Bulletin No. 38 - Cultivated Shade and Forest Trees

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UNIVERSITY OF WYOMING.
Agricultural College Department.

WYOMING EXPERIMENT STATION,
LARAMIE, WYOMING.

BULLETIN NO. 38.
SEPTEMBER, 1898.

CULTIVATED SHADE AND FOREST TREES.

BY B. C. BUFFUM.

Bulletins will be sent free upon request. Address: Director Experiment Station, Laramie, Wyo.
Wyoming Agricultural Experiment Station.

UNIVERSITY OF WYOMING.

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SILVER SPRUCE ON THE GROUNDS OF EDWARD IVINSON, LARAMIE.
Cultivated Shade and Forest Trees.

B. C. BUFFUM.

Our mountains are covered with vast forests, while our plains and even our river valleys are practically treeless. Belts, groves and scattering specimens of cottonwood, boxelder, willow and alder are found along our streams for ten or twenty miles below where they leave the mountain range but farther down trees of any kind are generally absent or infrequent. At high altitudes the banks of the smaller streams and even those of the large rivers where they course through the mountain parks and valleys, frequently support no tree growth. At lower altitudes in the northern, central and eastern portions of the state small streams are often fringed with boxelder, occasionally a green ash is found and here and there a variety of bushes. In the extreme north-eastern part of the state there are some good-sized oak and birch trees. That there are no trees along the lower courses of our streams where the conditions of moisture are favorable has often been remarked, but as far as I know has not been explained. Undoubtedly the protection afforded by the mountains favors the growth of trees near them, but the same species thrive when planted upon irrigated uplands farther away. Small willows are commonly found the whole length of the stream. Our observations indicate that cottonwoods either will not live or that they make poor growth upon soils which contain large amounts of alkali salts. Willows which rapidly grow into trees will succeed better than any other species on alkali ground. The absence of trees away from the streams is easily explained by the
lack of sufficient moisture. Sagebrush is found almost everywhere and in certain localities where conditions of moisture and exposure favor its growth it actually attains the size and height of trees. Ordinarily it remains from six inches to two and one-half feet high.

It is not our purpose here to discuss the native forests of pine and spruce further than to briefly state their extent, the danger of their extinction, and the necessity of their preservation. It is estimated that approximately one-sixth the area of the state, or about 10,000,000 acres of land within our borders, is covered with timber. All this is in the mountain regions and forms great natural storage reservoirs which catch the snows of winter and hold them till late spring and early summer, giving a steady supply of water when most needed to irrigate growing crops in the valleys and on the plains below. Every year fires started, either accidentally or purposely, burn over thousands of acres of these forests. Irrigation is the life of our agriculture, and its future welfare in this state largely depends upon the proper care and management of the native forests. In addition they supply native lumber and an abundance of timber for buildings, fences and wood. Although we have these great mountain forests, a class of vegetation greatly needed upon our irrigated farms and ranches is trees. Man's power to mitigate the bad effects of climate and sudden changes of weather upon himself or the animals and plants useful to him is constantly increasing. He can overcome effects of weather in various ways but his ability to modify climate is limited. He builds houses and barns to shelter himself and his domestic animals, and glass houses in which to grow the tender plants. By planting trees, he provides a grateful shelter to himself and his live stock and provides conditions under which many plants can be made to succeed, which would not otherwise
grow at all. Shelter belts to protect animals from winds and storms are invaluable to the stockman. Protection from the cold saves dollars and cents in the value of the food which would be consumed merely to keep them warm. Upon large ranches where there is more stock than it is possible to provide buildings for, sufficient shelter belts often prevent heavy losses from exposure during storms. A good tree shelter of native cottonwoods is shown in the illustration which was made from a photograph taken on the Wyoming Hereford Ranch east of Cheyenne. We reproduce the cut through the courtesy of the Secretary of State, C. W. Burdick.

The influence of trees upon the growth of plants has not been given the attention and thought it deserves. In every new agricultural region of the west old timers commonly remark that the climate has changed. When they first came to the country it was impossible to grow many plants which now flourish. Apparently the meteorological records do not bear out the statement that there has been a change in climate, that the average rain-fall is more or less or that the temperature is higher or lower than for a series of years twenty years or more ago. That fruit trees or any other class of plants easily succeed now where in earlier times they generally died, is well known. These first attempts were made in exposed places where the winds and summer suns had unchecked access to their tender trunks and branches. It is true that many tender varieties were planted, but even the hardier kinds did not flourish. As the country develops, buildings and fences are constructed and that which is more important, windbreaks of hardy trees are planted which temper the winds, shade from the scorching sun, prevent rapid loss of water by evaporation and make the place habitable for plants which could not live there before. The people who came to Denver and Northern Colorado thirty years ago at first despaired of growing even har-
dy fruits and other crops. Now enormous quantities of fruits are raised and where sufficient shelter by surrounding hardy trees is furnished, even peaches are reaching perfection.

In Wyoming we have the same conditions, and that our young orchards have succumbed to sudden severe changes in the weather should not discourage the planter. There can be no doubt that they will eventually succeed.

The kind of plants which are useful to man have been made so by long years of cultivation and care, under conditions essentially different from ours. Therefore when planted here they must be given such care and shelter as will partially meet the conditions to which they have been accustomed. By increasing the number of hardy native trees we produce the best wind-breaks. When enough of them are growing upon every farm in a community the effect upon plants and stock is virtually the same as moving to a lower altitude or many miles to the south and the difficulties at first experienced in raising many fruits no longer exist. With these facts in mind it is readily seen that the planter of trees is a public benefactor, not only of his own time but of all time to come.

The kinds of trees to plant first are those which naturally grow under the most adverse conditions. After these become a protection more tender and desirable kinds will succeed. There are a few tree claims and wind-breaks outside of our towns, but the majority of our farmers have given the subject little attention.

The typical Wyoming ranch is everywhere thought of as a collection of low buildings, fences and hay stacks, without a tree in sight. Our picture is of such a ranch near the mouth of No Wood River in Big Horn County. This condition is rapidly changing, however. With the development of the irrigated farm these temporary ranches are being transformed into comfortable homes. In rural districts as in towns the first plantings are for shade and ornament and
practically all the trees other than fruits planted in Wyoming up to the present time have been set out for such purposes. In the interest of improvement and better taste we would discourage the usual methods pursued in so-called ornamental planting. Landscape gardening is the highest type of art and in its practice he who imitates nature most closely is the best artist. Nature never planted her landscapes with her most beautiful figures in rows, each row equally distant from its neighbor, the figures in the rows set at equal distances and all in mathematical exactness with regard to every feature of the scene, yet how often is this process followed out in the attempt to decorate home grounds. Were it not for the far reaching influence of such plantings in tempering the winds and climate and that trees anywhere are beautiful in contrast to the usual barrenness of the plain, I would say that it were better not to plant at all. I would not discourage rows of trees along our streets or fences, ditches, and the borders of orchards and gardens for shelter belts. Here they become a part of the general scheme, are useful, beautiful, in place. In ornamenting the home grounds let every yard be a landscape with harmonious effect, reflecting the artistic taste of the owner. A natural landscape delights us because there is variety, irregularity, and curved lines of beauty everywhere. We can only improve on such landscapes by adding variety while yet preserving harmony, and thus securing throughout a sense of order, unity and neatness. In planting yards, then, set trees and shrubs along the borders with well designed spaces to give the effect of seclusion in one part and of openness and distance in another. A small yard can be made to appear spacious by proper care exercised in the planting. Trees or objects which are grotesque or striking should never be put in prominent places as in the center or foreground of a lawn. In such localities they detract from the harmony of the whole, by suddenly attracting the attention

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to a single incongruous object. The entirety of the scene is marred or lost. By keeping these simple rules in mind every planter can produce effects which will be pleasing. There is the greatest opportunity for individuality and chance to secure results which have a meaning of their own. With our somewhat limited list of trees which succeed in unsheltered places, there is consequently a necessity for careful thought and study to secure the best results in the end.

THE PLANTING AND CARE OF TREES.

So much has been written on this subject that we will only try to indicate that which seems to be the best practice for our state.

1. In taking up trees get plenty of roots. Protect the roots to keep them from drying out.

2. The more roots the better. We do not believe in root pruning.

3. A transplanted tree should be set in the ground the same depth it was when standing in the nursery or forest before it was taken up, and no deeper.

4. A hole should be dug large enough to accommodate all the roots without bending or breaking them.

5. In setting trees spread the roots naturally. Sift good soil in, around and over them, pressing it down. Then fill the whole with water. After the water has seeped away finish filling with soil, packing firmly around the trunk.

6. Moderately prune back the tops of deciduous trees. Cutting back large tree trunks when transplanting is a bad practice, as they invariably die somewhat below the cut, becoming unsightly, and from this nucleus decay is very apt to
spread, gradually creeping down the center or one side of the main trunk, deforming and sometimes eventually killing the tree. Always make slanting cuts on top limbs and cover cuts with shellac or paint.

7. The roots of evergreens should never be exposed to the air. When they dry out the resin or pitch in the bark becomes thick and water will never again thin it.

8. After the tree is set out never let it suffer for water. Cottonwoods and willows need a continual supply but will not do well if there is no drainage.

9. Never allow sod or weeds to grow immediately around the trunks of trees. If the trees are planted close together in groves or belts for wind-breaks the sod will not trouble around the bases.

10. In pruning trees cut out all dead branches. If for wind-breaks or shelter allow the lower limbs to grow. In cutting off a limb or branch never leave a stub on the tree but trim it smooth with the trunk.

11. For ornament plant trees in clumps or groves instead of rows. For shelter plant on the sides from which prevailing winds blow. In this state this will almost invariably be on the south and west. For general utility plant in every favorable place where they can be irrigated.

12. Use judgment in feeding trees and in preventing insects and disease from feeding upon them.
EXPERIMENTS AND OBSERVATIONS.

In 1892 small plats were set aside upon the Experiment Farms at Lander, Laramie, Saratoga, Sheridan, Sundance and Wheatland for experiments with shade and forest trees. In no case were the plats protected by wind-breaks or other shelter, though the farms at Sundance and at Lander were favored somewhat by being near the surrounding mountains. As few had attempted to grow trees the first object was to determine by trial what kinds would succeed in each locality. The most of the trees set out the first year were two years old, though some seedlings were used. In 1895 seeds of a number of varieties were planted. The differences of altitude with accompanying weather changes and the conditions of climate and soil have produced different results in each part of the state. At high altitudes, as upon the Laramie Plains, the growing season is comparatively short. Sudden frosts in the fall arrest the growth of many trees before they have ripened their wood. Some of the slow-growing kinds, as the hard-wood trees, fail to increase in size above the ground because each season’s growth dies back to the original stem or to the top of the ground in the fall or winter. This has occurred year after year upon the ash, elm, and honey locust, and even upon the willows where given no protection or moisture through the winter. This is well illustrated in the picture of white ash and elm trees showing six years’ growth at Laramie, and of willows along the ditch in foreground of the picture showing cottonwoods and willows of five years’ growth at Laramie. There are two white ash at the left and a white elm at the right of the one foot rule. These trees were planted upon the Experiment Farm when seedlings and irrigated each summer. After having stood six years they were taken up and photo-
WHITE ASH AND ELM - 6 YEARS' GROWTH, LARAMIE EXPERIMENT FARM.
graphed. A good root development has been made for the size of the tops but the small whip produced each summer dies down to the ground the following winter. As the altitude decreases or more protection is afforded the season’s growth increases and the dying back in the winter becomes less frequent. In a protected place in Cheyenne a thousand feet lower than the Laramie Plains we have a record of a season’s growth on white ash of nearly three feet while only a few of the top limbs died in the winter. At Wheatland, two thousand five hundred feet lower than Laramie, white ash made a growth in one season of fifty inches and no trouble had been reported of even the top limbs dying back.

The cause of the winter killing of trees and shrubs, as is well set forth in Bulletin No. 15 of this station by Professor Aven Nelson, is the drying out during the winter. Reasons are also given in the same bulletin for believing that such loss of moisture is greater at high altitudes.

That shelter by surrounding trees, buildings, or other objects which protected from winds, secures the same effect in saving trees through the winter as does a lower altitude with its longer growing season, is well illustrated by the fact that we have been unable to grow boxelders at all upon the Experiment Farm while in sheltered yards in Laramie the trees have attained considerable size.

The following notes indicate briefly the results of our trials with different trees, the general hardiness and utility of each and how they may be propagated or obtained.

COTTONWOODS (*Populus*)

Five species of poplars have been found native in the state.* Three of these are commonly called Cottonwoods, one the Balm of Gilead and the other the Quaking Asp.

*See Bulletin No. 28, p. 180.

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The poplars are dioecious, i.e., the male and female flowers are borne on separate trees. As the cotton is such a nuisance in yards and along the streets it is quite important only to plant in such places the male trees, which produce no cotton. We know of no way of telling the trees which produce cotton from those which do not when they are young, but it is an easy matter to propagate the kind wanted. Cottonwoods grow readily from cuttings. Cuttings from male trees or those which do not bear cotton will produce male trees. Anyone raising their own trees from cuttings should bear this in mind, in order to get rid of this objectionable feature. Some trouble has been experienced in this state by such rapid growing trees becoming bark-bound, especially on the south and west sides. When this occurs, split the bark open up and down the trunk once or twice during the season. Cottonwoods will grow in most trying situations if given plenty of water. They have succeeded better with us where planted upon rather shallow soil with sandy or gravelly subsoil and given a continual supply of water. In regard to their general usefulness, Professor Bailey of Cornell, writing for New York State, says: "As a group, the poplars possess comparatively small value in landscape planting. *** A very rapid growing tree nearly always produces cheap effects. *** There is little that suggests strength and stability in willows and poplars and for this reason they should always be used as minor or secondary features in ornamental or home grounds. Where quick results are desired there is nothing better to plant than these trees, but better trees, like maples, oaks, or elms, should be planted with them and the poplars and willows should be removed as fast as the other species begin to afford protection. *** The cottonwood is perhaps the best of all, spreading its gray branches far and wide, but like the aspen, it is cheerful and restive. One is not moved to lie under it as he is under a maple or oak. Its leaves rustle with the
slightest movement of air. The ripple of its foliage always recalls to my mind the play of wavelets upon a pebbly shore. The day is never so dark but the cottonwood reflects a flood of light.”

Force of circumstances necessitate our disagreeing with a part of these remarks, for we would be loath, indeed, to discard the cottonwood for our permanent plantings. The number of kinds of trees which we know to be hardy enough to stand our climate is limited. In fact, the only one which is of any great use for shade at the altitude of a great part of the state is the cottonwood. We admit that their constantly moving foliage is not conducive to the midday siesta, but on the other hand they are emblematic of the nervous energy, the bustle, the push characteristic of western people. Once for all we might as well decide to accept the cottonwood with thankfulness that we have so noble a tree and set about conscientiously to make the best use possible of it in producing pleasing effects in our landscapes.

RYDBERG’S COTTONWOOD OR SMOOTH BARK.
(Populus acuminata Rydberg.)

This is the hardiest and best of our native cottonwoods for cultivation in this state. It will grow anywhere if sufficient moisture is supplied, and thrives especially well where a number are planted together, as they shelter one another. On account of its hardiness, rapid growth, and habit of assuming a good shape, there is nothing to equal it for general planting under adverse conditions, or for a first shelter to protect more tender species. It is especially useful for wind-breaks, for planting along our streets, and single specimens standing near the border of a yard are beautiful. Some specimens planted upon the Experiment Farm at Laramie have succeeded well, making several times as much growth as the broad leaved cottonwood.

At an altitude of over 7,000 feet trees one inch in diam-
eter will become five to seven inches in diameter in five years. Every ranchman in the state who can irrigate them should plant shelter belts and wind-breaks of this species and should have them in his yard for shade. Cottonwoods are greedy feeders and other trees or plants do not do well when planted too close to them, but their good influence will repay the amount of room required. This tree, as is true of all our native poplars, produces good fuel but is of little or no value for lumber.

BROAD LEAF COTTONWOOD OR CAROLINA POPLAR. (Populus deltoides Marsh, or P. monolifera Aiton.)

This tree is common at Wheatland and in the northwestern portion of the state. Around the first artificial lakes or reservoirs at Wheatland thickets of these trees came up from seeds which made their way down the ditches with the irrigation water. It is much used as a shade tree. There are some excellent specimens in Laramie. Seedlings set upon the Experiment Farm in 1893 subject to the exposure of the open plains have lived, though the growth has been comparatively slow. They have attained a height of eight to ten feet and a diameter of two or three inches. They have undoubtedly been dwarfed somewhat by injury from plant lice which were found in great numbers on the leaves in 1896 and 1897. Prevailing southwest winds have caused them to lean in the opposite direction. A few specimens are shown in the illustration of this variety, at Laramie. Others on the plat were removed to make room for the shed and stack shown in the cut.

At Wheatland small trees set out upon the Experiment Farm in 1892 became four inches in diameter and twelve to fifteen feet high in three years. This species is not so desirable for general planting especially at high altitudes as is the smooth bark or Rydberg's Cottonwood.
NARROW LEAF COTTONWOOD OR BLACK COTTONWOOD.

(*Populus angustifolia* James.)

This is one of the most common native species, often growing to great size. It is hardy but at high altitudes is apt to become scrubby and unsightly where not well cared for and systematically pruned. Many of these trees have been planted in towns and some are making a good appearance. Some of the finest trees in Laramie are of this species. It does not grow so rapidly as the smooth bark, but when large its great spreading tops make it as effective a tree. Ordinarily it is not so highly prized as either the smooth bark or broad leaf given above.

BALM OF GILEAD. (*Populus balsamifera* Linn.)

Apparently this tree is not abundant in the state. There is considerable variation in the shape and size of the leaves but they can be usually distinguished by the resinous or sticky buds. This tree is long lived and hardy, succeeding well almost everywhere, although the broader leaved varieties have been more or less tender in Laramie. Professor Bailey states that their tops are hardly broad enough for the best shade but are good to plant among other trees. The sticky buds and leaves collect too much dust and dirt to make them desirable in cities where there is much smoke. Our illustration made from a photographe of one of these trees in Laramie shows a broader head than is generally formed by this species. Balm of Gileads are reported as not doing well upon the Lander Farm as they require so much water that other things are injured by it.

QUAKING ASP OR ASPEN. (*Populus tremuloides* Michx.)

Many of these trees have been transplanted but I have yet to see one in cultivation which I consider a fine speci-
men. Those which have been transplanted do not seem to grow well, probably because they do not receive sufficient moisture through the winter. They are pretty trees, throwing out their catkins before others have started in the spring, bearing through the summer their gay foliage which is never still, and at the first heavy frost in the fall turning to bright yellow and gold. They are useful for planting in yards with other trees as single or scattered specimens and are more esteemed than the cottonwood for setting out in young evergreen plantations to shade and protect the trees.

HORTICULTURAL VARIETIES OF POPLARS.

There are a large number of varieties of poplars in cultivation, other than those which are native to this state. I only know of one of these which has been introduced here. This is the Lombardy Poplar, specimens of which have been noticed in several places. It is a short-lived tree, however, and probably will not be planted to any extent. Such striking growths are too often abused by being used indiscriminately where they produce unpleasant effects in the landscape. We have little regret that the Lombardy does not succeed well here as is it of so little value for shade, ornament, wood or timber. The so-called silver poplars which have been planted here are silver maples, spoken of under maples, rather than true silver poplars. A number of Russian Poplars have been introduced which would, no doubt, prove of value for planting in this state but as yet they have not been tried*.

WILLOWS. (Salix.)

The willow is fully as hardy as the cottonwood but is not as useful for all kinds of planting. They are easily propagated by cuttings but they require a large amount and a

*Anyone interested in these poplars should obtain Bulletin No. 9 of the Minnesota Experiment Station, St. Anthony Park, Minn. and Bulletin No. 68 of the Cornell Station, Ithaca, N. Y.
RUSSIAN (WHITE) WILLOW IN YARD OF EDWARD IVINSON, LARAMIE.
SCREEN OF NATIVE WILLOWS ON GROUNDS OF EDWARD IVINSON, LARAMIE.
continual supply of water. Some of our native willows grow to a large size but they do not produce a shapely tree. They are easy to cultivate, however, and may be used to advantage in many places. Our illustration of a screen of native willows represents their usefulness for this purpose. These willows grew from cuttings in three years. In this case they are used to separate the garden from the house and front lawn.

A so-called Russian willow* has been grown upon the Experiment Farms at Laramie and Lander. Upon the Laramie Farm they have died down to the ground nearly every winter. A few specimens which had more moisture have attained a larger growth, but, as a rule, they only produce a fringe of whips along the ditches, as shown in the illustration of cottonwoods and willows upon the Laramie Farm. Larger trees of the same species have succeeded well upon the University Campus and Mr. L. Fee has experienced little difficulty in raising effectual wind-breaks of them upon the river bottom.

If kept properly trimmed they form a shapely tree in a short time. We show a picture of one of these trees on the grounds of Mr. Ivinson as it appears three years after transplanting. At Lander they produced a fairly good wind-break in three years, having reached a height of twelve to fifteen feet. The larger ones now have diameters of from two to four inches.

Osier willows brought from Nebraska have succeeded well upon the Laramie Plains. Upon the ranch of Mr. James King, seventeen miles from Laramie, they have made large growths, producing an effective wind-break for his garden. A specimen upon the Experiment Farm which stands near the main lateral where it gets plenty of moisture has grown well and shows no tendency to winter kill.

*Our botanist, Prof. Nelson, sent specimens to Prof. Bebb, a few years ago, who stated that this was the white willow crossed with another species.
MAPLES. (*Acer.*)

So far as we are informed the hard or sugar maple has not been tried other than a few seeds planted on the Station Farms, which failed to grow. Soft maples will succeed in sheltered places below five thousand feet altitude. Those planted at Laramie have failed. Three species are native in the state, the small bush maple, common in mountain ravines; the boxelder, along nearly all our streams at low altitudes, and our botanist has found a species, the Utah maple, on Bear River near Evanston. The following species deserve special mention:

Boxelder (*Acer negundo* Linn.)—Boxelders are too tender above 7,000 feet altitude except in the most sheltered locations. They may be sparingly used in yards, where they often produce handsome trees. Seeds planted on the Experiment Farms have not succeeded very well except at Lander, where seeds planted in 1895 have produced trees two inches in diameter and twelve feet high. They are subject to attacks of the boxelder leaf roller which must be kept in check by spraying or the trees become a nuisance as long as they live and are eventually killed by these insects. (For remedy see Insect Pests.)

Silver Maple (*Acer saccharinum* Linn.)—This species is often planted in our towns under the false name of Silver Poplar. It is hardy but shows a tendency to die back in the winter at Laramie. It has a disagreeable habit of suckering from the roots, and if neglected soon forms an unsightly bramble of underbrush. Single specimens, well cared for, in the back yard, may be tolerated, but they are too gay and striking for good effects in front yards or along the street. Our illustration shows some fair specimens planted along a street in Laramie.
SILVER POPULAR (MAPLE) LARIMA
LOCUST. (Robinia.)

Honey Locust planted on the south side of the University campus lived four or five years, but did not increase in size, as the small growth made each summer died back to the main stem the following winter. At Lander a good stand of both Honey and Black Locust was secured from seed, but reports from there state that they are killed back each winter. In a yard in Laramie there are good specimens of Black and Yellow Locusts, but they have not been grown long enough to determine whether they can be made to live through the winter or not. Fine specimens of these trees have been observed in Cheyenne. They will undoubtedly succeed in Wheatland and at other places along the eastern border of the state.

CATALPA.

This species has not succeeded upon the Experiment Farms. It can probably be made to grow in sheltered places at low altitudes.

MULBERRY. (Morus.)

The Russian Mulberry tried upon the Experiment Farms has been killed during the winters. We have seen fine thrifty trees full of ripe fruit at nearly seven thousand feet altitude upon the ranch of Mr. Keach located in a protected valley in the mountains about twenty-five miles south of the Wyoming line. With proper protection they will undoubtedly succeed in parts of the state.

GREEN ASH. (Fraxinus lanceolata Brokh.)

The Green Ash is found native along streams in the northern part of the state, having been observed as far south as the Canon of the North Platte above Orin Junction. It will undoubtedly succeed where properly cultivated in that region.

—(6)
WHITE ASH. (*Fraxinus americana* Linn.)

The investigations by the station show that the White Ash needs a longer season than we have at altitudes above six thousand feet. The illustration of White Ash and Elms, grown from seedlings at Laramie show the small growth made in unsheltered places. Larger trees set out upon the Experiment Farm and the University Campus lived through the first winter but made very small growth. In Cheyenne, at six thousand feet altitude, there are some thrifty, well-shaped ash trees. In the railroad park near the depot they made a growth this season of from one to three feet. A good many White Ash were set out around the Capitol grounds. The State Engineer tells me he has concluded that the season is too short for them.

At Lander, Sundance and Wheatland they have succeeded well. At Lander they made a growth of over three feet in the season of 1895, but the heavy freeze on September 22nd of that year cut them back. Since that time they have made new growth and Mrs. Meyer reports now that they are two inches in diameter and nine feet high. We have no report on the White Ash from Wheatland since 1895, but at that time trees which were set out when one year old in 1892 had made a growth of six to ten feet high and about one and one-half inches in diameter. Our illustration of White Ash trees at Wheatland shows a growth of four feet two inches in 1895.

WHITE ELM. (*Ulmus americana* Linn.)

The larger trees of White Elms planted at Laramie died the first season. Seedlings set out in 1892 have lived but have made such small growth (see illustration) that they are difficult to see in the plat. They seem hardy at Wheatland where in three years they reached a diameter of two and one half inches and attained heights of ten to twelve feet. At Lander they have died back each winter. In nearly all
WHITE ASH TREE. Wheatland, 1895. Season's Growth, 4 ft., 2 in.
(Cut loaned by Hon. J. M. Carey.)
parts of the state they will require good shelter in order to succeed.

BUTTERNUTS AND BLACK WALNUTS. (Juglans.)

At Wheatland and at Lander Butternuts and Black Walnuts have lived but have only made small scrubby growths. In 1895, at the former place, they made a season’s growth of two feet. Black Walnuts are more hardy than Butternuts at Wheatland. Trees set out at Lander in 1892 are now about two inches in diameter at the ground and four feet high. They require a low altitude and the best of shelter from the wind and sun.

MOUNTAIN ASH. (Pyrus americana Marsh.)

This is a very ornamental little tree where it can be made to thrive. It is native to the state in ravines in the mountains above 8,000 feet. A dozen were set out at Laramie but we failed to make any of them live. They require a sheltered locality and plenty of snow or other moisture during the winter. In Cheyenne there are a few beautiful specimens.

BIRCH. (Betula.)

There is a native species in the Black Hills of Crook County. We have not attempted to grow them upon the Experiment Farm but believe them worthy of careful trial for ornamental planting.

FRUIT TREES FOR ORNAMENT.

Those fruit trees which succeed with us are of little value for shade. However, they can often be used to advantage associated with other trees in ornamental planting and their usefulness makes them doubly desirable. Some of the apples, as the Wealthy and the Siberian Crabs, are almost as hardy as cottonwoods and willows. They may be
planted with considerable freedom in the rear and at the sides of city lots and single specimens well placed are often attractive. The same may be said of hardy cherries and plums. Mr. O. D. Shields of Loveland, Colo., has brought out a new creation in the form of a weeping cherry which appears to be very hardy. It consists of the Rocky Mountain Dwarf Cherry (*Prunus Besseyi*) budded upon native stocks. It makes a rapid growth, is weeping in habit, and the long silvery leaves give it a thrifty, handsome appearance. It is a promising small tree to be used as single specimens in recesses between other trees or near groups of shrubs used to break the lines of buildings or fences.

**EVERGREENS.**

Up to the present season we have only attempted to grow evergreens upon the University Campus at Laramie. Last spring the Division of Forestry of the United States Department of Agriculture sent us about 25,000 seedling trees of Scotch, Austrian and Bull Pines. They were carefully planted upon the Experiment Farm according to plans furnished by the Department and have been irrigated often during the summer to keep them from drying out. About two thousand of them were protected by setting shingles on the south and west sides. At the present writing about twenty-five per cent. of those set out are alive. The use of shingles has apparently made no difference in the death rate. We have tried to grow evergreens upon the University Campus for six or seven years but with poor success. Instead of scattering specimens we are now planting in clumps with the hope that by supporting and protecting one another and catching the winter snow they will live. We transplanted at different times of the year but the experiments have not been under way long enough to enable us to report results. We have planted only native trees taken up in our mountains or those raised in a nursery. In protected
Grove of Douglas Spruce on University Campus, Laramie.
lots in town many have succeeded better than we. The following varieties merit special mention:

Silver or Blue Spruce (*Picea pungens* Englm.)—This is a rapid growing tree and the most beautiful of our evergreens. It is a native, growing along streams or in wet swampy places in the mountains. On account of its natural habitat it is the only evergreen which grows well upon our lawns where so much water is used. When small it closely resembles the Engelmann Spruce but the latter grows on high ground. Nurserymen claim to have little difficulty in growing Silver Spruce but our experience indicates that they can hardly be made to succeed where no protection from winds and sun is given. Out of dozens of them set out without protection we have succeeded in establishing a single tree so we know it is growing. A number recently set out seem to be growing well. There are many fine specimens in the yards and parks in Cheyenne and Laramie. Mr. Thessen, who was caring for the railroad park in Cheyenne this summer, states that he has not lost a single tree. The grass is not allowed to grow around the bottom of the tree trunks and when watering the lawn the tops of the spruce trees are sprayed every day. As our frontispiece we show an illustration of a very good specimen in the yard of Mr. Edward Ivinson in Laramie. This tree was transplanted to its present position about ten years ago when it was quite small.

Douglas Spruce (*Pseudotsuga taxifolia* (Poir) Britton.)—This is a common tree in our mountains which is sometimes transplanted with the thought that it is the Silver Spruce. They are easily told apart, however. It stands transplanting fairly well if carefully done but will not thrive where there is as much water as is required by the Silver Spruce. There are some fairly good specimens in yards in Laramie. Our picture shows a small grove of Douglas Spruce which has been set out on the University Campus the past two sea-
sons. This picture represents the manner in which we think the trees are more apt to grow by protecting one another and catching the winter snows and illustrates the correct method of producing artistic landscape effects.

Cedars (Juniperus)—Cedars do not seem to have taken kindly to transplanting in Laramie. There are some nice specimens in yards in Cheyenne. Single specimens are very ornamental, especially if properly backed by other trees so they form a part of the whole effect. The cultivated variety should be obtained from some reliable nurseryman.

ARTIFICIAL ROOT PRESSURE.

The artificial application of root pressure in horticulture is new. It has been introduced by Professor E. S. Goff of the Wisconsin Station. He gives a detailed account of experiments carried on along this line in the Fourteenth Annual Report of that Station. Professor Goff attributes the failure to start growth promptly after trees have been transplanted to the lack of sap pressure in the cells. Under normal conditions this pressure is supplied by the action of root hairs. These, of course, are destroyed in the process of transplanting. New root hairs must be produced before the plant can re-establish this sap pressure. During the time that the tree is taking up so little moisture from the soil it is continually losing a large amount by evaporation which naturally lowers its vitality and ability to make quick, rapid growth. It seems plausible, therefore, that artificially keeping up the pressure in the tree, supplying water to take the place of that lost by evaporation and continuing the natural conditions so it can perform vegetative functions would insure the life of the tree and accelerate its growth. Professor Goff has demonstrated the value of his method with newly planted apple trees. We have tried the method upon fruit trees at Laramie and, while our experiments were not con-
inclusive, it seemed very beneficial. Our object in presenting
the matter in this bulletin is to interest those who are plant-
ing trees of any kind, with the hope that they will co-
operate with this station in order to make the experiments
sufficiently extensive to determine what value attaches to it.

The method is so simple, inexpensive and easily applied
that anyone can use it and if it proves effectual in prevent-
ing the death of even a small percent of transplanted trees
it would pay for itself many times over. When the trees are
planted a receptacle holding distilled or rain water is placed
at the height of, or a little above, the top limbs and con-
ected to one of the roots of the tree by a tube and small
piece of rubber hose. Bottles and glass tubing or a metal
dish at the top of a piece of gas pipe may be used. It is not
claimed that attaching this apparatus will do any good ex-
cept during the time new root hairs are being formed, the
roots are establishing themselves and the new leaves are
starting. It is only needed a few weeks at the most and the
materials used can be utilized for other trees. Anyone who
will co-operate with the station in making tests upon newly
planted trees will confer a favor by corresponding with the
Director. We only care to experiment with it upon spring
planted trees, but would like to make careful tests upon any
kinds of trees, whether deciduous or evergreen and in different parts of the state.
INSECT ENEMIES.

Only a few insects which produce any alarming injury to our trees have been observed. There are a few, however, which demand immediate attention and energetic action in order to prevent the destruction of our hardiest varieties. It is not our purpose here to write a scientific treatise upon this class of insects, but to call attention to the danger from certain pests and give as briefly as possible remedies for their destruction.

PLANT LICE.

These are the most injurious insects in the state. They are especially destructive to cottonwoods and have been very injurious to willows and spruce. These wonderful little insects are known to everyone as plant lice or as "green" or brown flies. They are so small that even when they occur in great numbers they are easily overlooked and though they fatally damage the trees the work is done so unobtrusively and slowly that they are too often ignored. There are a good many genera and species of plant lice but it will not be necessary to describe or classify them here. Two species working on the cottonwood are named in Bulletin No. 2 of this station.*

"The two species of lice in this locality on the cottonwood are Pemphigus populimontilis ? Riley, and Chaitopherus viminalis ? The former is less numerous than the latter. The first-named species attacks the leaf near its margin. By the continual puncturing and irritation to the leaf the growth is retarded at this point. The growth on the oppo-

*This bulletin which was written by F. J Niswander, then with the Station, has been exhausted. As it can no longer be supplied I have quoted in full the section on species and a little further along the one on remedies.
site side of the leaf is so rapid that within a short time a pocket-like cavity is formed, in which the lice live. The other species differs in its habit from its relative. Instead of forming a gall or protective covering for themselves, they congregate upon both sides of the leaf near the midrib and by their continual puncturing soon cause the foliage to curl, become brown and finally drop from the tree.” Undoubtedly there are other species working upon the cottonwoods and willows. We have not observed that early dropping of the leaves generally follows the attacks of our common species. I have also found undoubted evidence of work upon the roots by one or more other species.

Plant lice may or may not produce galls either upon the leaves or roots, depending upon the species. Where there are attacks upon both the leaves and roots more serious injury is done in a short time. They are so destructive to the cottonwoods in Laramie that unless some change in natural conditions, as unfavorable seasons or the increase of their enemies, destroys them or unless the people take the matter in hand, we predict that in ten years’ time there will be very few trees left. The trees gradually become weak, but they may not show the bad effects until time of throwing out the leaves in the spring. The foliage comes out late and the leaves have a small, yellow, sickly appearance. After struggling along after this manner for one or more years, the entire tree dies. Where neglected by not being prunned or supplied with sufficient water they die more quickly. Our illustration shows trees on a street in Laramie which are being destroyed in this way. The one to the left in front is entirely dead. The one back of it, inside the fence, and the three to the right are so out of health that they will probably not come into leaf another year, while the large, green tree at the right shows little effect as yet and may live several years. The trees in this picture are typical of the condition of a
great many cottonwoods in Laramie and every tree owner should do something at once to prevent further destruction. These insects live by sucking the juices of the plant upon which they feed. They ordinarily collect in great numbers on the under side of the leaves or upon the roots under ground. Upon their backs, near the rear end of the body, they bear a pair of siphuncles or honey tubes, through which is secreted a sweet liquid known as honey dew. This liquid becomes sticky and where the lice are numerous often covers the leaf, helping along the destruction of the tree by choking it to death. Sometimes so much honey dew is excreted that it falls like rain, and walks under the trees are covered with it.

Ants are the friends of plant lice, attending them regularly to feed upon the honey dew and caring for them or their eggs through the winter. It has been proven that at least some species cannot live unless they are taken care of by ants. If this is true of the species affecting our cottonwoods, and it seems likely, destroying the ants is a good remedy. Mr. Ivinson informs me that they have destroyed the ants wherever they have been found on his grounds, by pouring boiling water into their nests, and that his trees have not been bothered by lice. So far as I have observed, they are the only trees in town which do not show injury from these insects. For destroying ants, there is probably nothing better than bisulphide of carbon. Pour two or three tablespoonfuls into each hole and press the soil around and over it with the foot. This will usually kill everything in the nest.

There are several kinds of plant lice which live on our evergreens. They are often numerous on the Douglas Spruce, and one species (Chermes abietis Linn.) produces small, brown, cone-shaped galls at the ends of the limbs of the silver spruce.
COTTONWOODS IN LARAMEE, SHOWING EFFECT OF PLANT LICE AND NECTAR.
Cultivated Shade and Forest Trees.

REMEDIES.—Professor Gillette of the Colorado Station recommends collecting and destroying the galls on the spruce during the last half of June or early in July and to apply kerosene emulsion during the latter part of May. He also states that kerosene emulsion is effectual in killing the lice on Douglas Spruce.

When there are lice on the roots of trees they may be destroyed by working from three to six pounds of tobacco dust or a good quantity of the stems into the soil around the base of the tree and then thoroughly wetting it. The water takes enough nicotine from the tobacco down around the roots to destroy the lice. Professor Smith, in his book on "Economic Entomology" (P. 131), says salty liquids will kill plant lice, and recommends the use of potash fertilizers around the trees. Bisulphide of carbon injected into the ground is sometimes used and is effectual in killing the insects, but it is more expensive than tobacco and, using too much, is apt to injure the tree. It is necessary to destroy insects which feed, as do the plant lice, by applying poisons which kill by coming in contact with their bodies. All that I need to say regarding remedies for the lice on the parts above ground and how to prepare and apply them is contained in the following quotation from F. J. Niswander, in Wyoming Bulletin No. 2: "Various remedies have been suggested for the destruction of plant lice, but none seems to be more effective than an emulsion of kerosene oil and soap. This emulsion is made as follows: 'Dissolve in two quarts of soft water one-fourth pound of hard soap by heating to the boiling point, then add one pint of kerosene oil and stir vigorously for from three to five minutes.'—(Cook). The best way to do the stirring is to pump the mixture from one vessel into another or back into itself with the force pump. This will form a thick, creamy mass that may be diluted to any desired strength. To the mixture just formed we then add
ten pints of water. This is the usual strength, although the emulsion will kill the lice if twelve pints of water are added. It is better to add the larger amount of water, as there is some damage done the foliage when only ten pints are added. The emulsion should always be applied with a force pump. Another excellent remedy for plant lice is Buhach or Pyrethrum. This is the yellow insect powder sold in the shops for the destruction of insects. If two tablespoonfuls of this be thoroughly stirred in a large pail full of water and sprayed upon the trees excellent results will follow the application. Too much care cannot be taken to make a thorough application, otherwise it will do no good.

"In the application of insecticides there is nothing that will insure success like thoroughness. A dashing spray, one that will reach every leaf upon all portions of the tree, is one of the essentials of a good force pump. There are many pumps upon the market and all have certain features that are commendable."

**BOXELDER LEAF ROLLERS.**

(*Caecicia semiferana* Walk.)

This insect proves very destructive, at times practically defoliating the boxelders, leaving them unsightly and in such condition that they are slow to recover. It is popularly thought to be the same as the leaf roller of fruit trees. In Bulletin No. 47 of the Colorado Station, Professor C. P. Gillette, in speaking of it, says: "This insect is a close relative of the Fruit Tree Leaf Roller and it is quite commonly thought not to be different. It seems to confine its attacks exclusively to the boxelder, however, in this state, as I have never yet found the larvae feeding upon anything else. Its habits and appearance are much like the fruit tree species."

**REMEDIES.**—As the larvae are external feeders, eating the whole leaf, they may be destroyed with any of the stomach poisons. Spray with Paris Green mixed with water
at the rate of one pound of Paris Green to 150 to 200 gallons of water, keeping it well stirred. Apply when the young larvae first appear upon the leaves and again a week or ten days later.

BOXELDER BUG—(Leptocoris trivittatus Say.)

This insect is common all over the state. It is a flat bug about one half inch long, black, with red margins on the thorax and wings. They may often be seen walking around slowly in the fall or winter time, or collected in great numbers here and there. The young bugs feed upon the boxelder.

REMEDIES.—Professor Gillette says that the old bugs seem proof against most applications used for such insects, but that kerosene emulsion will probably kill the young bugs. He recommends killing them with boiling water when large numbers of them are found collected in one place.

ATTACUS MOTH—(Attacus columbia Smith.)

A large, green caterpillar, almost the size of a cigar, when full grown, covered with knobs, with yellow and blue markings, is becoming a common pest upon the willows, currants and gooseberries at Laramie. They are enormous eaters, requiring a great many leaves at a meal, and have a habit of only resting a short time between meals, so entire branches may be defoliated in a single day. The larvae spin dark cocoons of silk and produce the largest moth found in our state, the wings expanding three and one-half to four inches.

REMEDY.—Where numerous, they should be destroyed with the same spray of Paris Green as that given for Boxelder Leaf Roller.*

*A number of caterpillars have been found eating the willows. Wherever they feed in such numbers as to be at all injurious they should be destroyed with the Paris Green spray which effectually kills any insect which feeds by eating a part or all of the leaf.

—(9)
TENT CATERPILLAR—(Clisiocampa fragilis?)
Specimens of tent caterpillar eggs have been sent me from Natrona and Crook Counties. The eggs are laid in bundles around the stem. The larvae feed upon the apple, spinning unsightly tents in the top limbs, and become very destructive where allowed to become numerous and continue their ravages unmolested.

REMEDIES.—The egg masses must be cut off in the winter and burned. If any escape observation, the young can be destroyed by cutting off and burning the tents, or by spraying with Paris Green. Where the trees are sprayed with Paris Green for the codlin moth the tent caterpillar is usually destroyed as well.

COTTONWOOD BORER—(Prionoxistus robiniae Peck.)
Injury from this insect is occasionally met with in cottonwoods in this state. They are apt to bore into the tree where there is a scar. The castings of the borers are pushed out to the surface and the sap runs out, making a bleeding place on the tree, which helps to rot the wood. The larvae become about two inches long.

REMEDIES.—As given by Professor Gillette, the remedies are to destroy the larvae by using a wire or to prevent his coming out as the adult moth by plugging up the hole or tacking a screen over it. It is difficult to destroy wood borers because they are so inaccessible.
SUMMARY.

Fifty million acres in Wyoming are treeless. About two million acres are now under ditch and large tree plantings are needed on every farm.

The influence of trees makes it possible to grow fruits and other plants which would not otherwise succeed. Shelter belts are invaluable protection to livestock. Without trees our landscape and homes are monotonous and unattractive.

As a people we should give more thought to the planting, care and pruning of our trees.

Our best trees for wind-breaks, shelter belts and street planting are cottonwoods and willows. Our most rapid growing cottonwood is the smooth bark or Rydburg's. Next in value are the broad leaf, black or narrow leaf cottonwood and Balm of Gilead.

The cause of the winter killing of our trees is believed to be their drying out during the fall, winter and spring. The remedy indicated is fall and winter irrigation, protection from wind and sun, catching the snow and any method to prevent evaporation, as mulching the ground and wrapping the trees.

The following list gives the trees which have been tried in the state for ornamental or other planting, arranged so far as we are able to do so, in the order of their hardiness, the most hardy being named first: Cottonwood, Willow, Silver Spruce, Douglas Spruce, Boxelder, Hardy Apples, Dwarf Cherry, Silver Maple, Cedar, White Ash, Green Ash.
Locust, Elm, Morello Cherries, Plums, Mountain Ash, Soft Maple, Black Walnut, Butternut, Birch, Mulberry, Catalpa.

Our cottonwoods and boxelders have been more injured by insects than other trees.

The insects doing greatest injury to trees in this state are plant lice, the boxelder leaf roller and tent and other caterpillars.

For insects which feed by sucking the juices of plants, as plant lice, spray with kerosene emulsion. Those feeding upon the roots may be destroyed with tobacco and bisulphide of carbon. For those which feed upon the leaves, use a spray of Paris Green. For ants, use bisulphide of carbon or hot water.