FOREST TYPES OF LUSK CREEK IN POPE COUNTY, ILLINOIS

WILLIAM C. ASHBY
Southern Illinois University, Carbondale 62901

ABSTRACT. — Forest types on the valley bottoms and on lower to mid slopes were described from 1562 trees sampled by the wedge prism method. Two distinct communities were consistently evident. On terraces adjacent to the major drainages sugar maple, beech locally, and tulip trees predominated. White oak predominated on the mid slopes. Associated species included red oak, oval pignut hickory, and black oak. The ecological structure and associated shrub and herbaceous species were characteristic for each community. Species typical of bottomland habitats along the Mississippi River were conspicuously absent. The hypothesis is presented that sedimentation during post-glacial events on the Ohio River eliminated the bottomland habitat characteristic of southwestern Illinois, and greatly reduced the lower slope habitat on the middle sector of Lusk Creek.

Lusk Creek is the major drainage of Pope County. It originates in the Shawnee Hills at 800 feet elevation. The drainage basin, 5 miles wide by 15 miles long, empties into the Ohio River, 310 feet meanpool elevation, at Golconda. In the hill portion the courses of the main stream and its tributaries follow geologic faults to a marked degree. Canyon and rock walls are prominent in Pennsylvanian sandstone formations. Relatively small areas of shale and limestone are found.

Several vegetation types are found in the middle Lusk Creek drainage. The broad ridges and broad valley bottoms which were cleared for farming are today either still being farmed or are occupied by successional vegetation. On the uplands this is largely little bluestem (*Andropogon scoparius*) with invading tree species such as winged elm, flowering dogwood, and red cedar. Numerous pine plantations are present. Bottomland old fields may have young canopy forests of box elder or of mixtures including box elder, river birch, sycamore, and tulip tree. A conspicuous herbaceous layer is usually present.

The remaining forest vegetation can be divided into several types. Along the larger streams river birch is a conspicuous species where gravel bars have been colonized by trees. Sycamore occurs along both the larger and the smaller intermittent streams.

The valley bottoms adjacent to larger streams support a well developed forest type, including sugar maple, beech, tulip tree, hickories, and black gum, which will be described in detail later in the paper, as will those of the lower and mid

slopes. The slope forests are dominated by white oak and other oaks and hickories. The upper slopes and ridges support oak-hickory forests in which black oak, scarlet oak, post oak, and oval pignut hickory may be important species. Understory trees such as ironwood, dogwood, and winged elm are characteristic of many slope forests.

The Illinoisan glaciation reached to within about 10 miles of the study area. Geologic influences of Wisconsin glaciation are found in loess deposits and in the levels of valley sediments. Surface soil materials are silty, usually with little sand, and little clay. On the slopes rock is often present, and local areas may have numerous large boulders or outcrops.

A marked change in slope occurs from the valley sides to level areas which may extend a few hundred feet in width adjacent to a stream. The active stream channel is entrenched 6 to 12 feet below the level valley bottoms. Usually silt predominates in the entrenchment wall, with sand variable and generally low in amount. No areas with substantial amounts of clay were found. Above the 400-foot contour, bedding in the stream bank revealed occasional areas with extensive gravel.

The channel areas between extensive pools which persist through the summer are predominantly gravel. Thickets of river birch, with occasional deciduous holly (*Ilex decidua*), may be found on these gravel areas. Usually the channel splits to form island-like segments of the flat valley bottom below the confluence of smaller drainages from the adjacent hills. Where the larger streams meet there may be broader, alluvial plains more than 1000 feet across which have been cleared for agriculture.

Climatically the county is characterized by hot summers (average July temperature over 78°F.), moderate winters (average January temperature over 34°F.), and generally well-distributed precipitation with an average at Golconda on the Ohio River of 45 inches (Page, 1949). The extent of topoclimatic variation in the hill country which includes steep canyons and narrow valleys is not known.

Materials and Methods

The study areas selected extended 6 to 10 miles upstream from a projected high dam site at 340 feet stream elevation in Section 32, Township 12 S, Range 6 E, Pope County, southeastern Illinois, approximately midway between Eddyville and Golconda. The estimated lake level of approximately 455 feet above sea level formed an upper limit for study areas both upstream and on hill slopes. Other limits were the occurrence of well-developed forests of adequate size for sampling. These became restricted as the valleys narrowed going upstream.

Preliminary forest evaluations were made from topographic maps and aerial photographs. Most of the area was also inspected by foot. A sight list of the trees was compiled for each area visited. Plotless estimates of basal area using point sampling with a wedge prism, basal area factor 10, (Grosenbaugh 1952, 1958) were carried out in selected stands approximately 100 feet or more across and several hundred feet in extent. Using an optical system to determine an exclusion angle in selecting trees to tally, the probability of tree selection is proportional to tree basal area. Trees less than 3.6 inches in diameter (4-inch class) were excluded. Sampling points were usually 100 feet apart. In areas of exceptionally large trees, greater distances were used. The valley bottom areas with good timber stands were sampled rather thoroughly. A total of 359 trees from 4 major areas were tallied in the Little Lusk Creek drainage, and 585 trees from 5 areas in that part of the Lusk Creek drainage

upstream from the projected dam site. Representative areas of good stand development on the slopes along Lusk Creek were sampled for a total of 618 trees on 6 major areas. The larger trees of the various species were measured to indicate relative sizes.

Observations were made of the ecological structure of the forest communities on the two physiographic sites. A cover estimate was made for the canopy, understory, shrub, and herbaceous strata or layers. Dominant species in the several layers were listed. Evidences of past disturbances such as stumps were recorded. In each point sample all dead trees were tallied, and where possible species identification made.

Slopes ranging from 7 to 26 degrees were chosen. The average count of trees for each location using the wedge prism was multiplied by the secant of the average angle of slope perpendicular to the contour. The valley bottoms were essentially flat and no correction was used. Steep slopes were not sampled, in part because of the greater correction necessary in using the wedge prism. The tree cover on steep slopes also showed a greater mixture of species from the forest types usually associated with ridges or valley bottoms than did the less steep slopes.

Edaphic and physiographic features were observed. Primary interest centered on the lay of the land with respect to the creeks and the hills. The nature of the surface soil materials, presence of rock and rock outcrops, nature of the drainage features, and the type of subsurface materials exposed along streams were noted.

Results and Discussion

A total of 42 tree species were tallied for the point samples. (Table 1). The species had characteristic dominance relationships in the several habitats, as will be discussed later. All the dominant species were those found widespread throughout southern Illinois in the appropriate habitats. Other tree species recorded include redbud (*Cercis canadensis*), pawpaw (*Asimina triloba*), persimmon (*Diospyros virginiana*), mulberry (*Morus rubra*), cottonwood (*Populus deltoides*), and willow (*Salix sp.*). Green ash (*Fraxinus pensylvanica*) was not separated out.

The average total basal areas for the three major areas — valley bottoms along Lusk Creek, along its tributary, Little Lusk Creek, and on slopes along Lusk Creek — showed a decrease in basal area from 106 to 97 to 86 square feet per acre. Four species were tallied on the valley bottoms and not on the slopes. Twelve were tallied on the valley bottom for Lusk Creek, and not on Little Lusk. Eight species were tallied for the slope points and not for the valley bottoms. The slopes had quite different proportionate basal area values for the several species which occurred on both types of site.

A clear-cut dominance of sugar maple, and of beech, was evident for the valley bottoms. Together they constituted 47% and 44% of the total basal area for the Lusk and Little Lusk areas respectively. With the addition of tulip tree these values became 69% and 53% respectively. The basal area for tulip tree, however, approximates about half that of the beech. Species with intermediate values for basal area included bitternut and oval pignut hickories, black gum, and ash. To the extent that species identifications were possible, the ash appeared to be *Fraxinus americana*, white ash. In order of basal areas, the 10 leading species on the 3 major study areas were:

Lusk Creek Terrace

1. Sugar maple
2. Beech
3. Tulip tree
4. Bitternut hickory
5. Black gum

6. Oval pignut hickory
7. Ash
8. Shagbark hickory
9. Sycamore
10. American elm

Little Lusk Terrace

1. Sugar maple
2. Beech
3. Tulip tree
4. Oval pignut hickory
5. Bitternut hickory
6. Black gum
7. Ash
8. Red elm
9. Black walnut
10. Red oak

Lusk Creek Slopes

1. White oak
2. Red oak
3. Oval pignut hickory
4. Black oak
5. Sugar maple
6. Tulip tree
7. Red elm
8. Black gum
9. Chinquapin oak
10. Shumard oak

White oak constituted a third of the basal area for the slope forest communities. The next 4 species constituted approximately 10% each so that a more mixed community with shared dominance was characteristic of these areas. Species more characteristic of the valley bottoms and found on the slopes were often associated with small drainage depressions on the slopes.

Dead trees included in the wedge prism points were tallied separately. They constituted 6 square feet or 6% additional basal area on the terraces and 8 square feet or 9% additional on the slopes. About half of the dead trees were identified to species or to genus. Of these trees the oaks (on the slopes) amounted to a third, the hickories a quarter, the elms a tenth, beech and sassafras less than a tenth, with 8 other species identified. Thus no striking disproportionate mortality to the numbers of live trees was evident, other than perhaps a low value for sugar maple.

The terrace and the slope communities were distinctive in ecological structure. In the white oak community on the lower and mid slopes the canopy was not fully closed, the understory of dogwood, hop hornbeam, winged elm, as well as reproduction of canopy species, was well developed, and the shrub and herbaceous layers were consistently present and generally not closed. In contrast, the sugar maple communities of the terraces had a more closed canopy, a poorly-developed understory tree stratum, and two well-developed often alternate lower story layers. In many areas, particularly along the wider terraces in the lower reaches of the stream, a pronounced herbaceous layer was essentially continuous, with very few woody plants in evidence. At the time of the major study in mid September white snakeroot (*Eupatorium rugosum*) was conspicuous in a layer about 3 feet tall. Other areas had a continuous shrub layer with bladdernut (*Staphylea trifolia*) often predominant. Spicebush (*Lindera benzoin*) was a common associate. Exceptional areas such as Martha's Woods bordered on three sides by a bend of Little Lusk Creek (Sugar Camp) had both a rich herbaceous layer and groupings of shrubs present. This area appears

to be essentially virgin, with no stumps, large trees, and a basal area of 120 square feet.

Interesting and rare herbs of the sugar maple communities included black cohosh (*Cimicifuga cordifolia*), richweed (*Collinsonia canadensis*), and valerian (*Valeriana pauciflora*). Frequently found were wild ginger (*Asarum reflexum*), baneberry (*Actea alba*) and Indian pipe (*Monotropa uniflora*). The rattlesnake plantain (*Goodyera pubescens*), so rare in Illinois, puttyroot (*Aplectrum hyemale*), and other orchids were found in the slope communities.

Examination of the tree data by local study areas reveals interesting variations. Sugar maple was generally distributed on the valley bottoms. Beech, in contrast, predominated in some valley bottom areas and was completely absent from a few others. The frequency of basswood, which has a limited distribution in southern Illinois, increased on going downstream. It generally occurred on the terrace next to the entrenched channel. Buckeye showed a somewhat similar pattern.

Several tree species showed noteworthy phytogeographic relationships. River birch, so common along the channel of Lusk Creek, is missing from the Ozark limestone region of southwestern Illinois, as are three upland oaks — Spanish, shingle, and scarlet. In contrast, the percentage of shagbark hickory at Lusk Creek was low compared to many areas of southern Illinois. The hickories were of taxonomic interest. Their variations exceeded that found in several other areas of southern Illinois and appeared to represent, in part at least, possible crossing between *Carya cordiformis* and another species, perhaps *C. ovalis*.

Bottomland species not found in the Lusk Creek study areas were silver maple (*Acer saccharinum*), generally found along streams, swamp white, cherrybark, overcup, swamp chestnut, and pin oaks (*Q. bicolor*), *Q. falcata* var. *pagodaefolia, Q. lyrata, Q. michauxii*, and *Q. palustris*) and other lowland species of southern Illinois such as pecan (*Carya illinoensis*), sugarberry (*Celtis laevigata*) and Kentucky coffee tree (*Gymnocladus dioicus*). The absence of these species, the occurrence of very few honey locust and only one sweet gum, and the widespread occurrence of species such as sugar maple, butternut, black walnut, tulip tree, and red oak strongly support the concept of the valley bottom sites along the streams being terraces. Phytogeographically they are quite unlike floodplains or bottomlands as usually considered.

An overall view of these ecological relationships in the study areas suggests that the valley bottoms (terraces) are high enough above the creek not to experience substantial or prolonged flooding. External, and internal, drainage is sufficiently good to explain the absence of typical bottomland species and the dominance of sugar maple and its ecological associates. Internal drainage may be somewhat limiting, however, and govern the local importance of beech versus sugar maple in several of the study areas. Fritts and Holowaychuk (1959) demonstrated a greater sensitivity of sugar maple than beech to impeded drainage in central Ohio. The distribution of basswood, which

has been considered to require still better drainage than beech or sugar maple (U. S. Dept. Agric., 1965), supports the concept of drainage as a variable on the terraces. The highest basal area (200 square feet) was found for a terrace "island" between two channels on Lusk Creek. Both basswood and buckeye occurred on the "island".

Quaternary events have greatly affected the unglaciated lower Ohio River valley and its tributaries (Ray, 1963). These events include alluviation and loess deposition. Ray (1967) states:

> "Lusk Creek, like others tributary to the Ohio River main stem, has a well-developed terrace in its lower valley. The terrace is underlain by clayey silt, blue-gray where unoxidized, and calcareous below a surficial leached zone of some 4, plus or minus, feet. In the Lusk Creek valley the terrace level is roughly at an altitude of 350 feet above sea level. It is genetically related to the Tazewell outwash valley train in the Ohio Valley and was developed about 19,000 years, plus or minus, before the present."

Detailed studies on the stream morphology, including terraces, of Lusk Creek are in progress by Terry L. Dyroff, a graduate student working with Dr. Stanley E. Harris, Jr. in the Southern Illinois University Geology Department. My present interpretation based on vegetational characteristics and geomorphology is that the type of terrace found in Section 32, elevation 340 feet, extends upstream above the bridge on the Eddyville-Golconda road and roughly to the confluence of Lusk and Little Lusk Creeks, or an elevation of approximately 380 feet. As Ray states, the older floodplain deposits of Lusk Creek contemporaneous with the lacustrine deposits may extend to an altitude of 380 to 400 feet. The low gradient of the stream below this level together with more prominent ponding and bars rather than bedrock in the "channel" support this view. The recurring narrow portions of the valley walls could further have been associated with extensive ponding of the creek at some earlier date, and contributed to local terrace formation.

In comparing the vegetational picture at Lusk Creek with that in several other areas of southern Illinois (Voigt and Mohlenbrock, 1964; Ashby and Kelting, 1963), not only is the bottomland type missing, but a ravine and lower slope type (red oak, tulip tree) is much less evident. If the valley bottoms along Lusk Creek are terraces filled in against the slope to cover the lower slopes on which red oak and tulip tree have their best growth and greatest occurrence, the juxtaposition of the sugar maple community and the white oak community is more understandable.

The vegetation of the Southern Illinois University Pine Hills Field Station in the Ozarks of southwestern Illinois adjacent to the Mississippi River shows interesting contrasts to that at Lusk Creek. There a well-developed slope vegetation (red oak, black gum, beech, tulip tree community) contacts a well-developed bottomland community (sweet gum, cherrybark oak, sugarberry, pin oak, etc.). The sugar maple community, which was recognized, was not sufficiently represented to be mapped and

discussed. These contrasts in vegetation relate to fundamental variations in habitat.

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Manuscript received January 22, 1968.

TABLE 1.—Basal areas and largest diameters recorded for species tallied in the wedge prism points for the three major study areas, the Lusk Creek valley bottom or terrace, Little Lusk Creek terrace, and Lusk Creek slopes.

Species	Lusk	Little L.	Lusk	DBH
	Terrace		Slope	
	Basal Area (square feet)			(inches)
Boxelder (*Acer negundo*)	0.5	.....	.....	15.7
Red maple (*A. rubrum*)	0.9	.....	.....	28.5
Sugar m. (*A. saccharum*)	27.6	22.7	8.2	28.5
Buckeye (*Aesculus glabra*)	0.5	0.5	.....	14.9
River birch (*Betula nigra*)	0.9	.....	.....	33.3
Hornbeam (*Carpinus caroliniana*)	0.4	0.5	.....	5.0
Bitternut h. (*Carya cordiformis*)	5.6	7.8	1.2	28.4
Pignut hickory (*C. glabra*)	0.5	.....	1.0	24.1
Kingnut h. (*C. laciniosa*)	0.2	0.5	0.1	.....
Oval pignut h. (*C. ovalis*)	3.6	8.4	8.6	23.5
Shagbark h. (*C. ovata*)	2.7	1.9	0.4	23.9
Mockernut h. (*C. tomentosa*)	0.2	.....	0.3	28.1
Hackberry (*Celtis occidentalis*)	2.4	1.6	0.1	29.5
Dogwood (*Cornus florida*)	.....	.....	0.1	4.8
Beech (*Fagus grandifolia*)	22.7	19.7	0.8	45.8
Ash (*Fraxinus sp.*)	3.4	4.3	0.4	28.7
Honey locust (*Gleditsia triacanthos*)	0.2	.....	.....	17.9
Butternut (*Juglans cinerea*)	0.4	0.5	0.1	19.0
Black walnut (*J. nigra*)	1.8	2.7	1.0	26.2
Red cedar (*Juniperus virginiana*)	.....	.....	0.1	10.2
Sweet gum (*Liquidambar styraciflua*)	0.2	.....	.....	29.8
Tulip tree (*Liriodendron tulipifera*)	12.7	8.6	2.6	29.5
Black gum (*Nyssa sylvatica*)	4.2	5.1	2.2	22.9
Hop hornbeam (*Ostrya virginiana*)	.....	.....	0.3	5.0
Sycamore (*Platanus occidentalis*)	2.7	0.5	0.4	33.5
Black cherry (*Prunus serotina*)	0.4	0.8	.....	9.6
White oak (*Quercus alba*)	1.6	1.1	29.7	28.0
Scarlet o. (*Q. coccinea*)	.....	.....	1.0	15.7
Shingle o. (*Q. imbricaria*)	0.4	.....	.....	.....
Southern red o. (*Q. falcata*)	.....	.....	0.1	22.5
Bur o. (*Q. macrocarpa*)	0.2	.....	0.3	26.4
Blackjack o. (*Q. marilandica*)	.....	.....	0.3	16.1
Chinquapin o. (*Q. muhlenbergii*)	1.1	.....	2.1	30.0
Red o. (*Q. rubra*)	2.0	2.7	9.7	32.2
Shumard o. (*Q. shumardii*)	.....	1.4	1.8	24.6
Post o. (*Q. stellata*)	.....	.....	0.1	12.5
Black o. (*Q. velutina*)	0.4	0.5	8.5	26.9
Sassafras (*Sassafras albidum*)	0.2	.....	0.4	13.5
Basswood (*Tilia americana*)	0.5	.....	.....	17.9
Winged elm (*Ulmus alata*)	.....	.....	0.1	17.0
American e. (*U. americana*)	2.7	0.5	.....	35.8
Slippery e. (*U. rubra*)	2.2	3.8	2.4	27.9
Total Basal Area per acre	106.2	97.0	85.8	
Total No. of Trees	585	359	618	
Total No. of Dead Trees	31	23	54	
Total No. of Points	55	37	72	