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FOREST PLANTING IN THE NORTH PLATTE AND SOUTH PLATTE VALLEYS.

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CONTENTS.

	Page
Introduction	5
The region	5
Topography	5
Soil	5
Climate	6
Purpose of forest planting	7
Protection	7
Commercial planting	8
Ornamental planting	9
What to plant	9
North Platte Valley	9
South Platte Valley	10
Species for experiment	10
Species best adapted to different uses	10
Fuel	10
Fence posts	10
Farm repairs	11
Windbreaks and shelterbelts	11
Ornamental planting	11
Establishment of plantations	11
Plant material	11
Planting	12
Spacing	13
Mixtures	13
Cultivation	14
Irrigation	14
Protection	15
Thinning	15
Notes on species	15
Green ash	15
Honey locust	15
Black locust	15
White elm	16
Hackberry	16
Cottonwood	16
Carolina poplar	17
Lombardy poplar	17
White poplar	17
Willows	17
Boxelder	18
Russian olive	18
Buffalo berry	18
Silver maple	18
Hardy catalpa	18
Western yellow pine	19
Jack pine	19
Rocky Mountain juniper	19
Blue spruce	20

FOREST PLANTING IN THE NORTH PLATTE AND SOUTH PLATTE VALLEYS.

INTRODUCTION.

There is very little natural tree growth in the North Platte and South Platte valleys. That which does exist is confined entirely to the water courses. A small amount of tree planting has already been done in both valleys, but often a poor choice of species or lack of care after trees were set out brought failure. With the further development of this region through extensive irrigation an increased amount of planting will be undertaken by the settlers. The purpose of this report is to furnish information to prospective forest planters upon the trees best adapted to the region and the proper methods of growing them.

THE REGION.

The region herein discussed includes all lands now under irrigation or ultimately to be reclaimed in the North Platte Valley from Guernsey, Wyo., to North Platte, Nebr., together with the irrigable portions of the South Platte Valley from North Platte, Nebr., to the limits of the irrigated lands a few miles south of Denver, and the territory adjacent to the South Platte River and watered by its tributaries, such as the Cache la Poudre River and Big Thompson, Little Thompson, Clear, and Cherry creeks.

TOPOGRAPHY.

There are two well-defined classes of land within the region—the valley land of the river bottoms, and the upland which borders them on each side.

The upland comprises the bulk of the area, and for the most part forms a plateau or table-land, though in the western portion of the South Platte region it becomes a gently rolling prairie.

SOIL.

Several types of soil occur. These are loam, sandy loam, sand, and gravelly loam.

Sandy loam is the prevailing type in both valleys. It is usually from 1 to 6 feet in depth, but in the river bottoms may be much deeper. The usual subsoil is sand, though in places it is gravel or a gravelly clay.

Loam is not an important type in the North Platte Valley, and occurs only near the Brule clay buttes or Brule clay outcrops, and here and there along the Platte bottoms. Frequently it is underlaid near its surface with unweathered Brule clay. Trees will not thrive in such situations, since their roots can not penetrate the subsoil. In the South Platte region the loam type covers a considerable part of the upland area where it forms a very heavy soil, which, when dry, clods readily and becomes exceedingly hard. It is underlaid at a depth of from 3 to 6 feet by a subsoil which varies from sand to sandy loam or even clay, and which absorbs water readily and retains it for long periods. Such land is especially adapted to orchard crops. Both the loam and sandy loam soils are very rich, and under irrigation are adapted to the growth of a number of tree species.

Sand exists chiefly in the sand-hill formation of the North Platte Valley in eastern Wyoming, on the north side of the river, and along portions of the Interstate Canal, especially between Wyncote and Laramie. Though not so common in the South Platte Valley, small patches are found throughout most of the region. The subsoil is not essentially different in composition from the surface soil. If set with grasses or shrubby growth sufficiently dense to protect the surface from wind erosion, these sandy lands are adapted to the growth of certain trees, such as pines. Bare, shifting sands can not be planted.

In the North Platte Valley the gravelly loam type occurs in scattered areas on a few of the higher hills and ridges, which can not be irrigated. In the South Platte region the gravelly loams, when they occur within the irrigated systems, are found near the Rocky Mountain foothills. This class of land is usually hard to irrigate. Where it can be given sufficient water, it is well adapted to the growth of fruits and certain field crops, such as small grain, alfalfa, and sugar beets. Forest planting is feasible where these crops can be grown.

CLIMATE.

The climate is characteristic of the semiarid plains. Some of the more striking features are illustrated by the following table, compiled from records of the United States Weather Bureau:

Temperature and precipitation in the North Platte and South Platte valleys.

Station.	Temperature.				
	Normal annual.	Absolute maximum.	Date.	Absolute minimum.	Date.
	° F.	° F.		° F.	
North Platte, Nebr.....	47.9	107		-35	
Gering, Nebr.....	47.9	106		-32	
Leroy, Colo. ^a	48.3	104	June 28, 1898 ^b	-28	Feb. 12, 1899
Fort Collins, Colo.....	46.8	100	Aug. 1, 1902	-38	do.....
Denver, Colo.....	50.0	105	Aug. 8, 1878	-29	Jan. 9, 1875

^a Leroy, Colo., lies a few miles to the east of the South Platte Valley, but weather conditions there are practically the same as for the valley in that part of the State.

^b Also July 8, 1901, and July 15, 1902.

Temperature and precipitation in the North Platte and South Platte valleys—Continued.

Station.	Precipitation.					
	Normal annual.	Normal, April to August, inclusive.		Maximum annual.		Minimum annual.
	Inches.	Inches.	Per cent of annual.	Inches.	Year.	Inches. Year.
North Platte, Nebr	18.27	13.45	74	29.88	1883	11.21 1891
Gering, Nebr	15.08	10.66	70	23.50	1905	9.82 1893
Leroy, Colo. ^a	15.72	11.09	70	25.60	1891	7.34 1891
Fort Collins, Colo	14.69	9.75	66	21.17	1901	5.65 1893
Denver, Colo	13.99	9.11	65	21.43	1891	8.48 1893

^a Leroy, Colo., lies a few miles to the east of the South Platte Valley, but weather conditions there are practically the same as for the valley in that part of the State.

As shown by the table the region is subject to great extremes of heat and cold, and therefore only the hardiest species can be successfully grown.

The annual precipitation at times departs widely from the normal, the minimum varying from a little more than 11 inches at North Platte to less than 10 at Gering and 6 at Fort Collins. Trees usually do not exist naturally where the annual precipitation is less than 20 inches. Some of the conifers, however, are able to thrive where the rainfall is a few inches less than this amount. Since the normal precipitation within the region is considerably less than 20 inches, forest planting on nonirrigated land will not be possible except on sandy soil, where certain pines will succeed without artificial watering. There is a possibility, however, that with continuous cultivation the hardiest broadleaf trees may be grown on nonirrigated sandy loam and loam soils. A feature of the precipitation which favors crops of all kinds is that from two-thirds to nearly three-fourths of the annual rainfall comes during the growing season, from April to August.

PURPOSE OF FOREST PLANTING.

PROTECTION.

Protection from wind is one of the important problems with which the inhabitants of the North Platte and South Platte valleys have to deal. Nothing serves the purpose better than a shelter of trees, and no other farm improvement will so well repay the money and time expended on it.

Trees in such a region shield the farm buildings and add greatly to the pleasure and comfort of the home. They offer shelter to stock, and, finally, they make successful orcharding possible.

The first concern of the settler will be, of course, to furnish effective protection to the farmstead. Shelterbelts should be planted north and west of the buildings, since it is from these directions that the severe cold winds come. A windbreak should also be established on

the south as a shield against the hot winds of summer. Protection on the east is not so essential, though a narrow belt of trees would be desirable.

Sufficient shelter during winter is one of the important problems in connection with the live-stock industry on the plains. Stock can be fattened and carried through the winter more economically under shelter than in the open. One of the most satisfactory shelters is a shield of trees.

Successful orcharding in this region is largely dependent on windbreaks. On the east and south exposures of the orchards they assist in keeping the buds of the fruit trees dormant until after the danger from frost is past. On the west and north they check the force of the driving winds, and wherever placed they protect the orchard from hail. The windbreak on the east need not be wide, but it should be high. On the south, west, and north it should be at least 2 rods wide.

The protection given by forest belts to field crops is receiving attention. In the corn belt of Nebraska, in seasons of light rainfall, the best yields are realized from fields with windbreaks on the south and west. This is due to the influence of the trees in checking the force of the wind, with the corresponding decrease in evaporation from the soil. Another important purpose of windbreaks is to protect crops from direct damage by wind. The influence of a single shelterbelt is, of course, only very local, but the general establishment of windbreaks throughout a region would break the force of local windstorms.

COMMERCIAL PLANTING.

While planting timber for commercial production will usually be impracticable, owing to small size of farms and high land values, yet with the same degree of care and skill that is given to the raising of other crops a certain amount of commercial planting will bring a profit. A large part of the timber supply, such as posts, fuel wood, and repair material, required on the farm, can be grown in the home woodlot.

On many farms there are patches which, though irrigable, lie in out-of-the-way corners or are otherwise not readily accessible for ordinary farming: these can be used in forest planting. Certain spots which, through seepage, have become too wet for field crops, are still of value because some forest trees will thrive there. Sandy lands on the farm or near it may often be planted to conifers, and will not require cultivation. The north and east exposures of these sandy areas are by far the more favorable for tree growth. South and west slopes can not as a rule be successfully planted. It should be borne in mind that shifting sands wholly devoid of vegetation must be held in place before they can be set to forest trees.

The trees adapted for planting on the loamy or sandy loam lands are green ash, honey locust, white elm, hackberry, Russian olive, western yellow pine, jack pine, and Rocky Mountain juniper. Those which may be planted on the sandy lands are jack pine and western yellow pine.

ORNAMENTAL PLANTING.

Much of the tree planting in the North Platte and South Platte valleys will be for ornament. Towns and cities should encourage street planting. The plan that Denver has just inaugurated, of maintaining a city nursery to supply its own forest-tree stock, is excellent. School and church grounds offer opportunities in ornamental planting for village improvement societies. Concerted effort along these lines will add greatly to the attractiveness of the country.

The practice of planting trees along roadsides has much in it that is commendable. In some States, notably New York, Pennsylvania, and Massachusetts, such planting is encouraged by a partial rebate of taxes on land thus improved. Not only do roadside trees add to the attractiveness of the farm, but they have a positive economic value in the protection they afford to the crops and farm animals and in the products they yield. The chief objection urged against roadside planting is that trees rob the soil and decrease the yield of adjoining crops. Where this objection holds it is simply a matter of choosing between the slight loss to crops and the advantage of having the trees.

WHAT TO PLANT.

The following list of species contains the more important of those that can be recommended for planting in the region. The uses and characteristics of these trees are discussed briefly under "Notes on Species," page 15.

NORTH PLATTE VALLEY.

Green ash.	Honey locust.
Black locust. ^a	White elm.
Hackberry.	Common cottonwood.
Carolina poplar. ^a	Lanceleaf cottonwood.
Narrowleaf cottonwood.	Lombardy poplar.
White poplar.	White willow.
Black willow.	Diamond willow.
Russian golden willow.	Boxelder.
Russian olive.	Buffalo berry.
Western yellow pine.	Jack pine.
Rocky Mountain juniper.	Blue spruce.

^a Trees whose adaptability for this valley has not been thoroughly determined.

SOUTH PLATTE VALLEY.

Any of the species adapted to the North Platte Valley may safely be recommended for the South Platte Valley. In addition, silver maple may be planted in any part and black walnut in the more western part of the region. Both of these trees do better near the foothills at Denver and in the Greeley district than farther east. Carolina poplar has been grown successfully throughout the South Platte region, except in a few localities where borers attack it, and black locust can be more safely planted in the South Platte than in the North Platte Valley.

SPECIES FOR EXPERIMENT.

While the list of twenty-five trees just given includes those that have given the best results in the South Platte Valley, these are not necessarily the only ones which will succeed here. New species are being introduced and doubtless the list may be considerably enlarged. Basswood, white birch, Scotch pine, and Austrian pine have already been planted with success. Some of the oaks are now being tested and are making a promising showing, while after further trial more of the Rocky Mountain species will probably prove well adapted to forest planting in the region.

In the North Platte Valley the planter will be more restricted in his choice of species, and at present should confine himself largely to the list suggested for that region. The Forest Service is inaugurating experiments in forest planting at North Platte, where new species will be tested, and it is hoped that in time the list can be extended.

SPECIES BEST ADAPTED TO DIFFERENT USES.

FUEL.

Because of their rapid growth and large yields the following species are recommended especially for fuel production:

Cottonwood.	Carolina poplar.
Russian golden willow.	White willow.
Black willow.	

With good care the cottonwoods and Carolina poplar will produce each year 3 cords per acre and the willows will yield almost as much.

FENCE POSTS.

Black locust.	Osage orange.
Honey locust.	Green ash.
Russian olive.	Diamond willow.
Rocky Mountain juniper.	Black walnut.
Hardy catalpa.	

Wherever the site is favorable, black locust and hardy catalpa should be given preference.

FARM REPAIRS.

Green ash.	Honey locust.
Black locust.	Hardy catalpa.
	Black walnut.

WINDBREAKS AND SHELTERBELTS.

Almost any tree may be planted for protection purposes, but the following list includes the best kinds:

Cottonwood.	Carolina poplar.
Russian golden willow.	White willow.
Hackberry.	White elm.
Russian olive.	Buffalo berry.
Silver maple.	Boxelder.
Western yellow pine.	Jack pine.
Blue spruce.	Rocky Mountain juniper.

ORNAMENTAL PLANTING.

There is greater latitude in selecting trees for ornament than for any other purpose. A perfect specimen of any tree is usually ornamental. The list below is not intended to be exhaustive, but includes the trees which, in general, are best adapted to ornamental planting.

White elm.	Hackberry.
Green ash.	Carolina poplar.
White poplar.	Russian golden willow.
Russian olive.	Boxelder.
Silver maple.	Blue spruce.
Bull pine.	Rocky Mountain juniper.

ESTABLISHMENT OF PLANTATIONS.

PLANT MATERIAL.

For establishing forest belts and woodlots with the broadleaf trees recommended in this report, 1-year-old or 2-year-old seedlings will be suitable. Ordinarily 1-year-old stock will be large enough, but in the case of Russian olive and buffalo berry 2-year-old stock will be better. In planting conifers, 3-year-old stock, once transplanted, is recommended. Wild seedlings of jack pine collected in the Lake States may be substituted for the nursery-grown stock in case the latter is not available.

In general, if ornamental planting is the sole object, larger stock is better, since results can be realized much sooner. In this case, con-

fers 4 or 5 years old, twice transplanted, will be suitable, although the price of such stock prohibits its use on a large scale. Broadleaf trees should rarely be over 2 inches in diameter at the ground if transplanting is to be successful. A common mistake is to select stock that is too large. Small trees are cheaper; they recover much sooner from the effect of transplanting, and usually develop a more shapely form.

In rare cases cuttings may be used to good advantage. These are made from branches from 1 to 2 years old and about one-fourth inch in diameter, cut into lengths of about 1 foot. Branches 1 or 2 years old will give the best results. Poplars and willows are frequently propagated in this way.

Care should be taken to procure only hardy stock. Home nursery-men should be given the preference, since stock grown near the region where it is to be used will be more likely to succeed than that brought from a distance. Stock grown in regions farther north or west than the one in which it is to be planted will give better satisfaction than that grown farther south or east.

When the stock is received from the nursery, if it is not to be planted at once, it should be "puddled" and "heeled-in." The root hairs are important parts of the root system and are exceedingly sensitive to the drying effects of sun and wind. This is particularly true of conifers. Even a few minutes' exposure in dry, windy weather may kill them. The roots of broadleaf trees are not injured quite so readily and will often recover even after becoming more or less shriveled. Carelessness in this respect, however, is always a menace to successful planting. During removal of the stock to the permanent site the same care should be taken to keep the roots moist.

PLANTING.

The best time for planting is about April 15 to May 15. It is well to wait until the spring rains begin and to select cloudy, damp days for the work. Dry, windy weather should always be avoided. Fall planting in these regions is never advisable.

The ground should be put into a state of thorough cultivation before planting. If the land is in sod, it should be broken up at least a year before the trees are set. Meanwhile the land should be cropped, or if this is not feasible, it should be disked twice during the summer to keep the weeds back and to hasten the rotting of the sod. It should then be "backset" 6 or 7 inches deep in the fall. After being disked again in the following spring and thoroughly harrowed the soil will be ready for planting.

No preparation need be given to soil of the sand-hill type, since plowing would subject it to wind erosion.

As a guide to the planters in setting the trees, rows should be marked out on the ground. For narrow forest belts the rows may run in only one direction, but for woodlots it is best to run two sets of rows, at right angles to each other.

On sites prepared by plowing, harrowing, and marking in two directions the trees should be set at the intersection of the rows. Planting crews should consist of from three to five men, one man to distribute the trees, the others to plant them. In all cases, the trees should be set a trifle deeper than they stood in the nursery row. The roots should be straight and well spread out and the earth thoroughly firmed about them. As a rule a crew of three men should plant 3,000 trees per day. On loose, sandy soils, which need not be prepared and marked out beforehand, it will be best to plant in rows one way. This may be done by laying out the first row with guide stakes and the others by the eye. In the sand hills the grasses occur in bunches with numerous vacant spots between. The trees should be planted in these open spaces.

SPACING.

Width of spacing will depend upon the purpose of the planting and the species used. In forming windbreaks of a single row with such trees as willow, Russian olive, or buffalo berry, a spacing of 2 to 3 feet may be used. With most other trees, both broadleaf and coniferous, 4 feet gives the best results. Where the windbreaks are several rows in width, 4 feet by 4 feet or 4 feet by 6 feet is best. In woodlots an initial spacing of 4 feet by 8 feet or 6 feet by 6 feet is recommended. In planting on the "hard land"—that is, loams and sandy loams—where for any reason irrigation is not possible, and where on this account continuous cultivation is necessary, the initial spacing should in no case be less than that for woodlots. For the nontillable, sandy lands, a spacing of 4 feet by 4 feet is best.

A spacing of 4 feet by 4 feet requires 2,720 trees per acre; 4 feet by 8 feet, 1,360; 6 feet by 6 feet, 1,210.

In ornamental planting trees are often placed too close together. The permanent trees should be placed seldom less than 30 feet apart, while 40 feet, or even 50 feet, is often better. Shade trees must not be crowded if they are to develop well-rounded, shapely forms.

MIXTURES.

The best results in wide forest belts and in wood-lot planting are secured when the trees are planted in pure stand. Where mixtures are advisable they should consist of but two species. White elm and green ash, for example, grow well together. Honey locust or hack-

berry is a good associate of either. Various cottonwoods may be planted together. Even the trees which will succeed in mixture will grow equally well in pure stands.

In narrow windbreaks mixtures can be used more freely, since the danger that some species will be shaded out by the others is slight. In street and lawn planting a mixture of rapid-growing trees with slower growing, more permanent ones, is often very desirable. Later the rapid growers can be cut out and the longer-lived trees left to form the permanent stand.

CULTIVATION.

Proper cultivation is as essential with trees as with any other crop. Its object is to conserve the moisture content of the soil and to prevent the growth of weeds and grass. Even if the ground moisture is plentiful, the soil should be stirred to keep it in a pliable, mellow condition. On irrigated land it is a good plan to stir the soil after each irrigation. Cultivation should be continued until the trees form a canopy dense enough to completely shade the ground. If the plantation is on dry table-lands, cultivation should be continued until the tops form a complete cover.

Level cultivation should be the sole practice. The method of ridging the dirt up about the trees, sometimes practiced, is very bad. By constant level cultivation a dust mulch is kept up and a minimum amount of surface is exposed.

The dagger-tooth harrow, the disk harrow, and the five-tooth cultivator are the best tools to use in cultivating trees. After the trees become too large for using a double harrow a single section of a dagger-tooth harrow, or a one-horse five-tooth cultivator, can be used to excellent advantage.

Fall cultivation should be avoided, since it tends to stimulate growth out of season and to render the trees susceptible to early fall frosts. On loose, sandy soil cultivation after planting is seldom necessary.

IRRIGATION.

The trees should be watered just after they are set out, and as often each season as is necessary to keep the ground moist and soft. Water should be withheld after the 1st of August, for late irrigation, like late cultivation, prevents the wood from properly maturing for winter. Late in the fall or in early winter, when no further growth is possible, it is often a good plan to turn the water on in order to keep the ground from becoming too dry through the winter. Trees constantly give off moisture, and conifers particularly, even in the winter season; unless they can replenish themselves through the roots, death may result from drought. Much loss that is ascribed to freezing is caused in this way.

PROTECTION.

Plantations in which live stock runs at large seldom succeed. Stock should be excluded from all plantations.

Whenever there is danger of fire, strips from 12 to 20 feet wide should be plowed around the plantation and kept free of weeds and grass.

THINNING.

A few years after planting, the tree tops will begin to interlace, and the struggle for light and growing space will begin. At this time a thinning should be made to remove all dead, dying, or otherwise undesirable trees, leaving only the better and more promising specimens to constitute the forest. By repeating the thinnings from time to time the best trees will be favored and a plantation of the highest value secured. The thinnings will usually more than pay the cost of the necessary labor.

NOTES ON SPECIES.

GREEN ASH.

Green ash is one of the hardiest trees that can be grown in the region, and should be widely planted. It is equally well adapted to bottom land and table-land. Though it does best on irrigated land, it can be grown even on high, dry uplands. In such situations, however, it should be given continuous cultivation. Not infrequently the only remnant of the "better days" on the table-lands is found in the few specimens of green ash, which, in spite of drought, fire, and abuse of live stock, are still in a thrifty condition. The wood of green ash is hard and strong and is excellent for farm repairs. It also makes fine fuel, and though its value as a fence post is not relatively high, it is widely used for this purpose.

HONEY LOCUST.

Honey locust is another very hardy tree which may be recommended. With proper cultivation it can be grown on the nonirrigable table-lands. It is somewhat more valuable than green ash for fuel and posts, and its growth is more rapid.

BLACK LOCUST.

The success of black locust in the region is problematical, especially in the North Platte Valley, where it has been planted with varying results from North Platte City to the Wyoming line. On a farm 2½ miles southeast of Mitchell, Nebr., is a row of black locust 14 years old. The trees range from 4 to 6 inches in diameter 4½ feet from the

ground, and each tree will make from one to three first-class fence posts. The owner states that some of the trees froze back the first two or three winters, but recovered and have since made a thrifty growth. Other successful specimens may be found as far west as Scotts Bluffs. Near Hershey, Nebr., there are two plantations 15 years old which, though seriously damaged in the winter of 1901-2, are now yielding a large number of excellent posts.

Although examples of successful planting may thus be cited, attempts to grow black locust have frequently failed. In the South Platte Valley it can be planted with greater safety than in the North Platte Valley, but in neither is it thoroughly hardy. The wood of black locust is very durable, and the tree when planted on good soil and given sufficient moisture will reach post size in ten years. The insect enemies which are injurious to its growth in other sections of the country have thus far done very little damage in these valleys.

WHITE ELM.

White elm is a very desirable tree for planting. While it prefers rich, alluvial soil, it will, nevertheless, do well on uplands under irrigation. It grows very rapidly, is hardy, and is excellent as an ornamental tree and for windbreaks.

HACKBERRY.

Hackberry closely resembles elm in general appearance, especially when young. It is more drought resistant, however, and will endure a wider range of soil conditions, and its hardiness is one of its chief virtues. It is an excellent tree for windbreaks as well as for ornamental planting. Its wood makes good fuel.

COTTONWOOD.

One of the best trees for general planting under irrigation is cottonwood. It is easily propagated, grows rapidly, and is very hardy. It thrives best on rich alluvial soils, and will succeed on any of the irrigated lands under consideration. The growing of cottonwood on the table-land without irrigation should not be attempted. It is a very common fuel on the plains, and in this region no other tree, with the possible exception of Carolina poplar, will, in a given time, produce so much fuel per acre. The timber is used quite extensively for the framework of farm buildings and for bridge planking. In some sections it is used for posts and telephone poles, though it is not durable in contact with the ground.

A common objection urged against cottonwood is the annoyance caused by the flying of the seed or "cotton." This may be avoided

by the use of cuttings from the male form of the tree, which does not bear seed. However, where the cotton is not objectionable seedlings are preferable to cuttings.

CAROLINA POPLAR.

Carolina poplar has been propagated from cuttings by nurserymen and the stock sold by them does not produce seed or cotton. This, together with the tree's rapid growth and good form, has given it a prominent place in ornamental planting, especially in the Middle West.

In the South Platte country, aside from a few localities where borers infest it, Carolina poplar is usually successful. Its insect enemies seem to be localized. At Greeley, Colo., for example, it is attacked by borers and dies within three or four years from the time it is set out, while in near-by localities, as at Fort Collins and Loveland, it reaches a large size. The tree has not been thoroughly tested in the North Platte Valley, but it can be planted with reasonable assurance of success.

Carolina poplar grows more rapidly than common cottonwood, but as propagated in the West it is neither so hardy nor so long-lived. However, its fuel value is high, and even if the trees die early, they will provide valuable fuel.

LOMBARDY POPLAR.

A tree that has proved hardy in these regions is the Lombardy poplar, introduced from Europe. Because of its narrow, upright form, it is especially adapted to ornamental planting. Its economic value is limited to its use for fuel.

WHITE POPLAR.

White poplar is another tree introduced from Europe that has been widely planted in the United States for ornament. It can be recommended for both valleys for this purpose.

WILLOWS.

For quick-growing windbreaks several of the willows are excellent, among them white, black, and Russian willows. Black willow is native, while the other two species are from Europe and by far the better trees. Like cottonwood, willow is a moisture-demanding tree, and does best on rich bottom soils. With proper irrigation, however, it will succeed on the table-lands. Willow does not yield quite so well as cottonwood, but its fuel value is somewhat higher and the wood is more resistant to decay. When planted singly, white willow and Russian willow are highly ornamental.

Diamond willow is durable in contact with the soil, and is valuable for fence posts. It has been much used in the Dakotas for this purpose. It is a small tree, seldom more than 4 inches in diameter, and is usually propagated by cuttings.

BOXELDER.

Boxelder is chiefly valuable for shade or shelter. Its fuel value is higher than that of cottonwood, but its yield is low. It is very hardy, grows rapidly, and is easily propagated. It is short-lived, however, and should always be planted with longer-lived trees.

RUSSIAN OLIVE.

Russian olive is another excellent tree that has been imported from Europe. It has not been widely planted in these valleys, but its success on the dry plains of the Dakotas recommends it for use here, especially under irrigation. Its silvery white foliage and fragrant yellow flowers give it high ornamental value. It is durable, and in many places is being planted for fence posts.

BUFFALO BERRY.

Buffalo berry, which reaches scarcely more than shrub size, is a native to this territory. It is closely related to the Russian olive, and is used only in ornamental planting and for windbreaks. It is exceedingly drought-resistant, and succeeds well on a wide range of soils.

SILVER MAPLE.

This tree has been extensively planted in the South Platte country, and is hardy for all parts of it. It is the principal shade tree of Denver. In the North Platte Valley it winterkills badly, from Bridgeport west. It succeeds at North Platte and can doubtless be grown successfully for some distance west of that city, but it can not be recommended for the valley as a whole. Aside from its use as an ornamental tree, silver maple makes a good windbreak, and its wood is valuable for fuel.

HARDY CATALPA.

Thus far hardy catalpa has not been successfully grown in the North Platte Valley. In the South Platte region it has been planted with more or less success from Julesburg west. In the depot park at Julesburg are a half dozen specimens 15 years old which average 7 inches in diameter $4\frac{1}{2}$ feet from the ground. At

other points—for example, Fort Collins and Denver—are equally thrifty specimens. In many cases, however, the winters prove too severe and the trees die in a few years. Because of its rapid growth and the durability of its wood, hardy catalpa is an exceedingly valuable tree, but it can not be recommended for general planting even in the South Platte country.

WESTERN YELLOW PINE.

Western yellow pine is especially adapted to sandy soils and is being planted by the Government in the sand hills of Nebraska. It can be recommended for general planting in both valleys. The wood is hard and fairly durable and is useful for many purposes.

JACK PINE.

This tree is native to the north-central and northeastern United States and Canada. It is especially adapted to sandy soils, and is being extensively planted in the sand hills of Nebraska. It is also suited for planting on similar soils in these valleys. It grows more rapidly than most conifers, and is a useful tree for windbreaks and shelterbelts. The wood is slightly inferior to that of western yellow pine. It is used for fuel and coarse lumber and, if treated with chemical preservatives, is fairly satisfactory for posts and ties.

ROCKY MOUNTAIN JUNIPER.

This is the western type of the tree commonly known as "red cedar," from which it differs in size, being generally smaller; but it is even more hardy. It has a wide natural distribution in the foothills of the Rockies and west, and is also found on the bluffs bordering the table-lands in the North Platte Valley. Farther east, in Nebraska, it is found in company with willow and cottonwood in the sandy soils of the Platte River bottom. It will succeed well on the upland soils in these valleys. No better tree can be used for forming permanent windbreaks, for it branches low to the ground, and since it holds its leaves the year round, it is fully as effectual a protection in winter as in summer. It should not be planted adjoining orchards, however, since it is subject to a fungous growth which injures fruit trees. The durability of its wood is well known, and on this account it is planted for fence-post production. It is also used extensively for ornamental purposes.

BLUE SPRUCE.

Blue spruce is native to the Rocky Mountains. Owing to its rich blue-colored foliage, it is a favorite tree for ornamental planting. It is well adapted for use in windbreaks, and it can be grown under irrigation, both on the bottoms and uplands.

Approved:

JAMES WILSON,

Secretary of Agriculture.

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