

# Project # 5



Nora Mitchell  
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# Tajima's D

Test statistic for determining whether sequence data are consistent with population being at neutral mutation-drift equilibrium

- ▶  $\hat{D} = 0$  : no evidence for change in pop size or selection
- ▶  $\hat{D} < 0$  : pop size increasing, or purifying selection
- ▶  $\hat{D} > 0$  : pop bottleneck, or diversifying selection

## *Pinus taeda*

This week's project deals with the loblolly pine, *Pinus taeda*

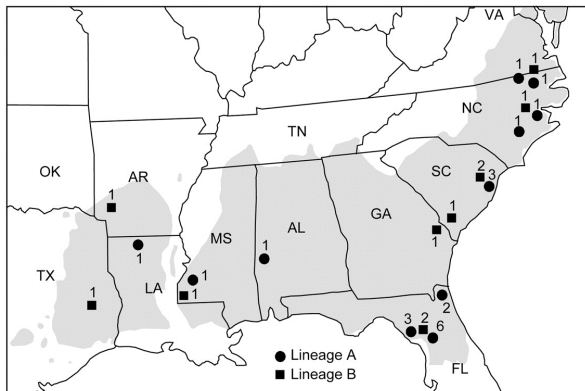


# *Pinus taeda*

- ▶ *Pinus taeda* is a species of Southern pine
- ▶ Usually found in muddy/swampy areas
- ▶ Largest sequenced genome, 22 Gb (7x size of human genome)

# Drought-stress response genes?

Gonzalez-Martinez et al (2006) investigated candidate genes for drought-stress sampled from 32 individuals



Let's look at both the coding and complete sequences for a subset of four loci

- ▶ *ccaomt-1*: caffeoyl-CoA-O-methyltransferase 1
- ▶ *cpk3*: calcium-dependent protein kinase
- ▶ *erd3*: early response to drought 3
- ▶ *pp2c*: protein phosphatase 2C-like protein

## Locus information

Locus	Coding	Complete
<i>ccaomt-1</i>	258	517
<i>cpk3</i>	378	630
<i>erd3</i>	625	882
<i>pp2c</i>	461	638

# Questions

1. Is there evidence for selection, a recent population expansion, or a recent population bottleneck at any locus when the complete sequence is considered?
2. Is there evidence for selection, a recent population expansion, or a recent population bottleneck at any locus when only the coding sequence is considered?
3. What kind of selection might account for the patterns revealed in your answers? Are the patterns of selection you detect consistent with these loci being adaptively important in drought responses?
4. Gonzales-Martinez et al. present evidence from microsatellite data that there is no significant population structure and no evidence for demographic processes. How strong is their evidence?



# Hints

- ▶ Use the `strataG` package and `tajimasD` function.
- ▶ If a locus is adaptively important in drought response, we might expect it to reflect the effects of directional selection rather than balancing selection.
- ▶ For question #4, you **MUST** back your answer up with logic, how did you arrive at your conclusion? I will not be 'giving' you an answer (think of it as a take-home exam question).

# References

- ▶ Gonzalez-Martnez, Santiago C., et al. "DNA sequence variation and selection of tag single-nucleotide polymorphisms at candidate genes for drought-stress response in *Pinus taeda* L." *Genetics* 172.3 (2006): 1915-1926.