

Beech in the Forests about Laughery Creek Valley¹

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Laughery Creek today meanders through a wide, magnificent valley, deeply entrenched in Ordovician rock strata. The majestic power of great masses of water which Laughery Creek carried in early post-glacial times is still evidenced in the silent grandeur of the high slopes and carved rocks. The master stream imposed his cutting power upon the smaller tributary creeks, so that the region presents a wide range of habitats with their selective action on plant life. This in turn results in segregation of species of trees and of forest types.

The region in general lies within the old Illinoian tillplain. These tillplain habitats are severally leached. Not only is the topography flat but the land offers great problems to the agriculturist. The greyish-brown soil is compacted to a degree that one wonders how roots of trees can ever penetrate, or how proper aeration can be attained. On the other hand, the nearby steep, rocky slopes may lack sufficient soil moisture during much of the growing season. Between the two extremes appear numerous habitats which are intermediate. This means variation in forest cover types in the various habitat sites.

We became interested in the wide range of *Fagus grandifolia* (beech) in this part of Ripley County. It is present in forests on the poorly-drained tillplains as well as in those on well-drained gentle north and east-facing slopes. While beech is present consistently in the whole range of different habitat sites, the associates vary much. This unique characteristic of *Fagus* suggested the present study in the Laughery Creek valley (Fig. 1). The numbers on the map used to show location of the various forests are the same as those designating tables and forest descriptions.

Location and Descriptions of the Forests

1. Versailles State Park stand is located within the park area, beginning at the fire tower road and running eastward. It covers about 10 acres. While there is little evidence of modifying cultural influence, some selective cutting may have taken place.

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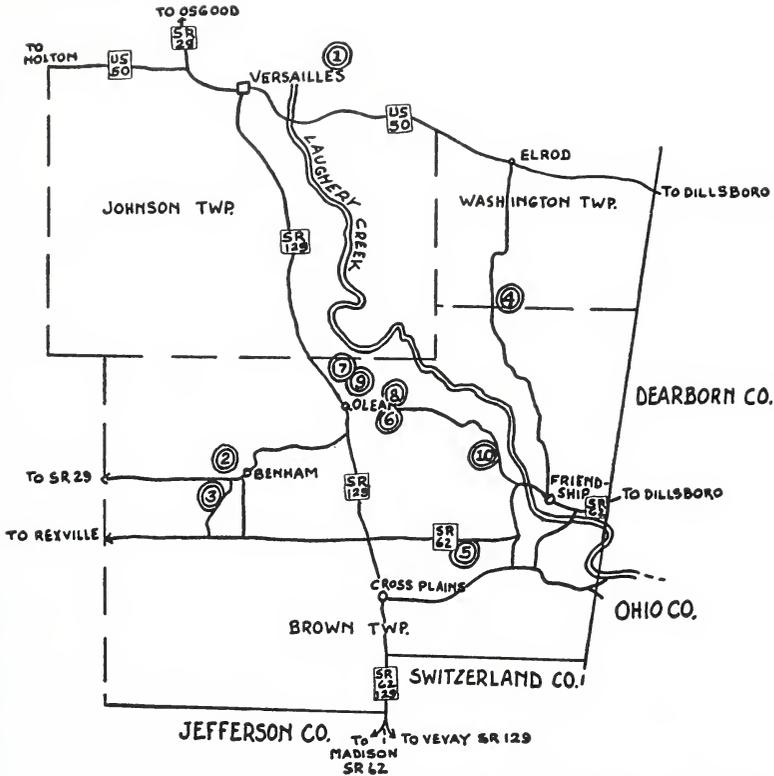


Figure 1. Partial map of the Laughery Creek valley to show location of forests studied.

2. J. H. Schwagmeier woods. It is one mile west of Benham. The area is between 20 and 25 acres. A small, shallow creek drains the wooded area. No cultural disturbance is evident.

3. W. S. Lemon woods. Its location is two miles southwest of Benham and 3.5 miles northwest of junction between roads 62 and 129. The area is about 15 acres. About half of the forested land is typical Illinoian tillplain habitat. The other half is influenced by drainage. Some intermittent streams penetrate the area and a deep ravine flanks the outer part. Pasturing and some cutting have been and are modifying influences.

4. Fred Cutter woods. This woods is located three miles north of Friendship, and three miles south of Elrod, on the Elrod-Friendship pike, along the Washington-Browntownship line. The area comprises about 10 acres. Only a few sections have suffered cutting.

5. Henry Thielking woods. Its location is 2.5 miles west of Friendship on state road 62; two miles east of junction between highways 62 and 129. Area is about 25 acres. This is a magnificent stand of timber,

in its prime. A few large *Juglans nigra* (walnut) were taken out about 10 years ago. No other cultural influences have played a part in the development of the stand. A small intermittent stream drains the center. The habitat is, thus, of the drained Illinoian tillplain type.

6. Ervin Thielking woods. The stand is located one mile east of Olean, on the Friendship-Olean pike, south side of the road. The forest covers about 20 to 25 acres. While the periphery of the forest shows evidences of some cutting, no disturbance of natural conditions is evident in the section where the tabulations were made. Both shallow and deep ravines give evidence that drainage is adequate.

7. Wm. J. H. Otte woods. Its location is one mile north of Olean on state road 129, and a half mile south. There is disturbance by some pasturing and cutting. Most of the stand is located on a steep slope to a Laughery valley tributary stream. Exposure is north-east.

8. George Stegemoller woods. This stand is one mile east of Olean on the Friendship-Olean pike, north side of the road. It covers approximately 15 acres. No modifying cultural influences were evident.

9. Wm. Gardeman heirs woods. Location of the 60 acres is one mile north of Olean on state road 129, and a half mile south. The topography is a rather narrow plateau of Illinoian tillplain type soil bordered by steep slopes to Laughery valley on the one side and to Raccoon Creek on the other. It is a mature stand of timber which has had a limited amount of selective cutting as modifying influence.

10. Frank Fisse woods. It is located one mile west of Friendship on the Friendship-Olean pike, north of the road. It covers about 5 acres. The topography is a long gentle west-facing slope with several secondary north-facing slopes faceting. The whole area is drained by a small creek. There is some evidence of former pasturing.

Methods

The junior author lived in Friendship, Indiana and was personally acquainted with the owners of the various stands, and he made all arrangements with the owners to have the studies carried out on the various properties.

With the exception of the Otte woods, woody species in twenty 10-meter-square quadrats were tabulated to obtain data on the sociology in the forests. In the Otte woods only ten such quadrats were studied. Each quadrat was delimited with a stout cord with loops at ten-meter intervals. The loops were slipped over wooden stakes driven into the ground. Stems 1-inch or over DBH. were measured with wooden calipers. Stems of smaller diameter were counted if height was at least 3 feet. Tables I to X present for each stand the stems in several diameter size-classes, the abundance and the per cent F. I. All stems 9 inches DBH. or over are considered of sufficient height to be represented in the crown cover. The percentage of the total of such stems which a given species had in the stand is shown graphically in figure 2. The aim was to find all types of habitats where beech formed a part in the forest

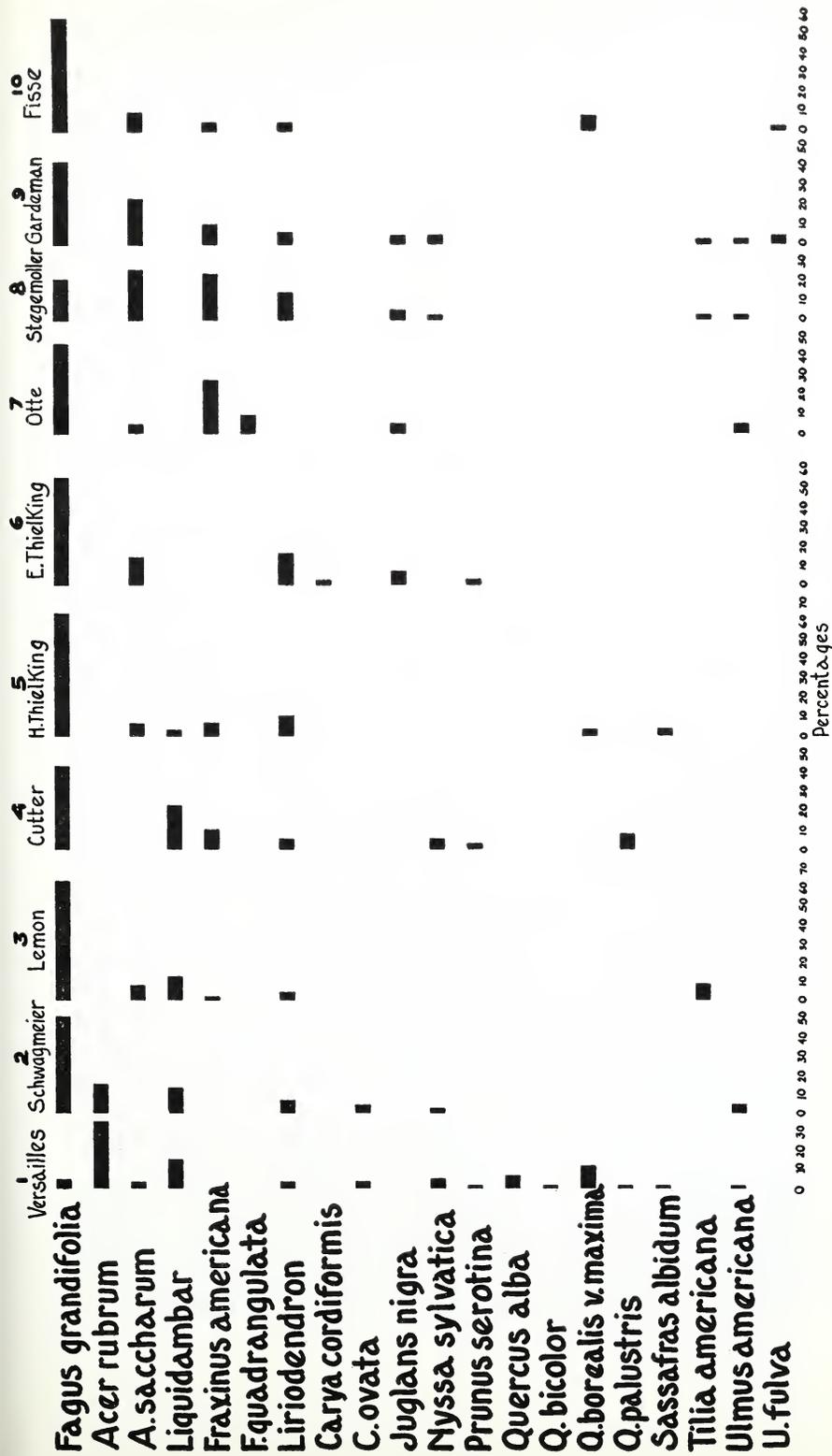


Figure 2. Percentage of stems 9 inches or over DBH, which any given species has of the total of such stems in a given forest. A method to show importance in crown cover.

TABLE II. Tabulation of woody species in twenty 10-meter-square quadrats in the Schwagmeier woods. Diameter classes in inches. (DBH.)

Species	Below 1 in.	1-2	3-5	6-8	9-15	16-20	Above 20	Total stems	Per cent F.I.
<i>Acer rubrum</i>	6	3	3	1	3	2	2	20	40
<i>A. saccharum</i>	4	1	1					6	20
<i>Carpinus caroliniana</i>			1					1	5
<i>Carya glabra</i>	1							1	5
<i>C. ovata</i>	87	13		2	1		1	104	90
<i>Fagus grandifolia</i>	249	11	5	1	8	12	4	290	90
<i>Fraxinus americana</i>	4		1	1				6	25
<i>Liquidambar styraciflua</i>	40	5	1	3	5		1	55	65
<i>Liriodendron tulipifera</i>	20	4		1	3			28	30
<i>Morus rubra</i>	4							4	20
<i>Nyssa sylvatica</i>			1		1			2	10
<i>Prunus serotina</i>	1							1	5
<i>Sassafras albidum</i>	1							1	5
<i>Ulmus americana</i>	2	2	1		2			7	30
<i>U. fulva</i>	1							1	5
<i>Aralia spinosa</i>	12	8	1					21	20
<i>Lindera benzoin</i>	209							209	65
<i>Rosa</i> sp.?	10							10	5
<i>Rubus allegheniensis</i>	6							6	15
<i>Sambucus canadensis</i>	17							17	30
<i>Smilax glauca</i>	55							55	75
<i>Viburnum acerifolium</i>	3							3	5

mendous reproduction in most mesic habitats, but seldom attains great abundance in the large size-classes. All shrubs, except *Smilax glauca* (green briar) and *Vitis* sp.? (grape) have a fidelity of 70 per cent or less. While 18 species of shrubs and 6 of small trees are present in the ten stands, none have sufficient abundance to produce well-defined strata.

Trees of Large Diameter

The farther we become removed from pioneer days and forest primeval the more we may feel inclined to believe that a large percentage of the trees constituting the forest primeval were of gigantic size, and so it is perhaps justified to add a few records gleaned from the study of ten stands in the Laughery Creek valley, which as a whole had not been disturbed greatly. Potzger and Friesner (3,4) pointed out that trees with extremely large diameters very likely were not so common as stories by "old timers" and idealized descriptions by early travelers might make one believe. Any description of a forest which is not based on some quantitative sampling is very likely to be far from accurate. In the ten stands we recorded 17 stems 30 inches or over DBH. Figures in parentheses refer to the forest or forests where these trees were observed. *Acer saccharum*, 36, 36 (5); *Carya cordiformis*, 39 (6); *Fagus grandifolia* 30 (10); 30, 30 (9); 30 (4); 30, 33, 36, 37 (6); 30, 37, 38 (5); *Nyssa sylvatica*, 34 (4); *Quercus borealis* var. *maxima*, 35 (5).

TABLE IV. Tabulation of woody species in twenty 10-meter-square quadrats in the Cutter woods. Diameter classes in inches. (DBH.)

Species	Below 1 in.	1-2	3-5	6-8	9-15	16-20	Above 20	Total stems	Per cent P. I.
<i>Acer rubrum</i>	7	1	2					10	15
<i>A. saccharum</i>	12			1				13	30
<i>Aesculus glabra</i>			1					1	5
<i>Carya glabra</i>	3	1	1					5	20
<i>C. ovata</i>	3		1					4	15
<i>Cornus florida</i>	80	16	9					105	70
<i>Fagus grandifolia</i>	64	53	42	17	3	4	10	193	95
<i>Fraxinus americana</i>	19	11	6	4	3	1		44	45
<i>Liquidambar styraciflua</i>	4	2	3	1	9			19	30
<i>Liriodendron tulipifera</i>				1	1	1		3	15
<i>Morus rubra</i>			1					1	5
<i>Nyssa sylvatica</i>	2		1				2	5	15
<i>Ostrya virginiana</i>	15	9	6					30	45
<i>Prunus serotina</i>	1			1	1			3	15
<i>Quercus borealis</i> var. <i>maxima</i>		1						1	5
<i>Q. palustris</i>					3			3	10
<i>Ulmus americana</i>	1	1		2				4	20
<i>U. thomasi</i>		1	1					2	5
<i>Aralia spinosa</i>		1						1	5
<i>Rhus radicans</i>	41							41	15
<i>Ribes</i> sp.?	2							2	5
<i>Sambucus canadensis</i>	1							1	5
<i>Smilax glauca</i>	7							7	15
<i>Viburnum acerifolium</i>	4							4	10
<i>Vitis</i> sp.?	6	13	1					20	30

reference to composition of forests of the future. This has been stressed repeatedly by the senior author with reference to sugar maple and ash. One can gain some concept of the variation in association complex within the ten stands by a brief survey of the ten tables. We find 31 species of tall trees and 6 species of small trees participating in the sociology of the ten stands, but of these 31 the maximum representation in any one stand is 19 and the minimum is 11. This makes one wonder how much of the association aggregation is an expression of selection by habitat factors and how much is chance priority due to early invasion when the stand first developed. Potzger and Potzger (5) found different forest cover foreshadowed because of chance to invade an open area before larger numbers of one or more species occupy the crown cover. Since trees are long-lived, the crown cover once closed will very likely remain more or less static for centuries. One survey can hardly discover all such factors. This characteristic prompted Gleason (1) to sponsor the individualistic concept of the plant association, which is determined by space and time.

drainage on the Illinoian tillplain, sugar maple indicates the climax where optimum mesophytism prevails in the site. Less diagnostic are such species as tulip poplar, American ash and *Nyssa sylvatica* (sour gum). Their range is wide, and frequently similar to that of beech.

Summary and Conclusions

1. The paper presents data on ten forest stands in the Laughery Creek valley (Ripley County, Indiana) in which *Fagus grandifolia* is an important dominant.

2. The habitats where beech is important include poorly-drained Illinoian tillplain, well-drained Illinoian tillplain and well-drained north and east-facing slopes.

3. *Fagus* has a fidelity of 100 per cent but associates very much. Figure 2 shows graphically the percentage of stems 9 inches or over DBH. which any species had of the total number of such stems in a given forest.

4. Beech reproduces very abundantly in wet habitats but not so well in the most mesophytic habitats.

TABLE VIII. Tabulation of woody species in twenty 10-meter-square quadrats in the Stegemoller forest. Diameter classes in inches. (DBH.)

Species	Below 1 in.	1-2	3-5	6-8	9-15	16-20	Above 20	Total stems	Per cent F.I.
<i>Acer saccharum</i>	272	61	49	32	11			423	100
<i>Carya cordiformis</i>	5			1				6	15
<i>Celtis occidentalis</i>					1			1	5
<i>Cornus florida</i>	1	5	1	1				8	20
<i>Fagus grandifolia</i>	10	10	2	1	1		8	32	65
<i>Fraxinus americana</i>	19			1	5	4	1	30	50
<i>F. pennsylvanica</i>	7							7	5
<i>F. quadrangulata</i>	1							1	5
<i>Juglans nigra</i>					2			2	10
<i>Liriodendron tulipifera</i>					4	2		6	20
<i>Morus rubra</i>	17	3						20	45
<i>Nyssa sylvatica</i>					1			1	5
<i>Prunus serotina</i>	11							11	30
<i>Quercus alba</i>			1					1	5
<i>Tilia americana</i>					1			1	5
<i>Ulmus fulva</i>	7	3	1					11	25
<i>Aralia spinosa</i>	1							1	5
<i>Asimina triloba</i>	97	5						102	35
<i>Parthenocissus quinquefolia</i>	5							5	5
<i>Sambucus canadensis</i>	1							1	5
<i>Smilax glauca</i>	5							5	10
<i>Vitis</i> sp.?	1	8	1					10	15

TABLE IX. Tabulation of woody species in twenty 10-meter-square quadrats in the Gardeman forest. Diameter classes in inches. (DBH.)

Species	Below 1 in.	1-2	3-5	6-8	9-15	16-20	Above 20	Total stems	Per cent F. I.
<i>Acer saccharum</i>	24	31	12	5	10	1		83	70
<i>Aesculus glabra</i>	1							1	5
<i>Carpinus caroliniana</i>	2	1						3	15
<i>Carya cordiformis</i>	1							1	5
<i>Cornus florida</i>	15	3						18	35
<i>Fagus grandifolia</i>	27	6	3		2	5	13	56	80
<i>Fraxinus americana</i>	9	1	1	2		5		18	45
<i>F. quadrangulata</i>		1						1	5
<i>Juglans nigra</i>					2			2	10
<i>Juniperus virginiana</i>	1							1	5
<i>Liriodendron tulipifera</i>	18				2	1		21	30
<i>Nyssa sylvatica</i>	38							38	45
<i>Ostrya virginiana</i>	17	1						19	35
<i>Prunus serotina</i>	2							2	5
<i>Quercus muhlenbergii</i>	2							2	5
<i>Sassafras albidum</i>	8							8	15
<i>Tilia americana</i>	14		1		1			16	10
<i>Ulmus americana</i>	5	3		2	1			11	35
<i>U. fulva</i>	9	1			1	1		12	30
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<i>Aralia spinosa</i>	7	2						9	15
<i>Asimina triloba</i>	106	10						116	30
<i>Lindera benzoin</i>	380	7						387	95
<i>Ribes sp.?</i>	11							11	10
<i>Rhus radicans</i>	6							6	5
<i>Rubus allegheniensis</i>	188							188	50
<i>R. occidentalis</i>	2							2	5
<i>Smilax glauca</i>	57							57	40
<i>Vitis sp.?</i>	1	1						2	10

5. Forest cover types represented in the ten stands are as follows: beech-sweet gum; beech-sweet gum-red maple; red maple-sweet gum-beech-oak; beech-sweet gum-ash; beech-sugar maple-ash; beech-tulip poplar-sugar maple; beech-sugar maple; beech-sugar maple-ash-tulip poplar; beech-ash.

6. While 31 species of tall trees are recorded in the ten stands, only 11 to 19 of these were found in any one forest.

7. No well-defined small tree and shrub strata were found.

Acknowledgments

We express sincere thanks to Mrs. Esther Potzger for assistance in the survey work and for lettering on figures 1 and 2; to the various owners of the forest stands for permission to make this study on their property.

TABLE X. Tabulation of woody species in twenty 10-meter-square quadrats in the Frank Fisse woods. Diameter classes in inches. (DBH.)

Species	Below 1 in.	1-2	3-5	6-8	9-15	16-20	Above 20	Total stems	Per cent F. I.
<i>Acer saccharum</i>	7		1		2	1	1	12	40
<i>Carpinus caroliniana</i>	20	4	6					30	20
<i>Carya cordiformis</i>	4							4	5
<i>C. ovata</i>		1	3					4	10
<i>Cercis canadensis</i>	3			2				5	10
<i>Cornus florida</i>	18	3	6	3				30	45
<i>Fagus grandifolia</i>	18	1				4	19	42	95
<i>Fraxinus americana</i>	3	1	5		2			11	20
<i>Juniperus virginia</i>	18	5						23	45
<i>Liriodendron tulipifera</i>					1		1	2	5
<i>Nyssa sylvatica</i>	7	2	1		1		1	12	30
<i>Ostrya virginiana</i>	143	12	15	1				171	70
<i>Quercus alba</i>			1					1	5
<i>Q. borealis</i> var. <i>maxima</i>						1	2	3	10
<i>Ulmus americana</i>			1	1	1			3	10
<i>U. fulva</i>	2					1		3	15
<i>Asimina triloba</i>	31	6						37	15
<i>Evonymus atropurpureus</i>	10							10	20
<i>Lindera benzoin</i>	3							3	5
<i>Ribes</i> sp.?	5							5	5
<i>Rubus allegheniensis</i>	26							26	15
<i>Smilax glauca</i>	16							16	20
<i>Vitis</i> sp.?	2	9						11	10

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