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Evergreens in South Dakota

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Evergreens in South Dakota



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RECOMMENDED LISTS OF EVERGREENS

The Best Evergreen for Windbreaks

Pinus scopulorum — Black Hills Pine.

The Most Beautiful Evergreens

Picea pungens — Colorado Spruce.

Abies Canadensis — Black Hills Spruce.

Abies concolor — White Fir.

Best Small Evergreens for the Lawn

Juniperus communis — Common Juniper.

Juniperus scopulorum — of South Dakota.
(Black Hills type)

Juniperus Montana mughus — Mugho Pine.

Best Evergreens for Ground Cover

Juniperus horizontalis — Creeping Juniper.

Evergreens in South Dakota

N. E. HANSEN

This bulletin is a continuation of bulletin 246, "The Shade, windbreak and Timber Trees of South Dakota", March, 1930. It is to be followed by a bulletin on the ornamental trees and shrubs of South Dakota.

These bulletins will be a report on tests of trees
and shrubs carried on for many years
at this station and throughout
the state.

Descriptions of Evergreen Trees

The word "evergreen" is somewhat misleading as some members of the evergreen family drop their leaves in winter, while some plants that retain their leaves during the winter are not members of the great evergreen family. The word "conifer" which means cone-bearer, is a better term. The coniferae or cone-bearers are by far the most important family of forest trees. For example, what would our lumbermen in the west have done without the White pine? What would the lumbermen of Europe have done without the Scotch pine? The great majority of conifers are native to the temperate zone, only a few being tropical or sub-tropical. The conifers number about 300 species divided into nearly 40 genera. The North American flora contain not less than 100 species and sub-species, the largest variety being found on the Pacific coast. In addition there are at least 400 nurserymen's varieties selected mainly for their ornamental value.

As we look back over the history of conifer cultivation in America we must admit that we have neglected our native species, which are inferior to none, for imported species. For example, the Norway spruce and the Scotch pine have been planted more extensively than any other conifers. This is mainly because the seed is obtainable at low prices from western Europe where it is picked up in the forest by cheap labor as a waste product.

Our valuable native western evergreens have been like prophets, "not without honor save in their own country." Some of them are more popular in Europe than in America. The common evergreens of western Europe have been found valuable in our eastern states, but the farther northwest their cultivation extends on our prairies, the more uncertain is their behavior. The same may be said of our native eastern evergreens; while perfectly hardy in swamps, moist soils and protected localities even far northward, they fail on the windswept prairies.

Evergreens "B & B"

Evergreen trees sold with earth on the roots are called "B & B" (balled and burlaped) in the catalogs.

The great advantage gained in transplanting evergreens when the earth is retained on the roots has led nurserymen to supply the demand for evergreens handled in this manner. Some do the work at the nur-

sery by planting evergreens in boxes, tubs or baskets while others retain the ball of earth in place by sewing it up in burlap. The latter method is better adapted to such trees as spruce, which have an abundance of fibrous roots than to pines which have a more meager root system. Of course such trees are expensive and hence adapted for lawn specimens only. However, in transplanting large specimens for immediate effect, it is especially desirable to retain the earth on the roots. (10)

In later years the tendency is more and more to plant evergreens "B & B" even for windbreaks, because they are so much more likely to grow. They are cheaper in the long run. If trees 12 to 20 inches in height are selected, the added expense is not prohibitive. They cost more but they are worth more than evergreens planted with bare roots.

On the other hand, some evergreens, such as the native pine and spruce of the Black Hills, or the red cedar on high dry bluffs along the Cheyenne river west of the Missouri river, are found making vigorous growth in dry soil and the most exposed situations. It is time these general principles were well understood by planters, as numerous failures in the past from disregard of these rules have caused much disappointment and the loss of many thousands of dollars. In addition, evergreens have certain peculiarities which planters must learn before they can expect success. Nurserymen and others who have learned these characteristics transplant evergreens with about as much success as they do cottonwoods or willows.

It is scarcely necessary to discuss the desirability of having prairie homes sheltered by evergreens. Suffice it to say that a windbreak of evergreens will add to the value of the farm immensely more than it costs, and the cheering effect of the green foliage every day of the year, with the protection afforded from wintry blasts, will add immensely to the comfort of the homes upon our windswept but fertile prairies. (10)

Pruning

It is natural for evergreens to make their main growth by one central leader with side branches symmetrically arranged. When by some accident the leader is destroyed, a struggle ensues in the next lower whorl as to which is to be the leader. It often happens that two or more branches receive a nearly equal proportion of the flow of sap so that the symmetry of the tree is ruined. The planter should decide for himself which shoot should be selected for the new leader, and by bending it upward carefully and tying to the stub it will soon take the lead, rivals being pinched back if this is found necessary.

A good rule for pruning evergreens in general is to prune early to promote growth and prune late to check growth. By early pruning is meant early in the spring where it is necessary to improve an uneven evergreen hedge. But avoid pruning below live foliage as conifers do not break easily from old wood. In midsummer, shoots that are getting an undue advantage over their neighbors are checked by a light pinching. Often removal of the terminal bud is sufficient. It is a mistake to prune an evergreen hedge in the fall or winter, as the removal of outside limbs exposes the weaker inner branches which have not ac-

customed themselves to open exposure and which consequently are less hardy. Such injury is sometimes seen when an evergreen group which has become too close is thinned out.

One of the chief beauties of evergreens is lost when the trees are deprived of their lower branches. The limbs should be left intact from the ground up so that the symmetry and beauty of the trees are not marred. (10)

Summary

1. With proper care as to methods and varieties, South Dakota planters can grow evergreens with success upon our most exposed prairies.

2. Some of our hardiest and best native American evergreens have been greatly neglected for European varieties less desirable for prairie conditions. Special attention is directed to the native South Dakota evergreens.

3. Hardiness means ability to resist not only cold, but heat, wind-sweep and all other factors of climate. Much depends on the original source of the seed. Attempting to acclimate a mild climate evergreen to northwestern prairies is useless, as acclimating is a work that nature takes thousands of years to complete. It is best to take advantage of nature's work by selecting varieties already adapted to prairie conditions. (10)

Balsam Fir

Abies balsamea

Abies balsamea (L.) Mill

Balsam Fir. (*Abies balsamea*, (L.) Mill.) Native from Virginia to Labrador northwestward to Iowa, Minnesota, Hudson Bay and the Rocky Mountains. In Minnesota it is found chiefly in the northeastern part of the state. This tree is a native of swamps and damp woods, preferring a moist soil. A beautiful ornamental tree of conical habit with dark green leaves one inch long, whitish on the underside, divided by the green midrib. The needles leave a round scar upon removal. The main trunk is marked by the blisters containing balsam used in medicine. The balsam fir from Wisconsin has proved of slow growth even in sheltered situations at this station. The general experience with the eastern Balsam fir on open prairies is not favorable. The leaves are inclined to redden and sunburn. It should be sparingly planted if at all, and in sheltered positions.

A. Norby, 1907, reported on Balsam fir planted 20 years at Madison, S. D.; "of the less desirable kinds to plant in this section may be mentioned the common Balsam fir. True, it is fairly hardy and does quite well while young, but it soon loses its vitality and shows dead top and branches after a trying season."

"The Balsam fir is very striking and very pretty when young. On moist, retentive soil it holds on well in this section, but is poorly adapted for general planting, and should be used sparingly if at all." S. B. Green, "Forestry in Minnesota." (8)

"Evergreen forests from Labrador and Newfoundland to Minnesota south to Virginia and northeastern Iowa. In Minnesota common in the northeastern and northern parts of the state, not occurring beyond the

region of evergreen forests except in a few scattered localities in the southeast corner of the state. Flowers in April or May, cones ripe in the autumn of the same year. Seldom cultivated in Minnesota. Balsam fir in cultivation is very beautiful for a few years, but soon becomes thin and straggling." Rosendahl & Butters, in "Trees and Shrubs in Minnesota." (23)

Canada Balsam, the aromatic oil-like resin used in cough medicines, is obtained from the Balsam Fir by puncturing the blisters formed on the bark of the stem and branches. The smaller branches exhale a delightful odor. They are often dried to use to stuff sofa pillows and are prized for beds by campers in the woods. Canada Balsam is also used as a transparent cement for microscopic slides and optical instruments.

White Fir

Abies concolor

Abies concolor, Lindl. & Gord.

A beautiful tree, 100 to 250 feet high, native from southern Oregon to lower California, Utah, southern Colorado, New Mexico, Arizona, and Sonora in Mexico.

"Of all fir trees, the Colorado form best withstands heat and drought; very hardy, grows rapidly, and the most desirable of the genus in the eastern states. The form from the Pacific coast is less hardy and less desirable in the East as an ornamental tree. Seedlings of the Colorado form, with rather longer and more glaucous leaves, are found in nurseries as *Abies concolor violacea*." Charles S. Sargent, in Bailey's Standard Cyclopedia of Horticulture. (2)

White Fir. (*Abies concolor*, Lindl. & Gord.) This is also called Concolor or Silver fir. Native of the Rocky Mountains from Arizona and New Mexico to Colorado, California and Oregon. It is a worthy companion of the Colorado blue spruce and is becoming more popular as it becomes better known. The leaves are pale silvery green, one to two and one-half inches long. The Silver fir has stood several years at Brookings in open exposure, without injury and is a beautiful ornamental tree for the lawn. However, it cannot be said that its hardiness is fully established. Its scarcity in the nurseries has prevented extensive trial. (10)

There are two specimens of white fir from Colorado in open exposure on the State college campus at Brookings. One is 20 feet high, and 12 feet 3 inches across. The other now 16 feet high, 11 feet across, was set back by one transplanting. Both trees are hardy and are of outstanding beauty.

"In well sheltered positions the Silver fir (*Abies concolor*) stands fairly well and is certainly one of the most beautiful conifers on earth." A. Norby, Madison, South Dakota, 1904.

Pfitzer Juniper

Juniperus chinensis, var. *pfitzeriana*, Spath

Juniperus chinensis, the Chinese juniper, native of the Himalayas, China and Japan, is a variable species and is cultivated in many varieties. The Pfitzer Juniper forms a broad pyramid with horizontally spreading branches and nodding branchlets, grayish green. (4) Not

tested at Brookings. At Sioux Falls, Pfitzer juniper "seems to prosper under any conditions of climate, and soil. Will stand considerable shade. Is found in both blue and green. May be trained quite upright, but naturally grows low, broad, irregular." Geo. B. Tuttle, 1930.

Sargent Juniper

Juniperus chinensis L., var. *Sargentii*, Henry

Juniper var. *Sargentii*, Henry. Sargent J. "A prostrate shrub with long creeping stem and ascending branchlets forming dense mats: adult plants with the leaves mostly scale-like and bluish-green, needle-like and grass green on young plants: fruit bluish, slightly bloomy. Japan, Saghalin, and Kurile Islands. Introduced to America in 1892 by C. S. Sargent. A handsome form valuable as a ground-cover." A. Rehder in "The Cultivated Evergreens," L. H. Bailey. (4)

Not tested at Brookings. At Sioux Falls, "Sargent juniper likes plenty of sun; bright green, but taking a bluish cast in late season. Hardy." Geo. B. Tuttle, 1930.

Common Juniper

Juniperus communis

Juniperus communis, Linnaeus

Common Juniper. (*Juniperus communis*, Linn.) This is also called trailing or dwarf juniper. One of the most widely distributed conifers, being native across the continent from Labrador to Alaska and in the Rocky Mountains to Arizona, and across northern and central Europe and Asia. In Asia it ranges south into the Himalayas and India. The wide range of this species makes it variable in hardiness as found in cultivation. It is a beautiful dwarf ornamental tree which endures severe pruning and in formal gardens of Europe is used in topiary work, such as globes, vases, geometric figures, animals and many fantastic and grotesque forms. Many varieties have appeared under cultivation in Europe, some of which are very dwarf or of compact habit. One of these, the Irish Juniper, is not considered hardy in the northwest. As ordinarily found in the United States it is a densely foliated shrub three or four feet in height and of spreading habit. Occasionally it becomes taller, especially in its southern range. (10)

"The trailing juniper, when given full sunshine is a beautiful low evergreen and worthy of a place on the lawn." H. C. Warner, Forestburg, S. D., 1907.

"The Trailing juniper seems to do as well as the silver cedar." A. Norby, Madison. S. D., 1907.

"This is a native of the Black Hills; of spreading habit. In fact, it does not grow up in tree form, but after it gets up two or three feet high lops over on the ground all around, and its growth only increases its breadth and circumference. The terminal branches are always inclined upward, therefore, if it is trimmed in a round form, it makes the most beautiful saucer-shaped specimen for the lawn imaginable. It also makes one of the most delicate, beautiful little hedges." Geo. H. Whiting, Yankton. S. D., 1907.

"The common juniper is the most widely distributed tree of the northern hemisphere.—The great hardiness and pretty dwarf habit of the common juniper make it desirable in some situations for orna-

mental planting. It readily yields itself to shearing. Many fine specimens may be seen in the parks of St. Paul and Minneapolis, and elsewhere.—There are many varieties that are used in ornamental planting in this country and in Europe, some of which are distinguished by the color of the foliage, and others by the habit of growth, which may be columnar, pyramidal or dwarf and compact. Some of these varieties in English and Dutch gardens are trained into the shapes of globes, bowls, animals and other fantastic forms. The Swedish juniper, one of the most distinct varieties, has erect branches, which form a narrow pyramidal head." S. B. Green, "Forestry in Minnesota." (8)

"The common juniper, *Juniperus communis*, has many varieties, The commonest one in Canada in most of, if not all, the provinces, is var. *depressa*, also sometimes called var. *nana*. It forms broad masses usually on stony or dry soil, and reaches a height of three to four feet. It is seldom planted for ornament, but it does much to improve the appearance of otherwise barren places." W. T. Macoun, Dominion Horticulturist in "The Cultivated Evergreens," by L. H. Bailey. (4)

"Dwarf juniper (*Juniperus communis*). Grows sparingly in the Black Hills in Custer county." W. H. Over. (19)

Golden Prostrate juniper, (*Juniperus communis depressa aurea*). Brilliant golden color, bright in spring, dark in fall. Better with some shelter." Geo. B. Tuttle, Sioux Falls, 1930.

Mountain Juniper

Juniperus communis montana

Juniperus communis Linnaeus, var. *montana*, Ait.

Juniperus communis nana, Loud.

Juniperus nana, Willd.

Juniperus alpina F. F. Gray.

Juniperus sibirica, Burgsd.

"Low spreading or procumbent shrub, seldom over 2 feet high; leaves oblong-linear, abruptly pointed, usually incurved, densely clothing the branches, with a broad silvery white line above, $\frac{1}{4}$ to $\frac{1}{2}$ inch long. Arctic and mountainous regions." Alfred Rehder, in Bailey's *Cyclopedia of Horticulture*. (2)

"*Juniperus nana*, Willd. Juniper. *Juniperus Sibiricus*. Burgsd. On dry knolls in the Black Hills." D. A. Saunders. (26)

Saunders lists this as the Black Hills form of *Juniperus communis*.

Macoun refers the commonest form of *Juniperus communis* in Canada in most of, if not all, the provinces, to var. *depressa*, also called var. *nana*.

Spiny Creek Juniper

Juniperus excelsa, Bieb, var. *stricta*, Rollisson

The species *Juniperus stricta* is a native of Asia Minor and the Caucasus. This variety is a "columnar form with juvenile glaucous foliage." (22). At Sioux Falls, Geo. B. Tuttle reports, 1930, "Dense conical form nicely tapering, glaucous color, slow growing, desirable for foundation planting."

Creeping Juniper***Juniperus horizontalis****Juniperus horizontalis*, Moench.*Juniperus prostrata*, Pers.*Juniperus Sabina* var. *procumbens*, Pursh.*Juniperus repens*, Nutt.

The native North American form of Trailing juniper. (*Juniperus Sabina*, var. *prostrata*, Loud; or *Juniperus Sabina*, var. *procumbens*, Pursh.) Ranges from Nova Scotia south to New York, west to British Columbia and Wyoming. It is sometimes called Waukegan juniper. The native Black Hills form merits special attention from Dakota planters where a dwarf conifer is needed. It is now being taken up by South Dakota nurseries. (10)

"Creeping Juniper (*Juniperus sabina procumbens*, Pursh.) A prostrate or creeping evergreen shrub with two sorts of leaves, one awl-shaped and loose, the other scale-like and depressed; berries about one-third of an inch in diameter, on short recurved stalks. This was found in ravines at Pineau Hills, where it formed a thick mat over the surface of the ground. It was also sent from Westport. It is an excellent thing for use along embankments and other places likely to wash. The long, creeping stems are also valuable as Christmas decorations." Thomas A. Williams. 1895 (28)

"*Juniperus sabina prostrata*, (Pers.) Loud. Creeping Red Cedar. On dry foothills in the Black Hills." D. A. Saunders, 1899.

"The creeping juniper is a prostrate or creeping evergreen shrub similar to the trailing juniper, in habit of growth, but hugs the ground closer. The leaves are awl-shaped, loose and scale-like. Valuable for a variety on the lawn." Geo. H. Whiting, Yankton, South Dakota, 1907.

Prostrate Juniper. The "Black Hills type has proved the best. Gray green and low spreading. Does best in the gravel with full sun." Geo. B. Tuttle, Sioux Falls, 1930.

Waukegan Juniper*Juniperus horizontalis*, Moench, var. *douglasii*, Rehd.

"A distinctly "trailing form with bright steel-blue leaves, turning pale purple in autumn with glaucous bloom." Alfred Rehder. (22)

At Sioux Falls, "soft blue color in summer, deeper blue in winter. Hardy and very striking." Geo. B. Tuttle, 1930.

Japanese Juniper***Juniperus Japonica****Juniperus Chinensis*, Linn. var. *japonica*, Lav.

"Low shrub with decumbent branches and mostly with needle-like leaves." A. Rehder. (22)

At Sioux Falls "Juniper Japonica has been hardy and has an appeal of its light foliage. It stands shade better than most evergreens." Geo. B. Tuttle, 1930.

"*Juniperus Sabina*, var. *procumbens* is an excellent garden plant with wide-spreading stems which hug the ground and are clothed with bright green foliage. This is now usually considered an American variety of *Juniperus Sabina*, which is an erect shrub or small bushy

tree, occasionally 12 or 15 feet tall, and widely scattered through central and southern Europe and Siberia. If it has ever been properly tried in our gardens it has probably not proved hardy. The American plant is distributed from southern Maine to the shores of Hudson Bay, and westward in British America from Newfoundland to the Rocky Mountains of southern Alberta, and through northern New England and New York along the shores of the Great Lakes to northern Minnesota and over the mountain ranges as far as the eastern slopes of the Rocky Mountains in Montana. This is the hardiest and most beautiful of all the prostrate junipers which can be grown in our gardens, where it might well be seen much more frequently than it is." Charles S. Sargent, in "Garden and Forest," 1897.

"Prostrate juniper, *Juniperus horizontalis*, has been confounded with *Juniperus Sabina*. It grows wild in most of the provinces of Canada and usually lies close to the ground and trails over it, where it forms a virtual carpet. The foliage is bluish and when large masses are seen it has a very pleasing effect. It does well as a ground-cover in the prairie provinces." W. T. Macoun, in, *The Cultivated Evergreens*, by L. H. Bailey. (4)

Prostrate Savin Juniper. *Juniperus sabina prostrata*. A spreading or procumbent evergreen that is used considerably as a facing plant for larger evergreens. Also good on terraces as it will thrive in a comparatively dry location. Hardy in the northeastern states." Leonard H. Johnson, in "Foundation Planting."

Tamarix Savin

Juniperus sabina, Linn. var. *tamariscifolia*, Ait.

The species *Juniperus Sabina* is native of the mountains of central and southern Europe, western Asia and the Caucasus.

"Var. *tamariscifolia*, Ait. Tamari Savin. Procumbent or ascending rarely erect: leaves usually all needle-shaped and often in threes, slightly incurved, free at the tip and sharply pointed, dark green, with a white band above, often bluish-green." A. Rehder, in "Cultivated Evergreens," L. H. Bailey. (4)

Not tested at Brookings. At Sioux Falls, "Best of all for the rock garden. Foliage like the tamarix, vigorous, small, compact." Geo. B. Tuttle, 1930.

Colorado Juniper

Juniperus scopulorum

Juniperus scopulorum, Sarg.

In *Garden and Forest*, 1897, page 421, Charles S. Sargent, Director or Arnold Arboretum, proposed the name *Juniperus scopulorum* for this "Western Red Cedar" as it grows in Wyoming, Montana and Colorado. Sargent found the tree very common in the Yellowstone National Park where it grows on gravelly slopes at elevations of six or seven thousand feet with *Pinus flexilis*. The illustration shows a tree near the Mammoth Hot Springs. This Rocky Mountain tree has the slender branchlets and opposite leaves in pairs of the eastern tree, but the fruit is larger, and does not ripen until the second year, while that of our red cedar ripens during its first autumn."

Juniperus scopulorum is distinguished by "a broad head with stout, spreading branches often dividing into several stems near the base, and

by its shredding bark. The branchlets are somewhat shorter and stouter, and the foliage usually glaucous or yellowish green." Alfred Rehder, in Bailey's Standard Cyclopaedia of Horticulture.

Silver Cedar. This name is applied to the silvery leaved red cedar mentioned by Williams (under *Juniperus virginiana*): This variety, as found in the Black Hills, is being brought into cultivation by western nurserymen. (10)

"Red Cedar. A pale or glaucous-leaved variety is common along the Cheyenne river. It is a much prettier tree than the common form and would undoubtedly be valuable for an ornamental tree." Thomas A. Williams. (28)

"The Silver cedar (*Juniperus scopulorum*), is beautiful when the leaves hold their color, but often they lose that silver green and then are no better than the Red cedar." H. C. Warner, Forestburg, S. D. 1917.

"The Silver cedar is a good tree worthy of planting." A. Norby, Madison, South Dakota, 1917.

"Rocky Mountain juniper (*Juniperus scopulorum*). More or less common over the western part of the State." W. H. Over. (19)

Red Cedar

Juniperus virginiana

Juniperus virginiana, Linnaeus

Native from Florida to New Brunswick west to Texas, Nebraska, South Dakota and North Dakota. The seeds of the junipers are in blue, berry-like cones. This waxy layer prevents germination the first year. A valuable ornamental tree, slow of growth at least in the early years, but drought-resistant and hardy in exposed situations on the lawn or for windbreaks in hedges. The great trouble with the red cedar in cultivation in the northwest, was the total disregard of its variable hardiness. Into Iowa, for example, many thousands of red cedars were shipped from Tennessee. They could not be distinguished from the red cedar found native in Iowa and Minnesota except that after a hard winter the northern red cedar would be alive and the southern trees would be dead or severely injured. This fact of varying hardiness was not understood in the early days of our prairie horticulture. It is another illustration of the essential fact that botanical names do not tell the whole story. In recent years the red cedar as found native along the Platte river of Nebraska was extensively collected and grown by various nurserymen in Iowa and Nebraska. This form has done reasonably well in southern South Dakota. For Dakota planters it would be better to gather the seed from such places as along the bluffs of the Cheyenne river west of the Missouri and other places in the state where found native. The "cedar apples" found upon the red cedar is a fungus which lives part of the time upon the red cedar, and part of the time upon the apple and its allies such as junberry and hawthorn, where it forms orange colored spots on the leaves. Two or three years ago an interesting case of this disease was observed in a South Dakota nursery. The red cedar hedges were badly infested with cedar apples and the young apple trees in the nursery row, especially the Wealthy, had the foliage badly affected with the other stages of the fungus.

The long tubes or thorn-like projections from the cedar apples after a shower contain the spores which spread to the apple foliage. This trouble is serious only at long intervals but eastern apple growers have long ago learned to have no cedar hedges near their orchards. The last four or five years a nursery blight has also affected the red cedar so that it has lost in popular favor with prairie planters and further developments are anxiously awaited.

A few years ago the writer was called to inspect an orchard that was dying, near Hudson, South Dakota. The trouble was easy to diagnose. There was an old hedge of red cedar covered with "cedar apples" along one side of the orchard. All the apple tree leaves were covered with orange rust. It was a choice of destroying either the apple trees or the hedge. In West Virginia the red cedar is outlawed near apple orchards.

"The red cedar is a native of the bluffs along our rivers and creeks west to the Black Hills. Propagate from seeds grown in the northwest and it will grow most anywhere. One row makes an almost impenetrable windbreak. Single specimens may be sheared to any form desired. It will also make a fine hedge. Small plants need protection in winter. The silvery form is more prized for ornament. Like other trees the cedar varies in form and color; as to growth it will keep pace with the spruces the first fifteen years and in that time average a foot a year in height." A. Norby, Madison, South Dakota, 1904.

"Our native Red cedar has behaved peculiarly of late. Last winter, 1905-06, it killed out by the thousand in this part of the state, almost any size from seedlings to six-foot trees, no matter what source the seed came from. I had little trees one to two feet raised from seed collected near Pierre that proved no better. Then there is a fungus disease or blight attacking the small trees in the nursery, killing them by the wholesale, in these wet seasons. I must say, however, that I have some rows of thrifty cedars, now 18 to 20 feet high, making an excellent barrier against the wind." A. Norby, Madison, S. D. 1907.

Red Cedar

Juniperus virginiana

(*Juniperus virginiana*, L.)

"Red Cedar. This cedar occurs as a small or medium-sized tree in the Sioux Valley, along the Missouri and its tributaries, and throughout the Black Hills. As in the creeping juniper the leaves are usually opposite and of two sorts. The scale-like leaves are usually obtusely pointed and the berries are on straight stalks and are only about one-fourth of an inch in diameter.

A pale or glaucous-leaved bluish green variety is common along the Cheyenne river. It is a much prettier tree than the common form and would undoubtedly be valuable for an ornamental tree." Thomas A. Williams. (28)

"*Juniperus virginiana*. Red Cedar. Rare in the Black Hills proper, common in the foothills and in the vicinity of streams from the Black Hills eastward to the Missouri river. It is found occasionally on the bluffs on the east side of the river." D. A. Saunders. (26)

"Red Cedar (*Juniperus virginianus*) Locally common over the state in early times but at present it has mostly been cut off. Owing to the enduring qualities of red cedar it has always been sought after for fence posts and rough building material. Our prehistoric Indians knew of its lasting qualities and utilized it for posts in their earth lodges and stockades, and the lower part that was set in the ground is dug up today from their old villages still in a fair state of preservation. Red cedar has always been much used for ornamental shade trees and for wind breaks, but as it is the host for the destructive apple leaf rust it is condemned today by the orchardists." W. H. Over. (19)

"Silver Cedar. This name is applied to the silvery leaved Red cedar mentioned in the preceding paragraph. This variety, as found in the Black Hills, is being brought into cultivation by western nurserymen." (10)

H. C. Warner, Forestburg, South Dakota, 1907, reports: "The Silver cedar, (*Juniperus scopulorum*), is beautiful when the leaves hold their color, but often they lose that silver green and then are no better than the Red Cedar."

Red cedar which attains a height of 100 feet is a very variable species. Of the many varieties that are in cultivation "the dwarf forms are often very similar to *Juniperus Sabina* and hard to distinguish without fruits except by the strong, disagreeable odor of the bruised branchlets of the latter." Alfred Rehder, in Bailey's *Cyclopedia of Horticulture*. (2)

Hill Pyramidal Juniper. (*Juniperus virginiana pyramidalis*). "Close growing pyramidal habit, dark green foliage, new," Geo. B. Tuttle, Sioux Falls, 1930.

Silver Red Cedar

Juniperus virginiana, Linn. var. *glauca*, Carr.

A "vigorous-growing pyramidal form with very glaucous leaves." A. Rehder. (22)

"Foliage very blue or silver. Has graceful branches, but is frequently clipped. Hardy to central South Dakota." Geo. B. Tuttle, Sioux Falls, 1930.

THE SPRUCES

The spruces are distinguished from the pines by having the leaves arranged one in a place and pointing outward all round the twig, like the spokes of a wheel. In the pines the needles are arranged in clusters or sheaths, from two to five in a sheath, depending upon the variety. As a class, the spruces are much slower in growth than the pines and must be considered more from the ornamental standpoint. The chief beauty about the spruce is its perfectly symmetrical habit of growth, forming a cone, thus making it attractive from the time it is a foot high. Some persons object to this primness and sedateness of habit but a well developed spruce tree standing in the open where it has a chance for proper development must be regarded as a jewel among trees to be sheltered from all enemies. Of these dogs are the worst, especially while the tree is young. Dogs, by the way, are very destructive to young evergreens on the lawn and should be kept at a distance while the trees are young, by a low barrier of poultry netting. Dog

urine kills the foliage and causes the death of young trees. (10)

If a spruce tree loses the leading or central shoot, it is highly necessary to tie up another shoot as a leader, as described under "pruning."

White Spruce

Picea canadensis

Picea canadensis, Britton, Sterns & Pogg, not Link.

Picea alba, Link.

Picea glauca, Voss.

Picea laxa, Sarg.

A tree attaining a height of 120 feet; native from "Newfoundland and Labrador to the vicinity of Bearing Sea, reaching the northern limit of tree growth, south ward to northern New England, New York, the upper Great Lakes, the Black Hills, and the Rocky Mountains of Alberta and British Columbia, forming extensive forests north of the belt of pines." Rosendahl & Butters, in "Trees and Shrubs of Minnesota."



Fig 2

Douglas Spruce

Balsam Fir

White Spruce. (*Picea alba*, Link: *Picea Canadensis*, Britt, Sterns & Pogg.) Native from Maine to Minnesota northward to Hudson Bay; also found from the Black Hills, northwestward to British Columbia and Alaska. The leaves are one-half inch long, resembling those of Norway spruce, but covered with a white bloom, especially in thrifty specimens. Cones are from one to one and one-half to two inches in length, falling during the first winter following their growth. One of the most valuable of ornamental evergreens owing to the perfect conical shape. The growth is too slow, as are all other spruces, to consider them from other than the ornamental standpoint. As received from Wisconsin the White Spruce has proved very hardy at this station. The abundant fibrous roots make them easy to transplant. (10)

"The common white spruce (*Picea Canadensis*) suffers from the hot winds which sometimes prevail on the prairies. It is better to plant the form which grows in the Black Hills. This is better acclimatized and seems to be at home on the prairies." L. R. Moyer, Montevideo, Minnesota, 1917.

Black Hills Spruce

This is the White Spruce as found native in South Dakota. Alberta spruce is the common name given in Standardized Plant Names to the White Spruce as found native of the Black Hills and northern Rocky Mountains. South Dakota planters are chiefly interested in the Black Hills form with narrower pyramidal crown, denser habit, and somewhat shorter and thicker cones.

"White Spruce (*Picea canadensis*, (Mill) B. S. P.) A handsome tree of large size growing on the higher hills in the Black Hills region. A valuable tree for forest planting. The occurrence of this tree in this region affords an interesting problem in the geographical distribution of plants. This is the *Picea alba* of Gray's Manual." Thomas A. Williams. (28)

During the Ice Age, the White spruce disappeared in the prairie sections of South Dakota, but survived in the Black Hills which did not suffer from the glacial invasion.

"White Spruce (*Picea canadensis*.) The only spruce of the state common in Spearfish Canyon and local through the Black Hills. Probably not utilized to any extent for commercial purposes." W. H. Over. (19)

"*Picea Canadensis*, (Mill.) B. S. P. White Spruce. In the Black Hills, especially in the northern part." D. A. Saunders. (26)

The Silvery Black Hills spruce. As found in the Black Hills some specimens of the Black Hills spruce are decidedly blue or silvery in color. These, of course, are more valued as lawn specimens than the ordinary green ones and as our horticulture becomes older these blue specimens will be highly prized and more generally propagated. (10)

The Alberta Spruce (*Picea glauca* Voss, var. *albertiana*, Sarg.) is found from British Columbia to Wyoming and Montana.

Engelmann Spruce

Picea engelmanni

Picea engelmanni, Engelm.

Picea columbiana, Lammon.

Abies commutata, Murr.

A very ornamental tree attaining a height of 150 feet; native from Alberta and British Columbia to Arizona and New Mexico. This is much more common than *Picea pungens* and is sometimes sold for it.

Engelmann Spruce. (*Picea Engelmanni*, Engelm.) Native of the Rocky Mountains from Arizona to British Columbia but found mainly in high elevations. This resembles the Colorado Blue spruce except that the needles are much softer. As received from the mountains the two species are sometimes mixed. They are readily distinguished by seizing hold of a young branch; the needle-like pointed leaves of the Blue Spruce will quickly make themselves felt. The Englemann spruce has not been given extensive trial as it has been overshadowed by its more popular neighbor, the Blue spruce. A few specimens received among Blue spruce from Colorado have, however, not proved themselves superior in any way so that the Colorado Blue Spruce will no doubt retain its lead. (10)



Fig. 3

Red Cedar

Arbor Vitae

"I have had the Engelmann spruce about fifteen years. It is the slowest grower of all the spruces. Compact and fairly hardy. I consider it of little value." A. Norby, Madison, South Dakota, 1907.

Norway Spruce

Picea excelsa

Picea excelsa, Link.

Norway Spruce. (*Picea excelsa*, Link.). Native of northern Europe and ranging eastward into Siberia, merging gradually into *Picea obovata*, Ledeb. (*Picea excelsa*, var. *obovata*, Koch.) This is distinguished by the absence of bloom, the leaves being plain green and by the large cones which are from five to seven inches long. It is the most common spruce in the nurseries, the seed being easily obtainable from western Europe. It is a hardy, beautiful and popular tree in the eastern states but does not enjoy the dry air of the western plains. There are some fair specimens on the lawns of Brookings and it has done well in the shelter of the forest plats at this Station, but it does not enjoy open exposure. The general experience is that there are other evergreens better adapted to prairie air. One of the most rapid in growth of the spruces in regions adapted to its best development. Upon my first trip to Russia in 1894 I learned that the Russian foresters had found that the Norway spruce of Germany, France and west Europe in general, was much inferior for planting on Russian steppes to Norway Spruce as found native in European Russia and in Siberia, although botanically the same. This illustrates the point that botanical names are sometimes inadequate for the horticulturist. This observation was confirmed while visiting Russia in 1897 and again in 1906 as



Fig. 4

Black Hills Spruce

White Spruce

Agricultural Explorer for the United States Department of Agriculture. A small amount of Russian seed of Norway spruce was obtained in 1897 but circumstances did not permit the carrying out the details of the experiment. Until our present system of seed-gathering is changed and for various other reasons, it will be difficult to test this matter in a commercial way. If we do our duty in the way of gathering the seed of Colorado Blue spruce there will be no special need for this as our native Rocky Mountain tree is unexcelled for its beauty. (10)

Norway spruce attains 150 feet, and has varied under cultivation into a great number of garden forms. These have not been tested but their hardiness is probably about the same as that of the ordinary type of Norway spruce.

Black Spruce

Picea mariana

Picea mariana, B. S. P.

Picea nigra, Link.

Black Spruce. (*Picea nigra*, Link; *Picea Mariana*, (Mill) B. S. P.) Native of the northeastern United States, westward into Minnesota and far north into Canada. The leaves are about one-half inch in length, bark of young shoots reddish. The cones hang on a number of years and soon become black and unsightly. The tree also loses its lower branches early and becomes thin and open and has proved itself short lived in prairie planting. Nurserymen generally do not aim to propagate this tree but it is often found as a mixture in White spruce, as they are difficult to detect when the young seedlings are dug from

the forest. Hence some prefer to raise White spruce from seed. (10)

A. Norby, Madison, South Dakota, 1907.—“The Black Spruce I got for White spruce some eighteen years ago. When about eighteen feet high they were leaning over to the north and looked ragged. All are now gone.”

“The Black Spruce is a poor oramental tree, as it soon loses its lower branches, which with its dead persistent cones and dark-colored bark makes it appear unsightly. It is also a short lived tree on dry land in this section. Most of the Christmas trees in our market of recent years have been of this kind, although the Balsam Fir is also used.” S. B. Green, in Forestry in Minnesota.” (8)

Colorado Spruce

Picea pungens

Picea pungens, Engelm.

Picea Parryana, Sarg.

A very handsome tree 80 to 150 feet high, with horizontal stout branches in whorls, forming a regular pyramid from the ground up. Native from Wyoming to Colorado, Utah and New Mexico.

Colorado Blue Spruce. Silver Spruce. (*Picea pungens*, Engelm. *Picea Parryana*, barron.) This is generally acknowledged in Europe as well as America to be the most beautiful of all spruces and indeed one of the most ornamental of the whole conifer family. It is found native in the mountains of Wyoming, Colorado and Utah. It attains large size in exposed situations in its native home. The seedlings vary greatly in color, from dark green to light silvery blue. The blue specimens are much higher in price and have become very popular in Europe, where selected blue varieties are propagated by grafting on Norway spruce seedlings. These selected blue specimens have in Europe been named *Picea pungens glauca* and *Picea pungens argentea*. Grafting is resorted to because the blue trees do not come true to seed. So far in America, at least in the western states, we content ourselves by digging up the young seedlings upon the mountains of Colorado and by raising seedlings from seed gathered from the best blue trees, a fair percentage of which will give blue seedlings. The green-leaved specimens are also worth planting, but have not the peerless beauty of the silvery specimens which appear as though dipped in a bath of molten silver, especially when the young growth has just formed for the season. At that time, in fact, many have considered it the most beautiful of all evergreens. In the gathering of Colorado Blue spruce and other Rocky Mountain evergreens it is highly desirable that they be gathered as far east as possible, as they will be better adapted to prairie conditions than those developed on the Pacific slope side of the mountains, where much more favorable climatic conditions obtain. (10)

“Too much cannot be said in favor of the Blue spruce. It is hardy, handsome, and an ornament to the finest lawn in the state.” H. C. Warner, Forestburg, South Dakota, 1907.

“Blue Spruce or *Picea pungens* is the most beautiful of all and is easily transplanted and as hardy as any.” C. W. Gurney, Yankton, South Dakota, 1907.

"For hardiness, general adaptation and oramental qualities, the Colorado Blue spruce stands at the head of the list of all conifers tried here. Never have I lost one from climatic cause. Only a small per cent take on the silvery color so much sought for, but all are certainly beautiful in contour and color." A. Norby, Madison, South Dakota; concerning trees grown from seed gathered in Colorado and planted in the spring of 1887. (S. D. State Horticultural Society, 1907 report.)

In Standardized Plant Names, the following varieties of *Picea pungens* are listed:

Blue Colorado Spruce (*Picea pungens glauca*, Cy.)

Dwarf Colorado Spruce (*Picea pungens compacta*, Cy.)

Golden Colorado Spruce (*Picea pungens aurea*, Cy.)

Koster Blue Spruce (*Picea pungens kosteri*, Cy; *kosteriana*)

Silver Colorado Spruce (*Picea pungens argentea*, Cy)

Weeping Blue Spruce (*Picea pungens glauca pendula* Cy.)

The green-leaved form of *Picea pungens* is referred by Rehder in Bailey's Cyclopedia, to *Picea pungens*, var. *viridis*, Regel with *Picea pungens* var. *commutata*, Hort., as a synonym.

A. Norby of Madison, South Dakota, in a paper before the South Dakota State Horticultural Society at Madison, January 1904, said: "To choose an evergreen for ornament the Colorado blue spruce would be my first selection—that is the specimen that wears the royal robes of silver; both the green and the blue forms are extremely hardy and remarkably well adapted to prairie planting. It is a better grower than the Black Hills spruce and seems to stand cold, heat or drouth equally well."

"*Picea pungens*, Engelm. A local and somewhat rare tree occurring in central Rocky Mountain region—Wyoming, Colorado, and Utah, between 6,000 and 9,000 feet. It prefers a damp soil, and grows rapidly in such situations, attaining a height of over 100 feet, with a diameter of three feet or more. The wood is light, soft, weak, and probably of little value. The trunks taper too rapidly to be cut into lumber to advantage.

Description.—Leaves $\frac{1}{2}$ to 9-10 of an inch long, rigid, 4 angled, needle-pointed. Cones light reddish-brown, $3\frac{1}{2}$ to 4 (often 5) inches long, by $1\frac{1}{2}$ inches in diameter; scales very thin, rhomboidal, truncated, with wavy, irregular, or entire margin. Bark grayish on large trees, very thick and furrowed; that of the branches rather smooth and glossy. A beautiful tree, of fine ornamental appearance, with more or less silvery-white foliage and sharply-tapering crown." George B. Sudworth, "Forest Flora of the Rocky Mountain Region" in Forest conditions of the Rocky Mountains. Forestry Division. Bulletin No. 2, United States Department of Agriculture, 1888.

Jack Pine

The pines are the most important group of conifers including over 70 species and 600 varieties. About 40 species are native to North America.

The pines have the needles arranged in sheaths from two to five in a sheath. As a class they should be transplanted in the early years

of growth, as older specimens suffer from the earth dropping off the roots in transplanting. This is because of the few side or fibrous roots and the long tap root. (10)

Jack Pine

Pinus banksiana

Pinus Banksiana, Lamb.

Pinus divaricata, Dum.-Cours.

Jack Pine. This is also called the Gray Pine and Northern Scrub pine. Leaves, two in a sheath about $1\frac{1}{2}$ inches long. This pine is easily distinguished by its habit of forming several whorls of branches each year on the new growth instead of one whorl as with other pines; also its light, somewhat yellowish, cast of foliage. It is found native from Northern New England, west to Minnesota, north to Hudson Bay and northwest to the Rocky Mountains. It attains a height of 40 to 60 feet and a diameter of 2 to 4 feet.

This pine has been found well adapted to open exposure. A plantation made at this Station in 1898 is shown in plates 5 and 6. This plantation had the full benefit of unobstructed windsweep on all sides except from the south. This is some distance removed so it is safe to say that this tree is well adapted to prairie planting and that at some distance. These trees were received from Carlton in north-western Minnesota. In this region it is found as one goes westward long after the White pine ceases, showing that it is more of a western prairie tree. While of rapid growth and hence desirable for wind-breaks, it can scarcely be recommended for its beauty, owing to its somewhat open habit of growth and stiffness of the branches and the peculiar cast of foliage. The Black Hills pine and the Jack Pine are the two hardiest evergreens for the Dakotas as both endure open exposure and dry seasons. (10)

C. W. Gurney, Yankton, South Dakota, writes: "Jack or Gray pine is also a very valuable fast growing tree, but, like the cedars, turns to yellowish green or brown in winter."

"A. Norby, Madison, South Dakota, writes: The Jack Pine is hardy and of rapid growth, but is not at home on my soil. It grows straggling and has a sickly yellowish color. On very sandy soils it is said to be a good tree."

The later experience at this Station and on lawns in Brookings is not favorable to Jack Pine. Old trees become very thin and open-topped and are worthless from the ornamental standpoint. It is well named the Scrub Pine.

"The Jack pine is not a pretty tree, and is seldom used in ornamental planting. It is, however, the hardiest native evergreen tree we have and is especially adapted to dry, loose soil, where it has a wondrous power of withstanding drouth. It is of rapid growth when young, which, together with its great hardiness, has led to its being planted on some of the sandiest dry lands of the West. In the timbered portion of Minnesota it often acts as a nurse tree, for the Red Pine, but too often is liable to crowd it out. The larger trees are generally sawed into lumber and pass as Red Pine, but they seldom

attain a size large enough to be profitably used for this purpose, but much of it is used for fencing, farm buildings, railroad ties and as fuel." S. B. Green, in "Forestry in Minnesota." (8)

Limber Pine

Pinus flexilis

Pinus flexilis, James

The Limber pine attains a height of 80 feet; is native from Alberta to California, west to Montana and western Texas. A tree of slow growth.

"A low pine, the spreading branches densely clothed with dark green leaves. It seems best adapted for planting on rocky slopes." L. H. Bailey. (4)

Not tested at this station.

"Limber Pine (*Pinus flexilis*). Very rare, only a few trees near the summit of Harney Peak, Black Hills." W. H. Over. (19)

"Limber Pine. (*Pinus flexilis*, James.) Asia called Western White pine, is a tree attaining a height of 50 feet; leaves five in a sheath like those of the Common White pine. It is a native of the Rocky Mountains from Alberta, Canada, to Arizona. It is rare in cultivation and of slow growth. A. Norby, of Madison, South Dakota has tested it the past eight years and reports it hardy but not as pretty as the common White pine." (10)

MUGHO PINE

Pinus montana mughus

Pinus mugo, Turra var. *mughus*, Zenari

The Mugho Pine is hardy at this Station and is desirable as a bush form of the Pine.

"*Pinus montana* Mill. Swiss Mountain pine, Mugho pine. Cultivated, native of the mountains of central and western Europe. A hardy, ornamental evergreen shrub used for covering rocky slopes or combining with other and larger conifers. Several unimportant varieties are distinguished by the shape of the cones." Rosendahl & Butters, "Trees and Shrubs of Minnesota." (23)

"Dwarf Mountain pine. (*Pinus montana*, var. *pumilio*, Willk.) This is an attractive shrub or dwarf tree of dense habit, usually not over three or four feet in height and sometimes attaining a height of ten or twelve feet. A dwarf variety of the Swiss Mountain Pine, native of the mountains of Central Europe. Leaves two in a sheath. The plants vary considerably in size and habit. This species has been divided into three-sub-species, based on the cones; var. *uncinata*; var. *pumilia*; var. *mughus*. It is extremely hardy and should receive attention for ornamental planting, either for single specimens in front of larger evergreens or for low hedges. In Europe it is found desirable for planting on sand-dunes, serving as a soil-binder. Professor J. L. Budd, many years ago planted about 200 Dwarf Mountain pines upon the grounds of the horticultural department of the Iowa Agricultural college. The present writer has a lively recollection of the great variation in size and habit in this plantation, some being very dwarf, low and spread-

ing while others were of the erect, compact habit, though all were dwarf. (10)

"Mugho Pine. *Pinus mughus*." Forms a low, moundlike plant, well suited for foundation plantings when used in front of taller plants. This is one of the evergreens that is reliably hardy and always looks good in a planting; it will fit in well either in formal or informal plant-



Fig. 5

Colorado Blue, or Silver Spruce

White or Concolor Fir

ings. Good to use in city plantings as it reflects the effects of coal smoke." Leonard H. Johnson, in "Foundation Planting." A. T. De La Mare Co., Inc. New York, 1927.

Lodgepole Pine

Pinus murrayana

Pinus murrayana, Balf.

Pinus contorta, Douglas, var. *latifolia*, Engelm.

Pinus Boursieri, Carr.

From 80 to over 160 feet tall.

"The commonest coniferous tree of the northern Rocky Mountains, often forming forests of great extent. It plays an important part in the natural regeneration of the forests of that region." L. H. Bailey. (4)

Not tested at this Station.

"Lodgepole pine (*Pinus murrayana*.) Found locally scattering in the Black Hills." W. H. Over. (19)

Austrian Pine

Pinus nigra

Pinus nigra, Arnold

Pinus nigra, var. *austriaca*, Schneid.

Pinus Laricio var. *austriaca*, Endl.

Pinus austriaca, Hoess.

Pinus nigricana, Hort.

Austrian Pine. (*Pinus Laricio*, var. *Austriaca*, Endl.) A native of Austria and of southern and central Europe. Leaves, two in a sheath, rigid, four to six inches long. The dark green color of the foliage and regular outline are characteristic. Professor S. B. Green



Fig. 6

Jack Pine

Black Hills Pine

reports the Austrian pine as very desirable for planting in Minnesota, being "rather longer lived and perhaps hardier than the Scotch pine." Upon the South Dakota Station grounds at Brookings the Austrian pine in open exposure browns its leaves in winter much more than the Scotch pine although it recovers during the summer. Eventually both will probably be replaced by our native pines better adapted to our climate. (10)

Red Pine

Pinus resinosa

Pinus resinosa, Ait.

Red Pine. (*Pinus resinosa*, Ait.) Leaves about six inches long, two in a sheath. Also called the Norway pine, but this is a lumberman's term; it is purely an American species and is not a native of

Europe. Native from Newfoundland and New England westward to Manitoba and Minnesota. A handsome ornamental tree of vigorous growth, attaining a height of 70 feet and a diameter of two feet. In open exposure at this Station the Red pine has not proved long-lived which is the general experience with it. However, it endures prairie conditions better than the White pine. It is not a common pine in the nurseries which may account for the limited experience with it. (10)

A. Norby, Madison, South Dakota, reported his 18 years test as follows: "The Red pine is also a native of our northern forests, and by some thought valuable for prairie planting, but here it is not equal to our test winters, when young at least, and should be planted with caution." (S. D. State Horticultural Society report 1907.)



Fig. 7

Austrian Pine

Scotch Pine

"As an ornamental tree and for windbreaks the Red pine will stand much more hard usage than the White pine, especially on light soil. It has a robust, vigorous appearance, and would undoubtedly be more commonly planted if young plants of it could be more cheaply obtained. Within and near its range it makes a very fine ornamental tree, and is very valuable for windbreaks." S. B. Green, "Forestry in Minnesota." (8)

Black Hills Pine
Rocky Mountain Yellow Pine
Pinus scopulorum

Pinus scopulorum, Lemm.

Pinus ponderosa Douglas, var. *scopulorum*, Engelm.

Rocky Mountain Yellow pine is the common name given preference

in Standardized Plant Names, but Black Hills Pine is given preference in this bulletin because the type of *Pinus scopulorum* described in this bulletin is the one found in the Black Hills of South Dakota.

This western pine has many names, such as Rock pine, Bull pine, Heavy-wooded pine, Western-yellow pine. For Dakota the name, Black Hills pine, will be preferred as it is the one species found native in this state. The word "ponderosa" means heavy, referring to the heavy wood and "scopulorum", in the rocks or cliffs. *Pinus ponderosa* is the largest and best of the far western pines, attaining a height of 300 feet and a diameter of 15 feet. Found native from British Columbia and Montana, south to California and northern Mexico. It extends into the Black Hills of South Dakota, and as found there and in the adjacent mountain region of Montana is the variety called "scopulorum." This is the best of all pines for our exposed prairies. It is a handsome ornamental tree; dark green leaves three to six inches long, generally three in a sheath. Planters have experienced some difficulty with it in transplanting but its peculiarities are now better known. It must be transplanted every year while in the nursery owing to its remarkable root system. A long tap-root is formed from the beginning, with comparatively few side-roots. Hence in digging a tree that has stood several years without transplanting, the most of the roots are lost as they have gone deep down to water. This explains its remarkable power to resist drought. If transplanted at one year of age in the nursery, instead of waiting until two, it forms more fibrous roots than when left undisturbed. Nurserymen find that no shading is necessary in raising this conifer from seed. (10)

"Yellow Pine (*Pinus ponderosa scopulorum*, Engelm.) This is the only pine found in the state. It reaches a fair size and is a valuable timber tree. The leaves grow in clusters of two or three and are from three to five inches in length. The cones require two seasons to reach maturity, ripening in autumn. This pine is very hardy. In many places in the west, fine trees may be found growing in the poorest soil under the most adverse conditions of drought and exposure. It is a promising tree for forest plantations. It occurs throughout the Black Hills." Thomas A. Williams. (28)

"The common pine of the Black Hills and the Sioux Forest Reserve of Harding county. The western yellow or bull pine constitutes 95 per cent of the timber of our forest reserves, the remainder being made up of eastern white spruce, aspen, birch, bur oak and green ash. It takes from 150 to 250 years for the pines to reach merchantable size. Many of them are from 400 to 600 years old. It is estimated by Mr. George Duthie, Chief Forester for the Black Hills, that the standing yellow pine on our reserves amounts to approximately 2,225,000,000 feet and that of spruce 50,000,000 feet. The old and mature trees are being disposed of to millmen and are sawed into lumber and distributed over much of the state. Therefore while this forest is a national reserve, yet it is truly an asset to South Dakota." W. H. Over. (19)

"*Pinus ponderosa scopulorum*. Rock Pine. Bull Pine. Heavy-wooded Pine. Western Yellow Pine. Leaves three to six inches long, rigid, generally in threes, but occasionally in twos, falling during third

and fourth seasons. Cones two to three inches long, grayish with stout prickles. Tree 80 to 100 feet high. The species, *Pinus ponderosa*, of which this is an important variety, is the most magnificent and widely spread of western pines, attaining a height of 200 to 300 feet and a thickness of 12 to 15 feet, and having much larger cones and longer needles than this variety. The Rock Pine is found throughout the Rocky Mountain region. It inhabits even the dry sand hills of Western Nebraska and Montana, and is perhaps the hardiest Western pine." S. B. Green, "Forestry in Minnesota." (8)

"*Pinus ponderosa*, Douglas, var. *scopulorum*, Engelm. (*Pinus scopulorum*, Lemm.) Rocky Mountain Yellow pine is a geographical variety, smaller in every part; usually to 75 feet tall, with nearly black furrowed bark: Leaves 3 to 6 inches long, sometimes in twos: cones smaller, ovoid. South Dakota to Mexico and Texas.—Somewhat hardier than the type." L. H. Bailey, "Cultivated Evergreens." (4)

THE BLACK HILLS PINE FOR SHELTER BELTS

A. Norby, of Madison, South Dakota in a paper before the South Dakota State Horticultural Society, Madison, South Dakota, January 1904, said:

"The value of good shelterbelts can hardly be overestimated in the way of comfort and saving. Plant and animal life which will thrive and flourish surrounded by rows of conifers would perish in the open.

We are fortunate in having evergreens native of our state—grand trees through centuries adjusted to conditions far more trying to sylvan culture than this section, and admirably adapted for windbreaks.

Look at the Ponderosa pine in its native habitat in the semi-arid region east of the Black Hills, in this and Nebraska, where it extends down to the 100th meridian.

Fine single specimens are found in the tough prairie sod and groves cap the dry rocky hills where a deciduous tree could not survive. In the Black Hills it is the only pine and the main timber tree.

Thirteen years ago I obtained a handful of *Pinus Ponderosa* seed from Custer county, Montana, which I planted. Today the trees raised from that seed stand fifteen to seventeen feet high, straight and thrifty. This rate of growth I think is very satisfactory, taking in consideration the fact that it takes a spruce or pine four or five years to reach the first foot in height. These trees stand on high ground and have had ordinary cultivation until lately.

To test the drouth resisting power of the Ponderosa small trees were stuck out in the prairie about eight years ago and left to fight their own way as best they could. Of nineteen trees put out eighteen are alive today and are apparently looking well and satisfied with the site and situation.

The Ponderosa transplant very satisfactorily as raised on our fine mellow soil frequently transplanted or root pruned, but wild plants generally fail. It is of value for ornament, the very long leaves keeping the silvery green colors all the year around."

George H. Whiting, Yankton, South Dakota, who made several trips to the Black Hills, told the State Horticultural Society of finding

the Black Hills pine in quantity on very high dry points and that wherever the forest fires were kept out the elevated plateaus soon become densely covered with a young growth. It is a remarkable drought-resistant tree. Near Piedmont he found the Black Hills form of the white spruce. In comparing the Black Hills spruce with the same species as found native in Wisconsin, Michigan, and farther east, Mr. Whiting notes: "This Black Hills type is more of a stocky, sturdy, grower and somewhat slower in its growth. Its foliage is of a darker shade and more inclined to bluish tints in fact, some of the specimens are decidedly blue, almost, if not quite as much so as a good blue specimen of the Colorado blue spruce. They certainly are better qualified to endure our bright, hot sun and our dry western winds. This is perhaps due to the fact that they have been grown there generation after generation and nature has gradually fitted them for their surroundings."—"It is safe to say that this Black Hills type is safer for us to plant on our dry South Dakota prairies than the white spruce from farther east. We find specimens of the spruce in the hills I should say that are 80 to 100 feet high and perhaps two feet in diameter, and almost invariably straight as a candle. Let two of them come up side by side, three feet apart, with no other tree near them, and when they get to be 100 feet high they will still be three feet apart at the tops. They do not grow away from each other as most other trees do." (Condensed from "My Trip to the Forests in the Black Hills" by Geo. H. Whiting, in Second Annual Report of South Dakota State Horticultural Society, 1905.)

White Pine

Pinus strobus

Pinus strobus, Linnaeus

White Pine. (*Pinus strobus*, Linn.) Leaves, five in a sheath, about four inches long. White pine is found native in Canada from Newfoundland to Manitoba, and in the New England states westward to Minnesota where it is common through the northern half of the state. It is not found in the western and southwestern parts of Minnesota. Its southeast extension is along the Alleghanies to Georgia. A beautiful and stately evergreen of rapid growth in regions where it is at home, attaining a height of 150 feet and a diameter of four feet. Extended trials by many planters have demonstrated that the White pine is not at home on exposed prairies. If planted at all it should be where well sheltered by hardier trees. (10)

A. Norby, Madison, South Dakota, reported in February, 1907 on White pines planted 18 years: "The noble timber tree of the northern forest, the White Pine, is not considered safe in exposed places in this state, being a native of a more humid section. Still, I have some nice specimens 15 to 18 feet, thrifty and vigorous, standing in a sheltered place. It is the prettiest of pines."

The White pine is one of the fastest growing and perhaps the most graceful of evergreens for ornamental planting. It grows rapidly when in retentive soil of a loose open texture, but is liable to kill out in wet, compact or very sandy soils. It should not be planted in very exposed situations, but should follow the planting of the more hardy

deciduous trees in such places; it is liable to be killed by drying winds in the early spring on our western prairies. It is not as hardy as the Scotch pine, nor will it make as fast a growth when young, but is longer lived than the Scotch pine, and in 15 years will make a much larger and more ornamental tree. Within and near its range it is very valuable for ornamental purposes.



Fig. 8
A Windbreak of Black Hills Pine, Madison

The White pine yields the most useful timber of the American forests, being especially valuable for sashes, doors, blinds, shingles, etc., and for a general-purpose timber in building and wood-working. It is largely used in cooperage, railroad ties, pulp, matches, and excelsior making. From the bark is obtained the compound syrup of White Pine now largely used in the United States as an expectorant." S. B. Green. "Forestry in Minnesota." (8)

Scotch Pine

Pinus sylvestris

Pinus sylvestris. Linnaeus

Scotch or Scots Pine is native of nearly all Europe and extending across Siberia to the Amur River region. Attains a height of 120 feet.

Scotch Pine. (*Pinus sylvestris*, Linn.) This is the common timber throughout northern Europe and extends far into Siberia. Leaves, two in a sheath, one and one-half to two inches long, bluish-green, somewhat twisted. The seed is very plentiful and cheap, being picked up as a waste product mainly in western Europe but occasionally seed is gathered further east on the Eurasian continent which furnishes hardier trees. As ordinarily obtained the seed is from the mild, moist climate of western Europe and from dwarf, scrubby trees on poor land. The Scotch pine has been planted more extensively than any other evergreen in the prairie northwest, and is popular for its rapid growth when young. However, it becomes open in habit when old. It often begins to fail when about 20 years old and when on dry soil is apt to die out soon after when it should be attaining stateliness and beauty. Upon moist soils and sheltered localities it lasts longer. Upon the grounds of this station, the Scotch pine has been planted to a considerable extent. Those in shelter of deciduous trees planted in 1888 show no signs of failing, while those in exposed situations on the lawn, with no protection from the windsweep, are showing marks of the severe test. In later years many of them have died, 25 to 30 years being the average limit of thrifty growth.

In government forestry planting in Russia, great difference has been found in the Scotch pine from various localities. Trees grown from seed obtained in France and Germany are greatly inferior in hardiness and vigor and rapidity of growth to trees grown from North Russia and Siberian seed. The same difference has been observed in the Norway spruce. Hence great care is now taken to have the seed gathered from the erect-growing giants of the forest instead of from low scrubby specimens. Our present commercial system of securing tree-seeds is not calculated to furnish the most desirable variety. (10)

Cultivated, native of Europe and of western Asia, occasionally planted for ornament. It is entirely hardy but seldom in this region forms anything but a small straggling tree with very little beauty." Rosendahl & Butters in "Trees and Shrubs of Minnesota." (23)

The hardest of European types of this pine is from northern Europe. Riga Pine (*Pinus sylvestris* var. *rigensis*, Loud.) "a form with very red bark and straight tall stem." L. H. Bailey, "Cultivated Evergreens." (4)

"For gardens there is scarcely any tree more picturesque than an old Scotch pine, or with a greater beauty of trunk, especially when lit up by the low rays of the winter sun. There are several forms that have been selected for their timber by continental foresters. An interesting series of these forms was planted, each in a large block, at Les Berres in France, by one of the de Vilmorins in the third and fourth decades of last century, which now clearly show certain differences in

winter. In spite of this repeated killing-back they gain year by year, but as a whole they can not be considered an unqualified success. At colour of trunk, character of bark, branching, etc. The best of them is considered to be var. *Rigensis*, or "Riga pine." W. J. Bean, in "Trees and Shrubs hardy in the British Isles." (5)

As commonly grown in the nurseries, Scotch pine is from parts of Europe with a climate much milder than that of the prairie Northwest. The trees at this station have suffered greatly in recent dry years. In fact, after 25 or 30 years they are no longer desirable trees.

Seed from Siberia should be tested as to its hardiness.

Col. C. W. Gurney, of Yankton, South Dakota, in a paper before the South Dakota State Horticultural Society, Huron, January 1905, said: "As to varieties: For a quick grove, a tree that transplants easily, use the Scotch pine. The only objection that I hear is that it is not as long lived as some of the others. This is true. Adjoining my place on the north is a grove of Scotch pine planted in 1872. Perhaps 75 trees. The largest girth is 69 inches and the average would not be less than 50. In the winter of 1898-9 all these trees were more or less injured, but none died, and all but three seem to have fully recovered. I would rather have the grove of *Ponderosa*, but it would take longer and take more trees to make it, as it is a more upright grower, and the safety in transplanting is in favor of the Scotch pine. Blue spruce or *Pungens* is the most beautiful of all and is easily transplanted and as hardy as any. Black Hills spruce is a slow grower, but when established has no superior for hardiness and utility. Red cedar is also a slow grower, but we all know how hardy and valuable it is. Jack or gray pine is also a very valuable fast growing tree, but, like the cedars, turns to a yellowish green or brown in winter. Balsam fir and Norway spruce will be of but little value in most parts of the state, but answer a good purpose in the southern counties. *Arborvitae* is a very beautiful tree and does well right around Yankton; probably would not stand in more northern latitudes."

Douglas-Fir

Pseudotsuga douglasi

Pseudotsuga douglasii, Carr.

Pseudotsuga taxifolia, Brit.

Douglas Spruce. (*Pseudotsuga douglasii*, Carr; *Pseudotsuga taxifolia*, Poir. Br.) This is also called Douglas fir. *Pseudotsuga* means false hemlock. This is a tree intermediate between the Fir and the hemlock. Leaves are about one inch long, with a distinct petiole or stalk. The distinguishing characteristic of the tree is the pointed red buds. Native from Mexico and Texas through the Rocky Mountains to California and British Columbia. In Oregon it attains a height of 300 feet. This is one of our most important American forest trees. It is a beautiful and graceful ornamental tree and is attracting the attention of European foresters owing to its rapid growth.—Ten years ago a considerable number of Douglas spruce from Colorado were planted at the South Dakota Experiment Station. They proved to be of rapid growth but of uncertain hardiness, the branches frequently killing back in winter or having the leaves much reddened at the close of the

their side the White spruce proved entirely hardy. It is probable that much depends upon the source of the seed. Several specimens received from Kalispell, Montana, have done quite well but they were not in open exposure. There is opportunity here for careful experimenting with the hardiness of the Douglas spruce as received from various regions. (10)

"Native to the forests of the Rocky Mountains and the Pacific Coast region from British Columbia south to Texas, Mexico, and central California. Only the trees from the Rocky Mountain region are hardy in Minnesota, where the Douglas fir is often planted as an ornamental tree. It is very hardy but has a tendency to grow thin in foliage. It has proved a successful plant for evergreen hedges, stands clipping well, and will endure dry weather better than most conifers. In its natural habitat, particularly in the vicinity of the Pacific coast, this is one of the finest of North American trees, reaching a height of over 200 feet, and a trunk diameter of 15 feet. It is the most valuable timber tree of British Columbia, Washington, and Oregon." (10)

"Seeds of conifers gathered on the Pacific slope are tender, while those gathered in Colorado produce hardy trees which endure both drought and cold. Unlike the firs, the Douglas spruce has fine fibrous roots like the Norway spruce and transplants as readily." C. S. Harrison, York, Nebraska, in Bailey's Standard Cyclopedia of Horticulture. (2)

Clarence Wedge, Albert Lea, Minnesota, in 1914 and 1916 located the most eastern form of Douglas Fir in the Snowy Mountains of central Montana, and grew hardy seedlings from this seed. These Snowy Mountains rise to the height of 8000 feet. Such seed should be very hardy. Minnesota State Horticultural Society reports: 1914: page 451; 1916: page 361.

"No evergreen in my collection takes on a more graceful form than the Douglas spruce, but here it is not as rapid a grower the first ten years from the seed as is generally claimed, neither will it stand as much exposure as the Blue and Black Hills spruces." A. Norby, Madison, South Dakota, 1904.

Japanese Yew

Taxus cuspidata, Sieb. & Zucc., var. *nana*

The species, *Taxus cuspidata*, is a native of Japan, Korea and Manchuria. This dwarf Japanese variety is "a low shrub, occasionally to 2 meters high or more, with wide-spreading branches densely clothed with short branchlets, rather dense and compact while young: leaves rather short, duller and more upright, or slightly 2-ranked." Alfred Rehder. (22)

Not tested at Brookings. At Sioux Falls, it is the "best of the yews for foundation planting or rock gardens. Will stand deep shade; waxy, shiny green." Geo. B. Tuttle, 1930.

American Arborvitae

Thuja occidentalis

Thuja occidentalis, Linn.

Arborvitae. (*Thuja occidentalis*, Linn.)....Native from North Carolina to Nova Scotia west to Illinois and eastern Minnesota north to

Lake Winnipeg. In this region it is very common in swamps and wet soils. The name White cedar is often applied to the Arborvitae but this properly belongs to another tree native far south. The Arborvitae has been planted extensively for evergreen hedges as it endures severe trimming, keeps a bright green color and retains its lower limbs. The general experience with it on the dry open prairies is unfavorable as it is a surface-rooted tree. In the early days of the Agricultural college at Brookings, a hedge of arborvitae was planted along the street on one side of the campus, only a few specimens now remain. In places where abundant irrigation can be given and there is no trace of alkali in the soil, an Arborvitae hedge can be maintained in good condition, but most planters will find the task beyond their capacity. The Arborvitae transplants easily. If planted at all a well sheltered situation and moist soil should be given if possible. Under cultivation in the eastern states and in Europe many varieties have appeared, such as the Siberian Arborvitae (which is really American) the Pyramidal, the Golden, Tom Thumb, and many more which are propagated from cuttings. We have not tested these. (10)

"Three varieties of arborvitae were planted in 1885 but the last passed away in three years." H. C. Warner, Forestburg, S. D., 1917.

"The arborvitae must be mentioned and warned against as unreliable for planting here." A. Norby, Madison, S. D., 1917, in a report on 20 years' experience.

"Arborvitae is a very beautiful tree and does well right around Yankton; probably would not stand in more northern latitudes." C. W. Gurney, Yankton, S. D., 1917.

"The Arborvitae is a popular plant for evergreen hedges, as it forms a close compact top when pruned, and is of a bright green color. It stands well in this section when growing on good retentive land, but suffers from a deficiency of moisture in the soil and occasionally from severe winds in winter, and on this account does best in somewhat sheltered locations." S. B. Green, in "Forestry in Minnesota." (8)

"Common in Minnesota in the northern portions of the region of coniferous forests, growing usually in wet situations, where it often forms dense pure stands, not common in acid bogs, occasionally in drier ground or on bare rocks, a single outpost of stunted specimens in southeastern Minnesota on limestone ledges at the summit of Gwinn's Bluff, southeastern Winona County.—Often cultivated as an ornamental tree or shrub, and much used for hedges as it bears clipping well. In the southern part of the state, it often "winter kills" badly from lack of moisture following a dry fall. Several forms of this species, distinguished by varying habit of growth and color of foliage, are handled by nurserymen." Rosendahl & Butters, in "Trees and Shrubs of Minnesota." (23)

Concerning three of the many cultivated varieties, Geo. B. Tuttle, Sioux Falls, 1930, reports: "The American arborvitae is satisfactory with shelter from north and west. They must be protected from the wind."

"Douglas Golden Arborvitae, (*Thuja occidentalis* Douglasii aurea), will grow with shelter from winds where the yellow foliage is desired.

"Hill Pyramidal Arborvitae, (*Thuja occidentalis* pyramidalis), the

best of the arborvitae, deep green, best of all in the pyramidal shape.

"American Globe Arborvitae, (*Thuja occidentalis globosa*), a compact, round ball."

Canada Hemlock

Tsuga canadensis

Tsuga Canadensis, Carr.

Hemlock. (*Tsuga Canadensis*, Carr.) Native from Minnesota to Nova Scotia and southward along the Alleghany Mountains. One of the most graceful of the evergreens, with small flat leaves one-half inch in length with short stalks. A favorite ornamental tree in eastern states. A single specimen on the lawn or a sheared hedge shows the ornamental possibilities of the hemlock. The result of many trials on the open prairies shows that it is not adapted to the prairie northwest. Too many of the plants fail in the early years for profit to the nurserymen and even older specimens have their leaves sunburned. The hemlock does not endure drought and is injured by cold winds. In extreme eastern Minnesota, where well protected and in moist soil, it has done well. (10)

"Coniferous forests, usually in acid soil containing considerable organic matter, from Nova Scotia to Delaware and southward along the Alleghanies, westward through northern Michigan and Wisconsin in which state it is abundant. The hemlock barely reaches Minnesota, occurring native only in Carlton county, just southwest of the head of Lake Superior." Rosendahl & Butters, in "Trees and Shrubs of Minnesota." (23)

The Firs. Among the firs we find some species of great value for ornamental purposes. Of the two species mentioned in this bulletin (*Abies balsamea* and *Abies concolor*), the western species (*Abies concolor*) is of much more promise. The leaves of the firs are arranged singly as in the spruces, but are flat instead of rounded as in the case of the spruce. (10)