Panola Mountain State Park

Watershed Trail

ⓘ This trail has RED markers.

Introduction

This 1¼ mile trail skirts two branches of a small creek draining the piedmont uplands. A watershed describes an area containing a network of streams and rivers that all drain into a larger body of water. This creek drains into the South River, which joins the Oconee, eventually becoming the Altamaha which empties into the Atlantic ocean. The vegetative cover of the watershed influences the rate and amount of runoff, as well as water quality. Along the trail you will see evidence of poor agricultural practices in the past, which greatly increased stream erosion and siltation. Modern resource management is improving the watershed's ability to conserve high-quality water.

Common Birds

Woodpeckers: Red-bellied, Pileated, Hairy, Downy, Northern flicker
Warblers: Pine, Common yellowthroat
Song birds: Blue jay, Eastern towhee, Northern cardinal, Carolina chickadee, Tufted titmouse, Eastern phoebe, Northern junco, White-throated sparrow
Soaring birds: Turkey vulture, Red-tailed hawk, Red-shouldered hawk
Ground birds: Mourning dove, Turkey

[A] Second-growth Forest

The trees here are similar in size and age. The original forest was removed decades ago to create agricultural fields. This second growth forest is composed of pioneer trees such as pines and sweetgum. Most of the pines are loblolly pines (*Pinus taeda*), a tree which can quickly colonize disturbed areas. Loblollies have three needles per bundle, and gray-brown bark broken into large plates.

[B] Prescribed Fire

Notice the black burn marks on the tree trunks. This forest is maintained by frequent, low-intensity fires set by the park staff (a process called prescribed burning). Fire releases nutrients, and opens up the understory. Deer can browse on the forest floor. Without fire, this open pine woodland would succeed to a dense mixed-hardwood forest. Stumps remain where trees were recently thinned. The remaining trees have more light, water and resources, promoting a healthy forest.

ⓘ Ascend the stone steps.

[C] Watershed

A watershed is an area of land drained by a network of streams and rivers. Precipitation is either absorbed into the soil or drains into the river system. Land use in the watershed greatly affects the amount of runoff. Buildings and pavement shed water quickly. When croplands are on slopes, rapid runoff can cause erosion. Keeping the uplands of a watershed forested replenishes ground water, which is released slowly into streams.

ⓘ Turn right at the trail intersection.

[D] Forest Structure

The forest has several levels. A high canopy layer forms the "roof", composed pines and hardwoods. There is a midstory of small trees, a shrub layer and a ground layer. Multiple layers allow plants to maximize sunlight. Behind and left of the marker are two flowering dogwoods (*Cornus florida*) common midstory trees. They have oval pointed leaves, and showy white blossoms in the spring. Their bark is divided into many small square plates. Other midstory trees are sourwood, American beech and black cherry. The shrub layer here is mainly composed of small trees. The ground layer is sparse. As the trail descends to the creek, notice how the forest structure changes.

[E] Erosion Gully

This deep gully is a scar from severe erosion during the agricultural period of the 19th and early 20th centuries. If you look across the gulley you can see the deep red-orange clay soils that erode easily. Tiny clay particles suspended in water reduce its clarity and degrade water quality. Stripping the land for agriculture increased runoff, speeded erosion and impoverished the soils.

ⓘ Turn left at the trail intersection.

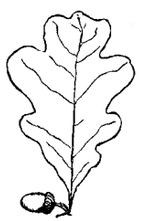
[F] Tree Roots

The 25-foot deep gully is dramatic evidence of uncontrolled erosion. The steep walls and fairly straight channel indicate high energy as the water sped downhill. The roots of this old tulip tree were undercut when the creek was rapidly down cutting its channel. Fortunately, upstream land use changed before this tree was toppled. Tree roots help hold the soil in the gulley sides, slowing sideways erosion and contributing to the gully's steep sides.

ⓘ Return to the trail and cross the bridge.

[G] Natural Recovery

This bridge crosses the deep gully, still apparent many decades after farming ceased in the area. Trees such as oak and maple are growing in the stream channel, indicating water flow is much less than when the stream was actively down cutting its channel. Tree roots help hold the clay soils during heavy rains. Roots at the surface of the stream channel act as a miniature dams, slowing water and allowing sediments to settle. The tall tree with somewhat shaggy bark to the right of the marker is a ← white oak (*Quercus alba*). The light green leaves are 5 to 9 inches long, and divided into 7 to 10 lobes. White oaks grow in a variety of conditions, from moist to dry.



[H] Hanging Channel

This side creek has much less water than the main creek. Rapid down cutting of the main creek channel left this side creek "hanging" about 20 feet above where it meets the main creek. The shallow profile of this side creek, low flow, and gentle gradient makes it easier for leaves to accumulate and plants to grow, speeding its recovery from erosion.

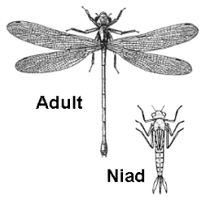
[I] Hardwood Forest

The canopy trees are mostly large hardwoods. During agricultural times forested buffers were left along streams, where the land was too steep to farm.

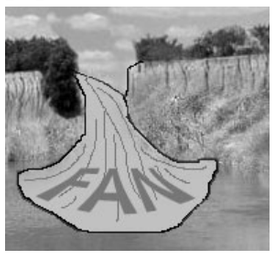
Southern red oak (*Quercus falcata*) has leaves of two different types: pear-shaped with 3 rounded lobes or with 3 to 5 irregularly-shaped lobes. The central lobe is usually strap-like and conspicuously long.

[J] Water Quality

This side creek flows over the hard granite bedrock, aerating the water, and improving its quality. Stones and woody limbs in the stream channel provide habitat for many types of small aquatic animals (called macro-invertebrates) such as damselflies. The adult looks like a dragonfly, while the larvae (called a niad) is equipped for an aquatic life. Other macro-invertebrates include crustaceans (crayfish, sideswimmers, and aquatic pillbugs), mollusks (snails, clams and mussels), and arachnids (aquatic mites). The presence of many types of macro-invertebrates indicates high water quality.



[K] Alluvial Fan



This is the outlet of the deep gully you saw at marker E. At the bottom of the hill, water velocity slowed resulting in a toe-like deposit (called an alluvial fan). The stream you just crossed was deflected to the right to flow around the toe of this fan.

[L] Meanders

Streams flowing in flat areas have sweeping bends called meanders. Meanders change position as faster water erodes the outside of the curve. Slower water on the inside of the curve deposits sediments. The narrow neck of land separating these two meanders will eventually erode, allowing the stream to resume its original (fairly) straight course.

[M] Floodplain

The flat area to the right of the stream is called a floodplain. It is formed by deposits when the creek overflows its banks during periods of high flow. The slower water drops its sediments, building up a flat plain. The forest is diverse and complex due to moist conditions, rich soil, shelter from high winds, and lack of disturbance. The tall shrub to the left of the marker at the end of the bridge is pinxter azalea (*Rhododendron canescens*), commonly found in the bottomlands. It has clusters of light green oval leaves with a tiny tooth at the end. Its showy, fragrant pink flowers appear at the branch tips in early spring.

[N] Water Bars

As the trail ascends the hill, it has steps called water bars. Timbers lying across the trail divert rain water to the side, where it percolates into the soil, reduces erosion and replenishes ground water. About 50 feet along the trail you can see natural steps from horizontal tree roots. Both natural and constructed water bars reduce erosion and trail damage.

[O] Mature Hardwood Forest

Almost all the trees here are hardwoods of many types. Notice that there are a few large trees, and many younger ones. Mixed-age trees are a sign of a healthy forest that has not been disturbed for many years. Right of the marker is a small water oak (*Quercus nigra*). Its leaves are 2-4 inches in length and wider toward the tip. Oak acorns are an important food for wildlife such as deer and squirrels.

[P] Slope Forest

As the trail ascends the slope, watch for a transition from the mature hardwood forest of the bottomlands to the second growth pines of the uplands. Stream gullies appear, relicts of erosion from former agricultural fields. A common tree of the slope forest is the American beech (*Fagus grandifolia*). Its alternate ovate leaves are 1½ to 3 inches long, with prominent straight veins and doubly-toothed edges. The leaves turn beige in autumn, and persist on the tree over winter. Turkey, squirrels and deer eat the beechnuts when they ripen in the fall.

[Q] Downy Woodpecker

The open pinewoods are ideal habitat for woodpeckers. You might hear the tapping or the squeaky call of a downy woodpecker (*Picoides pubescens*) foraging for insects on the dead pine 50 feet behind the marker. Woodpecker holes are often enlarged and used by other birds and flying squirrels as nesting cavities. Dead trees left standing are called “wildlife trees” as they provide food and homes for forest wildlife.

[R] Sparkleberry

Sparkleberry, (*Vaccinium arboreum*) is a tall blueberry with reddish-brown shredded bark. It has shiny oval leaves ½ - 2 inches long. The white bell-shaped flowers appear in the spring, and a round black berry matures in the fall. Sparkleberries are relished by birds and small mammals such as raccoons and opossums.

[S] Summary

While walking along the Watershed Trail you traversed a second-growth pine forest recovering from agricultural cultivation. Park staff are improving forest health with prescribed fire and thinning. As the trail descended from the uplands, deeply cut gullies appeared, a legacy of poor agricultural practices in the uplands. Without tree roots to hold the soil, erosional gullies developed where water with high energy shot down slopes during periods of heavy rain. Sediments deposited at slope bottoms created broad floodplains and alluvial fans that disrupted normal stream drainage. Fortunately, during the agricultural period, hardwoods were left along this creek, somewhat reducing erosion. The uplands are slowly recovering now that forest cover has been restored. Water quality is monitored by the number and diversity of macro-invertebrates in the streams. High water quality in a watershed depends on wise use of the surrounding lands.

ⓘ Turn right at the intersection to return to the trail head.

Please recycle this leaflet in the red box at the trail head.

Developed by volunteer naturalist Carol Schneier 2/09

Panola Mountain State Park

Rock Outcrop Trail

ⓘ This trail has WHITE markers.

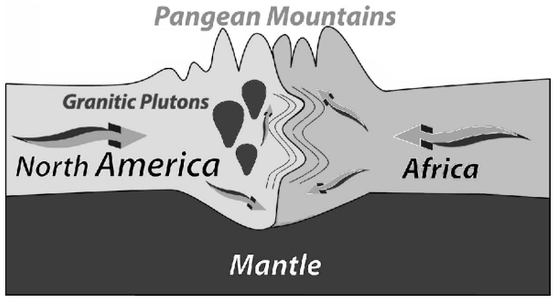
Introduction

This 3/4 mile trail overlooks a granite outcrop typical of many found in Georgia's piedmont. After traversing a second-growth pine-oak forest, the trail brings you to the edge of the outcrop where you can see evidence of the geologic forces that created the mountain, as well as the erosional forces shaping its present appearance. Along the way you will see some of the plants and animals found in this unique ecosystem. All have adaptations allowing them to survive on the bare rock face. This enchanting but harsh environment is called "nature's rock garden."

Common Birds

Woodpeckers: Red-bellied, Pileated, Hairy, Downy, Northern flicker
Warblers: Common yellowthroat, Pine
Song birds: Blue jay, Eastern towhee, Northern cardinal, Carolina chickadee, White-breasted nuthatch, Northern Junco, Carolina wren, Thrushes, Vireos
Soaring birds: Turkey vulture, Red-shouldered hawk, Red-tailed hawk
Ground birds: Mourning dove, Turkey

[A] Outcrop Origins



According to geologists, the earth's outer crust floats on a semi-plastic layer called the mantle. The crust is composed of several large pieces called "plates." During the assembly of the supercontinent Pangea about 300 million years ago, the African plate slammed into the North America plate, crumpling the plate edges and raising mountains. Great heat and pressure altered many rocks. Others melted into granitic magma which slowly rose in tear-drop shaped intrusions called plutons. Volcanoes arose where magma reached the surface. In Georgia's piedmont most of the magma slowly cooled deep underground, leaving a swarm of unconnected plutons.

[B] Weathering

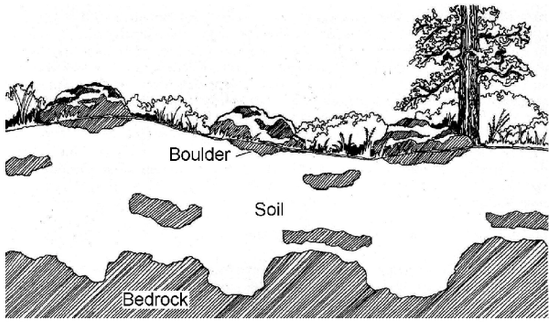
Over many millions of years, about twelve miles of rock overlying the Panola granitic pluton slowly eroded away. Weathering breaks down rock in two ways. Physical weathering is caused by frost cracking the rock, sandblasting from wind, heating and cooling in the sun, plant roots prying the rock apart, and animals digging burrows. Plants and animals also produce organic acids, causing the second type, chemical weathering. These acids plus carbonic acid from atmospheric CO_2 dissolve minerals in the rock, allowing them to wash away. Weathered rock particles (plus plant debris) form soil, which covers most of the Panola bedrock.

[C] Transition: Pines to Hardwoods

Until now, you have been walking through an open pine forest which grew up in abandoned agricultural fields. Ahead of you the forest abruptly transitions to hardwoods such as oaks, hickories, tulip trees and dogwood, indicating this area was not cleared. As you approach the edge of the outcrop, soils are thinner and rocks lie on the surface, making the area unsuitable for farming.

ⓘ Keep right at the trail intersection.

[D] Float Rocks



You can see exposed rocks dotting the forest floor. These float rocks have broken off from the underlying bedrock, and have been exposed as the soil erodes around them.

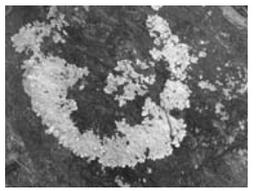
[E] Rock Joint

This large rounded boulder has a long crack in the center, called a joint. During the millions of years that the Panola granite pluton was cooling deep underground, the rock contracted and cracked, similar to the way that clay cracks as it dries and hardens. Joints collect water which speeds chemical weathering. During the winter ice expanding in joints also increases physical weathering. Sometimes trees start growing in rock joints, and the lateral pressure of their roots plus the weak tannic acid from their leaves will slowly widen the joint.

[F] Transition: Forest to Rock Outcrop

As the trail transitions to the outcrop, notice that the trees are smaller, as the soil thins. A few large trees tend to be in lines, as they are growing in cracks where the soil is deeper and there is slightly more water.

[G] Lichens



The splotches on the rock are several types of lichen. Lichens are a mutually beneficial combination of two species: a fungus and an alga. The fungus provides structure, protection and attachment, like a miniature greenhouse. The photosynthesizing alga makes food. Lichens get all the nutrients they need from the air and rain. They secrete acids that break down the rock into soil. Lichens grow very slowly. In the exposed conditions of the outcrop, it can take 25 years for a lichen to grow one square inch (about the size of a postage stamp).

[H] Rock Dens

This boulder outcrop forms hiding places and dens for animals such as the red fox (*Vulpes vulpes*). Each fox has a range of about 5 square miles. In the forest foxes can forage for blackberries, insects, rabbits, bird eggs and amphibians. Food is scarcer on the outcrop, but foxes can eat crickets, blueberries and small rodents such as mice and voles. The open outcrop allows the fox to see approaching threats, as well as allowing fast transportation to other parts of its range.

[I] Outcrop Overlook I

The exposed bedrock forms a gently sloping flat surface called a “pavement rock”, mostly covered with lichens and mosses. Water runoff removes the weathered rock particles, so there is little soil accumulation. You can see tiny drainage channels where the water cascades off the rock. The exposed rock surface is a harsh environment: hot in the summer, and cold in the winter, so few plants can survive. Those that live here have adaptations similar to desert plants: thick leaves with waxy coats or hairs to reflect heat Occasional pockets of soil allow a few hardy plants such as the yellow-flowering woolly ragwort (*Scenecio tomentosus*) to survive.

[J] Granite

The posts holding up the rails are made from Panola Mountain granite quarried in this area. Some of the rocks have polished faces. If you look closely you can see its “salt and pepper” structure. The black grains are biotite mica, and the white grains are quartz and feldspar.

[K] Spoonleaf Yucca

Spoonleaf yucca (*Yucca filamentosa*) is a member of the Agave family. Here in the southeast, it is also called bear grass. Its long leaves are thick to preserve water, and taper to a sharp tip to prevent animals from browsing. They have frayed fibers at the edges. The flowers are on a tall stalk to keep them from drying out in the intense heat on the rock surface.

[L] Outcrop Lichens and Mosses

You can see several species of lichens and a moss that can grow in conditions too harsh for flowering plants. Most abundant is the peppered rock lichen (*Xanthoparmelia conspersa*) which has flat yellow-green narrow-lobed rosettes. The dark patches are resurrection moss (*Grimmea laevigata*). It quickly turns green and starts to photosynthesize when even a tiny amount of water falls on it. The pale green finely branched cushions are Dixie reindeer lichen (*Cladonia subtenuis*). The yellowish-olive balls are a close relative, olive cladonia (*Cladonia strepsilis*).

[M] Edge Community

Here there is enough soil to support a few hardy trees such as red cedars and winged elm ← (*Ulmus alata*). The elm’s 2-inch leaves have prominent veins and corky growths on the twigs. It flowers in late winter. The winged fruits appear in early spring, providing an important early source of food for wildlife. During wetter years the edge community creeps out onto the outcrop. During periods of droughts vegetation dies back, allowing lichens and mosses to increase in area.

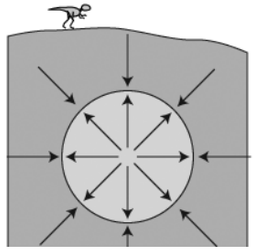
[N] Hawks and Vultures

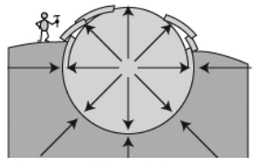
As sunlight warms the exposed outcrop, heated air expands and rises in thermals. This is a good area to watch for vultures and hawks soaring on these thermals, looking for food. The red-shouldered hawk (*Buteo lineatus*) is medium-sized with a striking barred black and white tail. The 3 to 4 foot wings are light below, and its belly has reddish bars. It feeds on small mammals (chipmunks and mice), frogs, snakes and small birds.

[O] Outcrop Overlook II

Stone Mountain appears to the north east. It is not connected to Panola Mountain, and has a slightly different granite. Here, the lichen-covered pavement rock is dotted with little rock gardens growing in depressions called solution pits that collect soil and catch water runoff. Taller vegetation indicates more soil and water. Deeper cracks support drought-tolerant pines, but their existence is tenuous. You can see several pines killed by drought.

[P] Exfoliation





Outcrop boulders tend to form thin slabs, caused by a process called exfoliation. As the granite pluton cooled deep within the earth, outward pressure balanced inward pressure. However, as erosion removed the overlying rock, pressures were no longer balanced. The rock expanded and formed horizontal cracks. Look for vertical drill holes from quarrying in the past.

[Q] Reptiles

These tumbled rocks provide homes for wildlife such as snakes and lizards. You might see a fence lizard ←(*Sceloporus undulates*) scurrying along. A common non-venomous snake is the black rat snake. Venomous copperheads sometimes sun themselves on the flat rocks. If you are lucky enough to see one, please leave it alone.

ⓘ Turn left at the trail intersection.

[R] Summary

The Georgia piedmont has thousands of rock outcrops, formed from granitic plutons cooling deep within the earth during tectonic plate collisions. Millions of years of erosion have removed overlying rocks, exposing the hard granite. This tiny outcrop area contains most of the features of these natural rock gardens. Trees in the surrounding forest diminish as the soil thins at the outcrop edge. The pavement rock is covered with yellow-green peppered rock lichen and dark resurrection moss. Solution pits trap soil and moisture, supporting herbs and grasses. Boulder crevices and exfoliated slabs provide shelter for animals such as foxes, fence lizards, and snakes. Soaring birds circle overhead in the thermals generated by the sun heating the outcrop.

The tiny annual Diamorpha ←(*Diamorpha smallii*) illustrates many survival strategies of outcrop plants. It germinates in late fall when temperatures are cooler and water is more abundant. Only 3 inches high, its fleshy red leaves conserve water and reflect sunlight. Its delicate pink flowers appear in April. The plant dies shortly after, avoiding the hot dry summer. Seeds hang on the dried stems where the air is cooler and drop into the solution pit in the fall.

ⓘ Continue straight on this handicap access trail to return to the trail head OR turn around, retrace your steps to the trail junction and turn left to continue on the Rock Outcrop trail.

Please recycle this leaflet in the white box at the trailhead.

Developed by volunteer naturalist Carol Schneier 2/09