GLAZE DAMAGE

WITH SPECIAL REFERENCE TO

THE NORTHERN HARDWOODS REGION

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Submitted in partial fulfillment of the requirements for the degree of Master of Forestry.

ANN ARBOR, MICHIGAN.

MAY 5, 1938.

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PREFACE

This report, based principally on a study of the glaze storm of March 17 to 19, 1936, in Pennsylvania and New York states, has as its primary purpose the determination of the factors which affect the amount of damage resulting from glaze storms, with the object of formulating specific silvicultural methods of treating our forests to lessen such damage. In addition to this primary purpose the various effects and possible effects of glaze breakage have been dealt with in considerable detail.

The majority of the data presented here-in were collected in the field by the author during the summer of 1937. This work has been supplemented by a complete review of all available pertinent information.

Free use has been made of photographs in the way of illustration of important facts, and much of the data has been presented in bar chart form.

The author is indebted to countless people in many localities for the many aids and courtesies extended by them. Some few of these people have been quoted and are listed in a special section of the bibliography.

Ann Arbor, Michigan. R.O. Gustafson.
May, 1938.

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INTRODUCTION

Throughout most of the northern hardwoods region, and in portions of the central hardwoods, appalachian hardwoods, and southern pine region, each specific locality has at some time or another experienced a severe glaze storm which has caused an enormous amount of damage to timber. The interest of local foresters and timbermen has been aroused for a short time and occasionally a report dealing with the amount of damage and recommending certain salvage operations has been published. Seldom have steps been taken, or even recommended, to guard against similar damage from future storms.

This is probably due to the fact that severe storms occur very infrequently in the ordinary sense of time. A severe storm may occur but once in a generation in certain of these localities. Naturally man is but little concerned about such a remote catastrophe. However, our timber must be produced on rotations ranging from 40 years for cordwood to 120 years for saw timber, and during such a period as the saw timber rotation we may reasonably expect not one but several or more storms. Also, the effect of these storms will not be simply the immediate loss of broken material. On the contrary, the effects of a storm will in all probability be manifest in the next rotation on the area, and they are sure to carry at least through to the end of the present crop rotation.

When the foregoing facts are clearly understood, it becomes apparent that we have been overlooking a serious item in our management plans, and in the silvicultural treatment of our forests.

It is the business of the forester and forest manager to be prepared to deal with conditions which arise following severe glaze storms, and, more important, to do all within their power to reduce the damage caused by such storms.

THE CAUSE AND OCCURRENCE OF GLAZE STORMS

GLAZE DEFINED.

Glaze, more commonly, though incorrectly, known as ice or sleet, was first given a distinct and separate classification among types of precipitation in 1916. Abbe, (1). Prior to that date it had been considered as sleet by many persons, and had been included with the various forms of frozen precipitation, with the exception of snow, under the general term of ice.

Glaze may be defined as the product of liquid or semi-liquid precipitation which freezes upon coming in contact with material objects. This definition immediately sets forth the principal conditions which must prevail in order that glaze might form. Namely, they must be such that precipitation occurs in a liquid or semi-liquid form, and that it freezes upon striking an object.

CAUSES OF GLAZE STORMS.

Brooks, (23), finds that the above conditions may be fulfilled in the following ways:

1. When there is liquid precipitation.
    - A. With the temperature of the surface air below zero degrees centigrade.
    - B. With the temperature of the surface air above zero degrees centigrade.
        1. With the temperature of the rain below zero degrees centigrade.

a. From passing through a stratum of cold air.

b. From cooling by evaporation in non-saturated air.

2. With the temperature of the rain above zero.degrees centigrade and the temperature of the object below zero degrees.

a. Because of residual cold.

b. From cooling by evaporation in non-saturated air.

Of the possible conditions listed by Brooks the first is the most common cause of glaze, and probably the only cause of severe glaze storms.

Frankenfield, (38), finds the following meteorological conditinns favorable for the occurrence of sleet and glaze storms.

1. Low temperature and high pressure to the northward.
2. Steep pressure and temperature gradients to the northward.
3. Surface temperature below the freezing point, usually between 22 and 28 degrees F.
4. Moderately high pressure and high temperature over the east gulf and south atlantic states.
5. Northward looping of the isotherms (surface inversion).
6. Gentle to fresh northerly winds.
7. Low pressure trough between two highs, trending from southwest toward northeast.

Briefly, the condition favorable for the occurrence of glaze is a warm current of air above a cold current. This may come about in two main ways as follows:

1. A cold northerly wind underrunning a warm southerly current. Meisinger, (54), Brooks, (23).
2. A cold surface wind being overrun by a warm southerly current. Henry, (44), Pierce, (58), Brooks, (23).

OCCURRENCE OF GLAZE STORMS.

It is obvious that conditions favorable for glaze will obtain more frequently in some regions than in others, and in those regions these conditions will occur most often during certain seasons of the year. Thus Frankenfield, (38 and 39), and Brooks, (23), find that regions and seasons of strong cyclonic activity, bringing precipitation and marked variations in temperature are most subject to glaze storms.

As shown by Plate 1. nearly all of the glaze storms in the United States occur east of the one hundredth meridian. In that area they are most frequent in the upper Mississippi drainage basin, in the southern Great Lakes region, and in the Appalachian mountains.

Storms may occur from October to April throughout these areas, but are most frequent during January and February over the middle Mississippi area, and during March and February over the upper lake area. Frankenfield, (38).

Records of storms in this country are not complete, but during the fourteen years from 1923 to 1936 the United States Weather Bureau recorded 228 glaze storms east of the great plains. Anonymous, (5), Plate 1. Of these, 158 were of such severity as to cause appreciable damage to timber.

Carpenter, (30), reports 20 storms in New York state during

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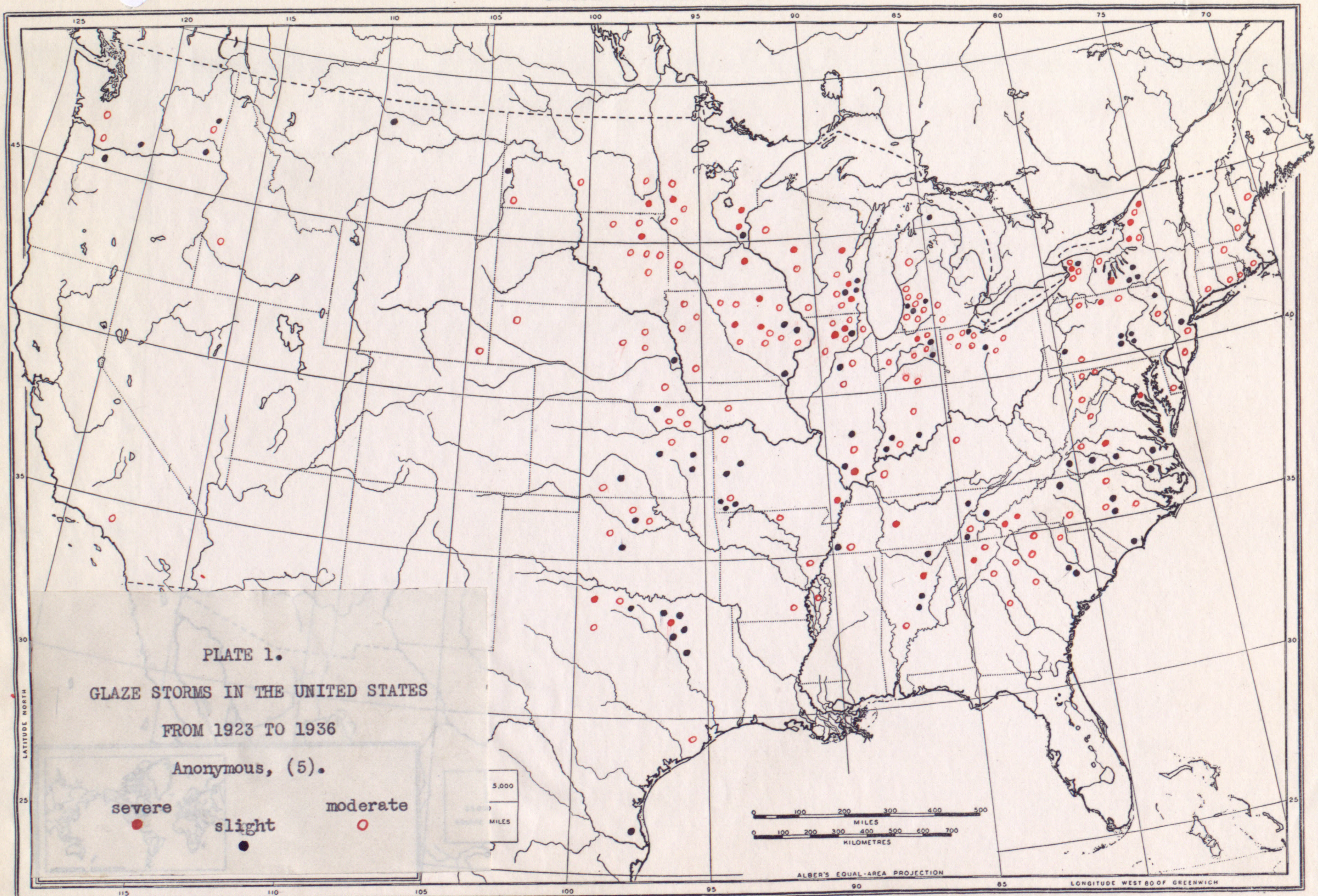

HALL'S OUTLINE MAPS AND GRAPHS

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the twenty-two years from 1908 to 1929 as causing damage to trees. Several of the areas which suffered damage were visited by two or more of these storms. This latter fact is of interest in that it indicates that glaze storms are definitely important environmental factors in certain regions, and may be expected to recur in certain areas. In support of this contention Ashe, (59), in a study of a storm in the Applachian mountains in Virginia found evidences of the occurrence of storms approximately fourteen and thirty-five years previously. Similarly Abell, (2), reported an area in North Carolina which had been visited by four storms during a seventy-five year period, and Downs, (35), refers to a severe storm in New York state in 1900 which occurred over part of the area that the 1936 storm covered.

POSSIBILITY OF FUTURE STORMS.

If the previously mentioned record of the weather bureau of 228 storms over a fourteen year period is considered to be a fair sample of the occurrence of glaze storms we may expect within one hundred years to have approximately 228 severe storms, 900 moderately severe storms, and 500 slightly severe storms.

When it is remembered that certain of these storms may be expected to cover millions of acres over several or more states it is evident that glaze damage assumes a more important place in the silvicultural treatment and management plans for our forests than most foresters have given it.

Cope, (75), estimates the probable occurrence of storms to be three times to a century in any area subject to glaze. This appears to be a reasonable estimation in the light of present information. More accurate and complete recording of the occurrence of glaze in the future will undoubtedly enable the forester to arrive at a better conclusion as to how important glaze damage will be in a specific area.

THE STORM OF MARCH 1936 IN PENNSYLVANIA AND NEW YORK

WEATHER CONDITIONS.

Since the major portion of the conclusions arrived at in this study were based on the effects of the March, 1936, storm, and since it is entirely possible that the effects of glaze storms may vary somewhat depending on conditions during the storm, it is well to briefly consider the weather conditions that prevailed during this storm.

The disturbance which caused the storm appeared over western Colorado on the morning of March 15. It moved southeastward and was centered over eastern Texas on March 16. On the morning of the 17th it was centered over northern South Carolina and precipitation was general over all states north of Georgia. On March 17 the storm moved slowly northeastward to northern Virginia where it remained nearly stationary during the night. By the morning of March 19 the center was over New York City, and by the 20th over western Quebec. Lichtenwalner, (49).

South of the southern part of New York state the precipitation fell as rain, while somewhat north of this rough boundary it fell as snow. Over an irregular area along this boundary, and extending down into north central Pennsylvania, depending on latitude and elevation the rain froze as it came in contact with objects on the ground. Thus an area of approximately 6,000,000 acres, Downs (35), suffered a severe glaze storm.

During the three-day period March 17-19 a total of 4.0 inches of rainfall was recorded at Kane, Pa., with the temperature ranging from

PLATE 2.

figure I.

Glaze on trees along the east border of a woodlot in Potter Co., P.. Observe the size of the twigs in the foreground and the lean of the unsymmetrical tree in the center.

figure 2.

Glaze on twigs at Kane, McKean Co., Pa.. Note the arbor vitae at the extreme right, and at the lower center, bent and frozen fast to the ground. Both trees recovered.

26 to 37 degrees Fahrenheit. During a part of this period the anemometer cups were frozen and the wind velocity was not recorded, but such readings as were obtained indicated a velocity of 3 to 8 M.P.H. in the open and 0.3 to 3 M.P.H. in second growth hardwoods. Soil temperatures ranged from 32 degrees F. at a 6-inch depth to 34.5 degrees at a depth of 18 inches. Hough, (78).

The amount of glaze that accumulated on exposed objects varied considerably, depending on latitude, elevation, and aspect among other factors. Downs, (35), and Shull and Hough, (65), reported twigs the size of a lead pencil as being 2 inches in diameter with the coating of glaze. Anonymous, (14), reports telephone and telegraph wires having a case of glaze 2 inches wide and having icicles 6 inches long and spaced close together. Some idea of the amount of glaze may be obtained from Plate 2, figs. 1 and 2, and from Plate 3, fig. 1.

SEVERITY.

It is difficult to compare the severity of this storm with that of previous storms since rarely have definite records been made of the mount of damage resulting from glaze storms.

In the storm under consideration damage ranged from zero to one hundred per cent of the trees on the different areas, with the average number damaged probably about forty percent.

The volume damaged in Potter County, Pa., was estimated to be 1,000,000 cords, and since about two thirds of the county, or approximately 350,000 acres, was in the storm area, the damage averaged about 3 cords per acre of total area. A chemical company in this county estimated that on two-thirds of their holdings a volume of 3.5 cords per acre was broken down and lying on the forest floor. Shull and Hough, (65).

PLATE 3.

figure I.

The east border of a woodlot in Potter Co., Pa. during the glaze storm of March, 1936. The second tree from the left with a single stem and compact crown has suffered less breakage.

figure 2.

A woodlot in McKean Co., Pa. after the storm. The top has been broken out of nearly every tree in the background.

PLATE 4.

figure 1.

Breakage in trees left after cutting operation. At left 4" Yellow Birch with stem broken. Center 4" Yellow Birch bent beyond the proportional limit. In foreground 8" Black Cherry uprooted. Area clearcut one year before the storm.

figure 2.

The top broken out of nearly every tree in a Red Maple stand. Average diameter, 5 inches.

EFFECTS OF GLAZE STORMS

EFFECTS ON TIMBER.

BREAKAGE. - For the most part the effects of glaze storms are dependent entirely on the amount and type of breakage of timber. For this reason as well as to determine the extent of damage to the trees themselves it is important that a clear picture of the various types of breakage is obtained.

It is possible, of course, to classify the types of breakage in a number of ways. For the purposes of this report and the surveys conducted in connection with it the following classification was used.

0. Undamaged or but slightly damaged.

1. Part of the limbs broken. Plate 3, figs. 1 and 2.

1a. All or nearly all of the limbs broken.
Plate 8, fig. 2. Plate 22, figs. 1 and 2. Plate 24, fig. 1.

2. Stem broken within the crown.
Plate 3, fig. 2. Plate 4, fig. 2. Plate 6, fig. 1.
Plate 8, fig. 1. Plate 18, fig. 2. Plate 22, fig. 2.

3. Stem broken below the crown.
Plate 4, fig. 1. Plate 6, fig. 2. Plate 12, figs. 1 and 2.
Plate 16, figs. 1 and 2. Plate 17, figs. 1 and 2.

4. Stem bent beyond the proportional limit, or uprooted.
Plate 4, fig. 1. Plate 5, figs. 1 and 2. Plate 7, figs. 1 and 2. Plate 10, fig. 1. Plate 11, fig. 2.

The type and amount of breakage suffered by the individual trees, and by the stands, varies considerably, with a number of factors such as species, crown form, aspect, elevation, etc. Because of this, breakage will be discussed more fully under these individual factors.

COMPLETE LOSS. - The first effect of a glaze storm to attract attention is, of course, the amount of timber that has been so damaged as to be lying on the forest floor, dead, or certain to be worthless within a short time. In other words, it is the amount of timber that is completely lost, assuming salvage will not be attempted.

Naturally, the amount lost will vary with the severity of the storm and with the area under consideration. For this reason, a statement of the amount of timber lost must not be interpreted as the probable loss in any area following any storm. With this in mind, Table No. 1 showing the estimated loss on lands belonging to a private forest company in north-western Pennsylvania is presented.

The totals presented in this table do not express the amount of omplete loss as defined above, since material of sawlog size was assumed to be salvageable and so was excluded.

TABLE 1.

AMOUNT OF IMMEDIATE LOSS ON 35,000 ACRES OF LAND BELONGING TO THE ARMSTRONG FOREST COMPANY

Shull and Hough, (65).

Unit No.	Percent of area damaged	Percent of volume in cords lost on area damaged	Percent of total cord volume lost
1	4.6%	45.2%	2.1%
2	61.8	39.5	24.4
3	75.8	34.1	25.8
4	24.5	41.1	10.1

PLATE 5.

figure 1.

Red Pine stumps at Wooster, Ohio, after the removal of trees following glaze damage. The trees were bent beyond the proportional limit and partly uprooted. Average D.B.H. 6".

figure 2.

Red Pine bent beyond the proportional limit. Average D.B.H. 4".

EXPOSURE TO FUNGI AND INSECT ATTACK. - The effect of glaze in exposing trees to insect and fungi attack is similar to that caused by any corresponding mechanical injury. Reed, (81), reports a large chestnut oak in New York state which suffered severe top breakage in a glaze storm in 1900 as being badly decayed, and Ashe (19), attributes much of the wormy and decayed timber in the southern Appalachians to the effect of glaze damage in exposing the trees to insect and fungi attack. The susceptibility of any individual tree to future damage will depend primarily on species, the size of the wound, and the condition of the tree.

In general, there will be but slight danger of fungi infection where only a few small limbs are broken. On the other hand, when the crown has been badly broken, or when a large limb has been broken, the danger of infection will be high. Campbell, (29).

Wounds which expose only sapwood will in all probability not result in serious decay, since these woulds will be relatively small and will heal within a few years. If, however, heartwood is exposed there is serious danger that heart rotting fungi will infect the tree and in time render it unfit for saw timber or cordwood.

The condition of health of the tree is important in that it will determine how rapidly wounds will heal. The danger of infection will not be directly proportional to the total exposed area since the more favorably situated trees, and those which suffered a smaller reduction in crown, will exhibit a more rapid growth of wound tissue and the exposed areas will be covered more quickly.

Since the species vary in their susceptibility to decay the danger of loss will vary between the species of trees although they suffer the same breakage. In general, the danger will be high in basswood, tulip poplar, aspen, red maple, and cucumber tree, while it will be materially lower in sugar maple, black cherry, sweet birch, yellow birch, beech, red oak, white oak, elm, and white ash.

Along with the danger of infection by wood rotting fungi there is also a high danger of loss due to other fungous diseases since the broken trees are possibly more susceptible to attack, and are surely in a weakened condition, and less able to overcome attack.

Just as breakage exposes the tree to fungi infection it exposes the tree to insect attack. Rhoades, (59), reports many pine in the southern Appalachians as being killed by the southern barkbeetle, Dendroctonus frontalis, one year after severe breakage by glaze. The situation with regard to hazard of loss due to insects is somewhat different, but again the vitality of the tree would seem to be of prime importance in determining how long the danger will be high, and whether or not the tree will overcome attack.

In addition to the possible loss due to wood boring insects there is danger of loss due to defoliators. Trees which have suffered a great reduction in crown may be completely stripped of leaves several years in a row and thus killed because a much smaller insect population working in a single tree may effectively complete the defoliation. There is also the possibility that the succulent vegetative growth exhibited by certain species of trees following breakage might prove to be a better food for certain defoliating insects.

The increase in litter, and in dead trees, will provide additional breeding places for insects, as well as places for the development of sap rotting fungi, and the possibility of attack will thus be increased.

On the whole, we may expect serious future losses in the badly damaged timber.

REDUCTION OF CROWN. - One of the most important effects of glaze breakage is the reduction in the crown of the tree. This reduction may range from the almost negligible loss of one small branch to the extreme of the loss of all branches. Naturally the effect of the reduction will be commensurate with the amount of crown lost.

In general, this effect will manifest itself in two principal ways. 1.) There will be a reduction in the amount of sugars synthesized by the tree and a consequent reduction in growth increment, and 2.) there will be a change in the C/N ratio.

Little need be said of the first effect since it is generally accepted that, other factors being favorable, the growth of a tree varies directly with the amount of sugars, manufactured; which in turn varies directly with the amount of green leaf surface or crown.

Unfortunately, the reduction of increment following glaze breakage seems never to have been determined, and it is impossible to cite any figures which would give an indication as to what such an average reduction might be. The present survey did not attempt such a determination as too little time had elapsed since the storm for a comprehensive study of the rate of growth following breakage. Unquestionably such a study would prove of value in measuring the loss due to breakage, and in determining the rate of recovery of individual trees.

The second effect is more obscure and probably not as well known as the first mentioned. It has been but two decades since the importance of the ratio of carbohydrates to nitrogen was first recognized, and, although much work has been done on the subject since that time, there is still some question as to just how great an effect the reduction of the crown of a tree has on the C/N ratio.

PLATE 6.

figure 1.
Sprout growth of Black Cherry one and one-half years after the top was broken by the storm.

figure 2.
Breakage and sprout growth in young trees in a slashing.
From right to left:
Red Maple with but little sprout growth; White Ash with good sprout growth; Red Maple with medium sprout growth; White Ash with good sprout growth.
The leaning tree is a Yellow Birch. Directly behind it is an upright White Ash.

In general a decrease in the ratio, such as is caused by a reduction in crown, will bring about a succulent vegetative growth in the top of the tree, a decrease in root growth, and the cessation of seed production until such time as the carbohydrates again come into a better balance with the nitrogen.

Of primary importance among these results is the succulent vegetative growth of the crown as illustrated by figures 1 and 2, Plate 6. It is this growth that will determine whether or not the tree will recover, and, if recovery is possible, the rate of recovery.

There is a possibility of winter injury to this sprout growth since it is succulent and subject to such injury.

EXPOSURE OF TREES.- Palpably such breakage as that resulting from but a moderately severe storm will bring about a decrease in the number of stems per acre. Certain trees are destroyed outright and others will succumb within a short time. This loss, coupled with the great reduction in crown size of certain remaining trees, may bring about such a decrease in the extent of the canopy that it will have a pronounced effect on the stand.

In connection with the decrease in the extent of the canopy it is interesting to note that this reduction may not be uniformly distributed over the forest. On areas which do not suffer serious damage the reduction is practically uniform. However, on the more severely damaged areas irregularly shaped openings as large as one tenth to one fifth of an acre may occur. These openings appear to result from one tree breaking and in falling, striking, and breaking another, which in turn falls and breaks the next tree and so on. A very similar occurrence has been observed in telephone poles during a glaze storm in which all the poles supported the ice until one of them failed. Then within the next minute or two the entire line of poles, being relieved of the tension on one side, would fail for distances of a quarter of a mile or more on each side of the first failure.

There are five principal direct future effects which may result from the exposure of the trees. They are not taken up in any special order but are presented individually for clarity.

1. Wind throw. - Obviously any break in the canopy which allows the full force of the wind to strike the trees will increase the possibility of wind throw. Openings such as those previously mentioned will allow the wind to strike the trees and damage is liable to result on shallow soils or with shallow-rooted species.

Bowlby, (74), reported some wind throw occurring in New York state following the 1936 glaze storm, but it is unlikely that serious loss will occur.

2. Future Glaze Storms. - The questions of the exposure of individual trees and of stand density as affecting the amount of glaze damage will be dealt with more fully along with the other factors which affect the amount of breakage. For the present it will suffice to say that stand density is not one of the more important factors in most cases, but the manner of exposure of the individual tree is important in that lopsided crowns may develop. This latter point is one of chance. Undoubtedly some of the trees exposed by breakage of others will develop symmetrical crowns, while some will develop unsymmetrical crowns. It is impossible at present to say which will be in the majority, but since it has

been found that unsymmetrical crowns are subject to more severe breakage there is a possibility of greater damage should another storm follow a decade or so after the first.

3. Poor Quality Lumber. - Naturally the exposure of trees will cause the development and persistence of larger lateral branches. This, together with the possible developement of so-called water sprouts, Plate 7, fig. 2, will result in less clear lumber and a consequent lower grade output of lumber from damaged forests.

This effect will not be serious in the more mature stands, but it will unquestionably cause a substantial loss in the developing second growth forests.

4. Sun Scald. - There is a possibility that the sudden exposure of certain trees may result in injury due to excessively high temperatures beneath the bark. The danger of such injury will be greatest among the thin bark species, such as beech, birch, maple, white pine, and spruce, and on the south and southwest slopes.

No instance of sun scald was observed during the course of the studies conducted by the author. This can be attributed mainly to the fact that relatively slight damage occurred on the south and southwest slopes during the 1936 storm.

Sun scald has not been reported as following exposure due to a glaze, but it is probable that it does occur. However, it may be assumed that the amount of such injury is slight and of no great consequence.

5.) Reduction of Competition. - Not all of the effects of exposure are necessarily harmful. The reduction in stems per acre, and

PLATE 7.

figure 1.

Deformed 12" D.B.H. Beech with six large sprouts. This tree was bent beyond the proportional limit by a previous glaze or wind storm. The tufts of sprouts on the center limb are typical of those following breakage in Beech.

The fruiting body of Fomes fomentarius seen on the lower left base of the trunk was the result of a butt injury and not the deformation of the tree and the subsequent death of the top.

figure 2.

A clump of Beech sprouts in the understory broken and bent by a falling Red Maple.

in the crowns of injured trees, will provide more growing space for those trees which suffered relatively little damage.

Providing the exposure is not great enough to cause serious deterioration in site an increase in growth may be expected in the remaining trees. This hypothesis cannot be substantiated by actual figures at present, but it is entirely logical to expect an increase in growth since the glaze breakage will have much the same effect as a thinning in freeing the crowns of certain trees, and in reducing root competition, without the extreme exposure of site which would attend a thinning that reduced the canopy by an equal amount. This is due to the fact that the trees are not completely removed, and all the broken material remains on the ground.

DEFORMATION OF TREES. - During a severe storm a number of trees may be bent beyond the proportional limit but not completely broken. Since the proportional limit has been exceeded these trees cannot right themselves and they remain "loopers." The majority of them will soon pass out of the stand due to competition, but some will persist and develop a form similar to that exhibited in fig. 1, Plate 7.

Less obvious but probably of more importance is the crown deformation of the trees which suffered top breakage. The development of crown following such breakage varies between the species. Ash, basswood, black cherry, cucumber and tulip poplar as shown by figures 1 and 2, Plates 6 and 8, develop clumps of sprouts, and with the passage of time the crwn will assume a compact oval shape. Other species, notably the oaks, may not suffer a complete loss of branches, and are prone to develop broad, flat, mushroom-shaped crowns. In either case

PLATE 8.

figure 1.
Typical one and one half years sprout growth on a tulip poplar following breakage of the stem just within the crown. This is a 10-inch D.B.H. tree on a north slope in McKean Co., Pa. Basswood exhibits a similar sprout growth.

figure 2.
One and one half years sprout growth on a severely broken 10" D.B.H. Cucumber Tree, which was left exposed by cutting operations one year before the storm. The Hemlock in the right background was uninjured.

the length of the main stem and the number of logs produced by the tree are sharply limited by the point of breakage even assuming recovery of the tree and the absence of decay.

Another important effect of the deformation which takes the form of broad, flat, crown formation is the development of wolf trees. Examination of many of the old wolf oaks will show that they have suffered top breakage which was directly responsible for their becoming wolf trees.

Ashe, (59), calls attention to similar crown formations which result from glaze breakage in the Southern Appalachians, and the author has noted typical glaze broken crowns in southern Michigan which resulted from the storm of February, 1922. This brings out the fact that such crown formation forms an excellent indication as to whether or not an area is subject to severe glaze damage.

CHANGE IN COMPOSITION. - As certain species of trees are less resistant to breakage than others a change in composition will practically always follow glaze damage in mixed forests. In some instances this change will be beneficial since certain inferior species, notably pin cherry and aspen, are very susceptible to damage. In other cases the change will be undesirable; as for example in the basswood - red maple stands in which the desirable basswood suffers heavily while the red maple is comparatively little damaged.

Downs, (35), cites an example of this change in a stand in which hemlock, sugar maple, yellow birch, sweet birch, red maple, and beech, gained, in that order, in the percent of total stand at the expense of black cherry. In all of the surveys conducted in connection with this report changes of a similar character were noted in the various types. It would be superfluous to cite each of these changes since they obviously will vary with each stand under consideration. Suffice to say they are of importance.

The probable trend of the change for any particular stand can be obtained from Table 7, which gives the relative resistance to breakage of the most common northern hardwoods, but it must be borne in mind that the rate of recovery of the species will also have an important bearing on any change in composition.

In connection with the change in composition it is interesting to note that glaze damage may have an important part in the ecological succession on an area. Should the area under consideration have an understory of hemlock, sugar maple or beech the progression to the climax type will be hastened. If, on the other hand, these species are absent, and the damage is very severe, aspen, paper birch, or pin cherry may come in, dominate the forest for one generation, and thus effect a setback in the natural ecological succession.

EFFECT ON MECHANICAL PROPERTIES.,- Certain authors, notably Ashe, (59), and Abell, (2), have mentioned windshake as one of the effects of glaze storms. More recently a study by Koehler, (48), indicated that much of the so-called windshake in trees is due to stresses set up in the wood during growth, and not to any mechanical force acting upon the tree. However, since numerous "loopers" or trees bent beyond the proportional limit by a load of glaze bear evidence of stresses set up within the tree during glaze storms it seems logical to expect such storms to bring about windshake in some instances, and to cause partial failure of the wood in certain trees.

DEVELOPMENT OF GLAZE SCARS. - Of little significance but perhaps worthy of note is the production of fine horizontal wound scars on the stems of smooth barked saplings and on the smaller limbs of trees. Such scars have been noted by the author following several glaze storms.

Lutz, (51), finds they are due to the uneven distribution of stresses in the tree as it is bent by the wind, or by the load of ice, while the glaze is on the stem. The ice cracks in horizontal lines under the force of the stress, and the strain in the tree being concentrated at these cracks causes a break in the bark. These wounds heal rapidly and no evidence of the entrance of insects or fungi at the point of injury has been found.

BENEFICIAL PRUNING OF DEAD LIMBS. - Illick, (46), calls attention to the breakage of dead and rotten limbs under loads of glaze. Just how important this beneficial pruning may be is questionable. Should the amount of glaze be sufficient to break such limbs and yet not cause other breakage the value of such a pruning will be evident. But if the storm is severe any such benefit will be nullified by the development of water sprouts and by the persistence and growth of the live lateral branches.

EFFECT ON THE SITE.

As was previously mentioned glaze storms may cause serious reductions in the forest canopy. This results in the exposure of the soil to the drying effects of sun and wind and consequently may bring about a reduction in site quality.

It is difficult to estimate the seriousness of such a reduction but it would seem to be less serious than is first indicated by the amount of decrease in the forest cover. This is due to the rapid sprout growth of the injured trees and to the shade provided by all the broken material. Although a fifty percent decrease in cover may result from glaze damage the exposure is of relatively short duration due to the rapid recovery of the damaged trees.

In the case of very severe damage to large areas an appreciable loss is to be expected since recovery must proceed to a greater degree, and the mortality rate of the injured trees will be high.

EFFECT ON WILD LIFE.

Within recent years the management of wild life on our forests has been receiving an increasing amount of attention, and it is well to at least point out the possible effects of glaze storms on our wild animals.

During a period of glaze there will probably be a break in the food supply of certain birds and animals. This break will usually be for but a short time, although certain storms have lasted for a week or more, but should the storm occur in late winter when the vitality of the animals is at a low ebb it is likely to prove fatal to certain individuals.

In addition to a temporary shortage of food some animals, notably the rabbits, are apt to be caught away from their burrows and find themselves unable to enter them because the glaze has effectively sealed the opening. Should such an occurrence take place the animal may die of exposure or fall easy prey to a predator.

Those animals which survive severe glaze storms will be benefitted by an immediate increase in both food and shelter. A luxuriant growth of succulent sprouts and herbs will occur in the openings created by the storm, and the tangled debris which covers the forest floor following severe breakage provides excellent shelter from enemies. In connection with this latter point it may be noted that certain areas prove all but impassable to man, and shooting through broken tree tops has discouraged many hunters of both large and small game.

In general the observations of the author indicate that severe glaze storms prove of definite value to most of our upland game animals. This is especially true where the forest stand is a dense second growth.

INCREASE IN FIRE HAZARD.

The large accumulation of litter, as shown by figures 1 and 2, Plate 9, which follows glaze breakage results in a dangerous increase in the amount of potential fuel. This, coupled with the increased drying of the fuels due to exposure, brings about a dangerous fire condition. Unquestionably the severely damaged sites should be classed as high hazard areas, and proper precautionary steps should be taken to reduce the possibility of loss.

Fortunately the danger will moderate within a few years due to the decay of litter and the growth of the remaining stand, but the seriousness of the condition immediately following the storm must be recognized and dealt with.

LOSS IN AESTHETIC VALUE.

Immediately following a severe storm the forest presents a

PLATE 9.

figure 1.

Accumulation of debris greatly increasing the fire hazard. A young Red Maple stand one year after the storm.

figure 2.

Another view of the same stand shows further accumulation of litter.

dismal sight. This is perhaps of little importance to the private owner interested in timber production alone, but it is of definite interest on our public forests where the desires of vacationists and other users must be taken into account.

Before the leaves come out certain areas look like forests of telephone poles, and during the first growing season the bare and jagged crowns of the trees are unsightly to the eye. But the recovery of the injured individuals is amazingly rapid in many cases. So much so that the unobservant may motor through a severly damaged area two years following the storm and be entirely unaware that but a short time previously anything out of the ordinary had occurred. In driving along the valleys through the beech-maple country the only incongruous sight which meets the eye is the bare grey limbs of the beech where formerly a solid wall of green presented itself.

Naturally, the extent of the loss in scenic value following a specific storm will depend on the species of trees in the forest. Hemlock forests being but slightly damaged will suffer a negligible loss. Beech forests, on the other hand, may be completely ruined for many years, as far as scenic value is concerned, since the trees seem to develop water sprouts very slowly, and since the mortality rate appears to be rather high. Plate 22, fig. 2, and Plate 24, fig. 1.

DAMAGE TO IMPROVEMENTS.

One of the first losses due to glaze storms that presents itself to the forest manager is the damage to improvements. Telephone lines are broken by the load of ice and by falling limbs. Roads and trails are blocked by fallen material, as shown by figures 1 and 2, Plate 12, and at times camps and similar buildings are damaged by falling trees. This may necessitate a considerable expenditure of funds for repairs, and an additional loss in delay of operations will result should roads be blocked.

ECONOMIC EFFECTS.

Following a severe storm the problem of salvage arises, and brings with it several possibilities of loss. Salvage operations are often hurried and inefficient. The most severely damaged areas are scattered and at times relatively inaccessible. Logging costs are undoubtedly increased in many instances.

Although it is not always necessary that the damaged trees be removed immediately an attempt is made to salvage all damaged material as quickly as possible. This need not result in a flooded local market and a consequent reduction in price, but such an occurrence may be expected in some instances. This is especially liable to be the case where the damage extends over large areas.

Intimately tied up with flooded markets is the decrease or perhaps cessation of purchases by the conversion companies ~~which companies~~ which own timber of their own but depend on outside purchases for a part of their supply. Such companies are forced to salvage their own damaged timber, and finding themselves with an oversupply of raw products in their yards they naturally cease to buy from outside sources.

In the case of pulp holdings there is a loss in sale value of products since much of the broken material cannot be peeled and must go to the chemical plants instead of to the pulp mill.

POSSIBILITY OF EROSION.

In general there will be but slight danger of loss through erosion, but on steep slopes which have suffered damage, and especially if the trees were uprooted, there will be a certain amount of loss. This will rarely proceed to gulleying but instead will be in the form of sheet erosion and the washing away of the litter.

An increase in runoff is to be expected and a resultant decrease in watershed protection. However, the danger of erosion will be of short duration.

FACTORS AFFECTING THE AMOUNT OF DAMAGE

The amount of damage suffered by any particular area during a specific storm will depend on a number of factors. These may be classed as climatic, physiographic, factors of the timber stand, and individual tree factors.

Various combinations will operate on the different sites, and at times it appears rather difficult to determine just which ones are of importance on a certain area. However, such a determination is possible, and must be made in order that corrective measures may be formulated and applied.

To be sure, we cannot hope to control the climatic or the physiographic factors, but once we determine what effect they are likely to exercise on a particular site we can modify our methods of treatment so as to allow for that effect.

In the discussions which follow the majority of the conclusions are drawn from the study of a single storm. Naturally certain of the findings cannot be expected to apply to any other storm. They are presented as an example of what has happened during one storm, and as an indication of what may happen in future storms. On the other hand, certain factors may be considered constant and should vary but slightly no matter what the conditions of the storm might be.

CLIMATIC FACTORS.

PRECIPITATION. - The amount of precipitation is of importance in that it determines to a large extent how severe a storm will be, providing the temperature is favorable for the formation of glaze. Carpenter

(30), has determined that o.3" of rain must fall before coniferous plantations will suffer an appreciable amount of injury. Just how much precipitation must fall before our natural hardwood forests suffer severe damage has not been determined, but it would appear that a somewhat larger rainfall, at least o.5" to 1", would be necessary since the recorded rainfall during severe glaze storms has ranged from 1" to 4".

TEMPERATURE. - The effect of temperature falls into the same category as precipitation. We must have a surface temperature of freezing or below before glaze will form.

There may, however, be a greater variation in temperature between two sites than in precipitation. Such a variation would explain the definitely lesser amount of damage on south slopes than on north slopes, as shown in Tables 3 and 4, during the March, 1936, storm. Temperature alone was undoubtedly the deciding factor in this case since the existence of snow on the north slopes while the south slopes were bare proves beyond a doubt that the latter exposures were warmer and thus did not suffer as heavy an accumulation of glaze. Along with this it seems likely that the south slopes were warmed sooner, and that the ice melted sooner on these slopes than on the northerly exposures.

WIND MOVEMENT. - The velocity and direction of wind movement is of considerable importance in determining how severe the damage from a storm will be. Breakage will increase with an increase in velocity, and storms which ordinarily would not cause much damage will result in an appreciable amount of breakage if accompanied by a strong wind. Illick, (46), cites a storm in which the breakage was sharply accelerated by sudden gusts of wind.

Velocity is not the only important action of wind during a storm for the direction of movement often has an effect in causing a larger amount of ice to form on the windward side of the trees. Rogers, (60), (61), and (62), and Lockwood, (50), cite storms in which almost all the ice accumulated on the windward side of the trees. This may have a serious effect in causing the trees to bend to that side and break.

AMOUNT OF GLAZE.- The amount of glaze formed determines the severity of damage on any given site if the wind movement is negligible. For this reason it is well to know just how much glaze must form before severe breakage.takes place. Table No. 2 gives the amount of glaze in relation to twig size for a number of storms.

TABLE 2.

THE AMOUNT OF GLAZE IN RELATION TO TWIG SIZE FOR VARIOUS SEVERE STORMS

authority	size of twig plus glaze in relation to twig size	authority	weight of twig plus glaze in relation to twig weight
Brooks, (24)	8x	Abell, (2)	15x
Downs, (35)	8x	Anonymous, (6)	25x
Illick, (46)	5x	Buckley, (27)	15x
Rogers, (60)	7x	Chapman, (31)	30x
Rogers, (63)	5 x	Frazer, (40)	30x
		Lockwood, (50)	20x
		Rogers, (60)	30x
		Seeley, (64)	30x
		Spencer, (66)	15 x
		Talman, (69)	30x
Average	6x	Average	25x

PHYSIOGRAPHIC FACTORS.

SLOPE.- A marked difference in the amount of breakage is to be noted on sites which have an appreciable difference in the percent of slope. In general the steeper the slope the greater will be the damage if the other factors are equal. This may be due to any, or a combination of several reasons. Kennedy, (79), in commenting on the greater damage on the steep slopes attributes this to the more rapid wind movement up and down the slopes, and a consequent greater accumulation of ice due to the fact that the greater the amount of air movement the greater the amount of precipitation striking the trees. This appears to be a logical reason, and it is entirely possibe that it might account for an increase in breakage.

The author has noted severe breakage of nearly all the trees along the top of sharp changes in slope while the trees immediately above and below were but slightly broken. This is attributed to the lop-sided crowns of trees thus situated as all of them have ample room to spread down the slope but are crowded from above. Trees that are thus broken are always lying downhill.

Such an occurrence as that cited above would lead one to investigate the possibility that the majority of trees growing on steep slopes develop crowns which are larger on the downhill side. Theoretically such a development is likely to occur, and actually numerous examples of this have been noted by the author. Furthermore it has been noted that there is a definite tendency of trees on steep slopes to fall downhill under loads of glaze.

An apparent refutation of the hypothesis that steeper slopes suffered more breakage was found in the case of south slopes where the reverse appeared to be true. (As shown by the difference between strips 6 and 6a, Table 3.) The logical explanation of this is that the steeper south slopes received more direct rays of the sun and thus either did not suffer as great an accumulation of glaze or the glaze melted sooner.

ASPECT.- As previously stated the southerly aspects suffered materially less damage than the north and north-east slopes. This is definitely shown by a comparison of strips 1, 2, and 5 with strips 3 and 6, Table 3. In this instance the northerly aspects suffered more than three times as much damage. The explanation of this has already been given, namely, the south slopes were warmer. However, such might not always be the case. Rhoades, (59), reports a storm in North Carolina in which the south and east slopes were damaged most.

Aspect is a factor which will be influenced by weather conditions during and after the storm, and its effect may be expected to vary somewhat for the various storms.

TABLE 3.

COMPARISON OF BREAKAGE ON THE VARIOUS SITES IN McKEAN COUNTY

strip no.	rating of strip % (1.)	basis no. trees	aspect	slope in %	elevation above sea level feet	stems per acre	age of stand yrs.	avg. dia. in in.	avg. ht. in ft.
1	23	52	N.E.	12	1940-1980	228	40	7.6	70
2	21	61	N.	23	1860-2000	348	35	6.5	60
2a	66	84	N.	14	1820-1860	393	35	5.2	50
3	92	71	S.	18	1800-1920	410	35	5.6	40
3a	68	14	S.	9	1920-1940	470	35	5.3	50
5	35	59	N.	21	1860-2020	294	35	7.1	60
5a	62	71	N.	14	1800-1860	296	35	7.4	50
6	75	110	S.W.	21	1880-2000	374	35	5.4	45
6a	38	161	S.W.	4	2000-2040	342	35	6.9	60
7	8	19	E.	9	2040-2080	346	40	7.3	60
8	22	23	W.	11	2100-2145	360	35	6.5	50
9	34	22	S.	11	2100-2145	350	35	6.4	50
10	33	9	N.	3	2130-2145	310	35	6.5	50
11	58	24	E.	5	2130-2145	1294	20	3.5	30
11a	80	10	E.	13	2100-2130	812	20	3.0	20
13	0	13	E.	40	1700-2100	130	virgin	12.3	100
29	15	13	N.	15	2020-2060	---	80	10.0	70
30	42	144	S.	5	2040-2080	---	40	7.0	60
31	20	86	N.W.	15	2020-2060	---	60	8.0	60
32	16	159	W.	10	2060-2080	---	60	8.0	60

(1.) Rating on amount of damage to Black Cherry on each site. 100% = no damage. For the methods used in obtaining the ratings see Appendix A, Analyzation of Data.

TABLE 4.

COMPARISON OF BREAKAGE ON THE VARIOUS SITES IN POTTER COUNTY

strip no.	rating of strip % (1.)	basis no. trees	aspect	slope in %	elevation above sea level in feet	avg. D.B.H. in inches	avg. height in feet
15	26	172	W.	15	2200-2300	12	70
16	10	160	N.E.	10	2300-2400	8	60
17	36	112	W.	5	2500-2520	8	45
18	18	77	W.	5	2500-2540	8	50
19	41	26	W.	5	2500-2540	8	50
20	60		S.W.	10	2400-2500	6	40
21	46	284	S.E.	45	2200-2400	8	60
22	29	57	N.	40	1900-2100	10	70
23	88	88	W.	2	1760-1800	12	60
24	80	59	E.	5	1760-1800	14	80
25	24	60	E.	40	1900-2200	14	100
26	26	137	N.	30	2300-2500	10	55
27	31	18	S.E.	40	2340-2500	6	50
28	63	58	S.E.	35	2180-2340	6	60

(1.) Rating on the amount of damage to Sugar Maple on each site. 100%=no damage. Each 1% severe breakage, i.e. breakage classes 2, 3,4, and 5, subtracts 1%. Each 1% moderate breakage, class 1, subtracts 0.5%.

For the methods used in obtaining the ratings see Appendix A, Analyzation of Data.

ELEVATION. - The extent of severe damage over the area affected by the March, 1936, storm was sharply limited by elevation. In Pennsylvania the damage decreased sharply below approximately 1800 feet above sea level as shown by Table 5, by comparison of strips 2 and 5 with 2a and 5a, Table 3, and by comparison of strip 25 with strip 24, Table 4. In New York state the damage was similarly sharply limited at 1000 feet above sea level. Downs, (35).

TABLE 5.

GLAZE DAMAGE BY ELEVATION IN SECOND GROWTH STANDS

Downs, (35).

elevation feet above sea level	basis no. trees	trees damaged %	trees severely damaged %
1700-1800	1,916	2.3	1.3
1800-1900	3,128	12.1	7.8
1900-2000	10,885	22.1	17.3
2000-2100	6,606	30.4	25.2

The effect of elevation may be expected to vary with the different storms, but where the country is mountainous we may expect results similar to those illustrated above.

LATITUDE. - Aside from limiting the extreme range in which severe storms may occur latitude will have a direct effect on the occurrence of glaze on various areas visited by a specific storm. Thus in the 1936 storm the damage extended to lower elevations at the higher latitudes. At the extreme northern boundary of this storm considerable breakage occurred as low as 600 feet above sea level. (Downs, (35).

FACTORS OF THE TIMBER STAND.

AGE CLASS. - Damage has been found to vary considerably between the different aged stands. Young hardwood stands up to twenty years suffer but slight injury, as is shown by strips 11 and 11a, Table 3, and of the many such stands inspected by the author the only ones which showed an appreciable amount of breakage were those in which aspen or pin cherry predominated.

In general the most severe damage was found to occur in the 30 to 60 year second growth and in the old growth with the former suffering more severly due to the fact that stem breakage is common in pole stands while breakage is confined to the crowns in the older stands.

Carpenter, (30), reports the most severe damage in coniferous plantations as occuring in the 15 to 25 year age class. Shull and Hough, (65), find that in hardwoods the 0-15 year class is damaged but little, the 15-30 year class suffered moderate damage, while the old second growth and old growth suffer severely. Buttrick, (28), and Illick, (46), report middle aged timber as suffering the most damage. These facts are illustrated by Table 6.

TABLE 6.

GLAZE DAMAGE BY AGE CLASSES

Downs, (35).

age-class	basis no. trees	trees damaged %	trees severely damaged %
young, 10-20 yrs.	5,337	7.1	6.1
sec.growth, 21-40 yrs.	22,535	21.5	16.9
old growth, culled	675	39.4	29.0

The reasons for the variations in amount of breakage are concerned primarily with the size of the tree. They will be discussed under the factors of the individual tree.

The question of whether even-aged, all aged, or some other age class combination stands suffer the most breakage was not determined by the author's study since nearly all of the stands inspected were even-aged.

DENSITY. - Within the usual limits of stand density encountered in naturally grown woods there appears to be but a slight variation in the amount of breakage, but a definite increase in breakage is to be notedin open stands and in badly crowded stands. The effect of the first condition is illustrated by a comparison of strips 17 and 19 with strip 18, Table 4. These strips were run in a continuous line across three woodlots which were similar in all respects except that the one in the middle, represented by strip 18, had been subject to approximately a 50% cut one year before the storm. As shown by the comparison this woodlot suffered approximately twice the amount of breakage that the other two experienced. Buttrick, (28), and Illick, (46), also report more damage to open stands. The logical explanation of this would appear to be a combination of the lack of mutual support, a free sweep of the wind, and a greater accumulation of glaze on exposed trees.

Overcrowded stands appear to suffer more severly also. This is well illustrated by figures 1 and 2, Plate 10. In the Red pine plantations thus illustrated the only differences noted were the size and the spacing of the trees. The injured stand was spaced 4x4, the uninjured approximately 6x7. It will be noted that the injured trees were at the edge of a recently created opening, but the uninjured trees were likewise

PLATE 10.

figure 1.

3" D.B.H. Red Pine of spindly form which had been exposed by cutting one year prior to glaze damage. Trees were spaced 4'x4' in this plantation which accounts for the weak spindly form.

figure 2.

6" D.B.H. Red Pine adjacent to the stand shown in figure 1. above. Spaced 6'x8', these trees suffered no damage although having the same exposure.

exposed on the same side. The injured trees were all spindly due to the crowded condition of the stand, and this undoubtedly accounts for the injury suffered.

Illick, (46), and Rhoades, (59), report an increase in damage in overcrowded young stands, and Carpenter, (30), in his study of coniferous plantations found a definite increase in damage below a 6x6 spacing, and a doubtful increase above a spacing of 8x8.

SPECIES COMPOSITION. - In stands in which the less breakage resistant species predominate we may expect to find all species of trees suffering greater damage. This is shown by a comparison of strip 11 with strip 11 a, Table 3. The only difference between these two strips was in the amount of pin cherry and black cherry on the strips. Strip number 11 contained many of these trees while Strip 11a had but few. Their effect was very pronounced for they were badly broken and in falling they had broken the more resistant species which were adjacent to them.

An identical occurrence was observed time and again by the author during the studies conducted, but the effect is not only that of direct breakage by falling and striking other trees, for the item of mutual support must not be overlooked. In stands which contain the less breakage resistant trees the effect of mutual support will be greatly minimized. This, together with direct breakage, will result in materially greater damage.

Another effect of species composition has been observed in coniferous stands. Both hemlock and white pine appear to be less injured in pure stands. This is explained in part by the absence of breakage by falling material, but it would also seem that the trees are sheltered to a greater degree, and do not receive as great an accumulation of glaze or as great a force of wind. These factors, coupled with mutual support, seem to explain the relatively slight damage.

PAST TREATMENT. - The treatment accorded the stand in the past will often be of prime importance in determining how severe damage will be. One example of the effect of a heavy cutting has been given under the item of density, namely the cutting resulted in the damage being twice as great. It is to be expected that any sort of cutting within a few years prior to a glaze storm will increase the damage for reasons previously given. Definite proof that thinnings will have such an effect has not been obtained, but Downs, (35), refers to reports from New York state which cite thinned stands as suffering 15% more damage than similar unthinned stands.

It is the author's opinion that judicious thinnings carried out as described in the section on possible silvicultural treatments in this report will materially lower the amount of damage providing a sufficient period of time, perhaps 10 years, elapses before the stand is subjected to a glaze storm.

The amount and time of cutting is not the only past treatment which may be of importance. The all too common selective cutting which selects the best trees for removal and leaves behind a stand of pathologically and mechanically defective trees will result in an increase in damage, since these trees are definitely more subject to breakage. On the other hand, should the defective trees be removed the damage will undoubtedly be less.

Similarly, if the breakage resistant trees are removed the damage will be greater, and vice-versa.

PLATE 11.

figure 1.

The north border of a 60-year old Beech-Maple forest one and one-half years after the storm. Damage was slight 100 feet inside the border. The bare limbs with tufts of leaves are Beech. The others are mainly Red Maple.

figure 2.

White Ash 8" in diameter on the edge of a slashing. The trees are partly uprooted and are bent beyond the proportional limit.

PLATE 12.

Figure 1.

6" D.B.H. Jack Pine at the side of a road. Trees just behind those bordering on the road suffered no damage.

Figure 2.

6" D.B.H. Jack Pine bordering on a road. This stand is on a different site from that in figure 1. Again only the border trees were broken.

UNUSUAL EXPOSURE. - A greater amount of breakage occurs along roads, along the borders of stands, and around natural openings in the woods. Thus as shown in figure 1, Plate 11, the damage may be severe for a short distance into the woods and then taper off sharply. This is due to the effects of exposure as previously stated.

Along roads, trails, and at the borders of stands the first line of trees usually have very unsymmetrical or lopsided crowns. This, coupled with a possibly greater accumulation of glaze, and the absence of support on the exposed side causes the trees to lean in the direction of the opening and break under loads of glaze. Quite often the adjacent trees also fall in that direction for the same reason. Figures 1 and 2, Plate 12, illustrate such occurrences.

INDIVIDUAL TREE FACTORS.

SPECIES. - The amount of breakage of the various species of trees has been found to vary greatly. This variation depends on a number of factors which change from one area to the next as well as depending on certain factors which may be considered constant. For this reason the difference in resistance to breakage between any two species will be constant only under one definite set of conditions. Also, it has been found that if the storm is slight or if the storm is very severe the difference between species is minimized. However, their relative rank should remain constant no matter what the prevailing conditions are.

In spite of the fact that the rank of the species should remain constant, there is an extremely wide divergence of opinion among men who have attempted to rate the species in order of resistance to breakage. This may be attributed to the unreliability of personal judgment, and to a lack of an understanding of the factors which cause the variations in breakage observed. Because of the divergence in published ratings it is thought best to refrain from quoting them, but it should be stated that by broad classes these ratings agree rather closely, and a fairly complete rating would appear to be as follows:

Resistant: Hemlock, northern white cedar, the spruces, and perhaps white pine, catalpa, and black walnut.
Moderately resistant: White pine, norway pine, sugar maple, white ash, elm, and perhaps the hickories and oaks.
Moderately susceptible: the oaks, sweet birch, yellow birch, red maple, beech, black cherry, cucumber tree, and tulip poplar.
Susceptible: Basswood, pin cherry, largetooth aspen, trembling aspen, willow, and cottonwood.

The ratings obtained in the present study are presented in Table 7, and on the whole they express the consensus of opinion of the work that has been done along this line.

In general it would appear that the conifers are somewhat more resistant to breakage than the hardwoods, but during a recent storm the coniferous plantations at the Ohio Agricultural Experiment Station, Wooster, Ohio, suffered considerable breakage while the hardwoods were damaged but very slightly.

For the most part the reasons for the breakage or resistance to breakage of the various species are obvious when the factors which affect breakage are reviewed. It might be stated, however, that the strength of the wood is usually of primary importance. There are in fact but two main factors which control breakage. Namely, they are the amount of ice which accumulates per unit area of the branch or stem and the strength of the wood.

In regards to this latter point it is felt that a misconception as to the relative strength of sapwood and heartwood must be corrected. Downs, (35), infers that the large amount of heartwood in black cherry accounts in part for the severe damage in this species, and states that this is due to the brittleness of the heartwood. The basis for such a statement is not apparent since in the countless tests carried out by the Forest Products Laboratories at Madison, Wisconsin, no consistent difference in the strength of heartwood and sapwood of any species has been discovered. Markwardt and Wilson, (52).

CROWN CLASS. - Damage varies greatly between the crown classes both in amount and type. As shown by figures 1 and 2, Plates 13 and 14, the dominant trees suffer the most damage, the co-dominants the next most, the intermediates the next, and the suppressed the least. These plates and tables also show that crown breakage is most common in the dominant classes while stem breakage is more common in the intermediate and suppressed classes. In connection with this it should be noted that most of the breakage of suppressed trees is due to falling material as shown by figure 2, Plate 7, and by a comparison of figures 1 and 2, Plate 14.

The type of breakage seems to be more dependent on size than on position in the canopy, but the latter factor is of extreme importance in that it will determine to a large extent the size and shape of the crown.

TABLE 7.

RELATIVE RESISTANCE TO BREAKAGE OF THE VARIOUS SPECIES AND A COMPARISON OF BENDING STRENGTH

species	Potter County rating in % (1.)	Potter County basis no. of trees	static bending modulus of rupture lbs. per sq. in.	McKean County rating in % (1.)	McKean County basis no. of trees
Hemlock, Eastern	186	137	6400		
Pine, white	114	87	5000		
Maple, sugar	100	742	9400	100	240
Ash, white	76	70	9600	97	233
Birch, Sweet	67	107	9400	81	61
Birch, Yellow	62	195	8300		
Oak, Red	55	287	8300		
Maple, Red	48	236	7700	74	360
Beech	34	331	8600	69	146
Cherry, Black	23	233	8000	45	977
Poplar, tulip			5400	41	119
Cherry, Pin			5000	10	29
Aspen, Largetooth and Trembling	3	41	5200		
Basswood	2	342	5000		

(1.) Sugar Maple is arbitrarily used as 100% and the various species are rated against it.

For the methods used in obtaining the ratings see Appendix A, Analyzation of Data.

PLATE 13.

TYPE AND EXTENT OF BREAKAGE BY
CROWN CLASS ON STRIPS 29 to 32

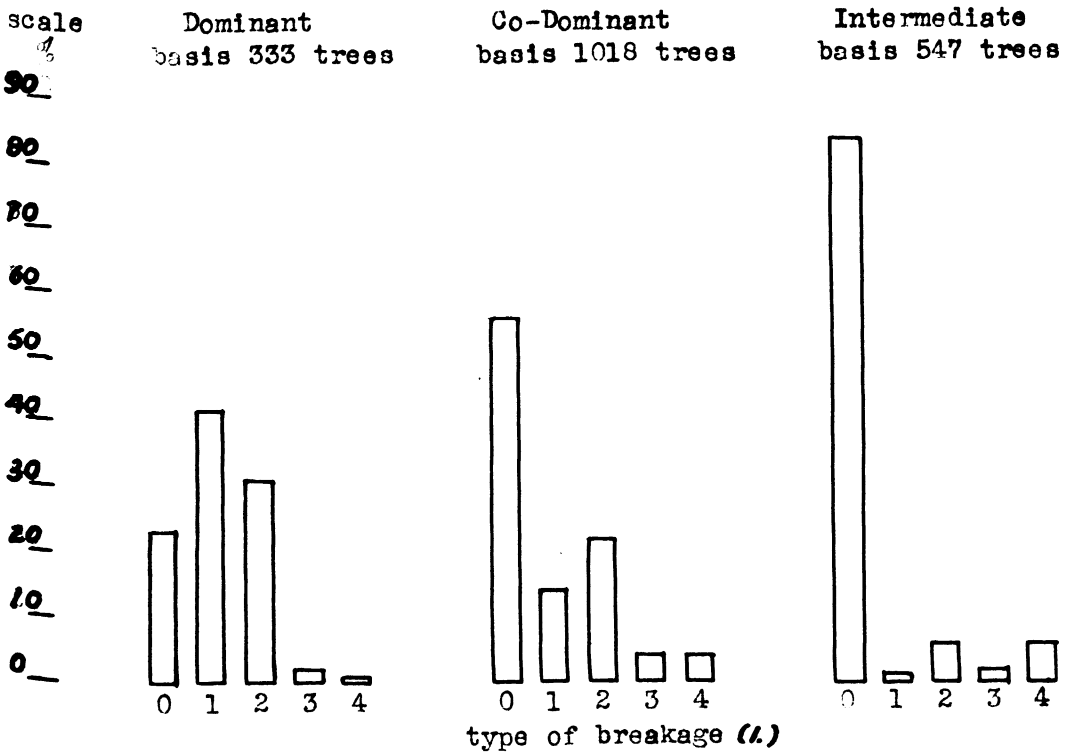
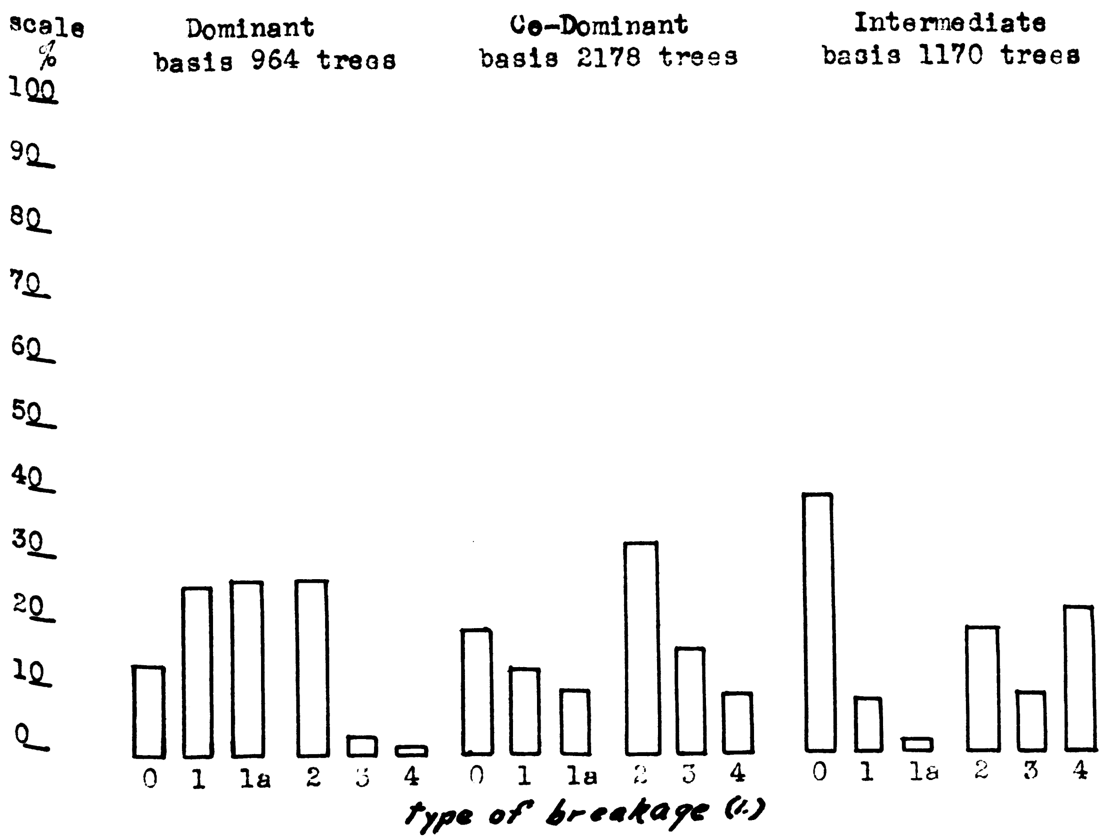


figure 2.

TYPE AND EXTENT OF BREAKAGE
BY CROWN CLASS ON STRIPS
15 to 28



(1.) see page 22.

PLATE 14.

figure 1.

TYPE AND EXTENT OF BREAKAGE BY CROWN CLASS ON STRIPS
1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10 and 13. (excluding indirect breakage)

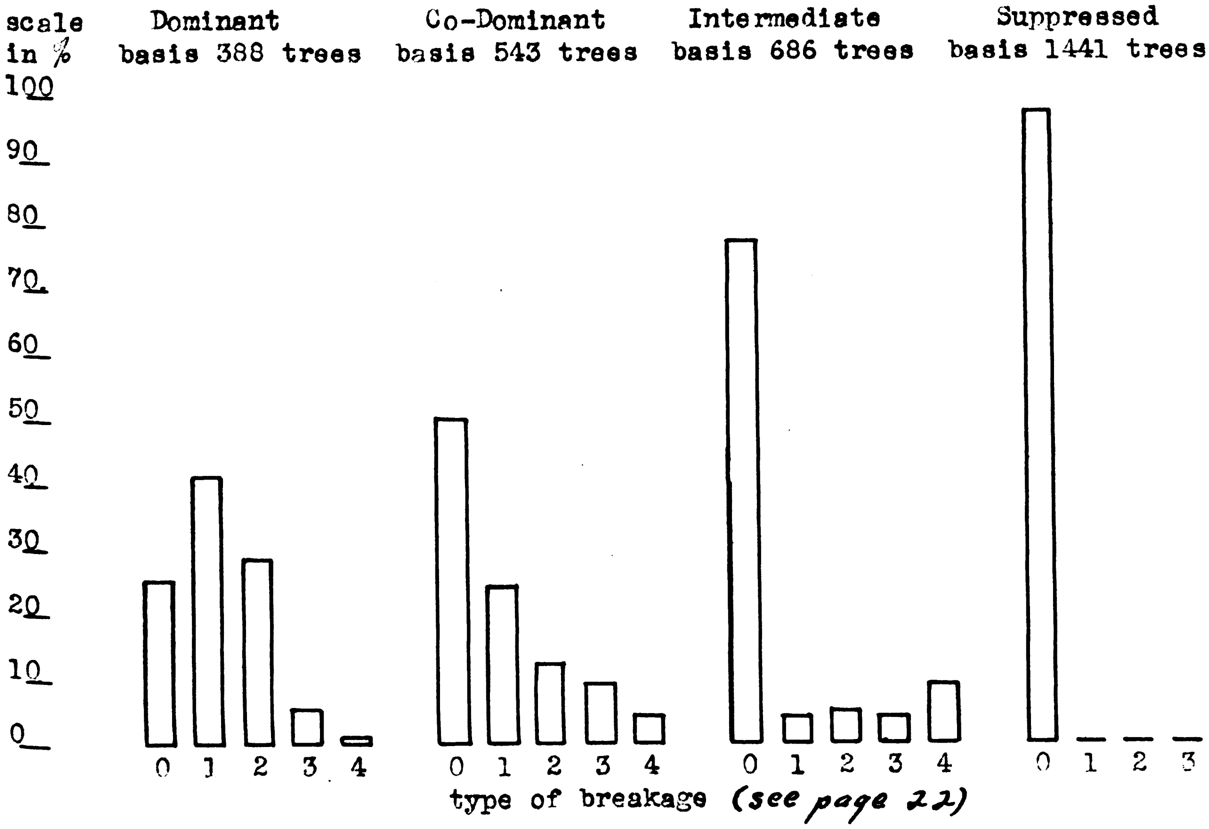
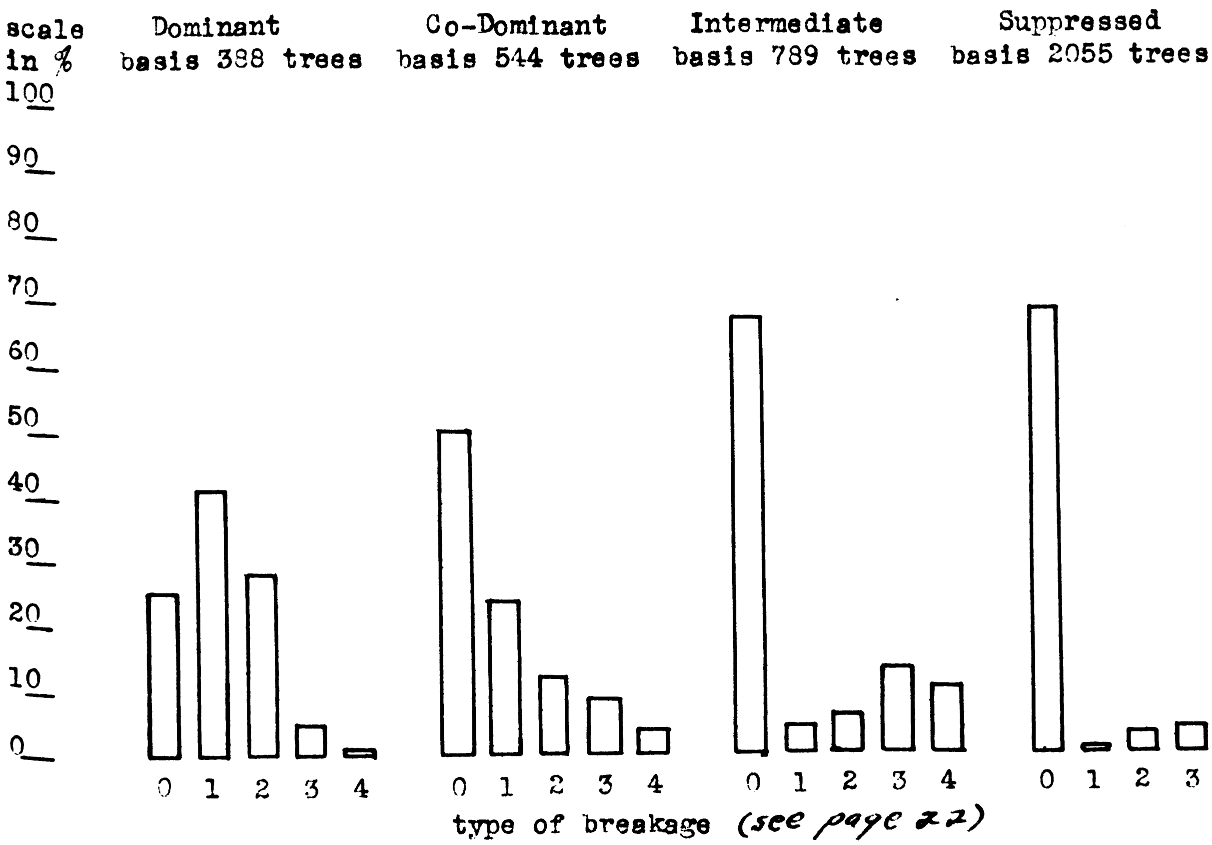


figure 2.

TYPE AND EXTENT OF BREAKAGE BY CROWN CLASS ON STRIPS
1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10 and 13. (including indirect breakage)



The greater amount of damage in the dominant classes may be logically attributed to the more complete exposure of these trees, and the consequently greater amount of glaze which forms on them, together with an exposure to the force of the wind, as well as to the typically larger crowns that dominant trees possess.

SIZE OF THE TREE. - There is a marked variation in breakage between trees of various sizes. It would appear that beyond a certain limit, probably about 5 inches D.B.H., the extent of breakage depends on position in the canopy. The various sizes, however, suffer different types of, and a different amount of, breakage. There is a distinct increase in breakage with an increase in size as shown by Plate 15.

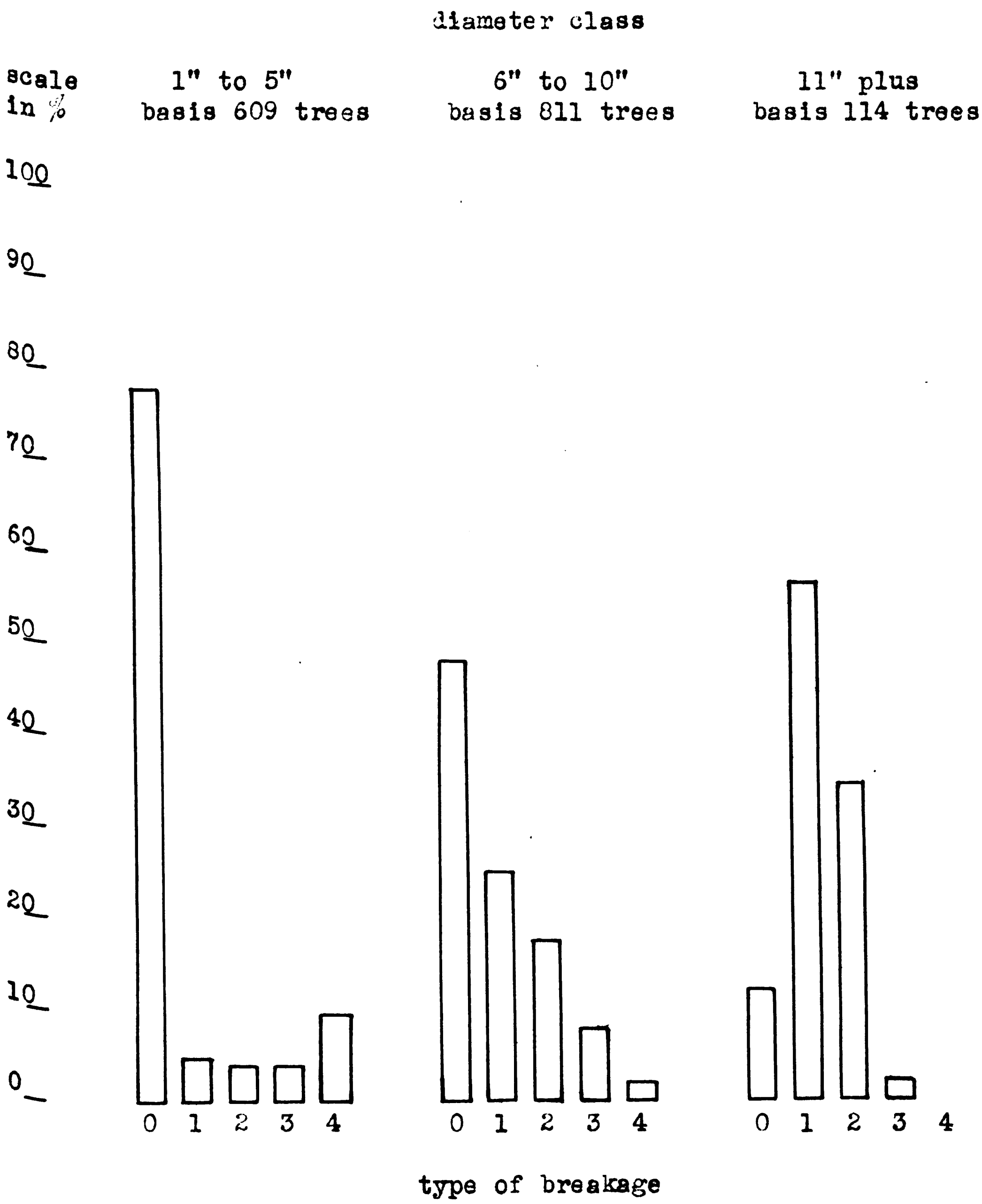
In general, the trees under 5 inches D.B.H. suffer most from bending damage, those from 6 to 10 inches D.B.H. suffer most from top injury, while the breakage of the larger trees is confined almost wholly to the crown. Bowlby, (74), Cope, (75), Downs, (35), Buttrick, (28), Illick, (46), and Abell, (2), report similar findings.

Below approximately 3 inches D.B.H. if the trees are not too tall and spindly they show a remarkable ability to regain an upright position after being bent to the ground. This accounts for the absence of breakage in the 0-20 year stands, and is due to the fact that under a given load deflection varies inversely as the width, inversely as the cube of the depth, and directly as the cube of the span. In other words, the long slim saplings are bent to the ground by relatively small loads, and then the weight of ice is supported by the ground. The larger trees on the other hand resist deformation and remain upright until they accumulate such loads of ice that breakage results.

PLATE 15.

TYPE AND EXTENT OF BREAKAGE

BY DIAMETER CLASS



(see page 22)

PLATE I6.

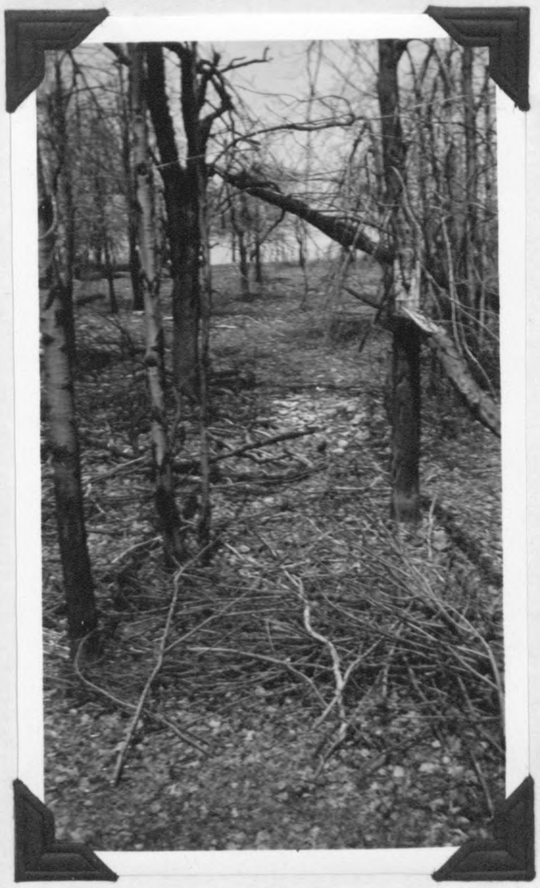


figure I.

Typical breakage of forked trees. At the left a black cherry IO" in diameter. At the right a sugar maple 5" in diameter. Notice the defective area in the crotch of the sugar maple.

figure 2.

Half of the fork broken from a red oak I4" in diameter.

Forked trees of all species suffered such breakage.

PLATE I7.

figure I.
Half of a fork split out of a sugar maple 8" in diameter. Similar breakage of white ash was common.

figure 2.

All four parts of a forked black cherry broken by the storm. Black cherry is often forked and suffered more of this type of breakage than any other species.

STEM FORM. - Other factors being equal the forked trees and twin trees suffer a greater amount of damage than the single trees. This is due to the fact that each half of a forked tree will react to a load of glaze exactly as a tree with a completely lop-sided crown. In other words, the load will be concentrated on one side of the stem and the fork will bend in that direction.

Figure 1, Plate 19, indicates that forked trees are subject to greater damage, but it must be pointed out that a greater proportion of forked than single trees were in the dominant classes and thus would in all probability suffer more severely. Also, as indicated above, forked trees must be considered in conjunction with the unsymmetrical trees before a comparison can be made on an equitable basis. Such a comparison is presented in Plate 20, and will be discussed more fully under crown form.

Rogers, (60), cites the severe breakage of elm forks during a glaze storm, but Downs, (35), on the other hand is inclined to believe that splitting at the fork is not as important as it first appears to be. However, it must be noted that forked trees commonly break at the base of the crown as shown by figure 1, Plate 6, and by figure 2, Plate 22.

Black cherry is commonly forked and suffers severely from fork breakage as shown by figure 1, Plate 16, and figure 2, Plate 17. But such damage is not confined to black cherry alone. Sugar maple, figure 1, Plate 17, and red oak, figure 2, Plate 16, commonly exhibit such breakage, and nearly all of the stem breakage of hemlock noted by the author occurred in either forked or completely unsymmetrical trees.

The manner in which forked trees react to loads of glaze is definitely shown by figures 1 and 2, Plate 18, and by figure 1, Plate 3.

CROWN FORM. - Trees which have a lop-sided crown are definitely more severely injured than those with symmetrical crowns. This is shown by figure 2, Plate 19, ~~and~~ by Plate 20, and by Table 8.

TABLE 8.

TYPE AND EXTENT OF BREAKAGE IN
BLACK CHERRY BY CROWN FORM ASSUMING
FORKED TREES TO BE UNSYMMETRICAL

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.

crown form (1.)	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
S	209	132	44	30	3	0	100	63.2	21.1	14.3	1.4	0
U	552	251	106	124	57	14	100	45.5	19.2	22.5	10.3	2.5

(1.) S symmetrical crown.
U unsymmetrical crown or forked.

It will be noted that the differences in percent undamaged are not very great, indicating that the difference in crown class was not as important a factor as in the case mentioned above. It will also be noted that the greatest difference is in the amount of stem breakage, and that a much larger percent of such injury is sustained by unsymmetrical trees.

Buttrick, (28), and Illick, (46), have noted the effect of unsymmetrical crowns upon the severity of damage, and this effect is shown by figure 1, Plate 2.

PLATE 18.

figure 1.

Sugar Maple at Ulysses, Pa. during the storm. The forked trees are all badly bent while the single stem tree, second from the right, stands upright.

figure 2.

Trees along the border of an orchard at Kane, Pa. during the storm. The Tulip Poplar on the left has been stripped of branches. On the extreme right a forked Mountain Ash shows the typical top breakage of forked trees.

PLATE 19.

figure 1.

TYPE AND EXTENT OF BREAKAGE
BY STEM FORM

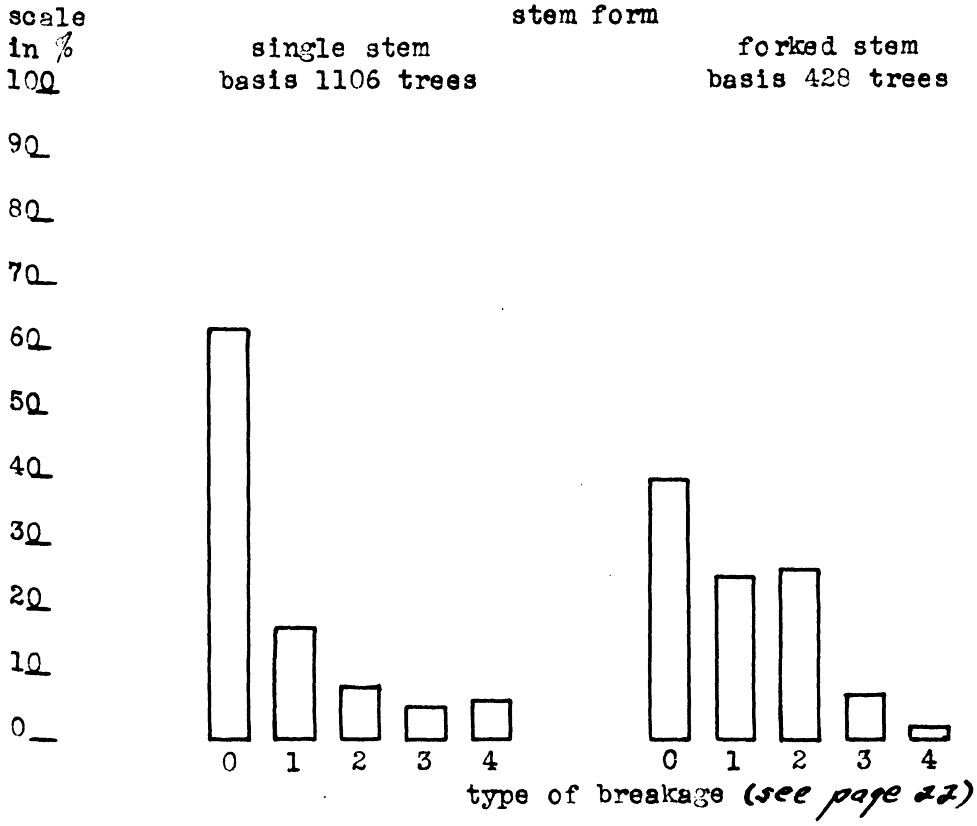


figure 2.

TYPE AND EXTENT OF BREAKAGE
BY CROWN FORM

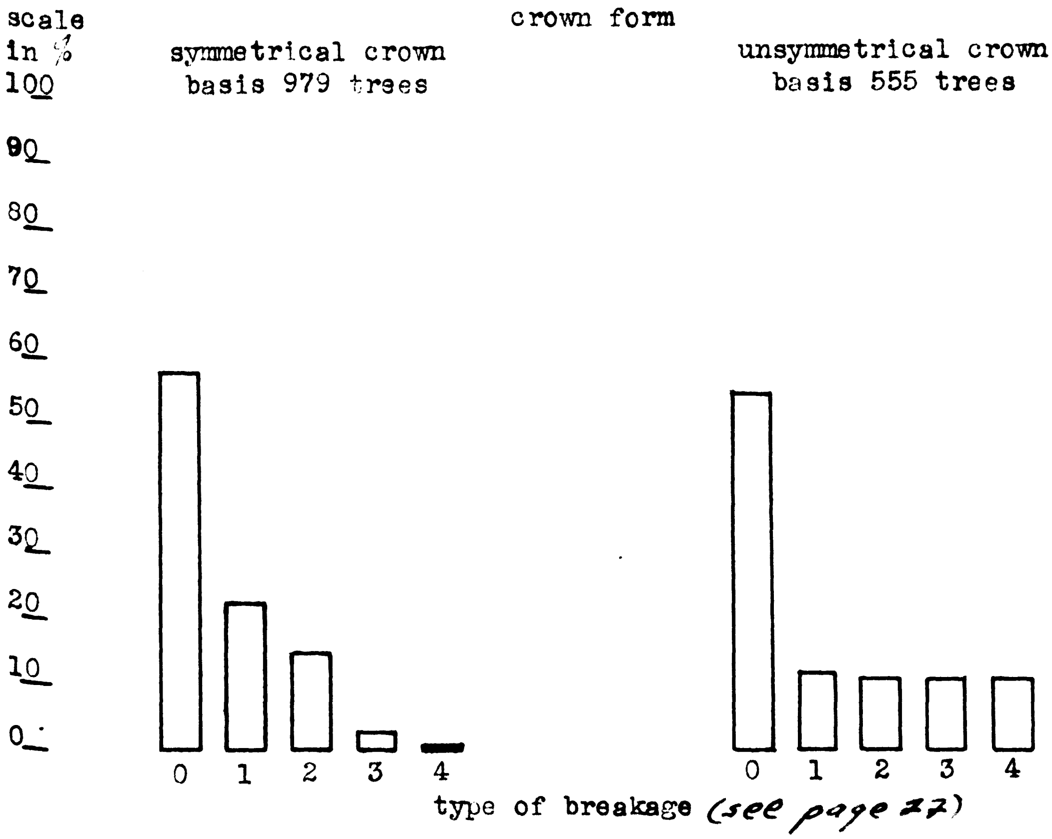


PLATE 20.

TYPE AND EXTENT OF BREAKAGE IN
BLACK CHERRY BY CROWN FORM ASSUMING
FORKED TREES TOBE UNSYMMETRICAL

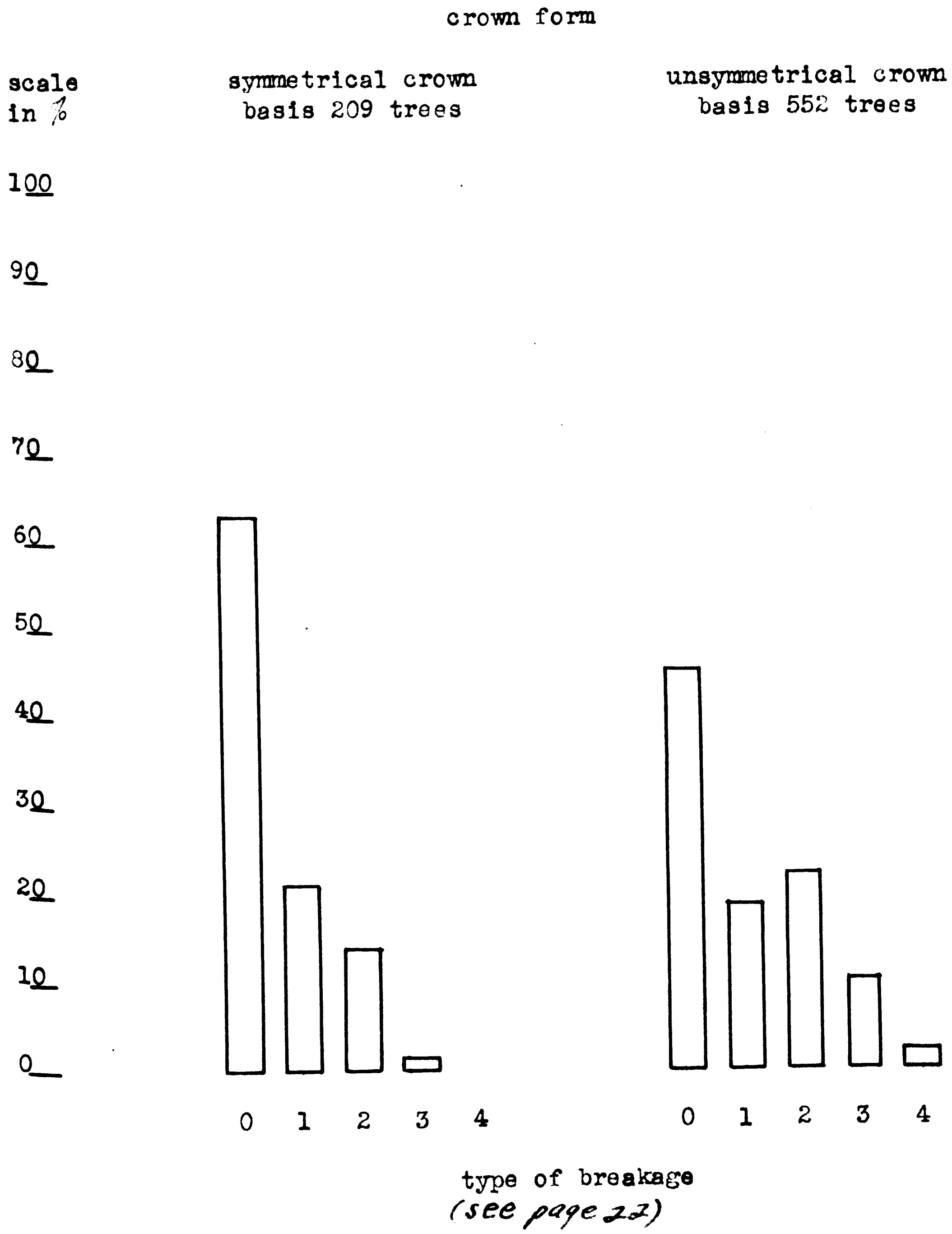


PLATE 21.

figure 1.

TYPE AND EXTENT OF BREAKAGE
BY PERCENT OF CROWN

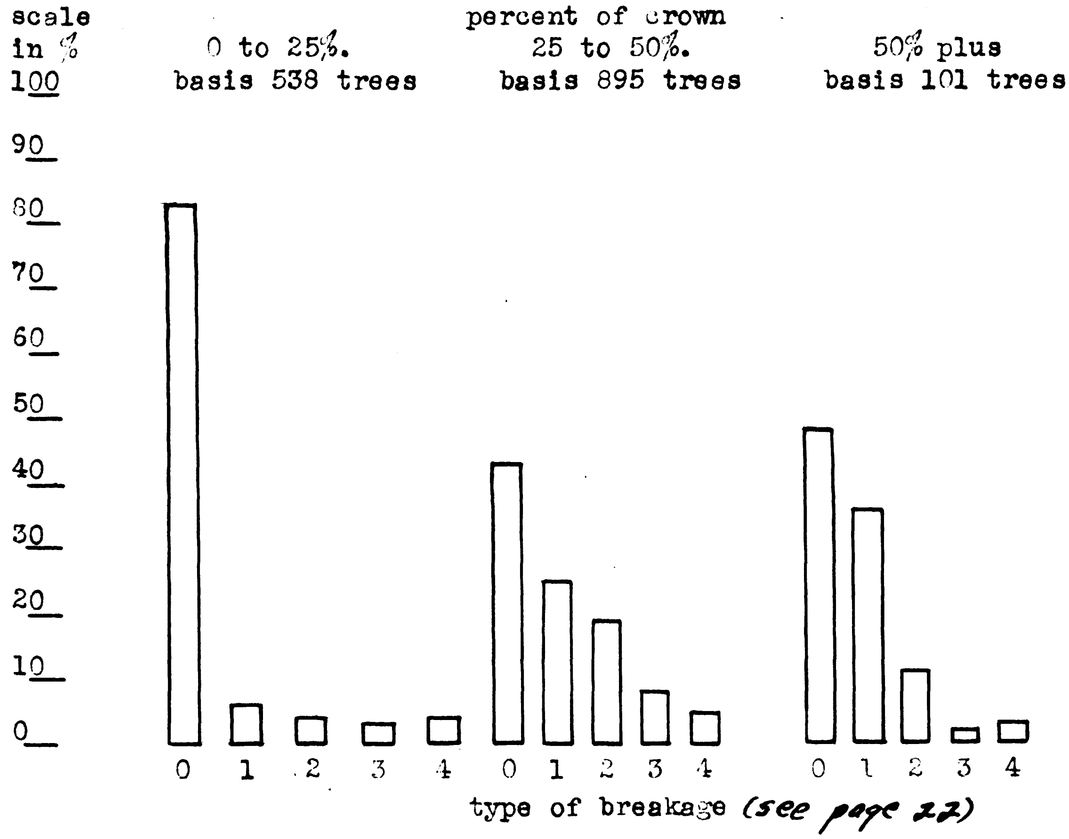
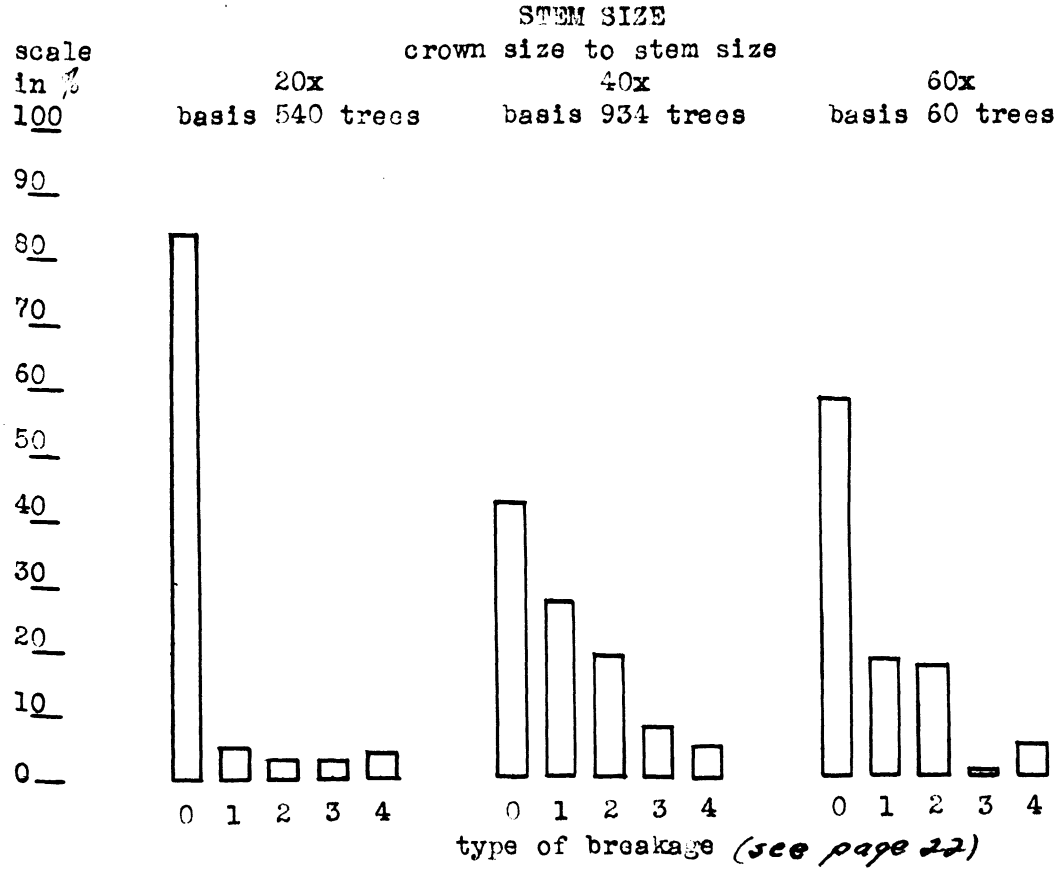


figure 2.

TYPE AND EXTENT OF BREAKAGE
BY CROWN SIZE IN RELATION TO
STEM SIZE



CROWN SIZE IN RELATION TO STEM SIZE. - A large crown upon a small stem will result in a greater load of ice to be supported per unit of cross section of stem than in the case of a small crown on a large stem. Obviously the damage will be greater to those trees which have large crowns and small stems, this fact is clearly indicated by figure 2, Plate 21.

The apparent discrepancy in the results obtained in the 60x class may be explained by the weak basis of 60 trees. It must also be stated that many of the small crown trees were in the intermediate class, and this might explain a part of the difference. On the other hand, it is possible that the fact that the intermediate trees do have small and compact crowns accounts for their being less damaged.

PERCENT OF CROWN. - A marked similarity to the effect of crown size is shown by the effect of percent of crown. A comparison of figures 1 and 2, Plate 21, shows them to have an almost identical effect. This is due in part to the fact that the trees with the larger sized crowns often have the higher percentage of crown also.

However, the findings indicate that we may expect to have greater damage in those trees with the larger percentage of crown.

MECHANICAL PROPERTIES. - If all other factors were equal the severity of breakage of the trees would vary directly with their strength properties. That such is not the case is shown by Table 7. However, the strength of the wood is of prime importance in determining how severe damage will be, and in general the species with the stronger properties will be most resistant to breakage.

The mechanical properties of trees vary widely within a species as well as between species. This is often the cause of marked discrepancies in the resistance to breakage between trees of the same species.

PATHOLOGICAL DEFECTS. - Trees which are pathologically defective will suffer severe breakage since those exhibiting advanced decay and/or incipient decay will break under a smaller load of glaze. Similarly, trees exhibiting Nectria canker, Larch canker, Tympanis canker or a similar defect will be more severely damaged.

Such breakage in itself may not result in serious loss since the trees are culls in any event. But in falling these trees may strike and break sound trees, and may cause damage to reproduction.

Illick, (46), cites the breakage of defective trees, and figure 1, Plate 16, shows the breakage of a defective sugar maple.

SIZE OF TWIGS. - Rogers, (60), calls attention to the relatively lesser damage suffered by catalpa, black walnut, and similar large twigged species than by certain fine twigged trees, although the differences in strength properties would not warrant such a difference in breakage. This is due to the fact that in general the larger twigged trees have a decidedly smaller number of small branches and twigs. As a result they accumulate a smaller amount of glaze.

Unfortunately, the author did not have an opportunity to inspect any of the larger twigged trees in the 1936 storm area, and as a result could not discover how severely they were damaged. However, the explanation given above appears logical and we may expect less breakage of such trees.

PLATE 22.

figure I.

A tulip poplar IO" in diameter with a heavy sprout growth one and one half years after all its limbs were broken by the storm.
On the right a norway spruce 8" in diameter with the top broken out but with no limb breakage. Drooping branches such as those on spruce will support greater loads of ice.

figure 2.

Typical breakage in black cherry an the left and beech on the right. Both trees IO" D.B.H..
The cherry exhibits a dense sprout growth while the beech has very little.

BRANCHING HABITS. - The length and direction of growth of the branches may be an important factor in determining how severely a species will be injured. Thus the trees with long, erect branches may be severely broken due to the bending load applied to them, while those trees with horizontal or drooping branches, figure 1, Plate 22, will be but slightly damaged. This is logically explained by the type of load to which the two types of branches are subjected. In the case of erect branches the force is mainly such as to produce static bending. In the case of horizontal or drooping branches the force quickly changes from static bending to tension parallel to grain or pulling. Tests show that in general the ultimate tensile strength considerably exceeds the modulus of rupture of static bending, and it is for this reason that the spruces and certain other conifers suffer but slight breakage of lateral branches, but commonly have their tops broken.

Rogers, (60), calls attention to the effect of the direction of branching and gives an explanation similar to the foregoing.

EXISTENCE OF FOLIAGE. - It would appear that trees having foliage at the time of the storm would receive a greater amount of glaze and thus be subject to greater injury. This in general might be assumed to be true, as illustrated by the damage to the coniferous plantations at Wooster, Ohio, but there are notable exceptions. Hemlock has been found to be very resistant to breakage in spite of its winter foliage. This seems to be due to the formation of a solid coat of glaze over the tree, as shown by Plate 23. The branches droop and are frozen together. This effectively causes the load to be evenly distributed over the entire tree while at the same time the glaze itself supports a part of the load.

PLATE 23.

figure 1.

Hemlock in the park at Kane, Pa. during the storm. The branches are drooping and frozen together. Only one limb has fallen to the ground. Observe the small amount of glaze on the sheltered branches at right center.

The greater shelter from wind has been previously cited as one possible reason for the absence of damage in pure coniferous stands.

PLATE 24.

figure I.

A beech IO" in diameter dead one and one half years after the storm. Practically every branch has been broken from the tree.
The trees in the background are red maple with crowns much reduced by breakage.

figure 2.

Fruiting bodies of Polystictus cinnabarinus on the broken stem of a black cherry. Broken material deteriorates rapidly and must be salvaged within a year or two.

TREATMENT OF DAMAGED STANDS

The problem of what to do with stands which have suffered severe breakage is of prime importance in that it will determine what the timber stand will be for at least one, and perhaps two or more generations.

If the broken material is to be salvaged no time should be lost in removing it from the stand for it is quickly attacked by slash rotting fungi, figure 2, Plate 24. Not only should the broken material be removed, but also those trees which have suffered such damage that they will soon die, figure 1, Plate 24, those which have been bent beyond the proportional limit, ~~and perhaps some of the ones~~ those which have suffered serious stem injury, andperhaps some of the ones which have suffered top injury. It is not necessary to remove such trees immediately, but their removal should be accomplished as soon as possible.

It has been previously noted that crown deformation leads to the development of wolf trees. Because of this, trees which appear likely to develop in that manner may be removed.

Recognition of the recovery of certain species must be taken into account. Up to the present the beech damaged by the 1936 storm have been slow in recovering while the black cherry, ash, basswood, cucumber, tulip poplar, sugar maple, and oaks have recovered rapidly. With this in mind, it would appear best to wait a few years to see how recovery is progressing before making a heavy salvage cut.

The folly of cutting all severely damaged trees where most of the stand has suffered such injury cannot be too strongly emphasized. Such a cut would bring about a serious site deterioration, and permit the entrance of inferior species. Where a large percentage of the trees have been severely broken they should be removed in two cuts, perhaps about five years apart, providing that such cuts are economically feasible.

SILVICULTURAL TREATMENT TO DECREASE LOSS

JUSTIFICATION.

A substantial reduction in the amount of loss due to glaze damage may be effected by a recognition of the factors which control breakage, and the handling of our forests so as to control or allow for these factors.

In areas which are subject to frequent storms the possible reduction in glaze loss alone may be sufficient to warrant specific silvicultural treatment. Fortunately, however, such treatment need not be justified on the basis of a reduction in glaze damage alone for the treatment to lessen damage should also result in an increase in growth and in quality of product. In other words, glaze damage treatment fits in nicely with timber stand improvement work, and may be assumed to be merely a strong point in favor of such work.

The possibility of reducing loss due to glaze damage may be questioned. Obviously treatment of our forests would be wasted if it did not result in a substantial decrease in the amount of damage. In dealing with a number of species it is immediately apparent that a reduction will result if the less breakage resistant species are discriminated against in cutting operations. It is not so apparent that a reduction may be accomplished within a species, but the foregoing discussions of factors affecting the amount of breakage strongly indicate that the most important of these factors are controllable. The proper treatment of these factors may not result in a decrease in the number of trees of a specific species injured, but it will result in a decrease in the extent of injury suffered by the individual trees. In other words, it will prevent stem injury.

With the present accessibility of the stands and the use of trucks it is entirely possible that a treatment of the stands would be paid for by the material removed, and in some cases a profit might be expected. In addition, the removal of defective trees will be in the nature of a thinning, and an increase in quality and increment may be expected.

RECOMMENDED TREATMENT.

Careful consideration of the factors operating on a particular area is necessary before specific treatment can be recommended. There are, however, certain general rules which should be followed. They are taken up individually as follows:

1.) Aspects which are known to be liable to more severe damage should be devoted to the more breakage resistant species.

2.) Steep slopes should be likewise devoted to breakage resistant and strongly rooted species.

3.) In mountainous country the higher elevations should be devoted to resistant species and the valleys to the less resistant species providing the sites are favorable for their growth and it is desired to grow both types.

4.) Care should be taken to avoid overcrowding the stand, and yet a closed canopy should be maintained. In other words, avoid the development of spindly trees, but at the same time do not expose the individuals.

5.) Discriminate against the less breakage resistant species in cutting operations where the species present are of equal value.

6.) Remove wolf trees since they are prone to serious injury and damage the adjacent trees in falling.

7.) Maintain protective borders of breakage resistant and well formed trees along the edges of the stand and along roads.

8.) Discriminate against forked trees and twin trees in cutting operations.

9.) Practice crown thinnings so as to develop symmetrically crowned trees, and discriminate against the trees with badly lop-sided crowns.

10.) Attempt to secure a well balanced crown size in relation to stem size. In other words, so regulate the stand as to avoid spindly trees with large crowns.

11.) Remove pathologically defective trees.

12.) So regulate the growth of the stand that the trees develop mechanically stronger wood.

It is obvious that these recommendations can be carried out during selective cutting or timber stand improvement. But in many stands a cut that practiced such a treatment would remove the majority of the trees, and thus defeat its purpose by severely exposing the site. In such cases personal judgment as to which trees should be removed is called for. It must be emphasized that too heavy cuttings in the northern hardwoods may prove disastrous not only due to exposure of site, but also because the inferior pin cherry and aspen are likely to come in and dominate the stand. (Ostrom, (57).

SUMMARY

In certain sections of the United States east of the great plains glaze storms occur periodically. These storms cause serious immediate breakage losses in our forests, and expose the timber to the possibility of equally serious future losses such as fungus infection, insect attack, site deterioration, wind throw, reduction in increment, losses attendant upon a change in the C/N ratio, future glaze storms, poor quality lumber, sun scald, deformation of crown, changes in species composition of stand, increase in fire hazard, loss in aesthetic value, erosion, and the effects of misguided salvage operations.

In general, the damage will increase with an increase in the amount of glaze formed, an increase in the velocity of the wind, and an increase in the slope. At times it will be more severe on northerly aspects, at higher elevations, and at higher latitudes.

The damage will also be more severe in the middle age timber of pole size, in open and in overcrowded stands, in stands which have been culled for the best timber, in stands which have a preponderance of easily damaged species, along the roads through the stand, and along the borders of the stand.

Breakage varies greatly between the species. Hemlock, spruce and cedar are resistant to breakage. White pine, red pine, sugar maple, white ash, and elm are moderately resistant. The oaks, hickories, birches, red maple, beech, black cherry, tulip poplar, and cucumber tree are moderately susceptible to breakage. Basswood, pin cherry, largetooth aspen, trembling aspen, cottonwood, and willow are susceptible.

Damage is greatest in the dominant crown classes, in the medimm sized timber, (although perhaps a higher percentage of larger trees are injured), in forked trees, in trees with lop-sided crowns, in the larger crowned trees, in the mechanically weak trees, and in trees which are pathologically defective. It appears to be less in trees with large twigs and relatively few twigs, and in trees with drooping branches.

The removal of injured trees is recommended providing it does not result in too great an exposure of the site, and does not allow inferior species to seed in.

Silvicultural treatment to decrease loss is justifiable since it merely means modification of thinning practices, of selective cutting, or of timber stand improvement work; and since it is relatively certain to decrease the loss.

The favoring of breakage resistant species on severely damaged sites, such as steep slopes, severe exposures, northerly aspects, and high elevations is urged. In addition the discrimination against breakage susceptible species, forked trees, unsymmetrically crowned trees, and defective trees is recommended. The regulation of the stand so as to develop mechanically stronger trees should be attempted.

APPENDIX A.

METHODS OFCOLLECTING AND ANALYZING DATA

COLLECTION OF DATA.

For the most part the facts upon which this report is based were obtained by field studies conducted by the author during the summer of 1937. This work was supplemented by a review of all available published data, by correspondence with men in the field, and by interviews with interested observers.

The specific field work was carried out in McKean and Potter Counties, Pennsylvania, while general observations were made in New York state, in Michigan, in Ohio, and in other parts of Pennsylvania.

For the collection of specific data in McKean County the tally sheet shown in Plate 25 was used in the field. As noted there-on the individual trees were tallied by species, crown class, stem form, crown form, percent of crown, crown size in relation to stem size, and by diameter class. Under these headings each tree was tallied in its proper column by type of breakage suffered. In addition to the individual tree data pertinent facts as to the slope, aspects, elevation, density, age, age class, average height, and special remarks were recorded.

In the field work in McKean County one half chain strips were run straight up and down the slopes using a compass and pacing distances. The data was tallied separately for each 100 ft. thus run.

In the work done in Potter County the tally sheet illustrated in Plate 26 was used. Trees were merely tallied as to species, crown class, and type of breakage. As in the McKean county work all information as to site, exposure, and stand was noted. In this work definite strips were not run. Instead all trees close enough to the author to be fully observed were tallied as progress was made through the stand.

ANALYZATION OF DATA.

Little need be said of the methods by which the data collected was treated in compiling this report since for the most part it is a straight-forward presentation. However, the methods of rating the various sites and the species must be explained.

In reviewing the data collected it was found that a great variation in amount of breakage exists between the sites and between the crown classes. It was also discovered that the species were not evenly distributed in these various factors. For example, the birches were commonly found in the intermediate crown class but seldom in the dominant classes. Again the oaks were common on the high ridges where breakage was severe but were rarely found in the valleys where slight damage occurred. To make an equitable comparison it was necessary to compensate for these factors.

In rating the sites one species common to all sites was used. A correction factor was then computed for this species to reduce the breakage in the intermediate and co-dominant classes to terms of breakage in the dominant class. The resistance percents obtained for the three classes were then weighed and averaged to obtain the final rating. The rating thus obtained by use of a species common to all sites was checked by comparing the sites using a different species.

In rating the species the sites which had nearly similar

PLATE 25.

TALLY SHEET USED IN COLLECTION

OF DATA IN McKEAN COUNTY

(Turned and reduced for ease of printing.)

diameter class	11" plus										
	6" - 10"										
	1" - 5"										
crown size in relation to stem size	60x										
	40x										
	20 x										
per cent in crown	50 plus										
	25-50										
	25 minus										
crown form	symmetrical										
	unsymmetrical										
stem form	single stem										
	forked stem										
crown class	suppressed										
	intermediate										
	co-dominant										
	dominant										
type of breakage		0	1	2	3	4	0	1	2	3	4
species		sugar maple					black cherry				

aspect ------------------density------------------avg. ht.-----------

slope -------------------age--------------------dist. run----------

elevation----------------age class---------------location-----------

date---------------

strip no.----------

PLATE 26.

TALLY SHEET USED IN THE COLLECTION

OF DATA IN POTTER COUNTY

(somewhat reduced)

species	type of breakage	crown class		
		dom.	c-d.	int.
sugar maple	0			
	1			
	1a			
	2			
	3			
	4			
basswood	0			
	1			
	1a			
	2			
	3			
	4			
red oak	0			
	1			
	1a			
	2			
	3			
	4			

date.....................

location.................

aspect...................

slope....................

elevation................

density..................

age......................

age class................

avg. ht..................

avg. D.B.H...............

remarks..................

strip no.................

ratings were first grouped to obtain a better representation of individuals. Then the co-dominant and intermediate crown classes were reduced to terms of the dominant class by using correction factors determined for each species. The percentages thus obtained were weighed and averaged, and following this the various species were rated within the groups against a species common to all the groups. The group ratings thus obtained were weighed and averaged to obtain the final rating.

APPENDIX B.

ORIGINAL FIELD DATA UPON WHICH THE REPORT IS BASED.

The data collected in the field are presented in the following tables. Little need be said in the way of explanation of these tables except to point out that Table 9 presents the type and extent of breakage on the various sites in McKean County, Pa., by species and crown class while Table 10 presents the same data as collected in Potter County, Pa. Tables 11, 12, and 13 present these same data in a condensed form.

The remainder of the data collected in the field is presented in condensed form in Tables 14, 15, 16, 17, 18, and 19.

TABLE 9.

TYPE AND EXTENT OF BREAKAGE ON THE VARIOUS SITES

IN McKEAN CO. BY SPECIES AND CROWN CLASS

Strip No. 1.

species	crown class	total trees	type of breakage (1.) 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	14	4	9	1	0	0	100	28.6	64.3	7.1	0	0
Sugar	C-D.	7	3	1	1	0	2	100	42.8	14.3	14.3	0	28.6
	Int.	13	8	0	1	0	4	100	61.5	0	7.7	0	30.8
Maple	Sup.	30	23	1	1	0	5	100	76.7	3.3	3.3	0	16.7
	Dom.	37	4	5	21	7	0	100	10.8	13.5	56.8	18.9	0
Black	C-D	15	6	4	1	4	0	100	40.0	26.7	6.7	26.6	0
	Int.	9	5	2	1	1	0	100	55.6	22.2	11.1	11.1	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	0	1	2	0	0	100	0	33.3	66.7	0	0
Beech	C-D.	4	0	2	1	0	1	100	0	50.0	25.0	0	25.0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
	Sup.	13	10	0	1	0	2	100	77.0	0	7.7	0	15.3
	Dom.	2	0	0	1	1	0	100	0	0	50.0	50.0	0
Red	C-D.	3	0	0	0	3	0	100	0	0	0	100	0
	Int.	4	1	1	0	2	0	100	25.0	25.0	0	50.0	0
Maple	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 2.

species	crown class	total trees	type of breakage (1.) 0	1	2	3	4	total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	8	2	6	0	0	0	100	25.0	75.0	0	0	0
Sugar	C-D.	16	15	1	0	0	0	100	93.8	6.2	0	0	0
	Int.	43	39	0	1	1	2	100	90.7	0	2.3	2.3	4.7
Maple	Sup.	64	61	0	0	0	3	100	95.3	0	0	0	4.7
	Dom.	37	4	6	24	3	0	100	10.8	16.2	64.9	8.1	0
Black	C-D.	24	8	7	4	4	1	100	33.3	29.2	16.7	16.6	4.2
	Int.	5	2	2	0	0	1	100	40.0	40.0	0	0	20.0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

(1.) 0 = undamaged or but slightly damaged.

1 = limbs broken.

2 = stem broken in the crown.

3 = stem broken below the crown.

4 = stem bent beyond the proportional limit, or uprooted.

TABLE 9. (continued)

Strip No. 2 (continued)

species	crown class	total trees	type of breakage (1.) 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	10	0	4	6	0	0	100	0	40.0	60.0	0	0
Beech	C-D.	5	0	3	2	0	0	100	0	60.0	40.0	0	0
	Int.	6	3	1	0	0	2	100	50.0	16.7	0	0	33.3
	Sup.	6	6	0	0	0	0	100	100	0	0	0	0
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Red	C-D.	10	5	2	2	1	0	100	50.0	20.0	20.0	10.0	0
	Int.	14	7	3	1	1	2	100	50.0	21.4	7.2	7.1	14.3
Maple	Sup.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Yellow	C-D.	1	1	0	0	0	0	100	100	0	0	0	0
	Int.	10	6	0	1	0	3	100	60.0	0	10.0	0	30.0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sweet	C-D.	2	1	0	0	0	1	100	50.0	0	0	0	50.0
	Int.	5	2	0	1	1	1	100	40.0	0	20.0	20.0	20.0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 2 a.

species	crown class	total trees	type of breakage (1.) 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
Maple	Sup.	44	44	0	0	0	0	100	100	0	0	0	0
	Dom.	23	13	6	4	0	0	100	56.5	26.1	17.4	0	0
Black	C-D.	61	51	4	3	2	1	100	83.6	6.6	4.9	3.3	1.6
	Int.	56	56	0	0	0	0	100	100	0	0	0	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Beech	C-D.	1	1	0	0	0	0	100	100	0	0	0	0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	5	5	0	0	0	0	100	100	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Yellow	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	3	2	0	0	0	1	100	66.7	0	0	0	0
Birch	Sup.	8	8	0	0	0	0	100	100	0	0	0	0

Strip No. 3

species	crown class	total trees	type of breakage (1.) 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	2	2	0	0	0	0	100	100	0	0	0	0
Sugar	C-D.	5	5	0	0	0	0	100	100	0	0	0	0
	Int.	17	17	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	30	30	0	0	0	0	100	100	0	0	0	0
	Dom.	33	31	1	0	0	1	100	94.0	3.0	0	0	3.0
Black	C-D.	38	32	3	3	0	0	100	84.2	7.9	7.9	0	0
	Int.	47	44	0	0	2	1	100	93.6	0	0	4.3	2.1
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	3	0	0	0	0	100	100	0	0	0	0
Beech	C-D.	9	9	0	0	0	0	100	100	0	0	0	0
	Int.	11	10	1	0	0	0	100	90.9	9.1	0	0	0
	Sup.	56	56	0	0	0	0	100	100	0	0	0	0
	Dom.	11	11	0	0	0	0	100	100	0	0	0	0
Red	C-D.	9	9	0	0	0	0	100	100	0	0	0	0
	Int.	19	17	0	1	1	0	100	89.5	0	5.3	5.2	0
Maple	Sup.	17	17	0	0	0	0	100	100	0	0	0	0
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Yellow	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	2	2	0	0	0	0	100	100	0	0	0	0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 3a.

species	crown class	total trees	0	1	2	3	4	total %	0 %	1 %	2 %	3 %	4 %
	Dam.	1	1	0	0	0	0	100	100	0	0	0	0
Sugar	C-D.	5	4	1	0	0	0	100	80.0	20.0	0	0	0
	Int.	24	24	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	42	42	0	0	0	0	100	100	0	0	0	0
	Dom.	9	4	3	0	2	0	100	44.5	33.3	0	22.2	0
Black	C-D.	5	5	0	0	0	0	100	100	0	0	0	0
	Int.	6	6	0	0	0	0	100	100	0	0	0	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Beech	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
	Sup.	5	5	0	0	0	0	100	100	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	2	2	0	0	0	0	100	100	0	0	0	0
	Int.	6	5	1	0	0	0	100	83.3	16.7	0	0	0
Maple	Sup.	2	2	0	0	0	0	100	100	0	0	0	0
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Yellow	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	2	2	0	0	0	0	100	100	0	0	0	0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 9. (continued)

Strip No. 5

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	12	6	6	0	0	0	100	50.0	50.0	0	0	0
Sugar	C-D.	9	6	1	1	0	1	100	66.7	11.1	11.1	0	11.1
	Int.	30	22	2	1	0	5	100	73.3	6.7	3.3	0	16.7
Maple	Sup.	108	107	0	0	0	1	100	99.1	0	0	0	0.9
	Dom.	18	2	12	3	1	0	100	11.1	66.7	16.7	5.5	0
Black	C-D.	41	14	14	7	6	0	100	34.2	34.2	17.0	14.6	0
	Int.	13	5	3	4	0	1	100	38.5	23.1	30.8	0	7.7
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	10	1	9	0	0	0	100	10.0	90.0	0	0	0
Beech	C-D.	4	0	3	0	1	0	100	0	75.0	25.0	0	0
	Int.	9	5	1	2	1	0	100	55.6	11.1	22.2	11.1	0
	Sup.	18	17	0	0	0	1	100	94.4	0	0	0	5.6
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	3	0	1	0	2	0	100	0	33.3	0	66.7	0
	Int.	5	2	1	1	0	1	100	40.0	20.0	20.0	0	20.0
Maple	Sup.	6	5	0	0 0	0	1	100	83.3	0	0	0	16.7
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Yellow	C-D.	1	0	0	0	0	1	100	0	0	0	0	100
	Int.	4	2	0	0	1	1	100	50.0	0	0	25.0	25.0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sweet	C-D.	6	5	0	0	0	1	100	83.3	0	0	0	16.7
	Int.	5	3	0	0	0	2	100	60.0	0	0	0	40.0
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 5 a

species	crown class	total trees	0	1	2	3	4	total %	0 %	1 %	2 %	3 %	4 %
	Dom.	2	2	0	0	0	0	100	100	0	0	0	0
Sugar	C-D.	2	2	0	0	0	0	100	100	0	0	0	0
	Int.	7	7	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	89	87	0	0	0	2	100	97.8	0	0	0	2.2
	Dom.	26	14	9	3	0	0	100	53.9	34.6	11.5	0	0
Black	C-D.	45	33	3	6	2	1	100	73.4	6.7	13.3	4.4	2.2
	Int.	30	28	1	1	0	0	100	93.4	3.3	3.3	0	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	5	5	0	0	0	0	100	100	0	0	0	0

TABLE 9. (c0ntinued)

Strip No. 6

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	8	4	4	0	0	0	100	50.0	50.0	0	0	0
Black	C-D.	3	2	1	0	0	0	100	66.7	33.3	0	0	0
	Int.	4	2	0	2	0	0	100	50.0	0	50.0	0	0
Cherry	Sup.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	5	5	0	0	0	0	100	100	0	0	0	0
Beech	C-D.	4	4	0	0	0	0	100	100	0	0	0	0
	Int.	18	18	0	0	0	0	100	100	0	0	0	0
	Sup.	46	46	0	0	0	0	100	100	0	0	0	0
	Dom.	28	28	0	0	0	0	100	100	0	0	0	0
Red	C-D.	25	25	0	0	0	0	100	100	0	0	0	0
	Int.	50	49	0	0	1	0	100	98.0	00	0	2.0	0
Maple	Sup.	24	24	0	0	0	0	100	100	0	0	0	0

Strip No. 6a

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	5	5	0	0	0	0	100	100	0	0	0	0
Sugar	C-D	3	2	0	1	0	0	100	66.7	0	33.3	0	0
	Int.	47	43	1	0	0	3	100	91.5	2.1	0	0	6.4
Maple	Sup.	317	308	0	0	0	9	100	97.2	0	0	0	2.8
	Dom.	64	14	25	21	4	0	100	21.9	39.1	32.8	6.2	0
Black	C-D.	97	48	21	13	12	3	100	49.5	21.6	13.4	12.4	3.1
	Int.	47	32	2	5	4	4	100	68.1	4.3	10.6	8.5	8.5
Cherry	Sup.	2	2	0	0	0	0	100	100	0	0	0	0
	Dom.	23	7	14	2	0	0	100	30.4	60.9	8.7	0	0
Beech	C-D.	19	7	12	0	0	0	100	36.8	63.2	0	0	0
	Int.	44	36	6	0	1	1	100	81.8	13.6	0	2.3	2.3
	Sup.	76	75	0	0	0	1	100	98.7	0	0	0	1.3
	Dom.	9	7	1	0	1	0	100	77.8	11.1	0	11.1	0
Red	C-D.	14	10	1	0	3	0	100	71.5	7.1	0	21.4	0
	Int.	41	33	0	2	2	4	100	80.5	0	4.9	4.9	9.7
Maple	Sup.	39	39	0	0	0	0	100	100	0	0	0	0
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Yellow	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	6	5	0	0	0	1	100	83.3	0	0	0	16.7
Birch	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sweet	C-D.	7	7	0	0	0	0	100	100	0	0	0	0
	Int.	28	27	0	0	0	1	100	96.4	0	0	0	3.6
Birch	Sup.	1	1	0	0	0	0	100	100	0	0	0	0

TABLE 9. (continued)

Strip No. 7

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	11	6	2	3	0	0	100	54.5	18.2	27.3	0	0
	Int.	37	29	1	1	2	4	100	78.4	2.7	2.7	5.4	10.8
	Sup.	56	55	0	0	1	0	100	98.2	0	0	1.8	0
	Dom.	13	0	2	10	1	0	100	0	15.4	76.9	7.7	0
Black	C-D.	6	0	3	3	0	0	100	0	50.0	50.0	0	0
	Int.	6	0	0	3	2	1	100	0	0	50.0	33.3	16.7
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	1	0	0	1	0	0	100	0	0	100	0	0
Beech	C-D.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
	Int.	2	1	1	0	0	0	100	50.0	50,0	0	0	0
	Sup.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	1	0	0	1	0	0	100	0	0	100	0	0
Red	C-D.	1	0	0	1	0	0	100	0	0	100	0	0
	Int.	1	0	0	1	0	0	100	0	0	100	0	0
Maple	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	0	3	0	0	0	100	0	100	0	0	0
White	C-D.	3	0	2	1	0	0	100	0	66.7	33.3	0	0
	Int.	2	1	1	0	0	0	100	50.0	50.0	0	0	0
Ash	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 8

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	8	7	1	0	0	0	100	87.5	12.5	0	0	0
Maple	Sup.	94	94	0	0	0	0	100	100	0	0	0	0
	Dom.	3	0	3	0	0	0	100	0	100	0	0	0
Black	C-D.	20	7	5	5	3	0	100	35.0	25.0	25.0	15.0	0
	Int.	8	8	0	0	0	0	100	100	0	0	0	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	2	0	2	0	0	0	100	0	100	0	0	0
Beech	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
	Sup.	24	24	0	0	0	0	100	100	0	0	0	0
	Dom.	4	1	3	0	0	0	100	25.0	75.0	0	0	0
Red	C-D.	9	5	3	0	1	0	100	55.6	33.3	0	11.0	0
	Int.	33	30	1	0	1	1	100	91.0	3.0	0	3.0	3.0
Maple	Sup.	41	41	0	0	0	0	100	100	0	0	0	0

TABLE 9. (continued)

Strip No. 8 (continued)

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
White	C-D.	8	7	1	0	0	0	100	87.5	12.5	0	0	0
	Int.	4	4	0	0	0	0	100	100	0	0	0	0
	Sup.	7	7	0	0	0	0	100	100	0	0	0	0
	Dom.	4	0	2	2	2	0	100	0	50.0	50.0	0	0
Tulip	C-D.	1	0	1	0	0	0	100	0	100	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
Poplar	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 9

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	5	5	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	62	61	0	0	0	1	100	98.4	0	0	0	1.6
	Dom.	1	0	0	1	0	0	100	0	0	100	0	0
Black	C-D.	22	9	8	5	0	0	100	40.9	36.4	22.7	0	0
	Int.	22	17	0	1	4	0	100	77.3	0	4.5	18.2	0
Cherry	Sup.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	7	2	5	0	0	0	100	28.6	71.4	0	0	0
Red	C-D.	11	8	3	0	0	0	100	72.7	27.3	0	0	0
	Int.	19	15	1	0	0	3	100	78.9	5.3	0	0	15.8
Maple	Sup.	44	44	0	0	0	0	100	100	0	0	0	0
	Dom.	4	3	1	0	0	0	100	75.0	25.0	0	0	0
White	C-D.	4	3	1	0	0	0	100	75.0	25.0	0	0	0
	Int.	2	2	0	0	0	0	100	100	0	0	0	0
Ash	Sup.	8	8	0	0	0	0	100	100	0	0	0	0
	Dom.	3	0	3	0	0	0	100	0	100	0	0	0
Tulip	C-D.	4	1	3	0	0	0	100	25.0	75.0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
Poplar	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 9. (continued)

Strip No. 10

								In Percent					
	crown	total	type of breakage					total		type of breakage			
species	class	trees	0	1	2	3	4	%	0 %	1 %	2 %	3 %	4 %
	Dom.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
Sugar	C-D.	1	0	0	0	0	1	100	0	0	0	0	100
	Int.	1	0	0	0	0	1	100	0	0	0	0	100
Maple	Sup.	11	11	0	0	0	0	100	100	0	0	0	0
	Dom.	5	1	2	2	0	0	100	20.0	40.0	40.0	0	0
Black	C-D.	4	1	0	2	0	1	100	25.0	0	50.0	0	25.0
	Int.	3	1	1	1	0	0	100	33.4	33.3	33.3	0	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	0	0	3	0	0	100	0	0	100	0	0
Red	C-D.	8	1	4	1	2	0	100	12.5	50.0	12.5	25.0	0
	Int.	14	3	2	2	1	6	100	21.4	14.3	14.3	7.1	42.9
Maple	Sup.	5	2	0	0	0	3	100	40.0	0	0	0	60.0
	Dom.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
Tulip	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
Poplar	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 11

	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	24	9	0	0	0	15	100	37.5	0	0	0	62.5
Maple	Sup.	28	26	0	0	0	2	100	92.9	0	0	0	7.1
	Dom.	5	3	0	1	1	0	100	60.0	0	20.0	20.0	0
Black	C-D.	19	9	2	1	2	5	100	47.4	10.5	5.3	10.5	26.3
	Int.	13	4	0	0	0	9	100	30.8	0	0	0	69/2
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	1	2	0	0	0	100	33.3	66.7	0	0	0
Red	C-D.	8	4	2	1	1	0	100	50.0	25.0	12.5	12.5	0
	Int.	40	14	0	2	1	23	100	35.0	0	5.0	2.5	57.5
	Sup.	5	4	0	0	0	1	100	80.0	0	0	0	20.0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
White	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	2	2	0	0	0	0	100	100	0	0	0	0
Ash	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	1	0	0	0	1	0	100	0	0	0	100	0
Tulip	C-D.	1	0	0	1	0	0	100	0	0	100	0	0
	Int.	7	1	0	1	0	5	100	14.3	0	14.3	0	71.4
	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	1	0	0	1	1	100	33.4	0	0	33.3	33.3
Pin	C-D.	19	2	0	0	2	15	100	10.5	0	0	10.5	79.0
	Int.	22	2	0	2	2	16	100	9.1	0	9.1	9.1	72.7
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 9. (continued)

Strip No. 11a

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	2	2	0	0	0	0	100	100	0	0	0	0
Sugar	C-D.	8	8	0	0	0	0	100	100	0	0	0	0
	Int.	37	37	0	0	0	0	100	100	0	0	0	0
Maple	Sup.	47	47	0	0	0	0	100	100	0	0	0	0
	Dom.	3	3	0	0	0	0	100	100	0	0	0	0
Black	C-D.	7	5	0	2	0	0	100	71.4	0	28.6	0	0
	Int.	4	3	0	0	0	1	100	75.0	0	0	0	25.0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	2	1	0	0	0	100	66.7	33.3	0	0	0
Red	C-D.	3	2	0	0	1	0	100	66.7	0	0	33.3	0
	Int.	11	9	0	0	0	2	100	81.8	0	0	0	18.2
Maple	Sup.	4	4	0	0	0	0	100	100	0	0	0	0
	Dom.	1	0	1	0	0	0	100	0	100	0	0	0
Tulip	C-D.	4	3	1	0	0	0	100	75.0	25.0	0	0	0
	Int.	10	8	1	1	0	0	100	80.0	10.0	10.0	0	0
Poplar	Sup.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	9	8	0	0	1	0	100	88.9	0	0	11.1	0
Pin	C-D.	14	9	0	0	2	3	100	64.3	0	0	14.3	21.4
	Int.	3	2	0	0	1	0	100	66.7	0	0	33.3	0
Cherry	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 13

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	17	1	14	0	1	1	100	5.9	82.3	0	5.9	5.9
Sugar	C-D.	5	0	3	0	0	2	100	0	60.0	0	0	40.0
	Int.	15	10	0	1	0	4	100	66.7	0	6.7	0	26.6
Maple	Sup.	186	180	0	2	1	3	100	96.8	0	1.1	0.5	1.6
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Black	C-D.	2	0	0	0	2	0	100	0	0	0	100	0
	Int.	11	3	1	1	2	4	100	27.2	9.1	9.1	18.2	36.4
	Sup.	4	4	0	0	0	0	100	0	0	0	0	0
	Dom.	7	0	4	1	1	1	100	0	57.1	14.3	14.3	14.3
Beech	C-D.	18	1	11	2	1	3	100	5.6	61.1	11.1	5.6	16.6
	Int.	17	8	3	2	2	2	100	47.1	17.6	11.8	11.7	11.8
	Sup.	57	53	0	0	0	4	100	93.0	0	0	0	7.0
	Dom.	1	0	1	0	0	0	100	0	100	0	0	0
Basswood	C-D.	2	0	1	0	0	1	100	0	50.0	0	0	50.0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
	Sup.	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 9. (continued)

Strip No. 29

species	crown class	total trees	type of breakage 0	1	2	3	4	total %	In Percent type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	8	0	6	1	1	0	100	0	75.0	12.5	12.5	0
Sugar	C-D.	21	8	5	7	1	0	100	38.1	23.8	33.3	4.8	0
Maple	Int.	28	13	5	5	3	2	100	46.4	17.9	17.9	10.7	7.1
	Dom.	10	0	3	6	1	0	100	0	30.0	60.0	10.0	0
Black	C-D.	3	0	0	1	2	0	100	0	0	33.3	66.7	0
Cherry	Int.	1	0	0	0	1	0	100	0	0	0	100	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	1	0	1	0	0	0	100	0	100	0	0	0
Maple	Int.	1	0	0	1	0	0	100	0	0	100	0	0
	Dom.	1	0	0	1	0	0	100	0	0	100	0	0
Sweet	C-D.	4	1	1	1	0	1	100	25.0	25.0	25.0	0	25.0
Birch	Int.	2	0	0	1	0	1	100	0	0	50.0	0	50.0
	Dom.	6	0	3	3	0	0	100	0	50.0	50.0	0	0
Tulip	C-D.	1	0	0	1	0	0	100	0	0	100	0	0
Poplar	Int.	0	0	0	0	0	0	0	0	0	0	0	0

Strip No. 30

species	crown class	total trees	type of breakage 0	1	2	3	4	total %	In Percent type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Sugar	C-D.	3	3	0	0	0	0	100	100	0	0	0	0
Maple	Int.	16	15	0	0	0	1	100	93.8	0	0	0	6.2
	Dom.	36	11	10	13	1	1	100	30.5	27.8	36.1	2.8	2.8
Black	C-D.	108	57	8	22	11	10	100	52.7	7.4	20.4	10.2	9.3
Cherry	Int.	31	19	0	4	4	4	100	61.3	0	12.9	12.9	12.9
	Dom.	4	0	3	1	0	0	100	0	75.0	25.0	0	0
Beech	C-D.	1	0	1	0	0	0	100	0	100	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	21	13	6	2	0	0	100	61.9	28.6	9.5	0	0
Red	C-D.	72	58	6	7	1	0	100	80.6	8.3	9.7	1.4	0
Maple	Int.	51	45	0	1	0	5	100	88.2	0	2.0	0	9.8
	Dom.	1	0	0	1	0	0	100	0	0	100	0	0
Sweet	C-D.	1	0	0	0	0	1	100	0	0	0	0	100
Birch	Int.	1	0	0	1	0	0	100	0	0	100	0	0
	Dom.	14	2	7	5	0	0	100	14.3	50.0	35.7	0	0
Tulip	C-D.	39	15	7	17	0	0	100	38.5	17.9	43.6	0	0
Poplar	Int.	16	11	0	5	0	0	100	68.7	0	31.3	0	0
	Dom.	19	18	1	0	0	0	100	94.7	5.3	0	0	0
White	C-D.	88	79	5	2	0	2	100	89.7	5.7	2.3	0	2.3
Ash	Int.	44	43	0	1	0	0	100	97.7	0	2.3	0	0

TABLE 9. (continued)

Strip No. 31

								In Percent					
	crown	total	type of breakage					total		type of breakage			
species	class	trees	0	1	2	3	4	%	0 %	1 %	2 %	3 %	4 %
	Dom.	17	6	9	2	0	0	100	35.3	52.9	11.8	0	0
Sugar	C-D.	60	53	2	1	3	1	100	88.3	3.3	1.7	5.0	1.7
Maple	Int.	41	41	0	0	0	0	100	100	0	0	0	0
	Dom.	41	1	16	23	1	0	100	2.4	39.1	56.1	2.4	0
Black	C-D.	45	12	7	19	5	2	100	26.7	15.6	42.2	11.1	4.4
Cherry	Int.	11	7	0	2	1	1	100	63.6	0	18.2	9.1	9.1
	Dom.	10	1	9	0	0	0	100	10.0	90.0	0	0	0
Beech	C-D.	7	0	7	0	0	0	100	0	100	0	0	0
	Int.	1	0	1	0	0	0	100	0	100	0	0	0
	Dom.	6	1	5	0	0	0	100	16.7	83.3	0	0	0
Red	C-D.	19	10	3	4	1	1	100	52.6	15.8	21.0	5.3	5.3
Maple	Int.	10	9	0	1	0	0	100	90.0	0	10.0	0	0
	Dom.	1	0	1	0	0	0	100	0	100	0	0	0
Yellow	C-D.	0	0	0	0	0	0	0	0	0	0	0	0
Birch	Int.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
Sweet	C-D.	36	27	0	5	0	4	100	75.0	0	13.9	0	11.1
Birch	Int.	57	53	1	0	0	3	100	93.0	1.7	0	0	5.3
	Dom.	19	1	8	10	0	0	100	5.3	42.1	52.6	0	0
Tulip	C-D.	31	8	6	17	0	0	100	25.8	19.3	54.9	0	0
Poplar	Int.	5	4	0	1	0	0	100	80.0	0	20.0	0	0
	Dom.	5	4	1	0	0	0	100	80.0	20.0	0	0	0
White	C-D.	24	23	1	0	0	0	100	95.8	4.2	0	0	0
Ash	Int.	3	3	0	0	0	0	100	100	0	0	0	0

TABLE 9. (continued)

Strip No. 32

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	4	1	3	0	0	0	100	25.0	75.0	0	0	0
Sugar	C-D.	49	45	1	3	0	0	100	91.9	2.0	6.1	0	0
Maple	Int.	67	63	1	1	0	2	100	94.0	1.5	1.5	0	3.0
	Dom.	43	1	11	28	0	3	100	2.3	25.6	65.1	0	7.0
Black	C-D.	116	26	23	53	8	6	100	22.4	19.8	45.7	6.9	5.2
Cherry	Int.	21	14	0	4	0	3	100	66.7	0	19.0	0	14.3
	Dom.	11	0	11	0	0	0	100	0	100	0	0	0
Beech	C-D.	5	0	5	0	0	0	100	0	100	0	0	0
	Int.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	12	5	5	1	1	1	100	41.7	41.7	8.3	8.3	0
Red	C-D.	134	74	31	18	5	6	100	55.3	23.1	13.4	3.7	4.5
Maple	Int.	53	43	1	4	0	5	100	81.2	1.9	7.5	0	9.4
	Dom.	1	0	1	0	0	0	100	0	100	0	0	0
Yellow	C-D.	4	4	0	0	0	0	100	100	0	0	0	0
Birch	Int.	18	14	0	0	1	3	100	77.8	0	0	5.5	16.7
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Sweet	C-D.	5	3	0	2	0	0	100	60.0	0	40.0	0	0
Birch	Int.	12	11	0	0	0	1	100	91.7	0	0	0	8.3
	Dom.	14	0	10	4	0	0	100	0	71.4	28.6	0	0
Tulip	C-D.	61	10	17	34	0	0	100	16.4	27.9	55.7	0	0
Poplar	Int.	13	12	0	1	0	0	100	92.3	0	7/7	0	0
	Dom.	18	6	11	1	0	0	100	33.3	61.1	5.6	0	0
White	C-D.	62	50	6	3	3	0	100	80.7	9.7	4.8	4.8	0
Ash	Int.	58	56	1	1	0	0	100	96.6	1.7	1.7	0	0
	Dom.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
Cucumber	C-D.	4	1	2	1	0	0	100	25.0	50.0	25.0	0	0
Tree	Int.	3	2	0	0	0	1	100	66.7	0	0	0	33.3
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0
Pin	C-D.	10	1	0	5	3	1	100	10.0	0	50.0	30.0	10.0
Cherry	Int.	1	0	0	0	1	0	100	0	0	0	100	0
	Dom.	6	6	0	0	0	0	100	100	0	0	0	0
Hemlock	C-D.	4	4	0	0	0	0	100	100	0	0	0	0
	Int.	0	0	0	0	0	0	100	100	0	0	0	0

TABLE 10.

TYPE AND EXTEND TO BREAKAGE ON THE VARIOUS
SITES IN POTTER CO. BY SPECIES AND CROWN CLASS

Sprip No. 15

									In Percent						
	crown	total	type of breakage (1.)						total		type of breakage				
Species	class	trees	0	1	1a	2	3	4	%	0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	28	0	22	-	6	0	0	100	0	78.6	-	21.4	0	0
Sugar	C-D.	92	6	27	-	34	19	6	100	6.5	29.4	-	36.9	20.7	6.5
Maple	Int.	52	15	9	-	6	9	13	100	28.9	17.3	-	11.5	17.3	25.0
	Dom.	18	0	1	-	17	0	0	160	0	5.6	-	94.4	0	0
Black	C-D.	2	0	1	-	1	0	0	100	0	50.0	-	50.0	0	0
Cherry	Int.	3	0	1	-	2	0	0	100	0	33.3	-	66.7	0	0
	Dom.	26	0	10	-	16	0	0	100	0	38.5	-	61.5	0	0
Beech	C-D.	80	0	16	-	41	21	2	100	0	20.0	-	51.2	26.3	2.5
	Int.	100	15	15	-	22	24	24	100	15.0	15.0	-	22.0	24.0	24.0
	Dom.	11	0	5	-	6	0	0	100	0	45.5	-	54.5	0	0
Red	C-D.	13	0	3	-	8	2	0	100	0	23.1	-	61.5	15.4	0
Maple	Int.	4	0	2	-	2	0	0	100	0	50.0	-	50.0	0	0
	Dom.	1	0	1	-	0	0	0	100	0	100	-	0	0	0
Yellow	C-D.	1	0	1	-	1	0	0	100	0	0	-	100	0	0
Birch	Int.	0	0	0	-	0	0	0	0	0	0	-	0	0	0
	Dom.	11	0	3	-	8	0	0	100	0	27.3	-	72.7	0	0
Sweet	C-D.	27	0	6	-	17	3	1	100	0	22.2	-	63.0	11.1	3.7
Birch	Int.	18	6	2	-	5	1	4	100	33.3	11.1	-	27.8	5.6	22.2
	Dom.	3	0	0	-	3	0	0	100	0	0	-	100	0	0
White	C-D.	4	0	00	-	1	3	0	100	0	0	-	25.0	75.0	0
Ash	Int.	8	3	3	-	1	1	3	100	37.5	37.5	-	12.5	12.5	0
	Dom.	2	0	0	-	2	0	0	100	0	0	-	100	0	0
Basswood	C-D.	2	0	0	-	2	0	0	100	0	0	-	100	0	0
	Int.	0	0	0	-	0	0	0	0	0	0	-	0	0	0
	Dom.	23	17	6	-	0	0	0	100	73.9	26.1	-	0	0	0
Hemlock	C-D.	21	14	4	-	2	1	0	100	66.7	19.0	-	9.5	4.8	0
	Int.	6	4	1	-	1	0	0	100	66.6	16.7	-	16.7	0	0

(1.) 0 = undamaged or but slightly damaged
1 = part of the lims broken
1a = stripped, i.e. all or nearly all limbs broken
2 = stem broken in the crown
3 = stem broken below the crown
4 = stem bent beyond the proportional limit,or, uprooted

TABLE 10. (continued)

Strip No. 16.

			type of breakage						In Percent total		type of breakage				
species	class	trees	0	1	1a	2	3	4	%	0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	32	0	11	17	1	3	0	100	0	34.4	53.1	3.1	9.4	0
Sugar	C-D.	71	3	7	23	18	13	7	100	4.2	9.9	32.4	25.3	18.3	9.9
Maple	Int.	57	10	1	2	9	10	25	100	17.5	1.8	3.5	15.8	17.5	43.9
	Dom.	13	0	0	0	12	1	0	100	0	0	0	92.3	7.7	0
Black	C-D.	16	0	1	0	10	5	0	100	0	6.3	0	62.5	31.2	0
Cherry	Int.	4	0	0	0	3	1	0	100	0	0	0	75.0	25.0	0
	Dom.	31	0	0	31	0	0	0	100	0	0	100	0	0	0
Beech	C-D.	44	0	5	32	4	2	1	100	0	11.4	72.7	9.1	4.5	2.3
	Int.	13	2	0	0	1	1	9	100	15.4	0	0	7.7	7.7	69.2
	Dom.	3	0	1	0	2	0	0	100	0	33.3	0	66.7	0	0
Red	C-D.	11	0	1	0	8	2	0	100	0	9.1	0	72.7	18.2	0
Maple	Int.	13	3	2	0	2	0	6	100	23.1	15.4	0	15.4	0	46.1
	Dom.	3	0	1	1	1	0	0	100	0	33.4	33.3	33.3	0	0
Sweet	C-D.	4	2	2	0	0	0	0	100	50.0	50.0	0	0	0	0
Birch	Int.	1	0	0	0	0	1	0	100	0	0	0	0	100	0
	Dom.	6	0	0	3	2	1	0	100	0	0	50.0	33.3	16.7	0
White	C-D.	5	1	0	2	2	0	0	100	20.0	0	40.0	40.0	0	0
Ash	Int.	3	1	0	0	2	0	0	100	33.3	0	0	66.7	0	0
	Dom.	21	0	0	4	17	0	0	100	0	0	19.0	81.0	0	0
Basswood	C-D.	70	0	0	4	50	16	0	100	0	0	5.7	71.4	22.9	0
	Int.	60	2	5	5	27	18	3	100	3.4	8.3	8.3	45.0	30.0	5.0
	Dom.	2	0	0	1	1	0	0	100	0	0	50.0	50.0	0	0
Red	C-D.	6	0	0	2	2	2	0	100	0	0	33.4	33.3	33.3	0
Oak	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Largetooth	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
& Tremb-	C-D.	1	0	0	0	0	1	0	100	0	0	0	0	100	0
lingAspen	Int.	2	0	0	1	0	1	0	100	0	0	50.0	0	50.0	0

TABLE 10. (continued)

Strip No. 17.

species	CROWN class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beech	C-D.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	5	0	1	0	3	1	0	100	0	20.0	0	60.0	20.0	0
	Dom.	1	0	0	0	0	1	0	100	0	0	0	0	100	0
Red	C-D.	13	0	2	1	7	3	0	100	0	15.4	7.7	53.8	23.1	0
Maple	Int.	15	1	4	1	9	0	0	100	7.7	26.6	6.7	60.0	0	0
	Dom.	2	0	1	1	0	0	0	100	0	50.0	50.0	0	0	0
Sweet	C-D.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Birch	Int.	3	3	0	0	0	0	0	100	100	0	0	0	0	0
	Dom.	35	0	8	13	14	0	0	100	0	22.9	37.1	40.0	0	0
Red	C-D.	50	3	11	9	23	2	2	100	6.2	22.0	18.0	46.0	4.0	4.0
Oak	Int.	27	12	5	3	6	1	0	100	44.5	18.5	11.1	22.2	3.7	0

Strip No. 18

species	CROWN class	total trees	0	1	1a	2	3	4	total %	0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	11	0	3	4	2	2	0	100	0	27.2	36.4	18.2	18.2	0
Sugar	C-D.	52	2	7	6	18	17	2	100	3.8	13.5	11.6	34.6	32.7	3.8
Maple	Int.	14	4	4	0	3	2	1	100	28.6	28.6	0	21.4	14.3	7.1
	Dom.	5	0	1	2	2	0	0	100	0	20.0	40.0	40.0	0	0
Black	C-D.	3	0	0	0	3	0	0	100	0	0	0	100	0	0
Cherry	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	12	0	0	11	0	1	0	100	0	0	91.7	0	8.3	0
Beech	C-D.	21	0	1	8	8	4	0	100	0	4.8	38.1	38.1	19.0	0
	Int.	6	2	1	1	1	1	0	100	33.3	16.6	16.7	16.7	16.7	0
	Dom.	3	0	1	1	1	0	0	100	0	33.4	33.3	33.3	0	0
Red	C-D.	14	1	2	2	6	3	0	100	7.2	14.3	14.3	42.8	21.4	0
Maple	Int.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
	Dom.	1	0	0	0	0	0	1	100	0	0	0	0	0	100
Sweet	C-D.	6	1	1	0	1	2	1	100	16.7	16.6	0	16.7	33.3	16.7
Birch	Int.	3	2	1	0	0	0	0	100	66.7	33.3	0	0	0	0
	Dom.	8	0	2	2	4	0	0	100	0	25.0	25.0	50.0	0	0
Red	C-D.	5	0	1	1	1	1	1	100	0	20.0	20.0	20.0	20.0	20.0
Oak	Int.	3	1	2	0	0	0	0	100	33.3	66.7	0	0	0	0
	Dom.	8	8	0	0	0	0	0	100	100	0	0	0	0	0
Hemlock	C-D.	5	4	1	0	0	0	0	100	80.0	20.0	0	0	0	0
	Int.	2	1	1	0	0	0	0	100	50.0	50.0	0	0	0	0

TABLE 10 (continued)

Strip No. 19

									In Percent						
	crown	total	type of breakage						total	type of breakage					
species	class	trees	0	1	1a	2	3	4		0	1	1a	2	3	4
									%	%	%	%	%	%	%
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	C-D.	13	3	3	1	4	2	0	100	23.1	23.1	7.7	30.7	15.4	0
Maple	Int.	13	6	4	0	2	1	0	100	46.2	30.7	0	15.4	7.7	0
	Dom.	3	0	0	3	0	0	0	100	0	0	100	0	0	0
Beech	C-D.	11	0	1	7	2	1	0	100	0	9.1	63.6	18.2	9.1	0
	Int.	11	3	0	0	4	3	1	100	27.3	0	0	36.3	27.3	9.1
	Dom.	9	0	2	4	3	0	0	100	0	22.2	44.5	33.3	0	0
Red	C-D.	18	0	2	2	10	4	0	100	0	11.1	11.1	55.6	22.2	0
Maple	Int.	22	8	4	0	5	1	4	100	36.4	18.2	0	22.7	4.5	18.2
	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
Sweet	C-D.	4	0	0	0	2	2	0	100	0	0	0	50.0	50.0	0
Birch	Int.	7	4	0	0	2	0	1	100	57.1	0	0	28.6	0	14.3
	Dom.	21	0	5	8	7	1	0	100	0	23.8	38.1	33.3	4.8	0
Red	C-D.	36	2	8	6	11	9	0	100	5.6	22.2	16.7	30.5	25.0	0
Oak	Int.	11	5	3	0	1	1	1	100	45.4	27.3	0	9.1	9.1	9.1
Largetooth	Dom.	3	0	0	3	0	0	0	100	0	0	100	0	0	0
& Tremb-	C-D.	2	0	0	1	1	0	0	100	0	0	50.0	50.0	0	0
ling Aspen	Int.	1	0	0	0	0	1	0	100	0	0	0	0	100	0

TABLE 10. (continued)

Strip No. 20.

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	1	0	1	0	0	0	0	100	0	100	0	0	0	0
Sugar	C-D.	4	2	0	0	2	0	0	100	50.0	0	0	50.0	0	0
Maple	Int.	1	0	0	0	0	1	0	100	0	0	0	0	100	0
	Dom.	3	0	0	2	1	0	0	100	0	0	66.7	33.3	0	0
Beech	C-D.	21	11	0	1	2	5	2	100	52.4	0	4.8	9.5	23.8	9.5
	Int.	14	8	0	0	0	0	6	100	57.1	0	0	0	0	42.9
	Dom.	6	1	3	1	1	0	0	100	16.7	50.0	16.7	16.7	0	0
Red	C-D.	17	5	4	1	5	2	0	100	29.4	23.5	5.9	29.4	11.8	0
Maple	Int.	2	1	0	0	1	0	0	100	50.0	0	0	50.0	0	0
	Dom.	2	1	0	0	1	0	0	100	50.0	0	0	50.0	0	0
Yellow	C-D.	5	1	1	0	3	0	0	100	20.0	20.0	20.0	0	60.0	0
Birch	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	2	0	0	1	0	0	1	100	0	0	50.0	0	0	50.0
Sweet	C-D.	8	1	0	1	4	1	1	100	12.5	0	12.5	50.0	12.5	12.5
Birch	Int.	4	2	0	0	0	0	2	100	50.0	0	0	0	0	50.0
	Dom.	8	1	6	1	0	0	0	100	12.5	75.0	12.0	0	0	0
Red	C-D.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oak	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Largetooth	Dom.	7	0	3	3	1	0	0	100	0	42.8	42.9	14.3	0	0
& Tremb-	C-D.	8	0	1	2	0	5	0	100	0	12.5	25.0	0	62.5	0
lingAspen	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 10. (continued)

Strip No. 21.

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	32	6	14	3	9	0	0	100	18.7	43.8	9.4	28.1	0	0
Sugar	C-D.	176	63	28	3	31	27	24	100	35.8	15.9	1.7	17.6	15.4	13.6
Maple	Int.	76	51	2	0	3	1	19	100	67.1	2.6	0	3.9	1.3	25.0
	Dom.	1	0	1	0	0	0	0	100	0	100	0	0	0	0
Black	C-D.	2	0	1	0	0	1	0	100	0	100	0	0	100	0
Cherry	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
Beech	C-D.	9	2	0	0	1	3	3	100	22.3	0	0	11.1	33.3	33.3
	Int.	16	3	0	0	0	0	16	100	18.7	0	0	0	0	81.3
	Dom.	6	0	0	0	4	2	0	100	0	0	0	66.7	33.3	0
Red	C-D.	37	5	2	1	14	9	6	100	13.5	5.4	2.7	37.9	24.3	16.2
Maple	Int.	6	4	0	0	0	0	2	100	66.7	0	0	0	0	33.3
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow	C-D.	3	0	0	0	0	0	3	100	0	0	0	0	0	100
Birch	Int.	1	0	0	0	0	0	1	100	0	0	0	0	0	100
	Dom.	2	0	0	0	2	0	0	100	0	0	0	100	0	0
Sweet	C-D.	33	15	1	0	4	2	11	100	45.5	3.0	0	12.1	6.1	33.3
Birch	Int.	23	9	0	0	0	0	14	100	39.1	0	0	0	0	60.9
	Dom.	10	1	7	0	0	1	1	100	10.0	70.0	0	0	10.0	10.0
White	C-D.	39	5	11	0	6	4	13	100	12.8	28.2	0	15.5	10.2	33.3
Ash	Int.	22	11	2	0	2	0	7	100	50.0	9.1	0	9.1	0	31.8
	Dom.	19	3	9	4	3	0	0	100	15.8	47.4	21.0	15.8	0	0
Red	C-D.	2	0	1	0	1	0	0	100	0	50.0	0	50.0	0	0
Oak	Int.	2	0	0	0	2	0	0	100	0	0	0	100	0	0
	Dom.	7	0	0	1	5	0	1	100	0	0	14.3	71.4	0	14.3
Basswood	C-D.	44	0	0	1	38	5	0	100	0	0	2.3	86.4	11.3	0
	Int.	33	3	1	2	19	3	5	100	9.1	3.0	6.1	57.6	9.1	15.1
Largetooth	Dom.	5	0	0	4	0	1	0	100	0	0	80.0	0	20.0	0
& Tremb-	C-D.	9	0	0	2	4	3	0	100	0	0	22.2	44.5	33.3	0
lingAspen	Int.	2	0	0	0	2	0	0	100	0	0	0	100	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hop-Horn	C-D.	5	1	0	0	0	0	4	100	20.0	0	0	0	0	80.0
Bean	Int.	1	1	0	0	0	0	0	100	100	0	0	0	0	0

TABLE 10. (continued)

Strip No. 22

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
Sugar Maple	Dom.	18	2	10	3	2	1	0	100	11.1	55.6	16.7	11.1	5.5	0
	C-D.	28	2	3	4	12	5	2	100	7.1	10.7	14.3	42.9	17.9	7.1
	Int.	11	5	1	0	0	3	2	100	45.4	9.1	0	0	27.3	18.2
Black Cherry	Dom.	20	0	1	1	17	1	0	100	0	5.0	5.0	85.0	5.0	0
	C-D.	14	0	0	1	10	3	0	100	0	0	7.1	71.5	21.4	0
	Int.	2	1	0	0	1	0	0	100	50.0	0	0	50.0	0	0
Beech	Dom.	8	0	1	7	0	0	0	100	0	12.5	87.5	0	0	0
	C-D.	6	0	0	5	0	0	1	100	0	0	83.3	0	0	16.7
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Birch	Dom.	31	2	9	9	6	4	1	100	6.5	29.0	29.0	19.4	12.9	3.2
	C-D.	92	11	10	6	20	15	30	100	12.0	10.9	6.5	21.8	16.3	32.6
	Int.	42	9	0	0	1	3	29	100						
Sweet Birch	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C-D.	8	0	0	0	0	2	6	100	0	0	0	0	25.0	75.0
	Int.	3	0	0	0	0	0	3	100	0	0	0	0	0	100
White Ash	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C-D.	2	1	0	0	0	0	1	100	50.0	0	0	0	0	50.0
	Int.	4	2	0	0	0	1	1	100	50.0	0	0	00	25.0	25.0
Red Oak	Dom.	4	0	1	3	0	0	0	100	0	25.0	75.0	0	0	0
	C-D.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Basswood	Dom.	12	0	0	0	11	1	0	100	0	0	0	91.7	8.3	0
	C-D.	12	0	0	0	10	1	1	100	0	0	0	83.4	8.3	8.3
	Int.	2	0	0	0	1	1	0	100	0	0	0	50.0	50.0	0
White Elm	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C-D.	7	1	0	0	3	1	2	100	14.3	0	0	42.8	14.3	28.6
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 10.(continued)

Strip No. 23

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	26	18	8	0	0	0	0	100	69.2	30.8	0	0	0	0
Sugar	C-D.	38	30	6	0	1	1	0	100	79.0	15.8	0	2.6	2.6	0
Maple	Int.	24	23	1	0	0	0	0	100	95.8	4.2	0	0	0	0
	Dom.	30	1	10	15	4	0	0	100	3.3	33.3	50.0	13.4	0	0
Black	C-D.	33	2	14	5	11	1	0	100	6.1	42.4	15.2	33.3	3.0	0
Cherry	Int.	15	4	3	1	7	0	0	100	26.7	20.0	6.7	46.6	0	0
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beech	C-D.	3	0	2	00	1	0	0	100	0	66.7	0	33.3	0	0
	Int.	6	3	0	0	3	0	0	100	50.0	0	0	50.0	0	0
	Dom.	1	0	1	0	0	0	0	100	0	100	0	0	0	0
Red	C-D.	3	2	1	0	0	0	0	100	66.7	33.3	0	0	0	0
Maple	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	1	1	1	0	0	0	100	33.4	33.3	33.3	0	0	0
Yellow	C-D.	9	8	1	0	0	0	0	100	88.9	11.1	0	0	0	0
Birch	Int.	7	5	1	0	0	0	1	100	71.4	14.3	0	0	0	14.3
	Dom.	3	0	2	1	0	0	0	100	0	66.7	33.3	0	0	0
White	C-D.	3	2	1	0	0	0	0	100	66.7	33.3	0	0	0	0
Ash	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	13	9	3	1	0	0	0	100	69.2	23.1	7.7	0	0	0
White	C-D.	9	6	3	0	0	0	0	100	66.7	33.3	0	0	0	0
Elm	Int.	7	5	1	0	1	0	0	100	71.4	14.3	0	14.3	0	0
	Dom.	7	1	3	3	0	0	0	100	14.2	42.9	42.9	0	0	0
White	C-D.	2	1	1	0	0	0	0	100	50.0	50.0	0	0	0	0
Pine	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	5	5	0	0	0	0	0	100	100	0	0	0	0	0
Hemlock	C-D.	5	5	0	0	0	0	0	100	100	0	0	0	0	0
	Int.	1	1	0	0	0	0	0	100	100	0	0	0	0	0

TABLE 10.(continued)

Strip No. 24

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	13	7	5	0	0	0	1	100	53.8	38.5	0	0	0	7.7
Sugar	C-D.	19	15	2	0	0	0	2	100	79.0	10.5	0	0	0	10.5
Maple	Int.	27	25	1	0	0	0	1	100	92.6	3.7	0	0	0	3.7
	Dom.	22	2	10	7	3	0	0	100	9.1	45.5	31.8	13.6	0	0
Black	C-D.	21	3	9	5	3	1	0	100	14.3	42.8	23.8	14.3	4.8	0
Cherry	Int.	5	3	1	0	1	0	0	100	60.0	20.0	0	20.0	0	0
	Dom.	8	0	5	3	0	0	0	100	0	62.5	37.5	0	0	0
Beech	C-D.	9	4	3	2	0	0	0	100	44.5	33.3	22.2	0	0	0
	Int.	3	3	0	0	0	0	0	100	100	0	0	0	0	0
	Dom.	2	0	2	0	0	0	0	100	0	100	0	0	0	0
Red	C-D.	9	5	2	0	1	1	0	100	55.6	22.2	0	11.1	11.1	0
Maple	Int.	9	7	0	0	1	0	1	100	77.8	0	0	11.1	0	11.1
	Dom.	6	1	3	0	1	0	1	100	16.7	50.0	0	16.7	0	16.6
Yellow	C-D.	15	7	2	2	1	0	3	100	46.7	13.3	13.3	6.7	0	20.0
Birch	Int.	10	8	0	0	0	0	2	100	80.0	0	0	0	0	20.0
	Dom.	1	0	1	0	0	0	0	100	0	100	0	0	0	0
White	C-D.	3	0	0	0	2	0	1	100	0	0	0	66.7	0	33.3
Ash	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
Basswood	C-D.	3	0	0	1	2	0	0	100	0	0	33.3	66.7	0	0
	Int.	8	6	0	0	2	0	0	100	75.0	0	0	25.0	0	0
	Dom.	6	4	2	0	0	0	0	100	66.7	33.3	0	0	0	0
White	C-D.	11	9	2	0	0	0	0	100	81.8	18.2	0	0	0	0
Elm	Int.	17	13	0	0	0	0	4	100	76.5	0	0	0	0	23.5
Largetooth	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
& Tremb-	C-D.	3	2	0	0	1	0	0	100	66.7	0	0	33.3	0	0
lingAspen	Int.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
	Dom.	23	6	12	3	2	0	0	100	26.1	52.2	13.0	8.7	0	0
White	C-D.	15	10	3	0	1	0	1	100	66.7	20.0	0	6.7	0	6.6
Pine	Int.	11	10	0	0	1	0	0	100	90.9	0	0	9.1	0	0
	Dom.	28	28	0	0	0	0	0	100	100	0	0	0	0	0
Hemlock	C-D.	37	36	0	0	0	0	1	100	97.3	0	0	0	0	2.7
	Int.	16	14	0	0	1	1	0	100	87.5	0	0	6.3	6.2	0

TABLE 10. (continued)

Strip No. 25

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	10	0	1	7	1	1	0	100	0	10.0	70.0	10.0	10.0	0
Sugar	C-D.	39	5	7	13	7	5	2	100	12.8	18.0	33.3	18.0	12.8	5.1
Maple	Int.	11	5	3	0	2	0	1	100	45.5	27.2	0	18.2	0	9.1
	Dom.	11	0	0	6	5	0	0	100	0	0	54.5	45.5	0	0
Black	C-D.	17	0	2	5	8	2	0	100	0	11.8	29.4	47.0	11.8	0
Cherry	Int.	3	0	1	0	2	0	0	100	0	33.3	0	66.7	0	0
	Dom.	1	0	0	0	0	0	1	100	0	0	0	0	0	100
Beech	C-D.	17	0	1	5	3	3	5	100	0	5.9	29.4	17.7	17.6	29.4
	Int.	12	2	1	4	1	3	1	100	16.7	8.3	33.4	8.3	25.0	8.3
	Dom.	3	0	1	2	0	0	0	100	0	33.3	66.7	0	0	0
Red	C-D.	15	2	1	6	2	4	0	100	13.3	6.7	40.0	13.3	26.7	0
Maple	Int.	1	1	0	0	0	0	0	100	100	0	0	0	0	0
	Dom.	7	0	2	2	0	1	2	100	0	28.6	28.6	0	14.2	28.6
Yellow	C-D.	30	2	1	5	1	6	15	100	6.7	3.3	16.7	3.3	20.0	50.0
Birch	Int.	8	4	0	0	0	0	4	100	50.0	0	0	0	0	50.0
	Dom.	4	0	0	1	3	0	0	100	0	0	25.0	75.0	0	0
Basswood	C-D.	11	0	0	2	9	0	0	100	0	0	18.2	81.8	0	0
	Int.	3	0	0	0	3	0	0	100	0	0	0	100	0	0
	Dom.	17	1	14	2	0	0	0	100	5.9	82.3	11.8	0	0	0
White	C-D.	23	8	10	2	2	1	0	100	34.8	43.5	8.7	8.7	4.3	0
Pine	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 10. (continued)

Strip No. 26.

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
Sugar Maple	Dom.	23	1	6	10	6	0	0	100	43.3	26.1	43.5	26.1	0	0
	C-D.	76	13	9	8	16	15	15	100	17.1	11.8	10.5	21.2	19.7	19.7
	Int.	38	19	2	0	1	3	13	100	10.0	5.3	0	2.6	7.9	34.2
Black Cherry	Dom.	8	0	0	3	4	1	0	100	0	0	37.5	50.0	12.5	0
	C-D.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beech	Dom.	9	0	0	9	0	0	0	100	0	0	100	0	0	0
	C-D.	13	0	0	11	1	0	1	100	0	0	84.6	7.7	0	7.7
	Int.	7	4	0	0	1	0	2	100	57.1	0	0	14.3	0	28.6
Red Maple	Dom.	3	0	0	3	0	0	0	100	0	0	100	0	0	0
	C-D.	13	0	1	3	5	3	1	100	0	7.7	23.1	38.4	23.1	7.7
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Oak	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
	C.D.	2	0	0	0	1	0	1	100	0	0	0	50.0	0	50.0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Basswood	Dom.	36	0	0	16	20	0	0	100	0	0	44.5	55.5	0	0
	C-D.	68	0	0	7	55	6	0	100	0	0	10.3	80.9	8.8	0
	Int.	18	0	0	1	13	4	0	100	0	0	5.6	72.2	22.2	0
Hemlock	Dom.	9	8	1	0	0	0	0	100	88.9	11.1	0	0	0	0
	C-D.	9	6	1	0	2	0	0	100	66.7	11.1	0	22.2	0	0
	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 10. (continued)

Strip No. 27

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
Sugar	C-D.	11	3	0	0	3	5	0	100	27.3	0	0	27.3	45.4	0
Maple	Int.	7	3	1	0	1	1	1	100	42.8	14.3	.0	14.3	14.3	14.3
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beech	C-D.	2	0	0	0	1	1	0	100	0	0	0	50.0	50.0	0
	Int.	3	2	0	0	0	0	1	100	66.7	0	0	0	0	33.3
	Dom.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	C-D.	17	2	3	0	9	3	0	100	11.8	17.7	0	52.9	17.6	0
Maple	Int.	16	8	0	0	1	0	7	100	50.0	0	0	6.3	0	43.7
	Dom.	1	0	0	1	0	0	0	100	0	0	100	0	0	0
Sweet	C-D.	7	5	0	0	0	1	1	100	71.4	0	0	0	14.3	14.3
Birch	Int.	3	3	0	0	0	0	0	100	100	0	0	0	0	0
	Dom.	26	2	7	4	10	1	2	100	7.7	26.9	15.4	38.5	3.8	7.7
Red	C-D.	70	15	10	5	15	19	6	100	21.4	14.3	7.1	21.4	27.2	8.6
Oak	Int.	22	14	1	0	2	0	5	100	63.7	4.5	0	9.1	0	22.7
	Dom.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
Basswood	C-D.	13	0	1	0	7	5	0	100	0	7.7	0	53.9	38.4	0
	Int.	10	2	0	0	4	1	3	100	20.0	0	0	40.0	10.0	30.0
Largetooth	Dom.	1	0	0	0	1	0	0	100	0	0	0	100	0	0
& Tremb-	C-D.	5	0	0	0	2	3	0	100	0	0	0	40.0	60.0	0
ling Aspen	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 10. (continued)

Strip No. 28

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
	Dom.	2	0	1	0	1	0	0	100	0	50.0	0	50.0	0	0
Sugar	C-D.	29	16	1	1	3	5	3	100	55.3	3.4	3.4	10.3	17.3	10.3
Maple	Int.	29	24	0	0	0	1	4	100	82.8	0	0	0	3.4	13.8
	Dom.	1	0	1	0	0	0	0	100	0	100	0	0	0	0
Red	C-D.	22	4	3	0	8	7	0	100	18.2	13.6	0	36.4	31.8	0
Maple	Int.	19	14	1	0	2	1	1	100	73.7	5.3	0	10.5	5.2	5.3
	Dom.	1	0	0	0	0	0	1	100	0	0	0	0	0	100
Sweet	C-D.	8	6	0	0	1	0	1	100	75.0	0	0	12.5	0	12.5
Birch	Int.	3	2	0	0	0	0	1	100	66.7	0	0	0	0	33.3
	Dom.	5	1	0	1	1	1	1	100	20.0	0	20.0	20.0	20.0	20.0
White	C-D.	21	10	0	1	4	1	5	100	47.6	0	4.8	19.0	4.8	23.8
Ash	Int.	9	5	0	0	1	0	3	100	55.6	0	0	11.1	0	33.3
	Dom.	7	0	2	3	2	0	0	100	0	28.6	42.8	28.6	0	0
Red	C-D.	1	1	0	0	0	0	0	100	100	0	0	0	0	0
Oak	Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dom.	3	0	0	1	2	0	0	100	0	0	33.3	66.7	0	0
Basswood	C-D.	46	1	1	1	30	9	4	100	2.2	2.2	2.2	65.2	19.5	8.7
	Int.	27	1	2	1	19	2	2	100	3.7	7.4	3.7	70.4	7.4	7.4
Largetooth	Dom.	13	0	1	3	6	1	2	100	0	7.7	23.1	46.1	7.7	15.4
Aspen	C-D.	22	0	0	0	13	6	3	100	0	0	0	59.1	27.3	13.6
	Int.	4	0	0	0	2	1	1	100	0	0	0	50.0	25.0	25.0

TABLE 11

TYPE AND EXTENT OFBREAKAGE
BY CROWN CLASS AND SPECIES

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10, 13.
(including indirect breakage)

								In Percent					
	crown	total	type of breakage					total		type of breakage			
species	class	trees	0	1	2	3	4	%	0 %	1 %	2 %	3 %	4 %
	Dom.	227	52	70	89	16	0	100	22.9	30.8	39.2	7.1	0
Black	C-D.	337	177	69	49	35	7	100	52.5	20.5	14.5	10.4	2.1
Cherry	Int.	218	157	12	17	19	13	100	72.0	5.5	7.8	8.7	6.0
	Sup.	9	7	0	0	0	2	100	77.8	0	0	0	22.2
	Dom.	60	20	36	2	1	1	100	33.3	60.0	3.3	1.7	1.7
Sugar	C-D.	54	34	8	6	0	6	100	63.0	14.8	11.1	0	11.1
Maple	Int.	248	169	5	10	6	58	100	68.2	2.0	4.0	2.4	23.4
	Sup.	1460	1030	10	38	75	307	100	70.6	0.7	2.6	5.1	21.0
	Dom.	56	8	34	12	1	1	100	14.3	60.7	21.4	1.8	1.8
Beech	C-D.	53	9	32	6	2	4	100	17.0	60.4	11.3	3.8	7.5
	Int.	116	76	12	5	9	14	100	65.5	10.3	4.3	7.8	12.1
	Sup.	262	188	3	9	7	55	100	71.8	1.1	3.4	2.7	21.0
	Dom.	27	11	9	5	2	0	100	40.8	33.3	18.5	7.4	0
Red	C-D.	59	29	14	4	12	0	100	49.2	23.7	6.8	20.3	0
Maple	Int.	148	93	10	10	14	21	100	62.8	6.7	6.8	9.5	14.2
	Sup.	183	147	0	3	6	27	100	80.4	0	1.6	3.3	14.7
	Dom.	1	1	0	0	0	0	100	100	0	0	0	0
Yellow	C-D.	2	1	0	0	0	1	100	50.0	0	0	0	50.0
Birch	Int.	25	15	0	1	1	8	100	60.0	0	4.0	4.0	32.0
	Sup.	10	8	0	0	2	0	100	80.0	0	0	20.0	0
	Dom.	0	0	0	0	0	0	100	0	0	0	0	0
Sweet	C-D.	15	13	0	0	0	2	100	86.7	0	0	0	13.3
Birch	Int.	43	32	0	1	2	8	100	74.4	0	2.3	4.7	18.6
	Sup.	1	1	0	0	0	0	100	100	0	0	0	0
	Dom.	8	4	4	0	0	0	100	50.0	50.0	0	0	0
White	C-D.	16	10	4	1	0	1	100	62.5	25.0	6.2	0	6.3
Ash	Int.	11	8	1	1	1	0	100	72.7	9.1	9.1	9.1	0
	Sup.	15	15	0	0	0	0	100	100	0	0	0	0
	Dom.	9	0	6	3	0	0	100	0	66.7	33.3	0	0
Tulip	C-D.	5	1	4	0	0	0	100	20.0	80.0	0	0	0
Poplar	Int.	0	0	0	0	0	0	100	0	0	0	0	0
	Sup.	0	0	0	0	0	0	100	0	0	0	0	0
	Dom.	1	0	1	0	0	0	100	0	100	0	0	0
Basswood	C-D.	2	0	1	0	0	1	100	0	50.0	0	0	50.0
	Int.	1	0	0	1	0	0	100	0	0	100	0	0
	Sup.	15	2	0	3	3	7	100	13.3	0	20.0	20.0	46.7

TABLE 12

TYPE AND EXTENT OF BREAKAGE
BY CROWN CLASS AND SPECIES

Strips No. 29, 30, 31, 32.

species	crown class	total trees	type of breakage 0	1	2	3	4	In Percent. total %	type of breakage 0 %	1 %	2 %	3 %	4 %
	Dom.	130	13	40	70	3	4	100	10.0	30.8	53.8	2.3	3.1
Black Cherry	C-D.	272	95	38	95	26	18	100	34.9	14.0	34.9	9.6	6.6
	Int.	64	40	0	10	6	8	100	62.5	0	15.6	9.4	12.5
	Dom.	30	8	18	3	1	0	100	26.7	60.0	10.0	3.3	0
Sugar Maple	C-D.	133	109	8	11	4	1	100	82.0	6.0	8.3	3.0	0.7
	Int.	132	112	6	6	3	5	100	84.9	4.5	4.5	2.3	3.8
	Dom.	25	1	23	1	0	0	100	4.0	92.0	4.0	0	0
Beech	C-D.	13	0	13	0	0	0	100	0	100	0	0	0
	Int.	2	1	1	0	0	0	100	50.0	50.0	0	0	0
	Dom.	39	19	16	3	1	0	100	48.7	41.0	7.7	2.6	0
Red Maple	C-D.	226	142	41	29	7	7	100	62.9	18.1	12.8	3.1	3.1
	Int.	115	97	1	7	0	10	100	84.3	0.9	6.1	0	8.7
	Dom.	2	0	2	0	0	0	100	0	100	0	0	0
Yellow Birch	C-D.	4	4	0	0	0	0	100	100	0	0	0	0
	Int.	19	15	0	0	1	3	100	78.9	0	0	5.3	15.8
	Dom.	4	0	1	3	0	0	100	0	25.0	75.0	0	0
Sweet Birch	C-D.	46	31	1	8	0	6	1000	67.4	2.2	17.4	0	13.0
	Int.	72	64	1	2	0	5	100	88.9	1.4	2.8	0	6.9
	Dom.	42	28	13	1	0	0	100	66.7	30.9	2.4	0	0
White Ash	C-D.	174	152	12	5	3	2	100	87.4	6.9	2.9	1.7	1.1
	Int.	105	102	1	2	0	0	100	97.1	1.0	1.9	0	0
	Dom.	53	3	28	22	0	0	100	5.7	52.8	41.5	0	0
Tulip Poplar	C-D.	132	33	30	69	0	0	100	25.0	22.7	52.3	0	0
	Int.	34	27	0	7	0	0	100	79.4	0	20.6	0	0
	Dom.	2	0	1	1	0	0	100	0	50.0	50.0	0	0
Cucumber	C-D.	4	1	2	1	0	0	100	25.0	50.0	25.0	0	0
	Int.	3	2	0	0	0	1	100	66.7	0	0	0	33.3
	Dom.	0	0	0	0	0	0	100	0	0	0	0	0
Pin Cherry	C-D.	10	1	0	5	3	1	100	10.0	0	50.0	30.0	10.0
	Int.	1	0	0	0	1	0	100	0	0	0	100	0
	Dom.	6	6	0	0	0	0	100	100	0	0	0	0
Hemlock	C-D.	4	4	0	0	0	0	100	100	0	0	0	0
	Int.	0	0	0	0	0	0	100	0	0	0	0	0

TABLE 13.

TYPE AND EXTENT OF BREAKAGE
BY CROWN CLASS AND SPECIES

Strips No. 15 to 28 inclusive

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
Black	Dom.	128	3	24	34	64	3	0	100	2.3	18.8	26.6	50.0	2.3	0
Cherry	C-D.	108	5	28	16	46	13	0	100	4.6	25.9	14.8	42.6	12.1	0
	Int.	32	8	6	1	16	1	0	100	25.0	18.8	3.1	50.0	3.1	0
Sugar	Dom.	197	34	82	44	29	7	1	100	17.3	41.6	22.3	14.7	3.6	0.5
Maple	C-D.	648	163	100	59	149	114	63	100	25.2	15.4	9.1	23.0	17.6	9.7
	Int.	360	190	29	2	27	32	80	100	52.8	8.1	0.5	7.5	8.9	22.2
	Dom.	102	0	16	67	17	1	1	100	0	15.7	65.6	16.7	1.0	1.0
Beech	C-D.	236	17	29	71	64	40	15	100	7.2	12.3	30.1	27.1	16.9	6.4
	Int.	194	45	18	5	36	33	57	100	23.2	9.3	2.6	18.5	17.0	29.4
Red	Dom.	49	1	17	11	17	3	0	100	2.0	34.7	22.5	34.7	6.1	0
Maple	C-D.	202	26	27	16	83	43	7	100	12.9	13.3	7.9	41.1	21.3	3.5
	Int.	107	47	13	1	24	2	20	100	43.9	12.2	0.9	22.4	1.9	18.7
Yellow	Dom.	50	5	16	12	8	5	4	100	10.0	32.0	24.0	16.0	10.0	8.0
Birch	C-D.	155	29	15	13	26	21	51	100	18.7	9.7	8.4	16.8	13.5	32.9
	Int.	69	26	1	0	1	3	38	100	37.7	1.4	0	1.4	4.4	55.1
Sweet	Dom.	24	0	5	5	11	0	3	100	0	20.8	20.8	45.9	0	12.5
Birch	C-D.	106	31	10	1	29	13	22	100	29.2	9.4	0.9	27.4	12.3	20.8
	Int.	66	30	3	0	7	1	25	100	45.5	4.5	0	10.6	1.5	37.9
White	Dom.	27	2	10	5	6	3	1	100	7.4	37.1	18.5	22.2	11.1	3.7
Ash	C-D.	78	19	12	3	15	8	21	100	24.4	15.4	3.8	19.2	10.3	26.9
	Int.	46	22	5	0	6	2	11	100	47.8	10.9	0	13.1	4.3	23.9

(continued on next page)

TABLE 13. (continued)

species	crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4 %
Basswood	Dom.	87	0	0	23	62	1	1	100	0	0	26.5	71.3	1.1	1.1
	C-D.	269	1	2	16	203	42	5	100	0.4	0.7	5.9	75.5	15.6	1.9
	Int.	161	14	8	9	88	29	13	100	8.7	5.0	5.6	54.6	18.0	8.1
Red Oak	Dom.	130	6	39	40	41	2	2	100	4.6	30.0	30.8	31.6	1.5	1.5
	C-D.	172	21	31	23	54	33	10	100	12.2	18.0	13.4	31.4	19.2	5.8
	Int.	65	32	11	3	11	2	6	100	49.3	16.9	4.6	16.9	3.1	9.2
Trembling	Dom.	31	0	4	15	8	2	2	100	0	12.9	48.4	25.8	6.4	6.5
and Large-tooth	C-D.	40	2	1	4	21	18	4	100	5.0	2.5	10.0	52.5	45.0	10.0
Aspen	Int.	10	0	0	1	5	3	1	100	0	0	10.0	50.0	30.0	10.0
White Elm	Dom.	19	13	5	1	0	0	0	100	68.4	26.3	5.3	0	0	0
	C-D.	27	16	5	0	3	1	2	100	59.3	18.5	0	11.1	3.7	7.4
	Int.	24	18	1	0	1	0	4	100	75.0	4.2	0	4.2	0	16.6
White Pine	Dom.	47	8	31	6	2	0	0	100	17.0	65.9	12.8	4.3	0	0
	C-D.	40	19	14	2	3	1	1	100	47.5	35.0	5.0	7.5	2.5	2.5
	Int.	11	10	0	0	1	0	0	100	90.9	0	0	9.1	0	0
Hemlock	Dom.	73	66	7	0	0	0	0	100	90.4	9.6	0	0	0	0
	C-D.	77	65	6	0	4	1	1	100	84.4	7.8	0	5.2	1.3	1.3
	Int.	25	20	2	0	2	1	0	100	80.0	8.0	0	8.0	4.0	0

TABLE 14.

TYPE AND EXTENT OF BREAKAGE BY CROWN CLASS

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.
(excluding indirect breakage)

crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Dom.	388	96	160	110	20	2	100	24.7	41.2	28.4	5.2	0.5
C-D.	543	274	132	66	49	22	100	50.5	24.3	12.1	9.0	4.1
Int.	686	529	29	35	29	64	100	77.2	4.2	5.1	4.2	9.3
Sup.	1441	1398	1	4	2	36	100	97.0	0.1	0.3	0.1	2.5

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10, 13.

(including indirect breakage)

crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Dom.	388	96	160	110	20	2	100	24.7	41.2	28.4	5.2	0.5
C-D.	544	274	132	66	49	23	100	50.4	24.3	12.1	9.0	4.2
Int.	789	529	30	46	102	82	100	67.1	3.8	5.8	12.9	10.4
Sup.	2055	1398	13	53	93	498	100	68.1	0.6	2.6	4.5	24.2

TABLE 14. (continued)

Strips No. 29, 30, 31, 32.
(direct breakage only)

crown class	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Dom.	333	78	142	104	5	4	100	23.4	42.6	31.3	1.5	1.2
C-D.	1018	572	145	223	43	35	100	56.2	14.2	21.9	4.2	3.5
Int.	547	460	10	34	11	32	100	84.2	1.8	6.2	2.0	5.8

Strips No. 15 to 28 inclusive
(direct breakage only)

crown class	total trees	type of breakage 0	1	1a	2	3	4	In Percent total %	type of breakage 0 %	1 %	1a %	2 %	3 %	4
Dom.	964	138	256	263	265	27	15	100	14.3	26.6	27.3	27.5	2.8	1.6
C-D.	2178	424	280	224	700	348	202	100	19.5	12.8	10.3	32.1	16.0	9.3
Int.	1170	462	97	22	225	109	255	100	39.5	8.3	1.9	19.2	9.3	21.8

TABLE 15.

TYPE AND EXTENT OF BREAKAGE BY DIAMETER CLASS

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.

								In Percent					
	D.B.H.	total	type of breakage					total	type of breakage				
species	inches	trees	0	1	2	3	4	%	0 %	1 %	2 %	3 %	4 %
Black	1-5	196	156	10	14	8	8	100	79.6	5.1	7.1	4.1	4.1
Cherry	6-10	517	227	122	112	50	6	100	43.9	23.6	21.7	9.7	1.1
	11	48	0	18	28	2	0	100	0	37.5	58.3	4.2	0
Sugar	1-5	186	156	5	3	2	20	100	83.9	2.7	1.6	1.1	10.7
Maple	6-10	74	47	15	8	1	3	100	63.5	20.3	10.8	1.3	4.1
	11	22	9	12	1	0	0	100	40.9	54.6	4.5	0	0
	1-5	34	25	3	2	2	2	100	73.5	8.8	5.9	5.9	5.9
Beech	6-10	76	33	32	8	1	2	100	43.4	42.2	10.5	1.3	2.6
	11	37	5	25	7	0	0	100	13.5	67.6	18.9	0	0
Red	1-5	120	78	12	6	10	14	100	65.0	10.0	5.0	8.3	11.7
Maple	6-10	95	55	17	9	11	3	100	57.9	17.9	9.5	11.6	3.1
	11	4	0	3	1	0	0	100	0	75.0	25.0	0	0
Yellow	1-5	25	16	0	1	1	7	100	64.0	0	4.0	4.0	28.0
Birch	6-10	1	1	0	0	0	0	100	100	0	0	0	0
	11	0	0	0	0	0	0	100	0	0	0	0	0
Sweet	1-5	41	34	0	1	1	5	100	83.0	0	2.4	2.4	12.2
Birch	6-10	12	11	0	0	0	1	100	91.7	0	0	0	8.3
	11	0	0	0	0	0	0	100	0	0	0	0	0
White	1-5	7	7	0	0	0	0	100	100	0	0	0	0
Ash	6-10	23	15	7	1	0	0	100	65.3	30.4	4.3	0	0
	11	2	0	2	0	0	0	100	0	100	0	0	0
Tulip	1-5	0	0	0	0	0	0	100	0	0	0	0	0
Poplar	6-10	13	1	9	3	0	0	100	7.7	69.2	23.1	0	0
	11	1	0	1	0	0	0	100	0	100	0	0	0
TOTAL	1-5	609	472	30	27	24	56	100	77.4	4.9	4.4	3.9	9.4
OF ALL	6-10	811	390	202	141	63	15	100	48.1	24.9	17.4	7.8	1.8
SPECIES	11	114	14	61	37	2	0	100	12.3	53.5	32.4	1.8	0

TABLE 16.

TYPE AND EXTENT OF BREAKAGE BY STEM FORM

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.

								In Percent					
species	stem form(1.)	total trees	type of breakage 0	1	2	3	4	total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Black	S	460	272	74	64	36	14	100	59.2	16.1	13.9	7.8	3.0
Cherry	F	301	111	76	90	24	0	100	36.9	25.2	29.9	8.0	0
Sugar	S	250	191	31	6	2	20	100	76.4	12.4	2.4	0.8	8.0
Maple	F	32	21	1	6	1	3	100	65.7	3.1	18.7	3.1	9.4
Beech	S	122	49	50	16	3	4	100	40.1	41.0	13.1	2.5	3.3
	F	25	14	10	1	0	0	100	56.0	40.0	4.0	0	0
Red	S	171	116	18	6	16	15	100	67.8	10.5	3.5	9.4	8.8
Maple	F	48	17	14	10	5	2	100	35.4	39.2	20.8	10.4	4.2
Yellow	S	22	15	0	0	1	6	100	68.2	0	0	4.5	27.3
Birch	F	4	2	0	1	0	1	100	50.0	0	25.0	0	25.0
Sweet	S	50	42	0	1	1	6	100	84.0	0	2.0	2.0	12.0
Birch	F	3	3	0	0	0	0	100	100	0	0	0	0
White	S	22	15	6	0	0	1	100	68.2	27.3	0	0	4.5
Ash	F	10	6	3	1	0	0	100	60.0	30.0	10.0	0	0
Tulip	S	9	1	7	1	0	0	100	11.1	77.8	11.1	0	0
Poplar	F	5	0	3	2	0	0	100	0	60.0	40.0	0	0
TOTAL	S	1106	701	186	94	59	66	100	63.4	16.8	8.5	5.3	6.0
OF ALL SPECIES	F	428	174	107	111	30	6	100	40.6	25.0	26.0	7.0	1.4

(1.) S = single stem

F = stem forked below the crown or twin trees.

TABLE 17.

TYPE AND EXTENT OF BREAKAGE BY CROWN FORM

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.

species	crown form(1.)	total trees	type of breakage 0	1c	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Black	S	459	225	107	107	20	0	100	49.0	23.3	23.3	4.4	0
Cherry	U	302	158	43	47	40	14	100	52.4	14.2	15.6	13.2	4.6
Sugar	S	215	171	31	8	2	3	100	79.6	14.4	3.7	0.9	1.4
Maple	U	67	41	1	4	1	20	100	61.2	1.5	6.0	1.5	29.8
Beech	S	106	43	51	11	0	1	100	40.6	48.1	10.4	0	0.9
	U	41	20	9	6	3	3	100	48.8	22.0	14.6	7.3	7.3
Red	S	119	77	22	10	5	5	100	64.7	18.5	8.4	4.2	4.2
Maple	U	100	56	10	6	16	12	100	56.0	10.0	6.0	16.0	12.0
Yellow	S	16	13	0	1	1	1	100	81.2	0	6.2	6.3	6.3
Birch	U	10	4	0	0	0	6	100	40.0	0	0	0	60.0
Sweet	S	32	30	0	1	0	1	100	93.8	0	3.1	0	3.1
Birch	U	21	15	0	0	1	5	100	71.4	0	0	4.8	23.8
White	S	21	15	5	1	0	0	100	71.4	23.8	4.8	0	0
Ash	U	11	7	4	0	0	0	100	63.6	36.4	0	0	0
Tulip	S	11	0	8	3	0	0	100	0	72.7	27.3	0	0
Poplar	U	3	1	2	0	0	0	100	33.3	66.7	0	0	0
TOTAL OF ALL	S	979	574	224	112	28	11	100	58.6	22.9	11.5	2.9	1.1
SPECIES	U	555	302	69	63	61	60	100	54.4	12.4	11.4	11.0	10.8

(1.) S = symmetrical crown

U = unsymmetrical crown

TABLE 18.

TYPE AND EXTENT OF BREAKAGE
BY CROWN SIZE IN RELATION TO STEM SIZE

Strips No.1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10.

species	crown to stem(1.)	total trees	type of breakage 0	1	2	3	4	In Percent total %	type of breakage 0 %	1 %	2 %	3 %	4 %
Black	20x	321	260	24	17	13	7	100	81.0	7.5	5.3	4.0	2.2
Cherry	40x	418	116	120	129	46	7	100	27.7	28.7	30.9	11.0	1.7
	60x	22	7	6	8	1	0	100	31.8	27.3	36.4	4.5	0
Sugar	20x	47	45	0	0	0	2	100	95.7	0	0	0	4.3
Maple	40x	213	148	31	11	3	20	100	69.5	14.5	5.2	1.4	9.4
	60x	22	19	1	1	0	1	100	86.4	4.6	4.5	0	4.5
	20x	27	27	0	0	0	0	100	100	0	0	0	0
Beech	40x	109	28	58	16	3	4	100	25.7	53.2	14.7	2.7	3.7
60	60x	11	8	2	1	0	0	100	72.7	18.2	9.1	0	0
Red	20x	76	63	3	2	1	7	100	82.9	4.0	2.6	1.3	9.2
Maple	40x	142	70	28	14	20	10	100	49.3	19.7	9.9	14.1	7.0
	60x	1	0	1	0	0	0	100	0	100	0	0	0
Yellow	20x	16	13	0	0	0	3	100	81.3	0	0	0	18.7
Birch	40x	7	3	0	1	1	2	100	42.9	0	14.3	14.2	28.6
	60x	3	1	0	0	0	2	100	33.3	0	0	0	66.7
Sweet	20x	42	35	0	1	0	6	100	83.3	0	2.4	0	14.3
Birch	40x	11	10	0	0	1	0	100	90.9	0	0	9.1	0
	60x	0	0	0	0	0	0	100	0	0	0	0	0
White	20x	11	10	1	0	0	0	100	90.9	9.1	0	0	0
Ash	40x	20	12	7	1	0	0	100	60.0	35.0	5.0	0	0
	60x	1	0	1	0	0	0	100	0	100	0	0	0
Tulip	20x	0	0	0	0	0	0	100	0	0	0	0	0
Poplar	40x	14	1	10	3	0	0	100	7.2	71.4	21.4	0	0
	60x	0	0	0	0	0	0	100	0	0	0	0	0
TOTAL	20x	540	453	28	20	14	25	100	83.9	5.2	3.7	2.6	4.6
OF ALL	40x	934	388	254	175	74	43	100	41.5	27.2	18.8	7.9	4.6
SPECIES	60x	60	35	11	10	1	3	100	58.4	18.3	16.7	1.6	5.0

(1.) 20x = crown diameter 20 times D.B.H. 40x = crown diameter 40 times D.B.H. 60x = crown diameter 60 times D.B.H.

TABLE 19.

TYPE AND EXTENT OF BREAKAGE BY PERCENT OF CROWN

Strips No. 1, 2, 2a, 5, 5a, 6a, 7, 8, 9, 10

								In Percent					
	crown	total	type of breakage					total	type of breakage				
species	%(1.)	trees	0	1	2	3	4	%	0	1	2	3	4
Black	25-	324	260	27	16	14	7	100	80.3	8.3	4.9	4.3	2.2
Cherry	25-50	421	118	120	132	44	7	100	28.0	28.5	31.4	10.4	1.7
	50	16	5	3	6	2	0	100	31.3	18.7	37.5	12.5	0
Sugar	25-	45	45	0	0	0	0	100	100	0	0	0	0
Maple	25-50	180	130	15	11	3	21	100	72.2	8.3	6.1	1.7	11.7
	50	57	37	17	1	0	2	100	64.9	29.8	1.8	0	3.5
	25-	**13**	13	0	0	0	0	100	100	0	0	0	0
Beech	25-50	112	44	48	13	3	4	100	39.3	42.8	11.6	2.7	3.6
	50	22	6	12	4	0	0	100	27.3	54.5	18.2	0	0
Red	25-	71	56	4	4	3	4	100	79.0	5.6	5.6	4.2	5.6
Maple	25-50	144	77	24	12	18	13	100	53.5	16.7	8.4	12.5	9.0
	50	4	0	4	0	0	0	100	0	100	0	0	0
Yellow	25-	19	14	0	1	0	4	100	73.7	0	5.3	0	21.0
Birch	25-50	5	2	0	0	1	2	100	40.0	0	0	20.0	40.0
	50	2	1	0	0	0	1	100	50.0	0	0	0	50.0
Sweet	25-	46	39	0	1	0	6	100	84.8	0	2.2	0	13.0
Birch	25-50	7	6	0	0	1	0	100	85.7	0	0	14.3	0
	50	0	0	0	0	0	0	0	0	0	0	0	0
White	25-	19	18	1	0	0	0	100	94.7	5.3	0	0	0
Ash	25-50	13	4	9	0	0	0	100	30.8	69.2	0	0	0
	50	0	0	0	0	0	0	0	0	0	0	0	0
Tulip	25-	1	0	1	0	0	0	100	0	100	0	0	0
Poplar	25-50	13	1	9	3	0	0	100	7.7	69.2	23.1	0	0
	50	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	25-	538	445	33	22	17	21	100	82.7	6.1	4.1	3.2	3.9
OF ALL	25-50	895	382	225	171	70	47	100	42.7	25.2	19.1	7.8	5.2
SPECIES	50	101	49	36	11	2	3	100	48.5	35.6	10.9	2.0	3.0

(1.) crown % equals percent of total height in crown.

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