Genetics of Southern Pine and Adaptation to Climate

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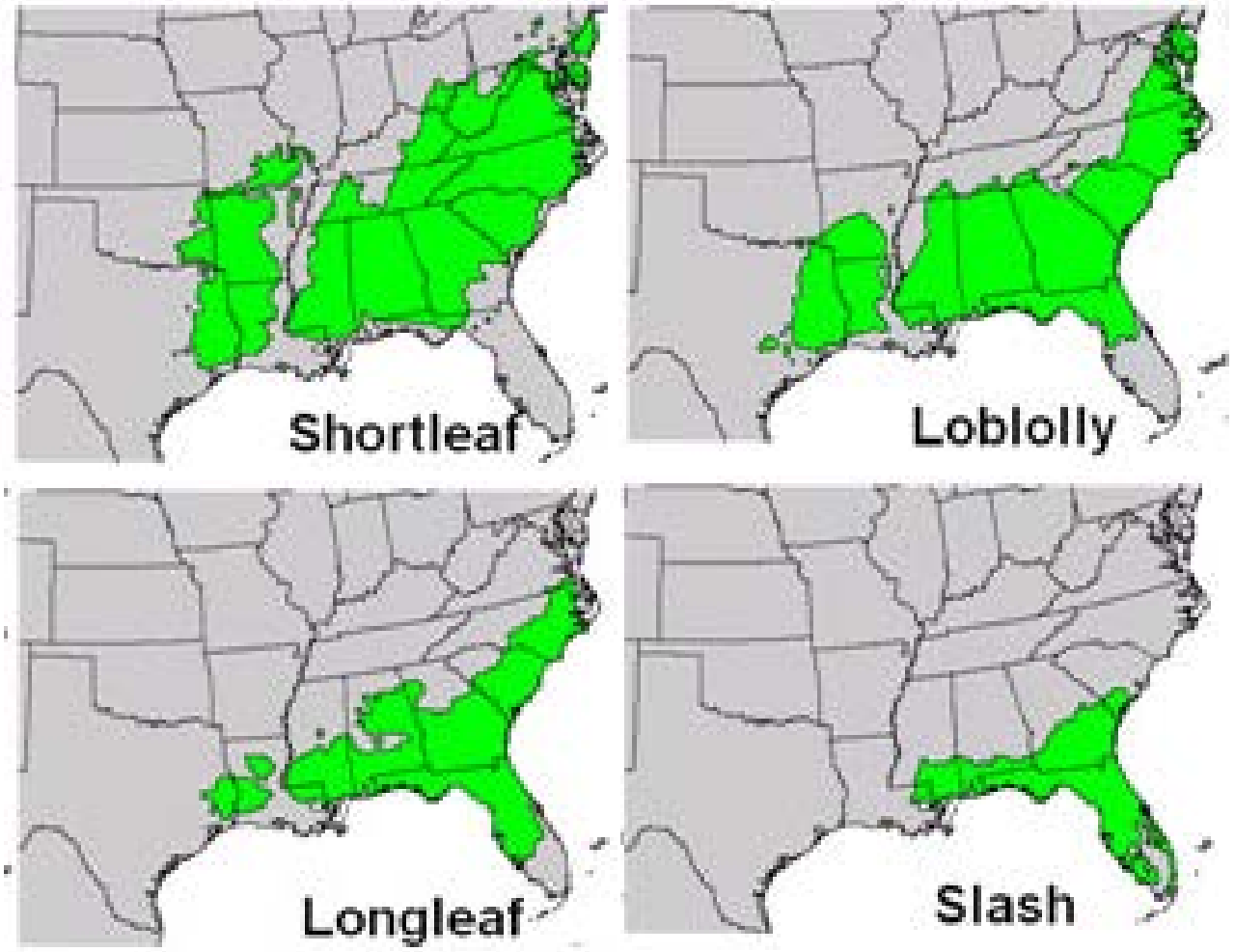
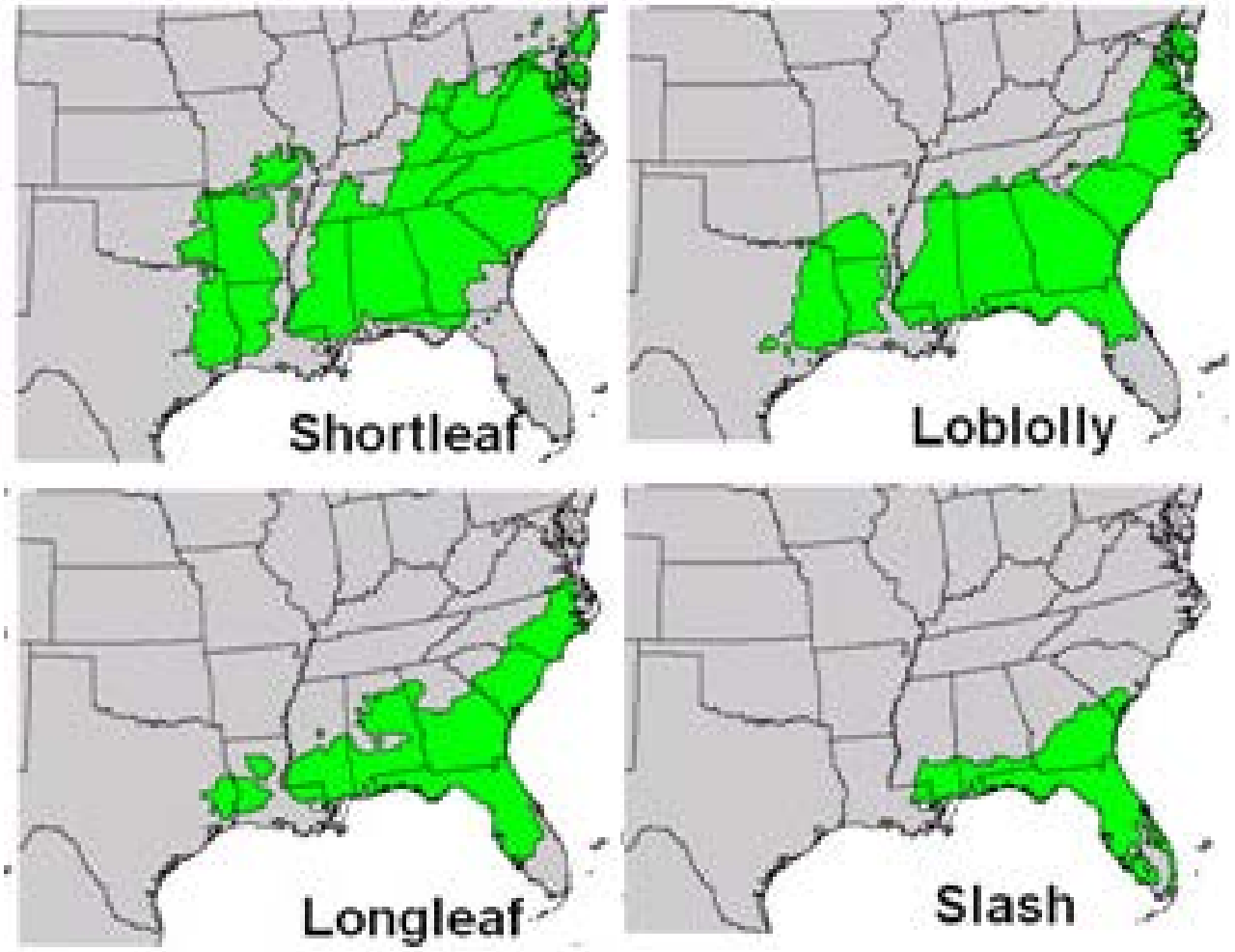
Natural Ranges of Southern Pine Species



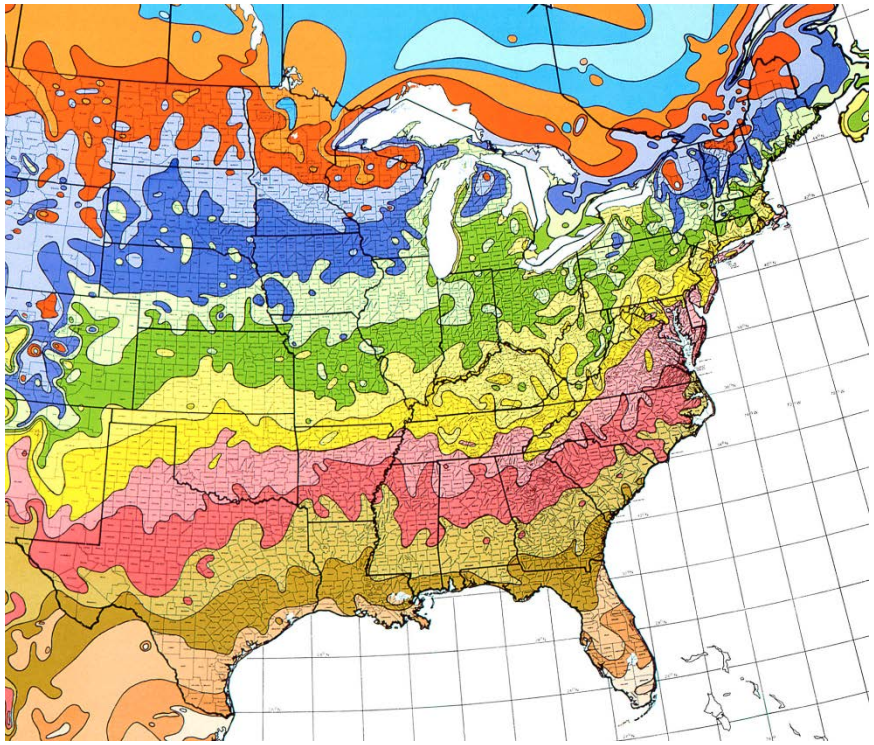
Comparison of Southern Pine Species

Species & Natural Range	Disease & Pest Tolerance	Drought & Fire Resistance	% of Planted Forestland in SE	Growth Rate	Status of Genetic Improvement	Status of Silviculture
	Strong rust resistance, moderate SPB resistance	Moderate to high drought tolerance, especially western provenances	80	Highest rate of early growth, most responsive to fertilization	3rd cycle nearing production; 4th cycle of breeding & testing underway	Advanced – rangewide trials for nutrition, stand density, competition control…
	Moderate to strong rust resistance, better SPB resistance relative to loblolly & shortleaf	Moderate drought tolerance,	18	Early growth rate second to loblolly, not as responsive to fertilizer	3rd cycle nearing production; 4th cycle of breeding & testing underway	Advanced – rangewide trials for nutrition, stand density, competition control…
	Weak to moderate rust resistance, good SPB resistance compared with loblolly & shortleaf	High drought and fire tolerance		Early growth significantly less than loblolly & slash, responsive to fertilization for grass stage	1st cycle in production; no active breeding	Early stage – competition control to rapidly pass through grass stage, most intolerant to competition
	Strongest rust resistance, Weakest resistance to SPB of all 4 spp.	High drought tolerance, Better fire resistance than loblolly & slash	negligible	Slowest early growth rate of all 4 spp., fertilization response unknown	none	Minimal

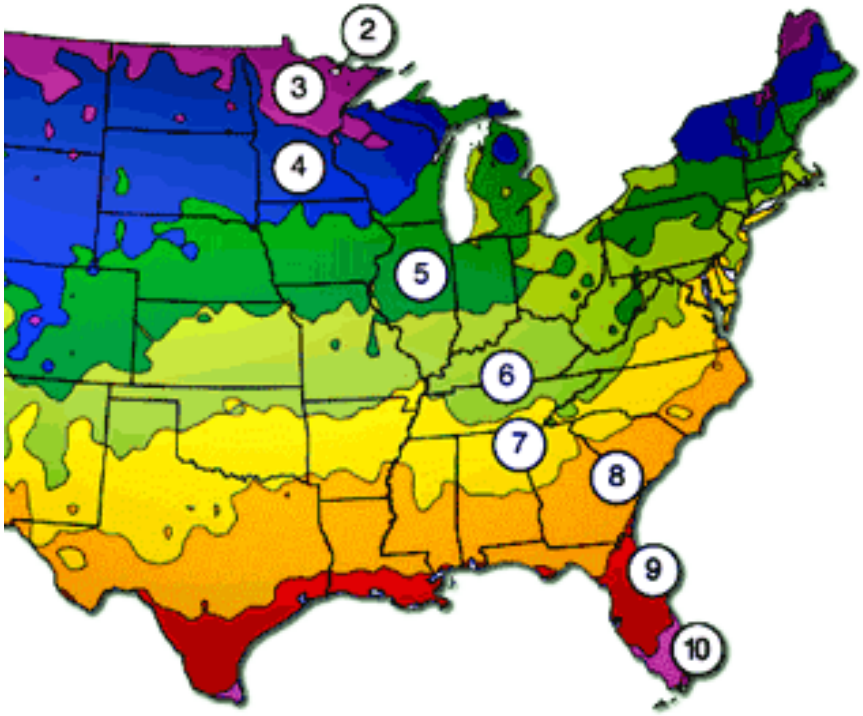
Natural Ranges of Southern Pine Species



USDA Plant Hardiness Zone Map: Based Primarily on Minimum Winter Monthly Temperature



Old map: 1995-2012



New map: 2012-present

History of Climate on Southern Pine Range & Genetic Diversity

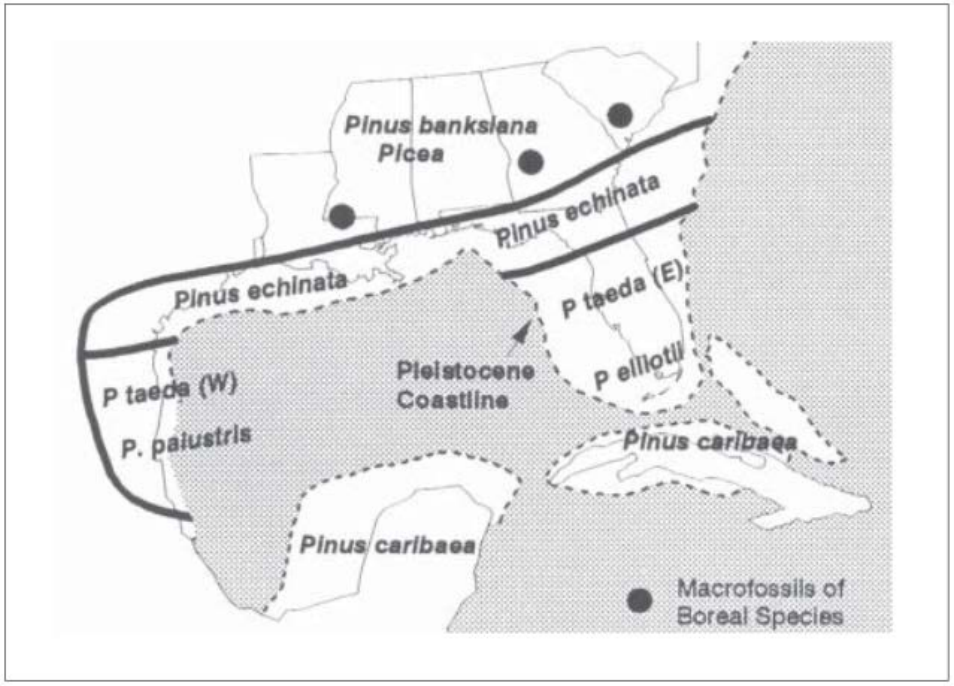
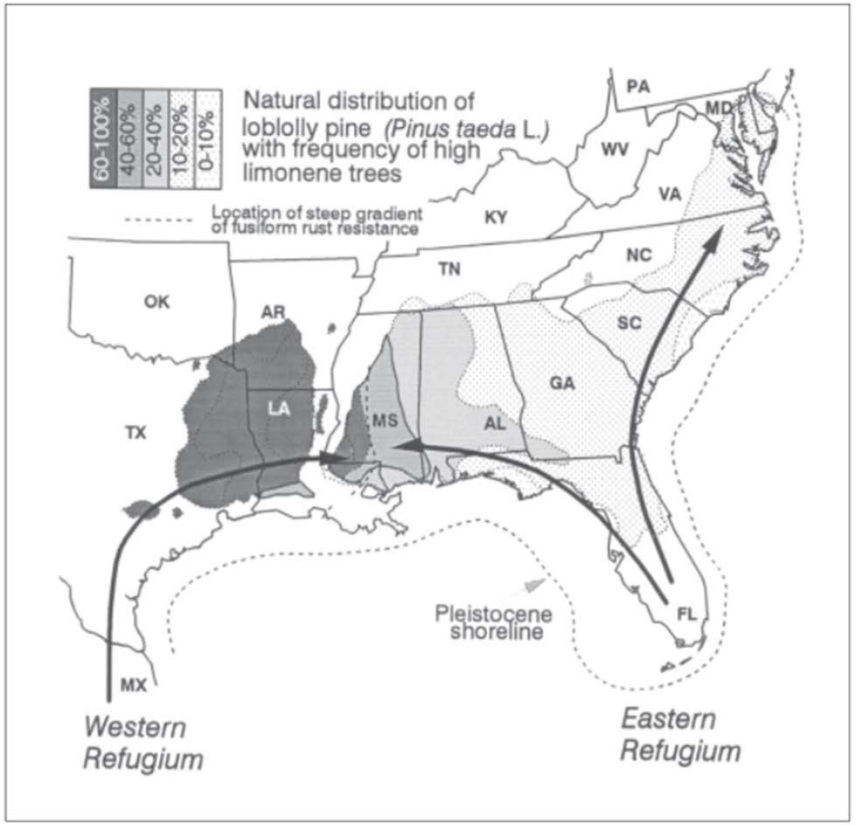


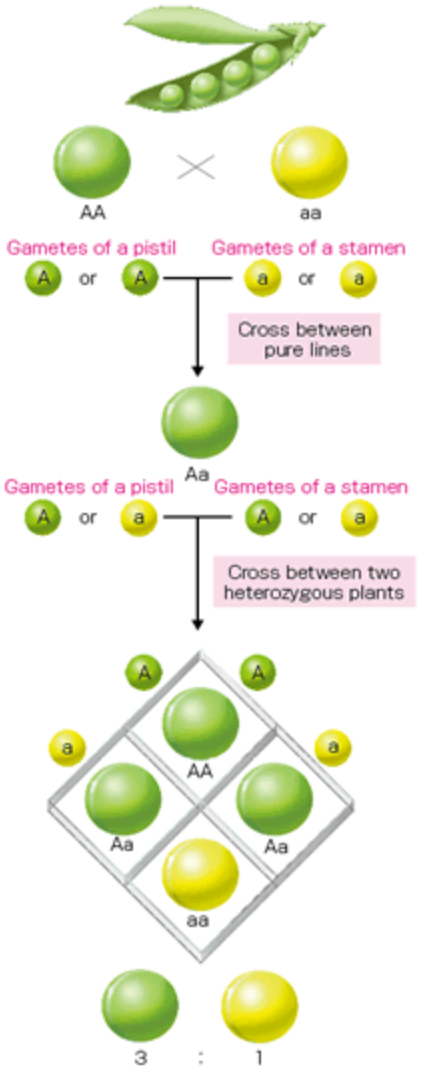
Figure 5.—Proposed location of the major southern pines during the Wisconsin Glaciation.



Simple vs. Quantitative Traits

Simple

- Categorical distribution
- Less influenced by the environment
- Monogenic traits
  - One to two loci with large effect on phenotype



http://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&docid=uMPndkKts1avTM&tbnid=5MBbIWda0tgLYM:&ved=0CAQQjB0&url=http%3A%2F%2Fcsls-text2.c.u-tokyo.ac.jp%2Finactive%2F03_01.html&ei=ClefUaf7BY3A9gTchIHgAw&bvm=bv.47008514,d.eWU&psig=AFQjCNE0jIo4mv89F4Tsi3LIhOGz5R91rQ&ust=1369483347057042

Quantitative vs. Simple traits

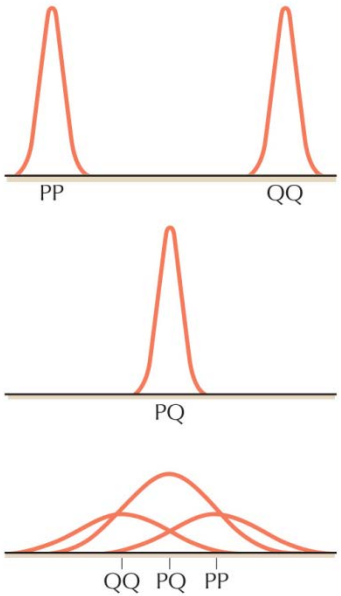
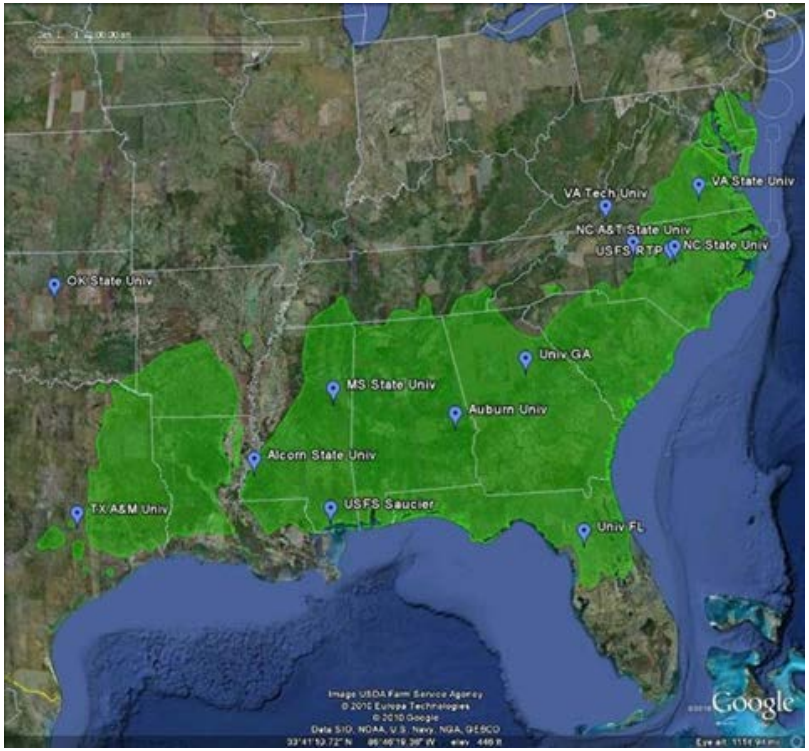


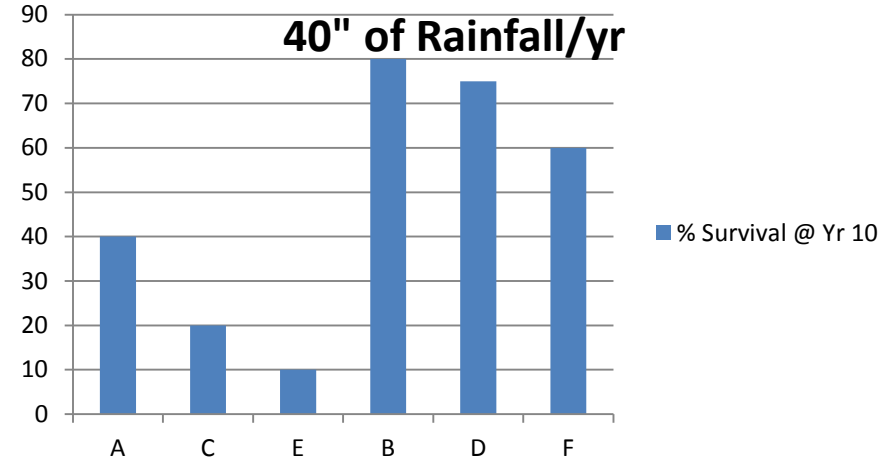
FIGURE 14.22. The distribution of a quantitative trait in individuals with different marker genotypes (PP, PQ, QQ) in parental, F_1, and F_2 generations.

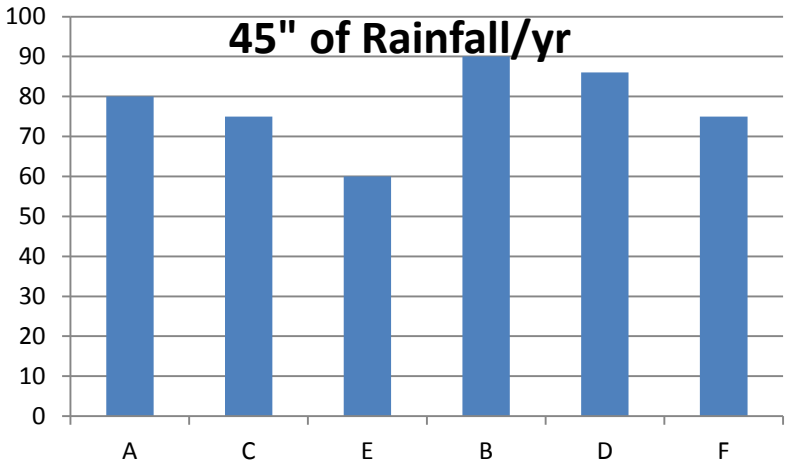
Quantitative/Complex

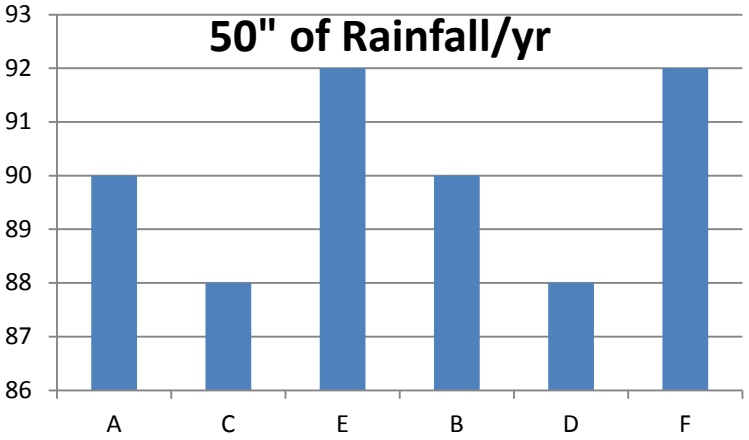
- Continuous distribution
- Phenotype is partitioned into genetic and environmental components
- Polygenic traits
  - Each locus has a small effect on phenotype

Influence of Rainfall on SURVIVAL of Genotypes from the Eastern & Western Loblolly Populations

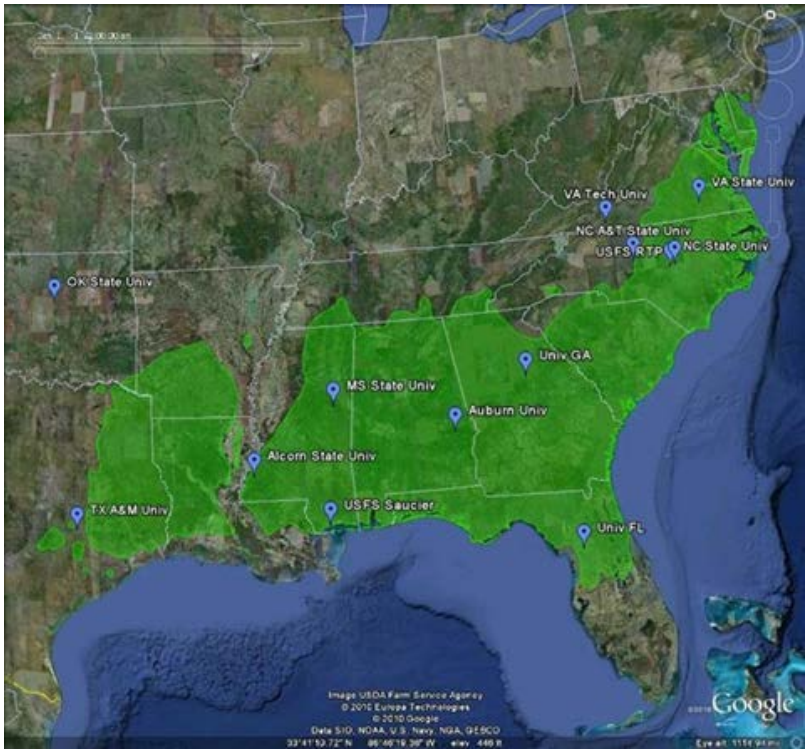


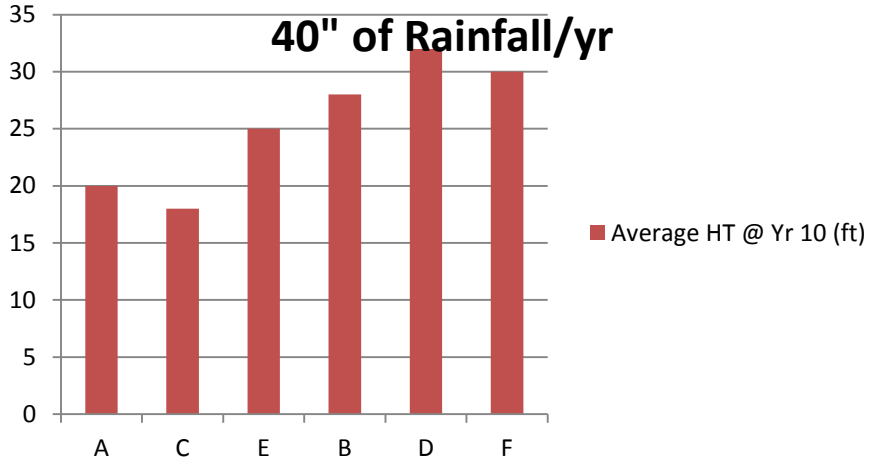


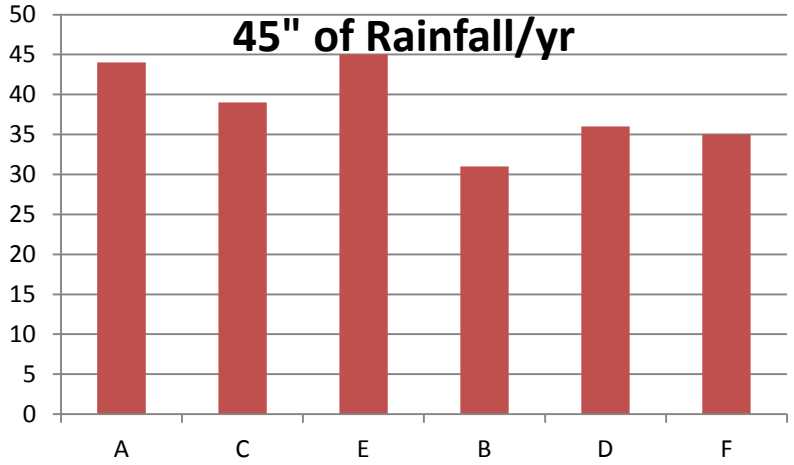


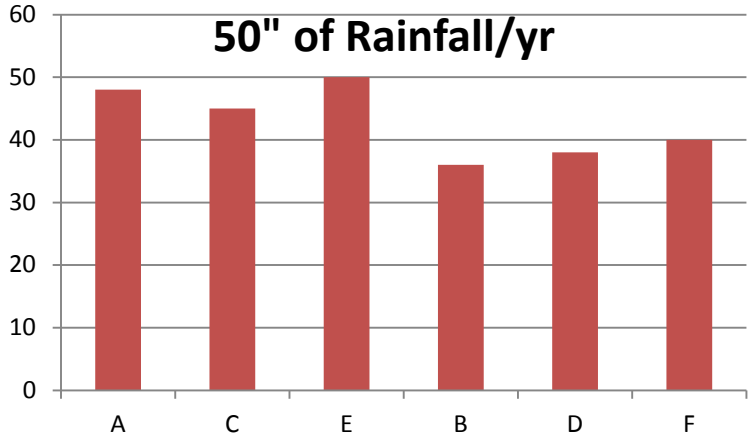


Influence of Rainfall on HEIGHT GROWTH of Genotypes from the Eastern & Western Loblolly Populations









Influence of Rainfall on Genotypes from the Eastern & Western Loblolly Populations