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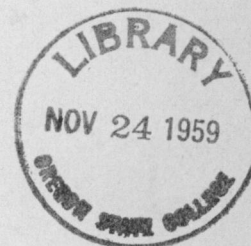
GROWTH STUDY OF COAST JACK PINE

*Pinus contorta*

by

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December 14, 1940



OUTLINE FOR GROWTH STUDY OF  
COAST JACK PINE (P. Contorta)

I. Location of Study

Otter Rock, Oregon, 9 miles North of Newport on the coast highway.

II. Objective of Study

To make a study of the growth of Jack Pine in relation to site and climate, in order to find what makes it possible for this tree to grow under coast conditions.

III. Procedure

- A. Research on the general conditions under which Jack Pine grows in other localities.
- B. Look up data on rainfall, and temperature for the past five years for a comparison with other localities.
- C. Lay out a study plot under representative conditions.
- D. Study of soil for depth, composition, and general characteristics of land as to slope, exposure.
- E. Study of the root habit, and comparison as to amount with trees in other localities.
- F. Study of reproduction and conditions under which reproduction will grow.

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III. Procedure

A. General Data on Jack Pine (lodgepole) Growth in the Rocky Mountains

1. Site

- a. Soil
- b. Rainfall and Moisture

B. Specific Data on Coast Jack Pine

1. Site

- a. Soil
- b. Temperature and Rainfall
- c. Slope, Aspect, and Extent

2. Physical Characteristics

- a. Height and Type of Tree
- b. Root Habit

3. Reproduction

- a. Conditions for Growth
- b. Where Found

4. Reproduction (Study Plot)

- a. Location
- b. Procedure and Results

C. Conclusions



## I. Location of Study

This study was undertaken in the vicinity of Otter Rock, Oregon, nine miles North of Newport, on the Oregon Coast highway.

## II. Objective of Study

The purpose of this project has been to study the habitat and growth of Jack Pine, (*Pinus contorta*), in an attempt to find the reason for it/s ability to grow under Coast conditions of soil and climate.

## III Procedure

A. General Data on Jack Pine (Lodgepole) Growth in the Rocky Mountains

### 1. Site

Jack Pine, as is well known, grows under widely diversified conditions of climate and soil (1). It is found, in modified forms, from the high mountain elevations and poor sites of the Rockies to the coast regions of the Pacific and the apparently good sites found therein. It is evident that some limiting factor or factors are found under both these extreme conditions of site which allows Jack Pine to grow equally well in either of them. In order to have a basis for comparison, it might be well to consider Jack Pine growth in a region far from that of the coast. Following are the major items concerning Lodgepole Pine growth in the Rocky Mountains.

a. Soil-- Various authors have differences of opinion as to how well Lodgepole pine is adapted to different types of



climate, but all agree that this tree prefers an acid type soil. Lodgepole Pine is able to live and grow on widely diversified soil types. It attains its best growth on deep fresh, well drained sandy loam, although it seems able to adapt itself to shallow, poor gravel or clay soils.

b. Rainfall and Moisture--- Moisture, I believe, is the most important factor affecting the successful growth of Jack Pine. Far from desiring to grow on the poorer sites, Jack Pine attains its optimum growth on deep, fresh soils with plenty of moisture. Mason (2) reports that in the Rocky Mountains, Jack Pine will grow only where average precipitation is 18 inches or more; that its best growth is had where precipitation exceeds 21 inches; and that total precipitation is not as important as the available moisture supply in the soil. Mason also states that at upper limits of its range Jack Pine gives away to Engleman Spruce and Alpine Fir, through an over-supply of moisture and an inability to grow with the increasingly shorter growing season found at very high elevations.

Data on the opposite page shows actual conditions of climate under which Jack Pine can grow. This data shows, that although Jack Pine is able to grow successfully at high elevations, the essential elements are not lacking. Thus it may be seen that Jack Pine growth is above well defined lower limits of moisture. This limit may be slightly lower than that of trees growing at lower elevations. The greatest adaptability of Jack Pine seems to be in length of growing

Data relative to climatic conditions as gathered by  
Mason (2) from reports of the U. S. Weather bureau.

Station	Species	Basis Years	Elev.	Ann. Percip.			Ann. Temp.		
				Mean	Max	Min	Mean	Max	Min
Colorado:									
Frances	Ldgple	8	9,300	25.89	33.72	21.65	40.6	86	-14
Breckin- ridge	"	24	9,536	20.90	46.41	14.22	33.7	90	-37
Montana:									
Fish Crk	"	3	7,800	23.31	24.70	20.69	35.1	80	-22
Colorado									
				- - - - - Killing Frost - - -					
			Mean Ann. Snow	Spr. Earliest			Fall, Latest		
Frances	"	8	183.5 in.	May 29			Sept. 10		
Breckin- ridge	"	24	193.9 in.	July 21			Aug. 9		
Montana									
Fish Crk.	"	3	182.5 in.				No record		



season. It is able to withstand a season as short as one month before finally giving away to the hardier Alpine Fir.

## B. Specific Data on Coast Jack Pine

### 1. Site

Site conditions at the coast differ to a large extent from those in the rockies. Temperature is much higher with plenty of rainfall and a long growing season. A representative part of the coast region is the area between Newport and Otter Rock, Oregon. The data below was gathered for this area.

#### a. Soil-- Characteristics of soil is as follows:

Horizon	Depth	Acidity	Phosphorus	Composition
A	1-3"	5.4	very low	Needles in stages of disintegration
B	1-3'	6.1	very low	Slightly sandy loam or clay loam
C	3'-	6.1	Fairly good	Broken or solid clay bed.

The above characteristics of soil are general along the immediate coast line in the Jack Pine type. Nearer the boundary of Jack Pine growth inland, which is between one-half and three quarters of a mile, the B and C layers of soil become more sandy in character. The C layer here becomes a hard sandstone layer at a depth of about 15 feet.

b. Temperature and Rainfall-- These present the greatest difference between this and any area of the inland. The following data was taken from Climatological data sheets and from the 'Climatic Summary of the United States', compiled by the Department of Commerce, Weather Bureau.

MONTHLY PRECIPITATION FOR  
NEWPORT AREA

	<u>1931</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>	<u>1939</u>	<u>1899-1930</u>
Jan	88.21	16.32	12.24	6.60	12.38	6.39	9.90	8.46	10.20
Feb	4.10	6.82	3.49	5.09	6.32	9.95	8.87	10.34	8.37
Mar	15.03	12.61	8.33	8.32	4.76	7.31	12.63	4.71	7.24
Apr	4.70	-----	2.37	3.59	1.75	8.04	4.31	1.30	4.94
May	1.06	7.86	3.54	0.36	5.76	2.42	1.32	0.94	3.80
June	4.80	3.41	1.01	2.18	2.69	6.92	0.89	2.75	2.50
July	0.00	0.31	0.99	0.93	1.58	0.20	0.49	1.31	0.77
Aug	0.00	1.00	1.07	0.41	0.03	1.27	0.34	2.08	0.79
Sept	3.90	9.28	1.34	2.78	1.11	1.21	2.23	0.51	2.94
Oct	5.58	6.50	9.61	3.58	0.53	5.19	5.65	6.10	5.01
Nov	11.20	3.51	19.04	3.54	1.14	18.66	7.24	1.99	10.57
Dec	14.42	24.54	11.46	6.08	9.25	15.74	6.01	13.50	10.28
Ann.	73.27		74.49	43.46	47.30	83.30	59.88	53.99	67.41

MONTHLY AVERAGE TEMPERATURE

OVER PERIOD OF 39 YEARS FOR NEWPORT AREA

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual</u>
Max	49.6	51.1	52.7	55.6	58.3	61.5	63.7	64.1	63.7	60.6	55.2	50.9	57.2
Min	37.4	48.7	38.9	41.1	44.3	47.7	49.6	50.3	48.5	46.1	42.6	39.2	43.7

FROST DATA FOR

39 YEAR PERIOD, NEWPORT AREA

Average date of  
last killing frost  
in spring

Average date of  
first killing frost  
in fall

Average length of  
growing season-last  
killing frost to first  
killing frost

March 23

November 26

248 days



c. Slope, Aspect, and Extent-- Jack Pine extends over a rather narrow strip along the coast, penetrating little more than three-quarters of a mile to the East of the coast line. It extends right to the beach line in the west and can be found with roots partially exposed on the high banks facing the sea. It is found nearly always on logged and burned-over lands and on open areas facing the sea not previously forested. Jack Pine is most commonly found on West slopes and on level exposed areas. It is never seen growing in mixed stands, although single or groups of trees may be growing on the same area close together. In several spots within the affor<sup>e</sup>mentioned area small stands of Jack Pine, even age, may be found. The trees are small in diameter, limby, and not over thirty feet tall.

## 2. Physical Characteristics

a. Height and Type of Tree-- Very seldom are Jack Pines found over thirty feet in height and as they are normally found ~~over~~ singly or widely spaced, limbs remain alive to within two feet of the ground. Their shape is therefore conical and the foliage is dark green in color. In the most exposed positions the tree is exceedingly short and scrubby and limbs and top may be found bent in the direction of the prevailing wind, which is Northwest for eight months of the year.

b. Root Habit-- Jack Pine has a taproot of variable depth, those observed being about eight feet in length, though in all probability older trees have good deal longer ones.

The lateral root system is very well developed, consisting of many roots of small diameter, ranging from six to twelve feet in length, one being measured at eighteen feet in length. These laterals spread widely in all direction some staying near the surface and others penetrating the lower levels.

### 3. Reproduction

a. Conditions for Growth-- Jack Pine is an intolerant tree as is shown by data gathered in a reproduction study as described below. Seedlings planted on an open, grass and weed covered site have survived and are growing, though with much slower growth than those growing naturally throughout the area. Of seedlings planted under a heavy brush and tree cover not one survived. On one area observed, a large mature Jack Pine was growing on typical brush cover land of Salal and Salmonberry, within ten feet of an open abandoned field. On the Open weed covered field a sample plot 25 feet from the tree and about 10x10 feet square showed three seedlings of various ages growing-- a like area in the brush covered area showed no seedlings.

b. Where Found-- Most profuse reproduction may be found on areas free of brush and with weed or grass cover. Thus cleared and abandoned fields and small natural open spots in the brush will be found with young reproduction on them. Single trees or groups of trees may thus crowd out surrounding brush once they reach a dominant position and by this slow process take over the land.



#### 4. Reproduction (Study Plot)

a. Location-- The study plot is located approximately 200 feet East of the shore line and directly opposite Gull Rock, well known promontory off the coast in this locality. The plot is situated in an open field with weed cover and bracken fern. The land slopes slightly towards the West. A second site approximately 400 feet East of the first, situated under a heavy brush cover, was also planted with Jack Pine seedlings at the same time. This site also slopes to the west and is identical with the former except in over head cover and perhaps a richer hum~~u~~s layer of soil.

b. Procedure and Results-- This site was chosen as being approximately a compromise between a thoroughly protected site and a very much exposed site, both of which will sustain Jack Pine growth. One and two year old seedlings were gathered from a spot within the vicinity, and these were planted on the area without preliminary scalping. At the present time these seedlings are making rather slow growth--due probably to the setback received in transplanting. Conditions on the second site have been wholly different than those on the first. Apparently in spite of a richer soil, these plants were unable to compete with the already well established brush stand, and consequently were dead within six months of planting. This gives at least a collaboration to the proof already evident that Jack Pine is well able to grow on the general beach site found, provided it may endure until it reaches above the brush cover.

Unfortunately the experiment was started too late in the year (January 1940) to gather any seed for planting. Seed was gathered during October of this fall however, which will be planted by the end of December. Location will be close to that of present study plots.

### C. Conclusions

Far from reaching any final answer to the reason for Jack Pine growth under coast conditions, this report has attempted to give some of the conditions to which Jack Pine is exposed at the beach. Far reaching conclusions relative to the exact reason Jack Pine can grow at the beach are hardly possible without a more intensified study and check on the actual growth process of Jack Pine, I believe.

It is reasonable to conclude from the data gathered in this report, however, that Jack Pine requirements for good growth are much the same as those for other conifers requiring good sites, namely, deep, well drained soil, plenty of moisture and optimum temperature.

Reviewing the data as given by Mason (2) it would seem that the most important limit to Jack Pine growth is moisture. Mason states that Jack Pine exist under conditions of moisture as low as 18 inches in the Rocky Mountains. At the beach moisture as an average is around 67 inches; here seems to be the greatest contrast between conditions of growth by Jack Pine at the coast and in the mountains.

Theories have been advanced that the reason for this ability of Jack Pine to grow at the coast is the high mineral content of the soil. Moisture is held in such a strong



solution that dry conditions are simulated and in reality Jack Pine has no more moisture available than under conditions of extreme or average dryness. However, a soil test which was made from soil gathered from a representative Jack Pine site, showed no over abundance of mineral content as is shown by the soil test data elsewhere in this report.

A more logical explanation of at least part of the reason for Jack Pine growth along the coast is found in the exceedingly dry prevailing winds. Without personal contact over a period of time it is hardly possible to realize the desiccating qualities of wind along this part of the coast. On an estate near the writers' home, and subject to the full force of the wind, it has been found impossible to grow ordinary varieties of shrubs and plants unless thoroughly protected by wind screens. Even grass, which is relatively well protected, will quickly show brown spots through lack of water unless a sprinkling system is employed through the greater part of the spring and summer months.

Rainfall although heavy, is not as noticeable as on the opposite side of the coast range. Volume is certainly as great as that farther back, but after from one to seven days of this heavy rain, clear weather will again prevail and the ever present wind will quickly dry out the ground and atmosphere to its original condition. During April in the summer of 1940 a sudden dry Southeast wind struck the coast, just as new shoots were well developed. This sudden action of the wind lasting not more than eight hours, killed this new growth as

completely as fire might have done. A redwood tree partially exposed to this wind had its leaves killed without exception on one side of the tree, while the opposite protected side was almost untouched. This of course was an exceptional case, but it serves to show the extreme drying effect of wind. With reference to the wind, it is very noticeable that Jack Pine is nearly always found in the most exposed positions along the very edge of the coast. Back one half to one mile from the coast line Jack Pine growth stops completely. It grows not in the small creek bottoms or in the protected positions, but on open flats and on steep hillsides. Sitka Spruce growing in the same relative position is a short stunted tree in no way comparable in growth to Jack Pine.

For these reasons, I believe the conditions making Jack Pine growth possible, in the main, are due to the strong dry winds, which serve to reduce any overabundance of moisture through excessive transpiration, that might be gained through heavy rainfall.



References:

- (1) G. B. Sudworth, Forest Trees of the Pacific Slope
- (2) D. T. Mason, Life History of Lodgepole Pine in the Rocky Mountains, USDA Bull. #154 .