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## Research Report No. 33, Climate and Growth

Christopher C. Brown

Hershel C. Reeves

J. David Lenhart

*Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University*

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# Climate and Growth

By

Christopher C. Brown  
(MSF Dec '94, College of Forestry, SFASU)

Hershel C. Reeves  
(Retired Professor, College of Forestry, SFASU)

J. David Lenhart  
(Professor, College of Forestry, SFASU)



## REPORT 33

From  
the  
East Texas Pine Plantation Research Project  
College of Forestry  
Stephen F. Austin State University  
Nacogdoches, TX 75962

January 1995

Is...

- Diameter growth and
- Height growth

of loblolly pine plantations in  
East Texas affected by...

- Temperature,
- Precipitation and
- Number of Raindays?

Growth of loblolly pine (*Pinus taeda* L.) plantations in East Texas is influenced by many factors - soil, genetics, insects, diseases, associated vegetation and climate - to list a few items. Insights into the role that these factors contribute to the production of wood might assist East Texas plantation managers in establishing, growing and harvesting planted trees.

Recent work by Brown (1994) has provided information on the impact of climatic factors on tree growth. Two of the research questions that Brown asked were:

- Are there differences in diameter growth between different levels of climatic factors?
- Are there differences in height growth between different levels of climatic factors?

This paper presents answers to these two questions.

Planted loblolly pine diameter and height growth data were obtained from the East Texas Pine Plantation Research Project (ETPPRP). The ETPPRP is a long-term on-going study tracking the development of pine plantations in East Texas. Data collection started in 1982 from an array of permanent plots located throughout the

forested region of East Texas. Diameter and height growth values were tabulated by analyzing sequential measurements of the permanent plots.

<u>Average Ranges</u>	
<u>for Nine Temperature Factors</u>	
<u>East Texas 1980 - 92</u>	
Annual Maximum	72 => 79° F.
Annual Minimum	52 => 60° F.
Spring Maximum	73 => 79° F.
Spring Minimum	47 => 57° F.
Summer Maximum	89 => 93° F.
Summer Minimum	67 => 72° F.
Annual Range	16 => 25° F.
Spring Range	18 => 29° F.
Summer Range	17 => 27° F.

Weather data was obtained from National Weather Service stations situated within East Texas. Stations with relatively complete temperature and precipitation data were utilized.

Each ETPPRP permanent plot was matched with a nearby weather station. If a station was not nearby, weather values were averaged from the closest two or three stations.

<u>Average Ranges</u>	
<u>for Three Precipitation Factors</u>	
<u>East Texas 1980 - 92</u>	
Annual	37 => 70 inches
Spring	2 => 5 inches
Summer	2 => 5 inches

Weather information was summarized into fifteen weather factors (listed in the blocks on this page). For each

factor, several levels were established across the observed range of values.

<u>Average Ranges</u>	
<u>for Three Rainday Factors</u>	
<u>East Texas 1980 - 92</u>	
Annual	43 => 77 days
Spring	10 => 26 days
Summer	7 => 23 days

An one-way analysis of covariance (with plantation age and number of trees per acre as covariates) was calculated for each climatic factor. Results are presented on the

next three pages.



## Effect of Climatic Factors

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### Diameter Growth

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Of the 15 climatic variables, statistical distinctions ( $P \leq 0.05$ ) in observed average annual diameter growth rates were detected between different levels of:

#### Annual Maximum Temperature

Regions in East Texas with lower average maximum temperatures (72-73°) tended to depict higher growth rates (0.7" per year) than the growth rates (0.3" per year) observed in regions of higher temperatures (78-80°).

#### Annual Minimum Temperature

Regions in East Texas with lower minimum temperatures (53-54°) tended to depict higher growth rates (0.6" per year) than the growth rates (0.5" per year) observed in regions of higher temperatures (59-60°).

#### Spring Maximum Temperature

Regions in East Texas with lower average maximum temperatures (74°) tended to depict higher growth rates (0.7" per year) than the growth rates (0.5" per year) observed in regions of higher temperatures (79-81°).

#### Summer Minimum Temperature

No particular trends were evident. Growth rates varied between 0.5" - 0.6" across a temperature range of 66° - 73°.

#### Spring Raindays

Regions in East Texas with more spring raindays (23 days) tended to depict higher growth rates (0.7" per year) than the growth rates (0.5" per year) observed in regions of fewer rain days (10 days).

#### Summer Raindays

No particular trends were evident. Growth rates were about 0.5" across a range of 7 - 20 summer raindays.

No statistical differences in diameter growth were seen between different levels of the other 9 climatic factors.

These growth rates are consistent with values computed by Ross and Lenhart (1994) in a comprehensive study of East Texas pine plantation growth values.

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## Height Growth

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Of the 15 climatic variables, statistical distinctions ( $P \leq 0.05$ ) in observed average annual height growth rates were detected between different levels of:

### Spring Minimum Temperature

Regions in East Texas with higher average minimum spring temperatures (56-59°) tended to display higher growth rates (4' per year) than the growth rates (3.3' per year) observed in regions of lower temperatures (47-48°).

### Summer Maximum Temperature

Regions in East Texas with lower average maximum summer temperatures (89-90°) tended to display higher growth rates (4' per year) than the growth rates (3.3' per year) observed in regions of higher temperatures (93-94°).

### Spring Temperature Range

Regions in East Texas with shorter average spring temperature ranges (18-20°) tended to display higher growth rates (4' per year) than the growth rates (3.3' per year) observed in regions of longer temperature ranges (26-28°).

### Summer Temperature Range

Regions in East Texas with shorter average summer temperature ranges (18-20°) tended to display higher growth rates (4' per year) than the growth rates (3.3' per year) observed in regions of longer temperature ranges (26-28°).

### Annual Precipitation

Regions in East Texas with more average annual rain (60" per year) tended to display higher height growth rates (5' per year) than the growth rates (3.3' per year) observed in regions of less annual rain (40" per year).

### Spring Precipitation

Regions in East Texas with more average spring rain (6-8" per year) tended to display higher height growth rates (4.3' per year) than the growth rates (3.7' per year) observed in regions of less spring rain (3-4" per year).

### Summer Precipitation

Regions in East Texas with more average summer rain (5" per year) tended to display higher height growth rates (4' per year) than the growth rates (3' per year) observed in regions of less summer rain (3" per year).

### Annual Raindays

Regions in East Texas with more annual rain days (75-80 days) tended to display higher height growth rates (5.3' per year) than the growth rates (3.3' per year) observed in regions of less rain days (45-50 days).

#### Spring Raindays

Regions in East Texas with more spring rain days (20-25 days) tended to display higher height growth rates (5' per year) than the growth rates (3.3' per year) observed in regions of less rain days (10-15 days).

No statistical differences in height growth were seen between different levels of the other 6 climatic factors.

These growth rates are consistent with values computed by Ross and Lenhart (1994).

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#### Literature Cited

- Brown, C. C. 1994. Effects of climatic conditions on growth and mortality of loblolly pine in plantations of East Texas. MSF Thesis. College of Forestry. SFASU. 90 p.
- Ross, H. A. and J. D. Lenhart. 1994. Observed growth rates of loblolly and slash pine plantations in East Texas. ETPRP Report 31. College of Forestry. SFASU. 18 p.
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