Coastal Forest Health: Themes and Variations

Senescence

- Strictly speaking, senescence = a *programmed* aging and death process of either plant parts of whole plants

- Humans undergo senescence in the strict sense, but few if any perennial plants do

- Perennial plants undergo **demographic senescence**: reduced fecundity and increased mortality correlated with increasing age beyond the onset of reproduction

- Many abiotic and biotic factors in a tree's environment can contribute to demographic senescence. Some are relatively predictable, some less so

Pattern 1: Accelerated demographic senescence of shade-tolerant species

Grand fir (Del Norte to Sonoma Counties)

- Large, "old" trees
- Less potent defense systems
- Numerous native natural enemies
- Balsam woolly adelgid: problem or not?
- Recruitment not as great a concern because of shade tolerance: grand fir will probably be with us into the future, rapidly filling unmanaged open spaces

Pattern 2: Accelerated demographic senescence of shade-intolerant species

Coastal pines (Del Norte County to southern California)

- Large, "old" trees
- Less potent defense systems
- Numerous native natural enemies
- <u>Introduction of aggressive non-native pests</u> contributes to this pattern, but also puts some of them in Pattern 4
- Active management probably necessary to maintain new generations because of need for open conditions
- On some sites, pines may have invaded more historically open vegetation types

Black and white oak woodlands (much of the state)

- Mismanaged successional pattern? Good news, management can correct!
- Oaks cope well with reset to earlier, more open successional conditions

Pattern 3: Vigorous but Beleaguered

Sitka spruce (Humboldt County)

- Trees of all sizes
- Non-native defoliators in periodic outbreaks
- Stress from pollutants and drought?
- Limited number of native pests (but beware *Phaeolus schweinitzii*)
- High capacity for fast growth
- Are some of these invaders of open spaces?
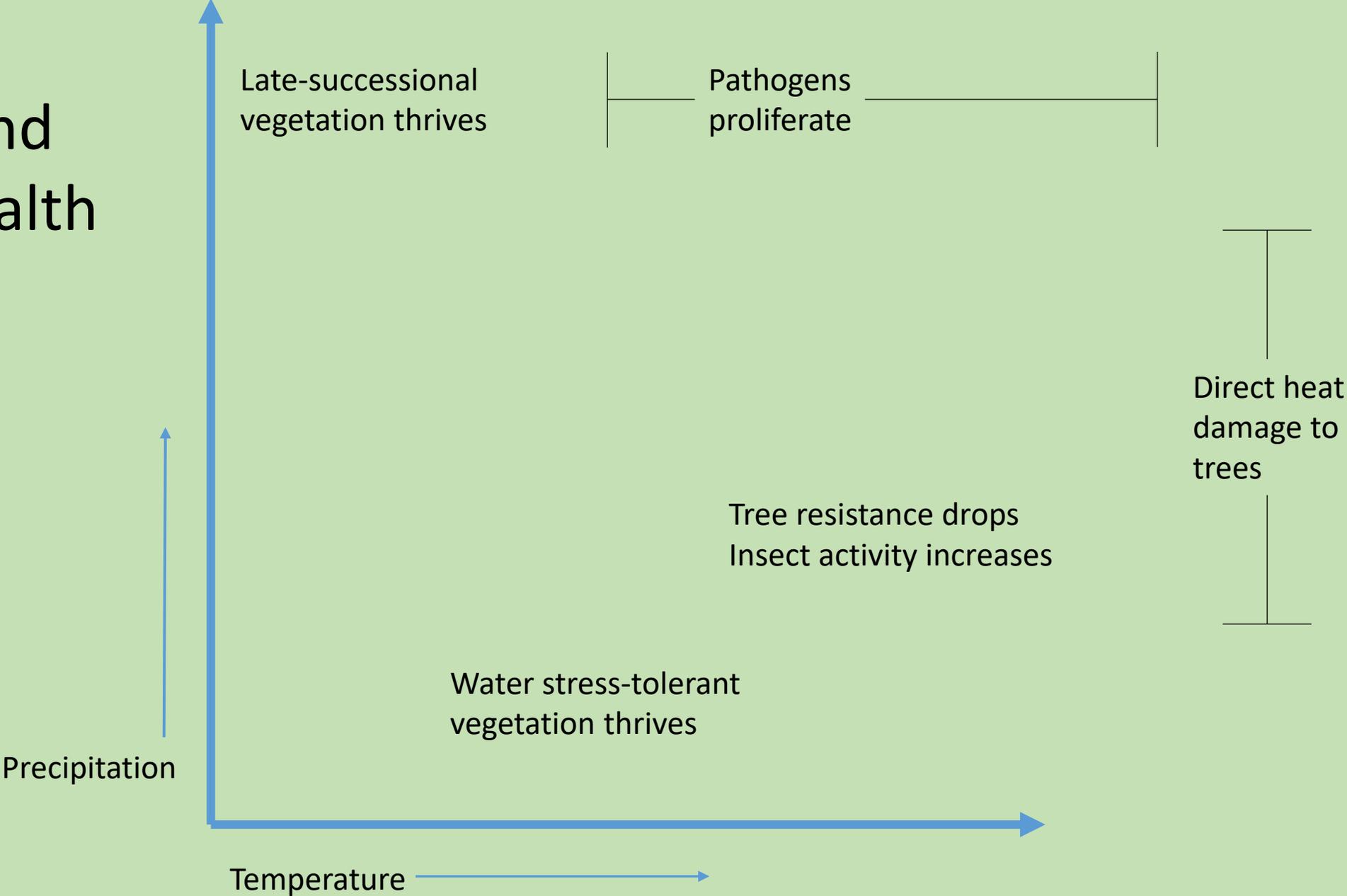- Very little total mortality so far

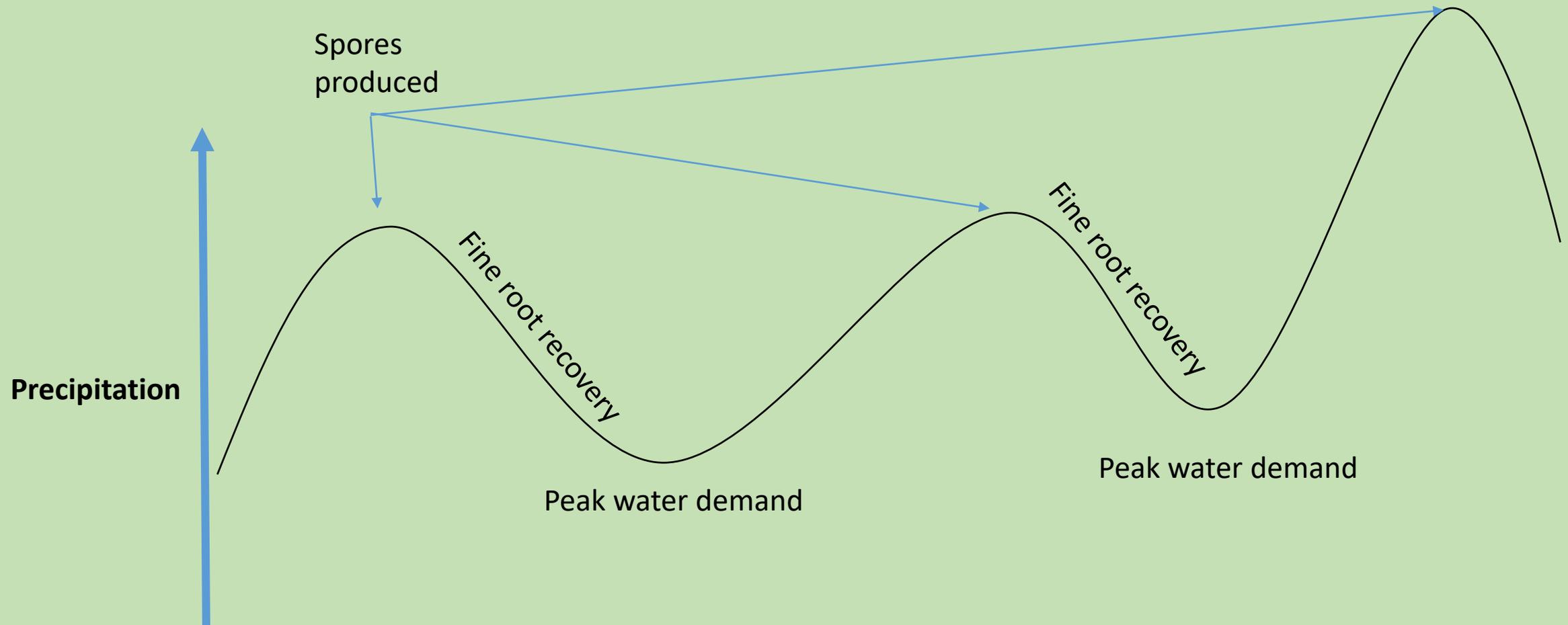# Pattern 4: Killing by Non-native Pathogen or Insect

Many host tree species

- Rapid mortality of large numbers of individuals
- Little if any natural resistance (potentially some resistance to pitch canker)
- Few effective management options
- Examples in coastal counties so far: SOD, POC root disease, pitch canker, invasive shothole borers, goldspotted oak borer. Which tree species is next?
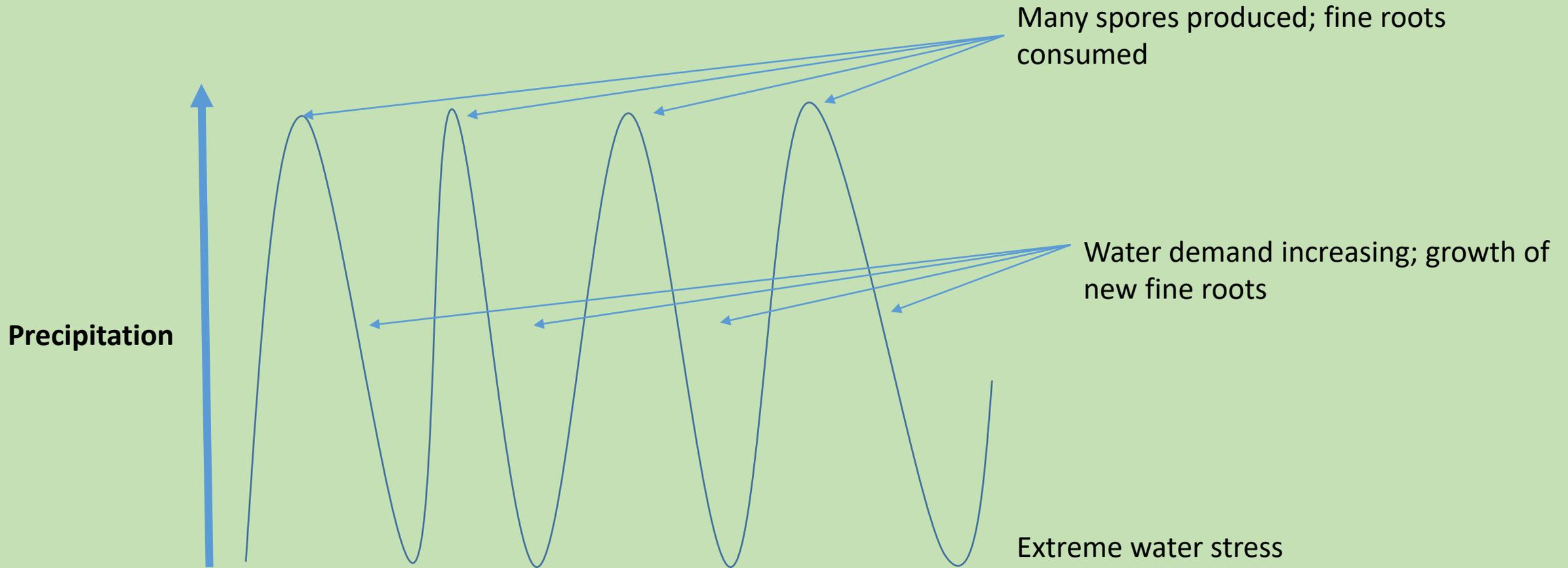
Climate Change and Forest Health

Late-successional
vegetation thrives

Pathogens
proliferate

Direct heat
damage to
trees

Tree resistance drops
Insect activity increases

Water stress-tolerant
vegetation thrives

Precipitation

Temperature

"Normal" precipitation scenario

Hydroclimate whiplash and *Phytophthora*

Many spores produced; fine roots consumed

Water demand increasing; growth of new fine roots

Precipitation

Extreme water stress

Finally . . .

- Douglas-fir and coast redwood are not immune—particularly to any as-yet unidentified non-native invaders

Douglas-fir: native pest problem
Douglas-fir pole beetle
Flatheaded fir borer

Coast redwood: non-native pest problem
Non-native *Phytophthora* spp.
Fusarium and *Ilyonectria* root pathogens