Forest ecosystems

-Ecosystem -> A community of organisms, their interactions (biotic, and abiotic), and the movement of energy and matter between them

- Community -> Populations of multiple species within a given area
- Population -> A group of individuals of the same species within a given area

What are some key prcosesses that shape forested ecosystems ->

- Climate (evolutioanry selection agent)

- **Disturbances! -** A process/event that alters the ecosystem - change in biotic or abiotic conditions of the ecosystem

Endogenous Disturbance

Endo = within; genous = genesis - formed -- Endogenous - formed within an ecosystem

- Fire? -- Lightning (weather) - often views as exogenous; Cultural fire; other species use of fire within ecosystems CAN BE endogenous - Fire Hawks - Austrailain brid of prey
- Insect/Disease outbreaks - native insects/disease cause tree mortality

Exogenous distrubance

Exo = outside ; exogenous means formed outside the ecosystem

Fire as a primary exogenous disturbance

- Flooding/landslides/ other extreme weather events
- Land use change - human development
- Many people also exist within ecosystems
- Invasive species


Michael Penke Photography

Intensity/Severity -

Intensity = The energy released or the energy of the disturbance... Fire: Heat; Flood: CFS
Severity = The effects the disturbacne on the ecosystem.
Categorical = Low; Moderate; High -- Fire: Tree mortality (**crown burn severity - <20%; 20-80%**; >80%). **Soil Burn Severity: organic matter consumption**

Frequency -

How often the distrubance occurs within the ecosystem. 5-30 year = frequent fire forest. (ponderosa) 300+ year infrequent fire (spruce fir).

Scale/Extent -

How large is the disturbance? What area is impacted by the disturbance?

- 100 acre OR **340,000** - watershed?
- -- What area was impacted by what severity/intensity?

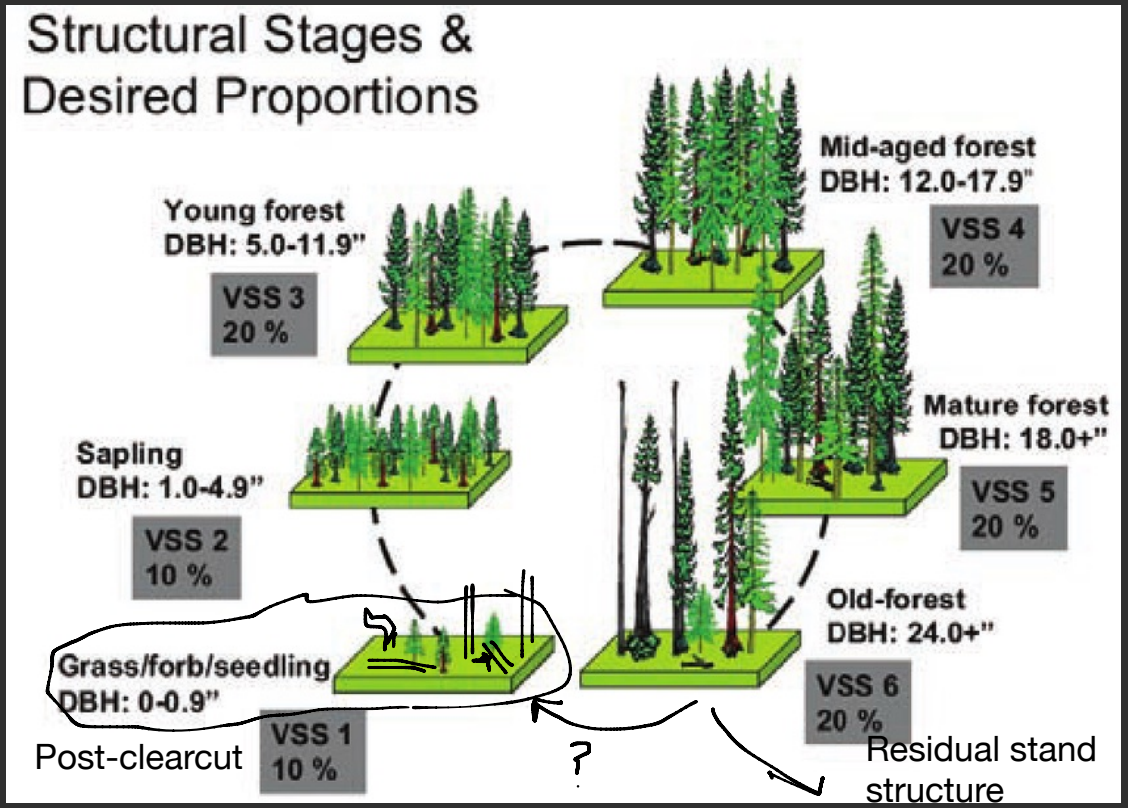
Disturbance and forest development -

- Disturbances contribute to nutrient cycling - helps promote new growth

Stages of stand development -

1. Stand initation - seedling growth in openings following high severity disturbance (exogenous)
2. Stem exclusion - Competition begins removing indiviudal trees (endogenous; low)
3. Understory reinitation - tree mortality creates gaps and openings for new recruitment in the understory (endogenous; low - moderate -- exogenous; low-moderate) --
4. Old growth - tree mortality and downed wood continue to diversify forest structure (endogenous; low-moderate; exogenous (low-moderate))


Stand initiation
Stem exclusion
Understory reinitiation
Old-growth



- High severity disturbance could result in new species?
- Disturbance removes residual structure of the ecosystem

- Stand continues to develop; despite shifts in species composition

How does understanding ecosystem process influence stand development and therefore forest management?

Forest Mangement that mimics natural disturbance and process

Ecological implications on Forest Management

Anticipating disturbance --
- **Wildfire risk reduction/mitigration** (WUI)
- Flood risk reductiobn etc
-- HVRAs - Highly Valued Resources and Assetts = Items that can be damaged by fire

Determines species composition and struction
- **Fire (flood)** tolerance, shade tolerance, water tolerance (dry adapted vs wet adapted)
-- Environmental filters determine species composition

- What is the species compoisition of a ponderosa pine forest that experiances fire every 5-7 years?
-- big ponderosa! GCI spatial pattern (groups, clumps, individuals, openings) (groupy-clumpy)
-- PIPO is fire tolerant/resistant

- What is the species composition of a ponderosa pine forest that has not experianced fire in 100+ years?
- -- Lots of small trees, dense, uniform composition - PIPO, ABCO, PSME
- -- Shade tolerant species establishing in the understory

Managing these two scenarios

- Large old PIPO, **GCI**, Frequent Fire forests

-- Prescribed fire to maintain the fire regime (managed fire)
-- Selective thinning (particallary in more desne parts of the stand) - Fuel Wood
-- Some removal of saw grade timber - Indiviudal tree selection
-- Maintain these things
- GCI
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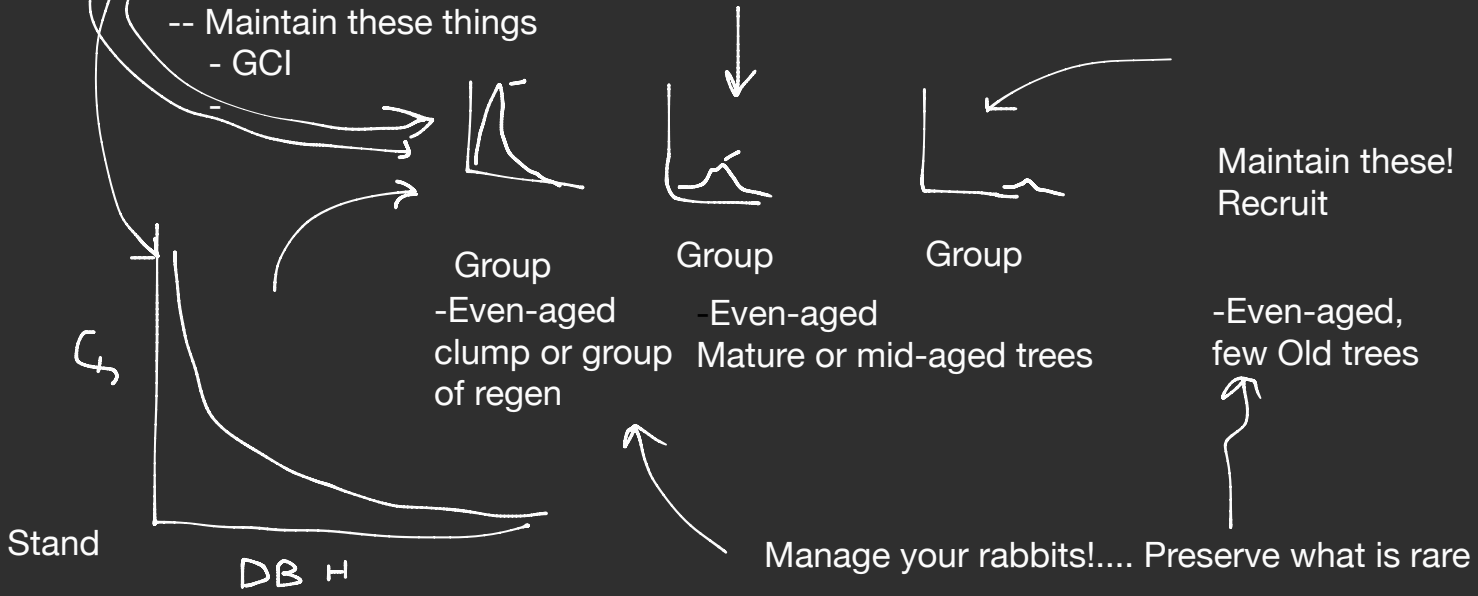
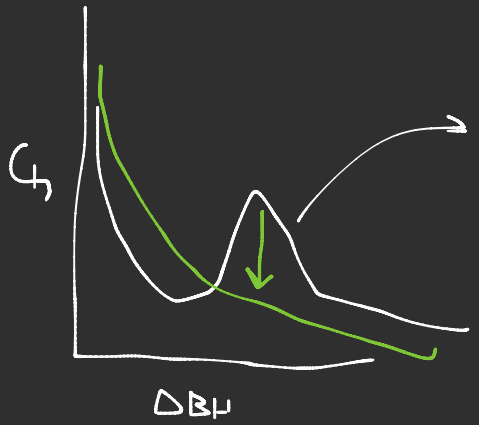
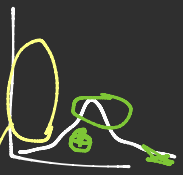


Managing a ponderosa pine forest that has not seen fire in 100 years

Logged piror to fire supression; white fir in understory





PIPO

White fir

What are our rabbits?

Promote: heterogenity

- GCI (thin from below)

Mangement actions:

- Fire
- -Mixed severity
- Thinning
- - Costly with little to no econopmic return
- Large tree removal?

GOALS

Promote PIPO regen

Removing white fir and middle aged PIPO

Promote large tree, old tree recruitment