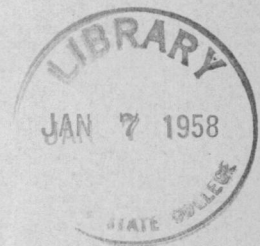


THE ECONOMIC SITUATION OF THE WHITE PINE BLISTER RUST  
IN THE PACIFIC NORTH WEST.

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# THE ECONOMIC EFFECT OF THE WHITE PINE BLISTER RUST IN THE PACIFIC NORTH WEST.

## Early History.

H. A. Dietrich in 1856, in a list of fungi of the Provinces of Russia mentions *Cronartium ribicola*. It was only used in connection with fungus upon leaves of *Ribes*, which was considered a distinct species. It has since been found that it not only attacks *Ribes* but certain young pines with disastrous results.

In the Old World *Cronartium ribicola* has been found in the following countries; Norway, Sweden, Denmark, Russia, Siberia, Austria Hungary, Italy, German Empire, France, Belgium, Holland, England, Scotland and Japan. It occurs practically throughout Europe except in the Balkan and Hispanic peninsula, being most common in countries where forestry is practiced most. The more tree nurseries, the greater the chance for its spread. The loss in Europe reached 100% in some places and the cultivation of *Pinus strobus* (white pine) had to be discontinued. In England the disease is so much on the increase that the outlook of the Weymouth (white) pine and other five-needle pines is almost hopeless.

We with difficulty can realize that this dreadful disease has gained a foothold upon this country and it will probably mean the loss of America's most valuable lumber trees, namely the five-needle pines. The hosts of *Cronartium ribicola* (blister rust) are the north American species of the five-needle pines, namely:-

- P. ayacahuite--S. Mexico into Guatemala.
- " strobiformis--S. Arizona into Mexico.
- " flexilis-----Rocky mountain region.
- " albicaulis----B. C. Alberta to Mont., Wyo., Wash., Ore., S. Cal.
- " balfouriana---California
- " aristata-----Colorado, S. Utah, Nev., S. Cal., N. Ariz.
- " strobus-----Newfoundland, Penn., Ga., Iowa, Minn., Canada.
- " monticola----Mont., S. B. C. to Wash., Ore., Calif.
- " lambertiana---Ore., Cal., Iowa, Cal., Mexico.

There are twenty six species of *Ribes* that *Cronartium* *ribicola* occurs on. Of these, thirteen are American species.  
*Chronartium* in America.

It was first recognized in America by Stewart in 1906. It's first known occurrence was on *Ribes aureum* in Kansas in the year 1892 but was not recognized until some years later. It was at this time erroneously named *Uredo confluens* but has since been identified. No explanation of this isolated occurrence in the middle of the American continent has ever been accounted for. The fungus has not been found since in the same locality or anywhere in America until 1906 and there have been no white pines in Kansas locality so far as is known.

The uredo and teleuto stages were found by Stewart at Geneva, New York in 1906 on the leaves of various species of *Ribes* at the State Experiment Station. The entire plantation was pulled and burned and the disease was apparently eradicated.

In the spring of 1909 it was discovered that the aecidial stage known as *Peridermium strobil*, had been imported on several millions of young white pines from the nursery of J. Heins Sohne of Halstenbek, Germany.

Investigations to date show that the disease has been thus far found in Kansas, New York, Pennsylvania, Vermont, New Hampshire, Massachusetts, Connecticut, Ohio, Indiana, Minnesota, Ontario, Canada, British Columbia, Washington and probably in Oregon.

In 1910 a great number of young trees were imported from French firms and a large quantity of diseased trees were found in the lots.

*Cronartium ribicola* or White Pine blister rust is now established beyond hope of eradication in New England, New York, and the Lake States. It has only been until recently that our forests of sugar pine (*P. lambertiana*) and western white pine (*P. monticola*) have been free from this dreadful disease. In the autumn of 1921 the blister rust was found in western British Columbia and the Puget Sound region of Washington.

White pine blister rust is caused by a fungus which can attack the pines only after it has grown on the leaves of wild or cultivated currant or gooseberry bushes. While on the pines the blister rust fungus lives in the bark. At first its presence is not noticeable, but slowly the bark swells and within several years from the time of infection, the blisters from which the disease gets its name push thru the bark early in the spring. These blisters are small protruding sacs and when they break open they liberate millions of yellow spores which are carried about by the wind and infect the leaves of currant and gooseberry plants. In the early summer the disease appears as a yellow rust on the under side of the leaves. The spores from this stage can not infect the pines, but are blown about and infect other currant and gooseberry leaves. Later in the same season the late summer stage of the rust appears on the diseased leaves. This consists of numerous small, brown, hair-like projections. The spores from this stage can not infect currant and gooseberry leaves, but when blown to a white-pine tree they infect it, this completing the life cycle of the fungus.

#### Method of Attack on Pines.

This disease kills the pines by working in the bark and girdling the tree. Its effect is slow, but very deadly. In gen-

eral, a small tree will be killed in a shorter time than a large one, but the large tree is no more resistant to infection and ultimate death than the smallest seedling. Most of the young trees attacked on the stem are killed the first season that the fungus forms aecidiospores. The greatest damage is done to young trees in nurseries, plantations and young reproduction growths. On older trees it attacks mainly the young branches and twigs. Although the fungus attacks old trees, it is rather difficult for it to inflict readily bark more than 20 years old.

The spores landing on the bark or branches of young trees find congenial surroundings and if there is sufficient moisture present they extrude a germ tube. This tube penetrates the thin young bark tissues and finds suitable conditions for further growth. Its action is rather slow until several inches is affected along the stem. This infection must take place after the latter part of July, as this is the earliest date the spores have been found.

No external symptoms of the disease are found in the pine for one to several years at which time the inner layers of the bark begin to thicken noticeably. It increases until two or three times its normalcy. After the swelling has become noticeable the pycnosporos may be formed at almost any time when the weather is suitable for growth. The earliest stage at which the pine shows the disease is about three years. It will require several inspections one year apart to weed out all the diseased trees in an infected lot.

The distance with which the spores can be carried by the

wind varies with local conditions. In 1898 the Prussian Ministry of Agriculture, Public Domains, and Forests issued an order requiring white pine to be planted at a distance of at least fifty meters from Ribes and the planting of another kind of tree between the two to prevent the wind carrying the spores from one to the other. In the work done during 1909 in the removal of Ribes from the vicinity of white pine plantations in America, 300 feet was taken as a safe distance. Vermont and New York took 500 feet as the width of the safety zone.

#### Germination:

The aecidiospores germinate within a few hours if there is sufficient moisture. The spores have germinated after being kept dry for five months.

#### Field Characteristics of the Rust on Pines.

Affected trees are peculiarly stunted in appearance, the tops in many cases having a bunched growth so characteristic that they can easily be picked out from the healthy ones by this characteristic alone.

Trees affected usually have the stem swollen at one end of a year's growth. The swelling usually is in the shape of an elongated cone rising quite abruptly to its maximum diameter and then tapering down to the normal stem diameter. In some cases the entire length of the year's growth is swollen irregularly and has a peculiar obese appearance. Scattered along this swollen area are a number of wart-like bunches, usually situated on old leaf scars.

The swelling on the stems and branches are usually located on wood which is at least three years old and has no needles,

so they are easily detected. Where the disease has been present for a number of years the bark becomes irregularly cracked and fissured and abnormally thickened. The fungus is capable of living indefinitely in the bark as long as the host tree remains alive.

#### Source of Diseased Stock Found in America.

With a single exception, diseased lots of white pine were traced to the nurseries of J. Heins Sohne, Halstenbek, Germany. In 1910 the New York Horticultural inspectors discovered diseased white pine stock received from Barbier and Co., Orleans, France. The horticultural inspectors of Ohio also discovered diseased stock in Ohio, which came from the French nurseries.

#### Methods of Combating.

The State and Federal regulations or quarantines have been promulgated with the view of preventing the further introduction and spread of the blister rust in the western United States. These quarantines restrict the movement of five-needle pines and of currants and gooseberries as follows: They (1). prohibit their entrance into the United States from any foreign country, including Canada; (2). prohibit their movement from all States east of and including Minnesota, Iowa, Missouri, Arkansas, and Louisiana, interstate, to points outside the quarantined area; and (3). prohibit their movement out of that part of Washington west of the summit of the Cascade Mountains to the rest of Washington or to any other State.

Due to the fact that the rust is very deceptive and not noticeably visible for several years after infection takes place, the disease can not be detected on dormant currant and gooseberry

bushes without a close microscopic examination. Owing to these facts the quarantine regulations include all host plants and not merely those which are visibly infected.

In places where disease is present, the only course is to remove the least important of the two hosts and destroy all diseased plants of the remaining host. Two or three inspections in July and August at intervals of ten days to two weeks should make sure of all infected Ribes if the diseased and suspected ones are destroyed when found.

In an infested lot of pines, inspections made during the month of May for several consecutive years should be sufficient, providing all suspicious trees are at once burned. In the case of an infected plantation or nursery of pines all wild and cultivated currants and gooseberries should be promptly removed to a distance of 500 feet from the edge of the area containing the pines. An inspection the following spring should result in the removal of those infected trees which were not detected the first time.

Trees younger than three years old should be inspected when they reach that age as the disease does not usually become visible before then.

Seed will not carry this fungus and is perfectly safe as far as the rust is concerned.

#### Danger to all Five-needle Pines.

The white pine blister rust is strange and almost unique among plant diseases. It originally attacked the stone pine (P. cembra) which is a native of Europe, the fungus itself being also endemic in Europe. About 400 years ago the white pine was introduced into Europe as one of the most promising of American con-

ifers. About 50 years ago the blister rust was found attacking *P. strobus* (eastern white pine). The has severely attacked and is continuing while on the stone pine it causes relatively slight damage and does not seem to be spreading rapidly.

The stone and white pine are five-needle pines and are quite closely related to each other. The rust has been found on western white pine (*P. monticola*) and sugar pine (*P. lambertiana*), which are five-needle species and even more related to *P. strobus* than *P. cembra*. What is the same blister rust has been noted in Denmark upon the Himalaya pine (*P. excelsia*), also a five-needle pine. The fungus has had every chance to infect other pines in Europe which are not five-needle so that it seems to fairly well prove that it attacks only the five-needle pines which belong to the white pine group.

#### In U.S.

In the United States the five-needle pines occur naturally in the forests of the entire country except the section from Texas and Oklahoma eastward and north to the Ohio river, which is occupied by the yellow pines. Even here the eastern white pine extends in the Appalachians to northern Georgia and Alabama. *P. excelsia* and *P. ayacahuite* are commonly planted in this section as ornamentals and their use is increasing.

Wild and cultivated species of *Ribes* occur throughout the country so that it would be nerely a question of time for the blister rust to spread over the entire country if it once becomes established.

When a disease once gets a foothold or is introduced into a

favorable new climate it is likely to become more virulent and to cause greater and more destruction than before. Such diseases do not run out. When a fungus is once established in a new region it is a permanent factor in the cultivation of its host plants ever after. The histories of the potato blight, grape mildew, asparagus rust, the holly hock rust and other parasitic fungi which have been carried from one country to another prove the truth of these statements.

#### Estimate of Possible Damage.

The total valuation of forest products derived from the five-needle pines, as far as they are separately obtained, for 1908 was about \$65,000,000. If only 1% was affected, which is a very conservative percentage, the loss would be \$650,000 a year. Estimates for 1909 show that the valuation of white pine now standing was about \$600,000,000 while sugar pine was \$120,000,000. Taking the conservative loss of 1% we have a loss of \$7,200,000. Estimates to the extent of nursery interests are not obtainable.

In New England, white pine is used in about 90% of all planting done. It has been estimated that 200,000,000 feet of lumber may be cut from the present plantations of New England, between 1930 and 1950.

The eastern states have planted large areas of white pines, the planting movement having reached an important volume.

If the rust becomes a permanent factor in the cultivation of this species in America the planting movement will be seriously discouraged and greatly checked at the very time it bids fair to accomplish results commensurate with our needs.

#### Importance of White Pines in the West.

The present stand of commercial five-needle pines in the United States is 78,571 million board feet. Approximately three-fourths of this timber, 57,071 million feet, is in the western forests. The two important commercial species are western white pine and sugar pine. These are the most valuable forest trees found in the West. White pine in western Montana, Idaho, eastern Oregon and eastern Washington amounts to 21,557 million board feet.

In the Inland Empire, from 1911 to 1915, the annual cut of white pine was over 320 million board feet. In 1915 the annual cut was 419 million feet.

Figures for 1913 show that the total annual cut for white pine in the U. S. was 2.5 billion feet.

Sugar pine is essentially a California tree. The total stand in this state amounts to approximately 39 billion board feet. Of the three most widely distributed and valuable conifers in Calif., redwood, yellow pine, and sugar pine are the three most important. Although the sugar pine ranks third in volume it is undoubtedly first in value of product.

In 1910 the amount of sugar pine used in various industries was 34,946,956 board feet.

In Idaho, from 1914 to 1918, more than one-third of the lumber produced was western white pine, and in California during the same period one-tenth of the lumber produced was sugar pine. The lumber manufactured from these pines is more valuable than that of other species; therefore these proportions are greater in dollar value than in board feet.

Ownership and Responsibility.

Federal holdings contain 25% of the western white-pine stumpage, State holdings 15%, and private holdings 60%. The Federal Government also owns 40% of the sugar pine stumpage, and private interests 60%. There are no species in the western white-pine region of Idaho and in the sugar-pine region of California that can replace these two trees in quality and value. Their loss would be a serious blow to the lumber and wood-using industries. In the five-needle pine regions of the West every thousand board feet of lumber manufactured, irrespective of ownership, means an average of \$13 to \$16 in pay rolls and supplies in the community and State. This represents a community interest far greater than that of the individual stumpage owner. From the mentioned statements it is apparent that the protection of the white-pine forests is a matter of individual, State, and national concern.

Present Danger.

Northwestern Washington, where the white-pine blister rust has been found, is directly connected with Idaho and California by unbroken chains of five-needle pines, and scattered among these pines are some 60 species of wild currants and gooseberries that are possible carriers of the disease. Unless the blister rust is checked, it will eventually spread by natural means throughout the commercial white-pine regions. The disease will probably never be excluded and in time will spread to all our commercial and valuable white-pines. The only action that can be exerted in combating this disease is the prevention of its rapid spread long enough to harvest our present stand of pines. It is like a chronic

sore, it may be prevented from growing worse, but it is very difficult to cure it completely.

After our present stand of white-pines are cut we will probably see the last of the virgin pines disappearing. This will be the passing of one of our most valuable timbers, an epoch that the country will suffer from severely.

We cannot afford to stop the great fight which we are now engaged in combating this enemy. We must go on and delay it's progress as long as we can hold out. We have our most valuable resource at stake, millions of dollars worth of the finest timber that ever grew and we must protect it from this dreadful disease.

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