An Annotated Bibliography of Figure in Wood

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Of Figure In Wood

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This publication presents abstracts of articles concerning figure in wood some of which have not been included in other bibliographies. An attempt has been made to include all references on this subject except those in Russian. Principal sources of information were major international journals in wood science and technology and personal communication with active researchers in this field. Since many references are in Scandinavian languages and some journals are obscure and generally not available in many libraries in the United States, a library source has been provided.

These abstracts indicate that the major portion of work on figure in wood in the United States was done many years ago and that little current research on this subject is being conducted. European literature indicates a concentration on the “Masur” figure, a type that has not been reported in North America.

This bibliography represents a portion of a larger study concerning figure in wood that will be published at a later date.


A nontechnical article considering various types of sloping grain and relationships of sloping grain to figure.

\(^3\) Associate Professor and Assistant Professor, Department of Forestry. The work was supported by McIntire-Stennis funds.

A well illustrated treatise on figure in non-technical language describing how various types of figure are formed. Relationships and differences among grain, texture, and figure are discussed.


Suggests several possible causes for bird’s-eye figure including heredity and slow growth. Appearance of this figure in living trees is described.


A brief note concerning bird’s-eye figure in sugar maple (Acer saccharum Marsh) with observations on growth rates of trees containing this figure. Mentions attempts by this Station and the U.S. Forest Products Laboratory to establish studies concerning heretibility of this figure in wood and propagation techniques started in 1928.


A note on dimpled grain occurring in several coniferous species. Cause of dimples is attributed to resin blisters pressing into the cambial zone, thus retarding xylem formation in the vicinity of the blisters. (See Chafe, S.C.)


A description of several possible methods of producing figure in wood by artificial means including twisting, mutilating, and deforming practices. Several grafted trees are described.


A series of four articles concerning figure formation. Part I considers anatomical aspects of figure formation such as grain, texture, structure, and color. Part II considers figure that occurs in different parts of trees and in more detail with various figure types formed by curly, wavy, and interlocked grain. Part III is a continuation on variations in structure and effects of conversion.
on emphasizing figures. Part IV discusses the more common distinctive figure classifications.


Fiddleback figure occurs on the radial face of certain woods while quilted figures appears on tangential faces. Fiddleback figure is regular in occurrence and exhibits a corrugated appearance when woods are split radially. Quilted figures are usually irregular and appear as convex intersecting areas on one side and concave surfaces on the other.


Not seen.


A preliminary study of the anatomy of bird's-eye figure in hard maple. The formation of “pegs” from the phloem into the xylem and an enlargement of rays are illustrated. “Stone cells” are a universal feature associated with the indented portion of “the eye” in phloem. Pit-like depressions in the bark of old bird's-eye trees result from the periderm following contours of the initial phloem indentation.


This publication does not consider figure in wood directly but mentions numerous reports from the citrus industry where the disease known as “quick decline” exhibits stem pitting similar to that found in the Masur figure in Birch (Betula spp.).


A description of pathological aspects of gall and burl formation. No conclusions are given as to formation of burls that are utilized for figured wood. Buds are associated with some types of burls, but it is not known whether these buds initiate figure in subsequent wood formation.

Wood pitting of unknown origin was discovered in unbudded citrus seedlings. This discovery caused speculation that such pitting may not be an indication of diseases as formerly suspected.


An examination of the formation of dimpled grain in lodgepole pine (Pinus contorta Dougl. var latifolia Engelm.), jack pine (Pinus banksiana Lamb.), ponderosa pine (Pinus ponderosa Laws.), and sitka spruce (Picea sitchensis (Bong.) Carr.). Dimpling in the pines was traced to resin blisters in the inner bark, but caused by sclerids in spruce.


A discussion of the need to consider figure as one qualification in selection of superior trees for propagation. Several figure types are illustrated.


Fiddleback figure that occurs in several native species including sycamore, maple, and ash is discussed. Occurrence of figure in other species, to a lesser extent is mentioned. Photographs illustrating fiddleback figure are included.


Observations of bird’s-eye figure in sugar maple (Acer saccharum Marsh.) splitting blocks containing this figure. Illustrations show how indentations follow rays and progress as indentations along the same radial line over many years.

Feihl, A. O. 1964. Rotary Cutting of Curly Yellow Birch. Dept. of For. Publication No. 1086 (Ottawa) Canada. 18 pp. 5 ill. 2 tables, 2 refs.

A description of difficulties encountered in cutting curly yellow birch (Betula alleghaniensis Britt.) veneer by the rotary method. Emphasizes veneer lathe settings rather than figure.

Fine Hardwoods Association. No date. Veneers — Figure in Wood. Book 4, Educational Series. 11 pp. 18 photos.

A booklet illustrating the most common figure types. Brief explanations of each figure type (including development) are given.
A non-technical publication that gives good coverage of most common figures with illustrations.


A discussion of burl formation in Redwood. Describes how commercial burls are utilized. Typical redwood burls do not arise from injuries but are thought to originate from dormant buds.

Gardiner, A. E. 1962. A Note on the Variation of Flamy Figure in Silver Birch (Betula verrucosa Ehrh.). Silvae Genet. 11(5/6):161-163.

Several types of flamy figure occur in Betula verrucosa. Descriptions of different variations of this figure are presented.


A discussion of the occurrence of flamy (curly) figure in Scottish birch (Betula spp.). Tabulations of data showing correlations of figured wood with bark characteristics are given.


A semi-technical article concerning figure and its formation. Some 20 or more woods are described with illustrations of the more typical figure patterns that occur.


A popular article describing the figured lumber of curly pine that occurs in several species of Southern Pine.


A short note on several types of figure in a number of woods citing examples of figure occurring in trees growing in rocky soil, effects of buttressed roots, and other suspected causes of figure formation.


A review of experiments in the growing of figured birch (Betula spp.) in Finland starting in 1929. Propagation has been by seed and vegetative propagation. Figured trees require pruning to make them suitable for veneer.

The title of this article refers to “curly” figure but the text is concerned with the “masur” figure. It was found that this type of figure occurs most commonly in *Betula verrucosa* and about 50 per cent of trees come true from seed. In addition, environmental factors such as stand density affects figure formation and quality.


A discussion of the “Wisa” (Masur) disease as it occurs in birch and several other species in Europe. Aspects of enlarged rays, stem pitting, including bark and other characteristic features are described and many older references are included.


Not seen. Not available in U.S. Libraries.


Statistical analysis of growth rate and presence of bird’s-eye figure in maple (*Acer saccharum* Marsh.) suggest that this figure is more prevalent in suppressed trees.


A reply to an article by F. K. Richter that contained criticism of the 1933 article on bird’s-eye figure by Holmberg. Holmberg’s 1934 article suggests that heredity might be a cause of bird’s eye figure but such figure is not initiated until the tree is almost mature.


A discussion of figure in *Betula verrucosa* known as “Masur” showing illustrations of trees and figured wood. Genetic studies indicate that Masur figure is hereditary. Masur figure is found in several parts of Europe.


Not seen.

Not seen.


A review of selected Swedish and Finnish literature on Betula verrucosa and B. pubescens.


Discusses several types of abnormal figure in birch including their causes. Past investigations are discussed briefly. Some recommendations for growing figured birch are included. Cites grafting experiments in Germany.


A general discussion of figure types occurring in several species of wood commonly used in furniture.


A review of the curly figure in walnut and the possibility of propagating figured trees by grafting.


Burl-swirl or “Drappe” figure in mahogany was traced to an influence of the strangler fig that creates a swirl figure by forcing trees to develop bulges and a burl figure by penetrating of rootlets into the wood.

Lamb, G. N. and A. Albini. 1956. Figure Types in Mahogany. Mahogany Assoc., Chicago. 31 pp. 40 plates. 15 Figs.

A trade booklet developed for designers, architects, and manufacturers showing various figures that occur in mahogany. Describes development of figure in the tree and also figures produced by different veneering operations.

Comprehensive descriptions of different forms of Masur figure in birch (Masurbirch) that are most common in *Betula verrucosa*. Appearance of mature trees and figured wood therein are illustrated and described. Grafting experiments and progeny testing are discussed. It appears that the Masur figure can be transferred by grafting and, to a large extent, by seed. This figure apparently is correlated with slow growth. This figure also may be caused by disease.


Not seen.


An account of breeding experiments in Sweden concerning several species of birch.


Not seen.


An illustrated account of variation of bark characteristics that occur in native and cultivated species of birch in Sweden. About 30 species of birch are considered.


A hybrid poplar formed by a cross between *Populus alba* x *P. grandidenta* (designated “Sherrill” Poplar) is described. Trees of this clone possess a wavy grain and can be propagated vegetatively. This figured wood may be suitable for ornamental purposes.


One of a series of articles concerning figure in wood. Curly, wavy, bird’s-eye, and smoky figures in wood differ among themselves but all can be traced to reflection of light from distorted fibers. Causes of distortions are known in some cases but lacking in others.

Figure in wood caused by growth rings varies in occurrence and intensity from species to species. Methods used to convert logs into lumber or veneer can influence type and intensity of figure.


Primarily a discussion of quarter-sawn figures developed in certain oaks (*Quercus spp.*). Several drawings illustrate this method of converting logs into lumber.


An extensive discussion of figure in several different species of wood. Illustrations show representative figure types. Figure can be traced to specific tissue formations, color and pigments, and certain effects from light refraction that influence appearance of wood. Methods to determine figure in logs include fiber direction on debarked logs, shape of end cracks, and patterns produced by grooves cut in log ends.


Contains illustrations and descriptions of conditions in apple resembling Masur and indented ring figures found in several species of commercially important trees.  

Discusses causes and formation of curly grain and some problems associated with production of curly grained walnut logs by grafting.

McKeen, H. B. 1940. The Texture, Grain, and Figure of Wood. J. Forestry 38(8):664-665.

An attempt to clarify definitions of texture, grain, and figure. Texture is defined adequately but denotations of grain and figure overlap. There is an apparent need for a distinction between grain elements and figure for patterns on longitudinal surfaces of wood.

Illustrates several types of figured wood and proposes some possible causes of figure formation. Suggests that bark characteristics are not reliable indicators of figured wood.


A review of strength properties of wood from Masur figured birch. Such properties as impact, static bending, compression, and hardness were examined.


Contains suggestions that figure in hardwoods should be selected and propagated for increasing value of trees. Deformities such as crotches, burls, and swollen butts that yield decorative veneers should not be overlooked in such a program.


A semi-popular article describing uses of burls since ancient times. States that burlwood has been more valuable than gold at certain times in history. Burls can be made into objects such as bowls, table tops, and turned articles by the use of a stabilizing treatment such as PEG.


A preliminary report on exploratory work with bark types and figure in Betula verrucosa. Essential results are contained in FPRL No. 57.


Birch trees 50 years of age were peeled and veneered to investigate the relationship between bark characteristics and figure grain. Six types of figure were distinguished. No precise correlation between bark form and figure was established.

Thirty trees were examined to determine relationships between bark characteristics, figure, and fiber length. Straight-grained wood usually occurs (but not always) within trees with thin smooth bark. Trees with thick, rough bark usually exhibit some type of disturbed grain. Such grain may be flamy or some variation of curly grain. Fiber length is usually greater in trees with thin smooth bark than in those with thick rough bark.


A further report concerning investigations of bark form and figure in birch. More extensive than FPRL Report No. 47. Essential results are reported in FPRL No. 57.


A comprehensive report on bark characteristics and figure that contains results from detailed examinations of 30 trees by peeling and cleaving. No definite correlation between bark types and particular figure types was established. However, certain bark types may serve as indicators of figure when used with other methods of figure detection.


Not seen.


A description of methods by which Japanese cedars with "crinkles" are produced artificially in the Kitayama Forest. Natural "crinkled" logs sell for as much as 100 times the price of unfigured logs. Causes of these crinkles are not known but sometimes such trees can be produced by vegetative methods from parent trees exhibiting figure. The method of producing crinkles by binding is illustrated.
A general discussion of figure in wood and figure variation. This is one of the more complete coverages of figure and figure formation. A somewhat better discussion may be found in the earlier edition of this text.

A brief description of some of the more common figures occurring in several native hardwoods. Illustrations show various patterns obtained by different cutting methods.

A note on bird’s-eye figure in sugar maple giving reasons why this figure cannot be caused by dormant buds as commonly thought.

A report on detection of figured wood in standing trees by the use of chips cut from the trunk. Characteristics of wood chips usually indicate whether curly or wavy grain is present.

A general description of common species of walnut (including *juglans nigra* and *j. regia*) that produce figured veneer of the trade. Several figure types are illustrated.

A comprehensive discussion of various figures in wood and their formation. Many figures are illustrated by photographs. Contains some unusual photographs of Curly Pine.

A letter to the editor suggesting that suppression might not be the direct cause of bird’s-eye figure in sugar maple. Suppression
is considered a contributing factor in addition to heredity and environment.


This report clarified confusion between the terms "curly" and "masur" as used to describe figure in *Betula verrucosa*. Masur figure is described in detail. Flamy figure, burls caused by bud initials and possibly by the fungus *Taphrina betulina*, and brown markings caused by larvae of *Dendromza betulae* also are discussed in relation to masur figure.


Examination of a small birch stand consisting of 39 stems showed that 28 trees possessed some degree of flamy figure. In addition, several of the other 11 trees exhibited other types of figure. It was suggested that this stand should be a source of seed or breeding stock.


Curly grain is found not only in birch, but in several other species such as alder, mountain ash, Norway spruce, and Scotch pine. In most of these cases, figure has been detected after trees have been converted into lumber and it has been impossible to propagate them.


A discussion of selection of propagation of figured hardwoods. Several species are discussed including ash, sycamore maple, and birch. External appearance of figured trees and stem section are illustrated. Propagation techniques are suggested.

An account of the supplies of flamy figured birch from Finland to East Germany. Only *Betula verrucosa* produces flamy figure in commercial quantities. Specifications and value comparisons of different figure types are discussed.


An account of the establishment and management of both straight and figured grained birch stands. Recognition of figured birches is separated into flamy and brown figured trees. Soil preparation and propagation techniques are discussed.


Range of the brown Masur Birch has been traced throughout Europe. It is felt that Central Europe offers the best possibilities for successful cultivation. Several factors concerning natural and artificial cultivation of Masur figure are discussed.


A discussion of recognition of figured trees in stands using various techniques such as bark characteristics and wood chips. Several veneer sheets are described and illustrated.


A discussion of “stem pitting” in apple stocks with illustrations. This type of pitting is similar to that found in the Masur birch.


Not seen.


Fiddleback figure occurs in about 1 to 5 per cent of sycamore maples (*Acer pseudoplatanus*) in the Hesse region. Occasionally
it is confined to one side of the tree. Advocates propagation of figured trees by grafting. Investigation of site conditions is also suggested.


A discussion of several types of figure as related to growth rings and distorted grain. Several figure types are illustrated showing split blocks and finished wood. Stresses effect on figure by cutting at angles rather than cutting parallel to the grain.


Extract from a thesis involving 1,447 specimens of Betula verrucosa from 18 sites. Bark types appeared to be largely hereditary but showed little correlation with site, age, or diameter. Bark types proved to be an important tool for determination of curly grain when combined with chip examination.


A non-technical discussion of relationships among figure, texture, and grain. Each factor is explained individually, showing effects on the others.


An examination of figured walnut grafted by G. N. Lamb in 1929. Grafted trees (22 years of age) exhibited figured wood that was more pronounced in outer parts of boles than near the centers.


A brief note on occurrence of “indented ring” figure that occurs in sitka spruce and Douglas fir with an illustration of this figure. The name “bear scratches” has been applied to this figure.


A brief description of the Kitayama forest where crinkled logs of several species are produced both naturally and artificially for use as alcove posts.

An illustrated study of the peculiar growth figure called “Hazel” but considered to be “indented rings.” This condition occurs in several softwoods and to a limited extent in hardwoods. This figure was traced to localized disturbances in the cambium, resulting in lenticular indentations in annual rings.
With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.

Research Unit Identification

🌟 Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
20. Ornamental Horticulture Field Station, Spring Hill.