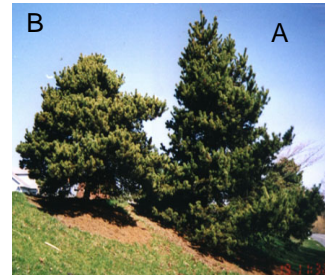


Natural Variation and Mechanisms of Evolution



Natural Variation

Why does one tree look different from another?



Why does one tree look different from another?

genes

environment

Genotype x E = Phenotype

Same question applies across scales

leaf → branch → tree → populations → race → species

Natural Variation and Its Sources

Scales of Variation

Source of Variation

Within individuals

Environment

Among individuals

Among populations

Among geographic races

Among species

Inheritance & Environment

Inheritance & Environment (evolution)

Within individuals:

Leaf variation between years

Pacific silver fir: *Abies amabilis*

Subalpine fir: *Abies lasiocarpa*



Chinook Pass

Within individuals:


growth form variation between centuries



Abies lasiocarpa: Medicine Bow Mountains, Wyo.

Within individuals

Don't underestimate the magnitude of variation within individuals




Leaves from one black cottonwood: *P. trichocarpa*

Leaves from one trembling aspen: *P. tremuloides*

VARIATION AMONG INDIVIDUALS

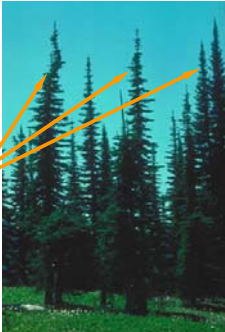
differences among trees



Riparian Forest, Snoqualmie River
Populus trichocarpa

VARIATION AMONG INDIVIDUALS


differences among trees




Abies lasiocarpa
Paradise, Mt Rainier

***Pinus caribeneana* – Merida, Venezuela**

differences among trees



How do we identify the source of variation among individuals? A TEST!



B A


1) PROGENY TEST:

Observe progeny in a common garden to test for genetic differences between parents.

Progeny are trees from crosses between different parents

Parents A x C

Parents B x C




PROGENY TEST

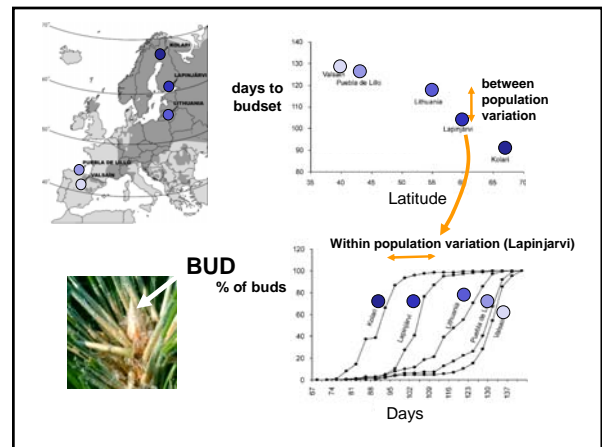
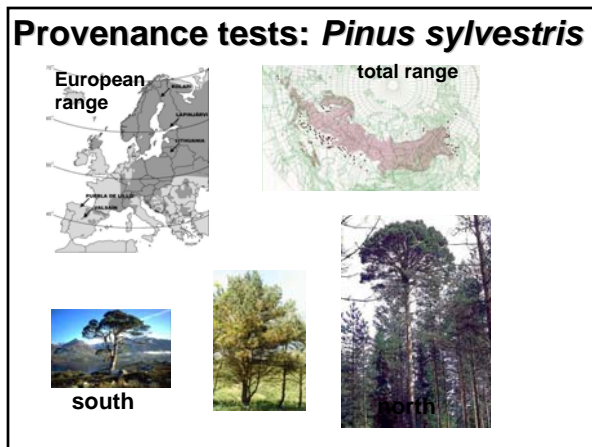
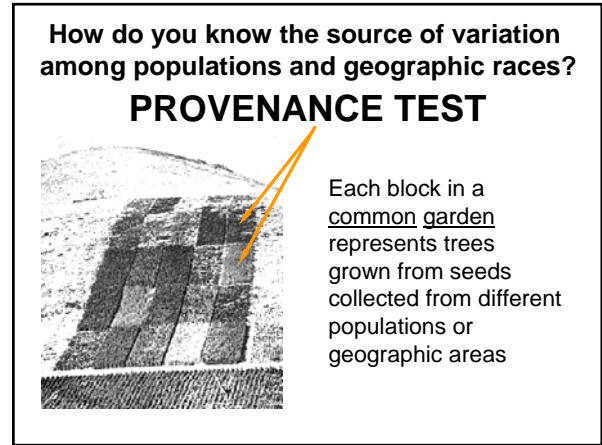
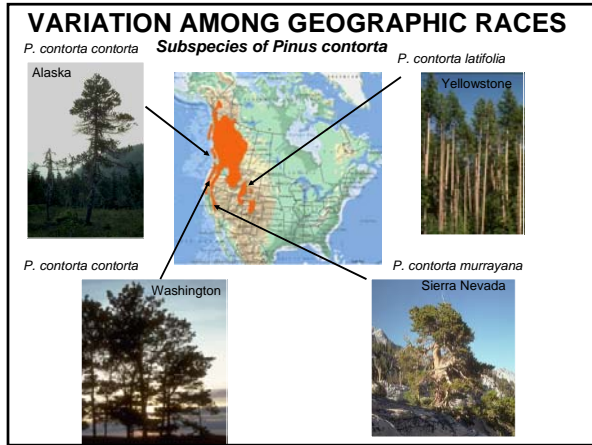
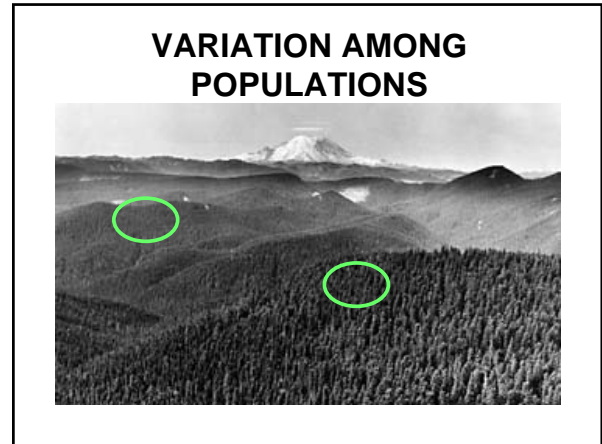
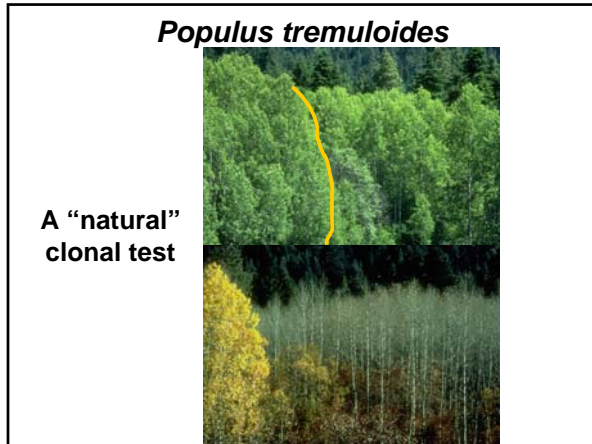
Sources of variation among individuals

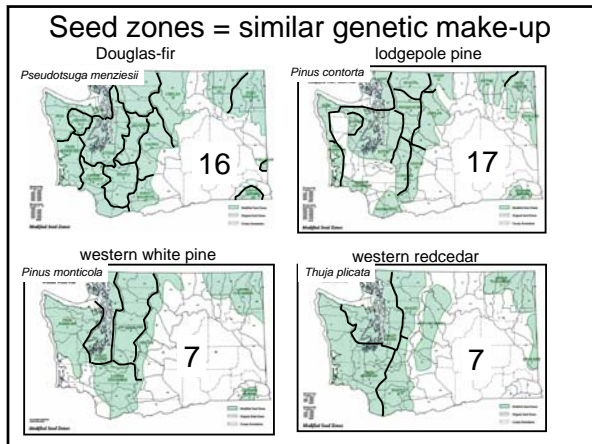
2) CLONAL TEST

Observe differences among clones in a common garden to test for genetic differences among individuals



Populus hybrid clonal test





Natural Variation: So What?

Fundamental characteristic of plants (& animals)

Fundamental to management strategies and practices (even when not explicitly recognized): production, restoration, conservation/preservation

Poorly understood, difficult to study, and no single story

What about endophytes as sources of natural variation?

Definition: fungus or bacteria growing inside of a plant

white pine stomates

grass leaves

bud meristems
stem tissue of woody plants
seeds