores cool, clean, fresh, free-flowing, natural water, underground, free; not in a bottle of unknown source. This is the source water for Chesapeake Bay as well as the Gulf of Mexico. There are more miles of the Great Eastern Continental Divide in Craig County than any other county in the Commonwealth of Virginia. Our common wealth of fresh water it is.

29) Protect the Source waters that are still clean.

30) Consider this region a "NO-BUILD-ZONE" due to the high risk of damaging clean water here.

2015 SEFOP: Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Virginia

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The information of Craig County's natural environment and natural resources was obtained from numerous sources including: the Virginia Division of Mineral Resources, the Department of Environmental Quality, Virginia Department of Forestry, U.S. Forest Service and the USDA Natural Resources Conservation Service and private Citizens of Craig County, including me. I have lived in Happy Hollow since 1987 and recorded precipitation events since 1996.

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About the Author

Nan Gray is a Licensed Professional Soil Scientist, has a Master of Science degree in Agronomy from the University of Illinois and a B.S. in Chemistry from Wilmington College, Wilmington, Ohio. Ms. Gray is also the President of Soil Works, Inc., a SWAM and DBE business. The author and her husband, Eric Day (State Entomologist) have lived in Sinking Creek Valley since 1987 and are also Farmers of fresh, local, mountain grown, organic asparagus. They thrive in Craig County, Virginia.

Appreciation to these folks who influenced me with this undertaking

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Natural Resource Conservation Service
Virginia Department of Environmental Quality Soil Science Society of America
National Society of Consulting Soil Scientists

Announcement for the Southeastern Friends of the Pleistocene (SEFOP) Annual Field Trip:

SEFOP 2015: Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

April 25-26, 2015 **THIS EVENT HAPPENED 25-26 April 2015**

The trip will explore the soils and surface processes of damplands, intermittently wet lands and wetlands in karst, alluvium/colluvium, sagponds, fens and seeps in Craig, Giles and Montgomery Counties, Virginia; Mountain Lake Biological Station Spruce Bog and NEON project, the lake at Mountain Lake, mosaic wetlands at Maywood in Sinking Creek Valley; the intermittently wet land turlough/polje of Meadow Creek; the Castle Sands Quarry near the Virginia Mineral Springs of New Castle; the ancient, giant rock-block landslide emplacement of Huckleberry Knob and its sagpond on Sinking Creek Mountain, and episodic infill features of John's Creek Valley where the endangered James spinymussel lives are all on the tour and more!

Day 1 will run from ~8 am – 5+ pm, Start in Sinking Creek Valley and end up in Craig's Creek Valley. Day 2 from ~8 am – 2 pm, start in Sinking Creek Valley, up to Mountain Lake, then John's Creek Valley.

Free primitive camping and delicious clean water will be available starting Friday night at a farm about 30 minutes North of Blacksburg, via 460 W to Newport and northeast on Route 42. The trip will depart from this location on both days. Or folks may find their own lodging in Blacksburg, VA.. Participants will be responsible for their own transportation and all of their own meals.

Cost: $$$ THIS EVENT HAPPENED 25-26 April 2015 cash or good check paid on site when you get here.

We shall stop at New Castle for lunch Saturday. You may pack your own lunch or order a box lunch for Saturday when you confirm the trip. All other food and fieldtrip/camping necessities should be brought with you, including

Hardhat

Safety glasses

Hard toe boots

for the quarry visit.

If you are interested in this trip and plan to join us, please contact me directly.

P.S. THIS EVENT HAPPENED 25-26 April 2015 in a perfect cold intermittent rain and cool temperatures, when a bonfire felt especially good and the company, engaging.

ROAD LOG GUIDE DAY 1 SEFOP Annual Field Excursion for 2015:

Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

<u>SEFOP Road Log Day 1, 25 April 2015</u>

Base Camp Silver Lining Farm
Turn north out of drive way and drive up Happy Hollow Rd.
Turn right at Rts 658 X 662
Turn left onto Rt 42, Cumberland Gap Rd.
Park at Maywood Triangle, Stop 2

Continue upgradient, northeast on Rt 42
Olga Smith Family House on left and Farm

Park at Sinking Creek Store, Stop 3
Walk up John Price driveway to see active sinkholes

Continue northeast on Rt 42
Notice sinkholes and surface water of Sinking Creek

Great Eastern Continental Divide
Continue on Rt 42
Turn left onto Rt 624
Notice gushing spring emerge from hillside – this is the “rises” of water outlet of polje on left
Go approximately 1 mile
Polje “sinks” and larger lake floor of polje/turlough on left

Turn left onto Rt 623, Stop 4
Waggle over to Rt 42
Turn left onto Rt 42
Notice Fish Hatchery on left, Big Spring on right, limestone quarry on right
Notice Sandstone blocks on left roadcut
Continue down mountain on Rt 42 to overlook on right, Stop 5

Continue down mountain to Rt 311, New Castle
Turn left onto Rt 311
Turn right onto Rt 615
Park at Mick or Mack Grocery Store for lunch

Turn left out of parking lot onto Rt 615

Turn left onto Rt 609
Continue on Rt 609 to Castle Sand Plant Quarry, Stop 6
Park on left side of road

Continue north on Rt 609
Turn right onto Pleasant Valley Rd
Turn right onto Rt 615
Notice landform of Virginia Mineral Springs area on left

ROAD LOG GUIDE continued DAY 1 SEFOP Annual Field Excursion for 2015:

Continue on south Rt 615 to New Castle
Turn left onto Rt 311

Turn right onto Craig’s Creek Rd., Rt 621
Continue to Caldwell Fields
Park in parking lot on left

Consolidate group into as few vans as possible
Drive to Huckleberry Knob, Stop 7 (this will take 25 minutes)
Return to parking lot

Turn right onto Rt 621
Continue to Rt 460
Turn west-right to Newport and Base Camp, east-left to Blacksburg
Turn right onto Rt 42 at Newport

Continue northeast on Rt 42, 8.5 miles

Turn left onto Rt 662, Happy Hollow Rd.
Continue on Rt 662, 0.7 mile
Turn left onto Tanyard Trail and Happy Hollow Rd. Base Camp

ROAD LOG GUIDE DAY 2 SEFOP Annual Field Excursion for 2015:

Damplands, Intermittently Wet Lands and Wetlands of the Valley and Ridge Province of Southwest Virginia

<u>SEFOP Road Log Day 2, 26 April 2015</u>

0.0 Base Camp Silver Lining Farm
Turn north out of drive way and drive up Happy Hollow Rd.
Turn right at Rts 658 X 662
Turn right onto Rt 42, Cumberland Gap Rd.
Continue to Newport

Turn right at Rt 42 X Rt 460 and head west Continue on Rt 460 to Mountain Lake Rd., Rt 700 Turn right onto Mountain Lake Rd.
Continue on Mountain Lake Rd to top of mountain
At Mountain Lake Hotel turn left onto Rt 613
Travel Rt 613 to Mountain Lake Biological Station, Stop 1

Leaving the MLBS turn left onto Rt 613
Turn onto Rt 700 past Mountain Lake Hotel
Turn left onto Cork Screw Rd., Rt 602
Turn left onto Rt 601 to go up and over John's Creek Mountain

Notice larges plates of sandstones, broken and heaved up at 30 degrees.

Continue down John's Creek Mountain into John's Creek Valley on Rt 601.
Turn right on to Rt 632, John's Creek Rd., Stop 2 Notice flood plain shape and sizes of deposit material.

Continue on John's Creek Rd to Rt 658. *

Turn right onto Rt 658 and go up and over the Great Eastern Continental Divide on John's Creek Mountain Turn right onto Rt 662, Happy Hollow Rd
Arrive Base Camp, turn right onto Tanyard Trail

* If time permits we may see Craig Healing Springs
Continue on Rt 632 to Maggie, turn left onto Rt 658, Dick’s Creek Rd.
Craig Healing Springs is near Rt 658 X Rt 569
Turn right onto Rt 569
Turn right onto Rt 632
Continue on Rt 632 back to Maggie
Continue on Rt 632 to Rt 658 over John’s Creek Mountain
Turn left onto Rt 658

INDEX

GLOSSARY

