

The Vegetation of an Actively Eroding Canyon In Canadian County, Oklahoma¹

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INTRODUCTION

Two general types of canyons are present in Caddo County and southwestern Canadian County, Oklahoma. Some are in an active state of being re-excavated and others have been eroded to the original sandstone walls and are now in a comparatively stable condition. Among the outstanding features of the older canyons are the vertical red sandstone cliffs and the disjunct stands of sugar maple (*Acer saccharum*).³

Little (1939) studied the vegetation of four of the stable canyons in Caddo County. He found the forests on the canyon floors to be dominated by *Acer saccharum*. Rice (1960) compared the micro-climate in one of these canyons with that of the adjacent uplands. Taylor (1961) made an ecological and taxonomic study of the Water Canyon complex in Canadian County which includes both stable and active canyons. The Water Canyon complex includes the canyon under investigation.

Objectives of the present study were to make a quantitative analysis of the vegetation of the actively eroding Activity Canyon and to correlate vegetation types and plant species with the habitats within the canyon.

Activity Canyon is located in southwestern Canadian County 4 miles east and 2 miles south of Hinton, Oklahoma. The head of the canyon is in Section 17, T11N, R10W. The canyon runs to the northeast and drains into the South Canadian River.

The canyon is cut into the Rush Springs member of the White Horse Sandstone formation of Permian age. Norris (1951) indicated the canyons of the area were originally carved during the Pleistocene period. Subsequently, they were alternately refilled and re-excavated, many of them being in the process of re-excavation at the present time.

The canyon is approximately 103 feet deep and 240 feet from rim to rim at the boxhead. There is a gradient of approximately 35 feet in the 4800-foot length of the canyon floor, which is traversed by a small spring-fed stream.

In the upstream quarter of the canyon the weathered sandstone cliff is exposed along the north side. On the south side the sediments have not been re-excavated. The loose sandy deposit slants from the canyon rim to the timbered floor at an angle that varies from 40 to 60 degrees. Small land slides are common on the slope. The more stable portions of the slopes are covered mainly by grasses, a few shrubs and a very few scattered trees. Farther downstream several vertical walls, composed of loosely cemented sediment, are subject to slumping during periods of heavy rainfall. The upper slopes of the downstream third of the canyon are more gradual and are heavily wooded.

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³Nomenclature after Waterfall (1966).

The vegetation of the canyon proper, except the downstream timbered slopes, was undisturbed by man or cattle. The sparse herbaceous vegetation of the timbered slopes, above the canyon rim, was quite heavily grazed.

METHODS

The field work on the vegetation of Activity Canyon was done between February 1 and October 1, 1962. Vegetation with the exception of vines and shrubs was sampled by the point-centered quarter method (Cottam and Curtis, 1956). When sampling trees and saplings, points were spaced at 20-pace intervals along a compass line. Herbaceous species were sampled at points two paces apart. The distance from the point to the center of the trunk or stem was measured. The diameter breast high of trees, actual frequency and actual density were recorded in the field. Relative basal area of trees, relative frequency, relative density and importance value (Curtis and McIntosh, 1951) were calculated. The line intercept method (Canfield, 1941) was used to sample the shrubs and vines. The specimens cited have been deposited in the Bebb Herbarium at the University of Oklahoma.

RESULTS

Because there can be considerable variation among relative values for frequency, density and basal area of a given species, the sum of these parameters, or importance value, best expresses the relative importance or dominance of that species.

The dominant trees on the floor of the canyon were *Salix nigra* and *Populus deltoides* with importance values of 152.0 and 93.4, respectively (Table I). *S. nigra* was more than twice as abundant as *P. deltoides*. The average basal area per tree was more than twice as great for *P. deltoides* as for *S. nigra*, 80.3 and 39.1 square inches, respectively. *Juniperus virginiana* and *Ulmus americana* were of secondary importance.

A comparison of the timbered slopes of the downstream portion of the canyon revealed that the dominant trees on the south-facing slope were *Quercus Muehlenbergii*, *Juniperus virginiana* and *Q. marilandica*, with importance values of 80.1, 74.3 and 55.2. On the north-facing slope the dominant species were *J. virginiana*, *Q. Muehlenbergii* and *Q. Shumardii* with importance values of 96.5, 87.0 and 52.4, respectively (Table I). The basal

Table I. Important Species of Various Canyon Habitats

Species	Importance Value in Habitat*				
	Floor of Canyon	South-facing Wooded Slope	North-facing Wooded Slope	Junction of Slope and Canyon Floor	Grassy Eroding Slopes Areas
<i>Salix nigra</i>	152.0				
<i>Populus deltoides</i>	93.4				
<i>Quercus Muehlenbergii</i>		80.1	87.0		
<i>Juniperus virginiana</i>		74.3	96.5		
<i>Quercus marilandica</i>		55.2			
<i>Quercus Shumardii</i>			52.4		
<i>Cornus Drummondii</i>				76.7	
<i>Andropogon scoparius</i>					98.9
<i>Conyza canadensis</i>					33.4
<i>Digitaria sanguinalis</i>					15.8
<i>Sorghum halepense</i>					15.0

* Importance value of trees based on possible value of 300. All other species based on possible value of 200.

area was 87.4 square feet per acre on the south-facing slope and 78.2 square feet per acre on the north-facing slope.

The upland species, *Quercus marilandica* and *Q. stellata*, were more prominent on the south-facing slope than on the north-facing slope. The south-facing slope had fewer trees per acre and a better developed herbaceous layer, in which *Andropogon scoparius* was a predominant plant.

Shrubs and vines were scattered throughout the canyon but were concentrated mainly in a narrow band along the junction of the slopes and the canyon floor. *Cornus Drummondii* was the dominant shrub with an importance value of 76.7 (Table I). *Rhus glabra*, *R. radicans* and *Rubus* sp. were secondary species. *R. glabra* was the most common shrub on the grassy slopes.

Seven grassy areas were sampled. These included an east and west slope of a side canyon, as well as north and south slopes of the main canyon. The coefficient of community (Oosting, 1956) was calculated for each possible combination. The grasslands of the east and west slopes had a coefficient of similarity of 61% but they were not similar to those on the north and south slopes. The coefficient of community ranged from 52% to 82% for the five grasslands sampled on the north and south slopes, indicating that they were similar communities.

Andropogon scoparius was by far the dominant plant, being the only plant present in all sample areas, with importance values ranging from 81.2 to 120.6. In general, *Conyza canadensis*, *Sorghastrum nutans*, *Ambrosia psilostachya* and *Elymus canadensis* were the species of secondary importance. More mesic species occurred on the north-facing slopes than on the south-facing slopes.

Seven actively eroding areas were sampled in scattered locations throughout the canyon. Based on total importance values, the predominant species were *Conyza canadensis* with an average of 33.4 and a range of 2.1 to 148.9, *Digitaria sanguinalis* (average 15.8) and *Sorghum halepense* with an average value of 15.0 (Table I). Secondary species included *Bromus japonicus*, *Eriogonum annuum*, *Helianthus petiolaris*, *Amaranthus tamariscinus* and *Ambrosia psilostachya*.

The principal plants of the stream were *Leersia oryzoides* and *Veronica anagallis-aquatica*. The main wetland vegetation along the stream included *Leersia oryzoides*, *Scirpus americana* and *Digitaria sanguinalis*.

DISCUSSION AND CONCLUSIONS

There are seven major types of vegetation in Activity Canyon. The floor of the canyon supports a cottonwood-willow community in addition to the wetland vegetation of the stream edge and the aquatic vegetation in the stream itself. The older, more stable slopes are covered by chinquapin oak-red cedar forests, whereas the more recent slopes support a faciation of the tall grass prairie. A shrub line is found at the junction of the slopes and the canyon floor. The actively eroding areas in the canyon are characterized by communities of annuals and weedy perennials.

The soil in the canyon and on the surrounding terrain is a loose sandy soil and is readily removed by flowing water. In some areas vegetation is held constantly in early stages of succession, either because of the direct action of flowing water or by the under-cutting of the slopes, resulting in earth slides. Even on the slopes where vegetation is well established, tiny to moderate erosion channels occur between clumps of grass. Where the grassy slopes have remained relatively undisturbed, several small *Quercus marilandica* and *Juniperus virginiana* trees have become established. Where

the slopes are more mesic and have been stable for some time, the chinquapin oak-red cedar forest has reached the most advanced state of succession found in the canyon.

Physical changes in the canyon floor have been slow enough so that a cottonwood-willow community has become established, but there are indications that this will be succeeded by a more mesic bottomland forest. Migration of plants is mainly by seeds, although there is evidence that some of the plants, particularly grasses, become established by slumping from the canyon rim. Only an occasional tree survives slumping.

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