A Preliminary Study of a Virgin Forest Tract of the Cumberland Plateau In Laurel County, Kentucky

Joe E. Winstead and Kenneth A. Nicely
Department of Biology, Western Kentucky University, Bowling Green, Kentucky 42101

Abstract

A deep gorge forest community, proposed as the Rock Creek Natural Area, is dominated by hemlock, tulip poplar, sweet birch, and red maple with a high density of trees and large basal area per hectare. It is a unique area that shows great potential for more detailed analysis of the structure and function of the mixed mesophytic forests of Kentucky.

Introduction

Although the literature is voluminous concerning forest structure in the eastern United States, there are very few studies involving undisturbed, virgin, or relict forest tracts in Kentucky, and the existence of mature forest stands that have not been subject to man's impact are rare indeed in the state. In order to add to information concerning what represents perhaps one of the few deep ravine forest communities of the Cumberland Plateau still in its primeval condition, and to initiate further investigations of the area, this study was undertaken in 1973–1974.

The site is in the Sawyer Quadrangle, U.S. Geological Survey Topographic Quadrangle Series (36° 59′ N. Lat., 84° 17′ W. Long.) and lies 30.6 km southwest of London in southwestern Laurel County, Kentucky (Fig. 1). The study area is designated as the Rock Creek Gorge which lies within the boundary of land proposed as the Rock Creek Natural Area (72.47 ha) by the U.S. Forest Service (Hemmingway 1938). That designation was made in 1939, and as such it has been preserved in unmodified condition with no timber removal and no agricultural use, and is within the boundaries of the Daniel Boone National Forest.

The Rock Creek Gorge extends from almost a sheer cliff line to a depth of approximately 48 m and covers an area from the Rockcastle River to the head of the gorge of about 2 km. The gorge is narrow and from rim to rim is perhaps 460 m. The natural beauty of the gorge and adjacent cliffs is striking. The sandstone cliffs dropping straight down or more often with "rock house recesses" to dense rhododendron stands, numerous small waterfalls from the cliff rim, and the immense trees, which often tower above the cliff line give this site a primeval appearance. The rugged topography makes it one of the most appealing places to visit within the Cumberland Plateau and perhaps in the eastern states. There are at best only a few such sites with these particular combinations of qualities remaining in the Appalachian Region.

This area lies within the Mixed Mesophytic Forest Region, Cliff Section, as described by Braun (1950) and was used by Braun as an example of gorge vegetation in hemlock mixed mesophytic forests. The location probably is representative of the original vegetation of this physiographic region. This site was included under the broad theme study of *Mixed Mesophytic, Western Mesophytic, and Oak–Chestnut Regions of the Eastern Deciduous Forest* by Catherine Keever for the National Park Service, Department of Interior, and was subject to evaluation by the National Park Service as a potential Natural Landmark. Such an evaluation was made by the authors for the National Park Service in 1973 and that work initiated the present investigation.

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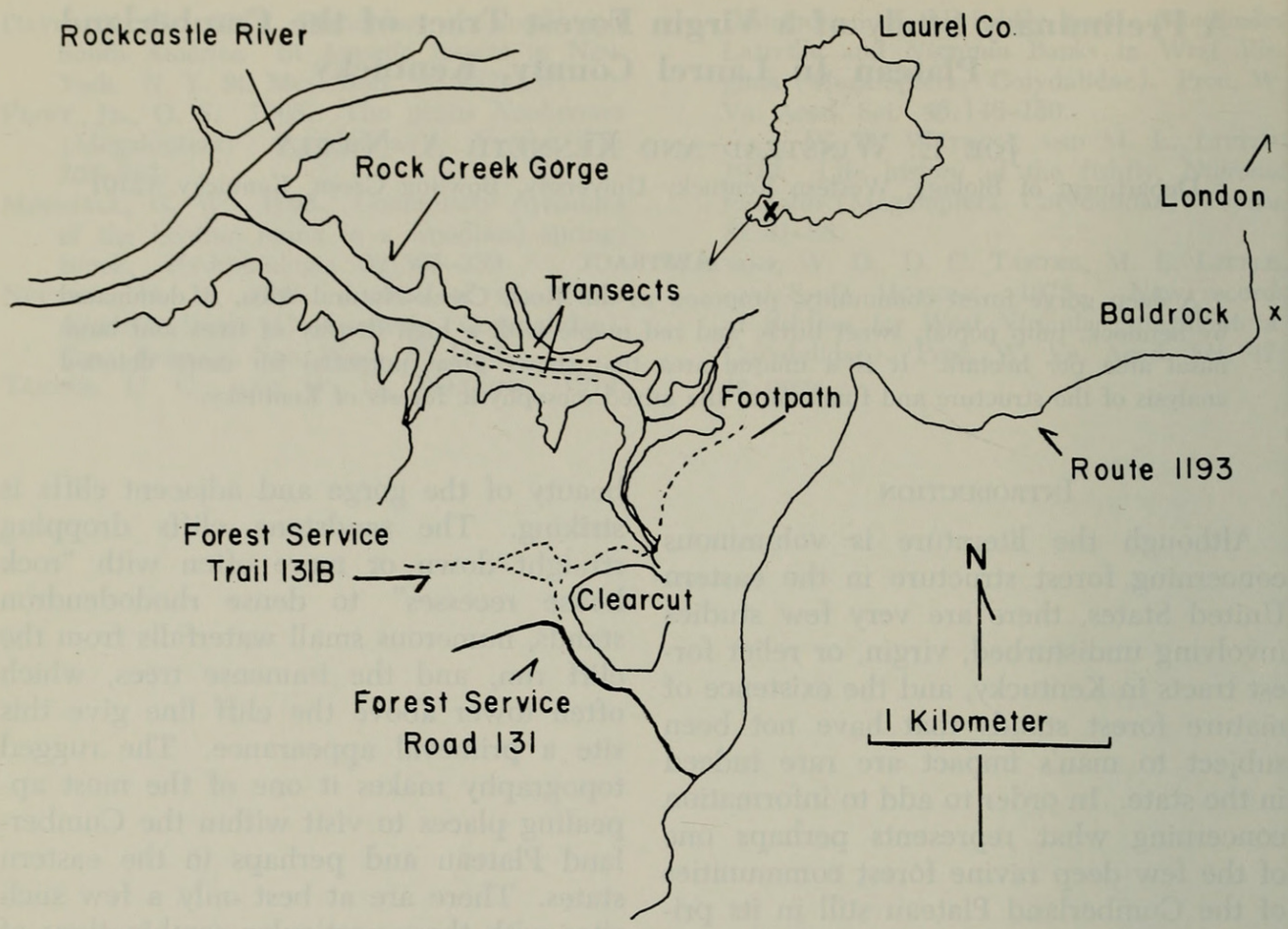

FIG. 1. Location of Rock Creek Gorge in Laurel County, Kentucky

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METHODS

In the upper section of the gorge, 2 750-m transects were arbitrarily placed approximately halfway between the stream and cliff line with one transect on either side of the stream (Fig. 1). Each transect ran in a northwesterly direction on a compass line of about 320 deg. Along each transect, trees greater than 10.16 cm (4 in) in diameter breast high (dbh) were sampled using the random pairs method of Cottam and Curtis (1949, 1950). The random pairs were determined at 30-m intervals along each transect line. A total of 50 pairs was sampled. The presence of numerous large trees was striking throughout the area and an additional 10 of the largest seen but not sampled in the random pairs method were also measured for diameter. One large hemlock was cored for growth ring analysis.

RESULTS

The analysis revealed 13 different species composing the tree flora with 4 species (hemlock, tulip poplar, sweet birch, and red maple) composing over 82 percent of the basal area measured and making up 64 percent of the total (Table 1). The average distance between trees sampled was 5.0 m with a range of 2.4 to 10.6 m. The average dbh of the 100 trees measured was 28.1 cm (11.1 in). Calculation of the mean area per individual (16.0 m^2) indicated that the area of the gorge sampled contains some 672.8 trees per hectare (272.4/acre). Using the average diameter value, the es-

TABLE 1.—THE NUMBER (N), BASAL AREA IN SQUARE METERS (BA), PERCENTAGE OF TOTAL BASAL AREA (%BA), AND AVERAGE DIAMETER BREAST HIGH IN CENTIMETERS (ADBH) OF TREES OVER 10 CM DIAMETER SAMPLED IN THE ROCK CREEK GORGE

	N	BA	%BA	ADBH
Tsuga canadensis	23	4.37	44.5	39.0
Liriodendron tulipifera	13	1.86	19.8	37.6
Betula lenta	14	.95	10.1	25.4
Acer rubrum	14	.75	8.0	24.6
Quercus rubra	5	.47	5.0	30.5
Ilex opaca	9	.30	3.2	19.1
Nyssa sylvatica	6	.27	2.8	21.2
Prunus serotina	5	.19	1.9	20.6
Fagus grandifolia	5	.08	.9	14.2
Quercus alba	1	.07	.8	30.5
Magnolia macrophylla	2	.04	.4	14.7
Carpinus caroliniana	1	.03	.3	19.1
Cornus florida	2	.02	.2	10.2

timated number of trees per hectare gives a calculated basal area of 47.5 m^2/ha.

The 10 measurements of very large trees noted outside the sampling area averaged 91.2 cm (35.9 in). Of the trees, 5 were hemlocks with diameters of 57.1, 74.9, 82.5, 91.7, and 100.1 cm, 4 tulip poplars measured 90.2, 103.1, 106.2, 113.0 cm dbh, and 1 red maple showed a dbh of 91.2 cm. The hemlock with a diameter of 57.1 cm was cored and 225 growth rings counted.

DISCUSSION

This brief analysis confirms in part an earlier cursory investigation by Braun (1950) and also indicates the need for much more detailed studies concerning the structure and functions of Kentucky's mixed mesophytic forest sites. The sampling of 117 canopy trees by Braun (1950) included 12 different species compared with the 13 tree species of the present study. The earlier work indicated hemlock, tulip poplar, and red maple as dominant species which coincides with this study except the 1974 analysis also shows sweet birch being equally as dominant as red maple. Braun's canopy study indicated sweet birch composing 6.8 percent of the total trees noted. The present study included 9 of the 12 different species listed by Braun. The random pairs analysis did not detect a trace of *Quercus montana*, *Oxydendron arboreum*, and *Castenea dentata* as recorded by the early survey by Braun. The removal of *Castanea dentata* from the area by the chestnut blight of the 1930's might have been an event that lead to the increase in sweet birch. Species included in the 1974 study that were not noted by Braun were *Prunus serotina*, *Quercus alba*, *Carpinus caroliniana*, and *Cornus florida*. The 5 percentage species composition of black cherry found in 1974 might also be the result of changes due to the elimination of the chestnut. The close similarity of the dominant tree species with data collected by Braun some 40 years earlier indicates the stability of this deep ravine woods of the mixed mesophytic forest.

Little quantitative data are available concerning undisturbed forest sites in Kentucky. Secondary succession studies in a hemlock–mixed mesophytic forest known as "Tight Holler" in Wolfe County have been recently published by Herman and See (1973). Although the "Tight Holler" site is referred to as virgin tract, there is evidence of considerable disturbance over much of the area by logging, and extensive agricultural activity along the immediate boundaries of the location also indicate dangers to its preservation. As a natural study area of an undisturbed forested area, the authors feel that the Rock Creek Gorge surpasses the better known Wolfe County location.

The Rock Creek Gorge probably compares favorably with sections of the Lilley Cornett Woods in Letcher County, Kentucky. Significant data on the composition of Lilley Cornett Woods have been compiled by Martin and Shepherd (1973), and Martin (1975). The hemlock communities of northeastern slopes in Lilley Cornett Woods show less density (321 stems/ha compared to 672 stems/ha) and basal area (42.4 m^2/ha compared to 47.5 m^2/ha) than the Rock Creek site. The existence of these 2 outstanding virgin forest tracts

and their protection from any commercial disturbance by man provides great potential for more in-depth studies comparing forest structure and function of the Cumberland Plateau.

Although no quantitative data have been gathered, the area above and adjacent to the cliff rim of the Rock Creek Gorge is worthy of mention. Second growth oak–hickory forest communities or in some instances oak–tulip tree and oak–pine or pine stands characterize the surrounding terrain. Common constituents are *Quercus alba*, *Q. velutina*, *Q. stellata*, *Carya ovata*, *C. tomentosa*, *Cornus florida*, and *Pinus echinata*. One would expect to find other oaks and hickories along with sourgum, red maple, and Virginia pine. These forests lie in interstream areas and have a somewhat xeric aspect in sharp contrast to the true mixed mesophytes in the gorge proper. Shrubs number only a few species but often form scattered and even dense patches. Species of *Vaccinium* and other heath type shrubs prevail. The most significant of these are the abundant patches of the box huckleberry *Gaylussacia brachycera*. This shrub is common, and occurs in similar habitats in Laurel and McCreary counties but is relatively rare as only 12 or so locations are recorded throughout the eastern United States. This in itself makes the general area somewhat unique. Along the small streams which dissect these forest communities and then drop suddenly into the gorge below, more mesic tree species and some secondary hemlock are present.

The area immediately surrounding the south side of the gorge has been designated a research area by the U.S. Forest Service. There is one clear-cut area that was established in 1965. This 10-year-old clear-cut section with excellent second growth mesic forest on the bluffs and ridges along with the primeval hemlock–hardwood association of the gorge gives this site a unique significance in regard to educational values. This site lends itself as a valuable demonstration of old, intermediate, and young growth stages of the Mixed Mesophytic Forest Region. The integrity of the Rock Creek drainage area is assured by the designation of the site as a research and natural area by the U.S. Forest Service and by the selection of the area as a registered natural landmark by the Department of the Interior.

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