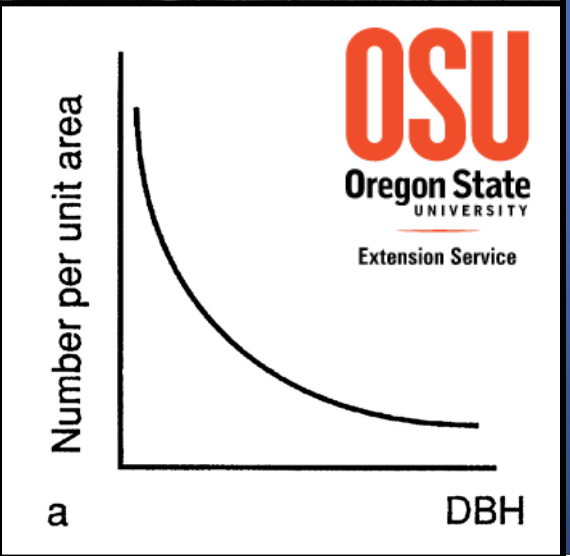

OSU
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Extension Service

Using Uneven-aged Management as a Restoration Strategy in Ponderosa and Dry Mixed Conifer Forests

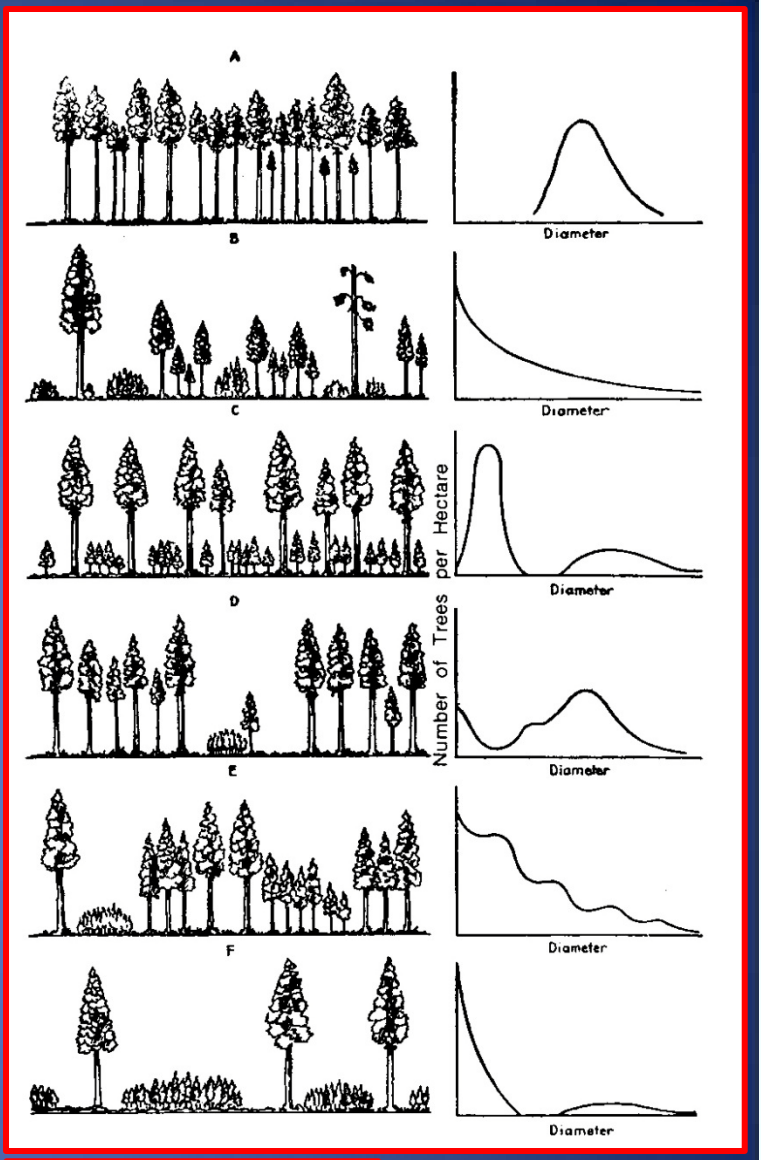
Stephen Fitzgerald
Oregon State University

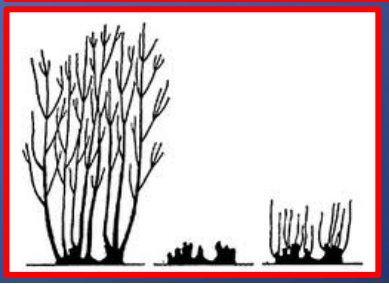
Presentation

- Overview of Uneven-aged Management (UEM)
- Historic structure of ponderosa & dry mixed conifer forests
- Demonstration of UEM in second-growth ponderosa pine forest
- Summary

Silvicultural Systems

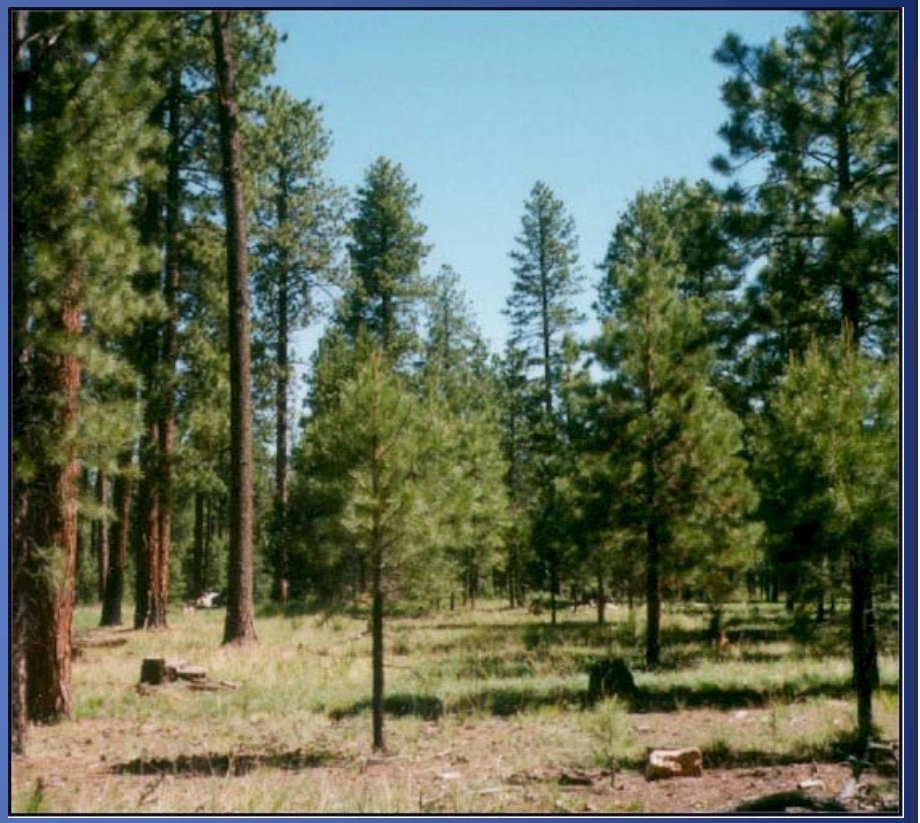
- Even-aged
  - Clearcutting
  - Shelterwood
  - Seedtree
- Two-aged
  - Shelterwood with reserves
- Uneven-aged
  - Individual tree selection
  - Group selection
  - Free selection
- Coppice



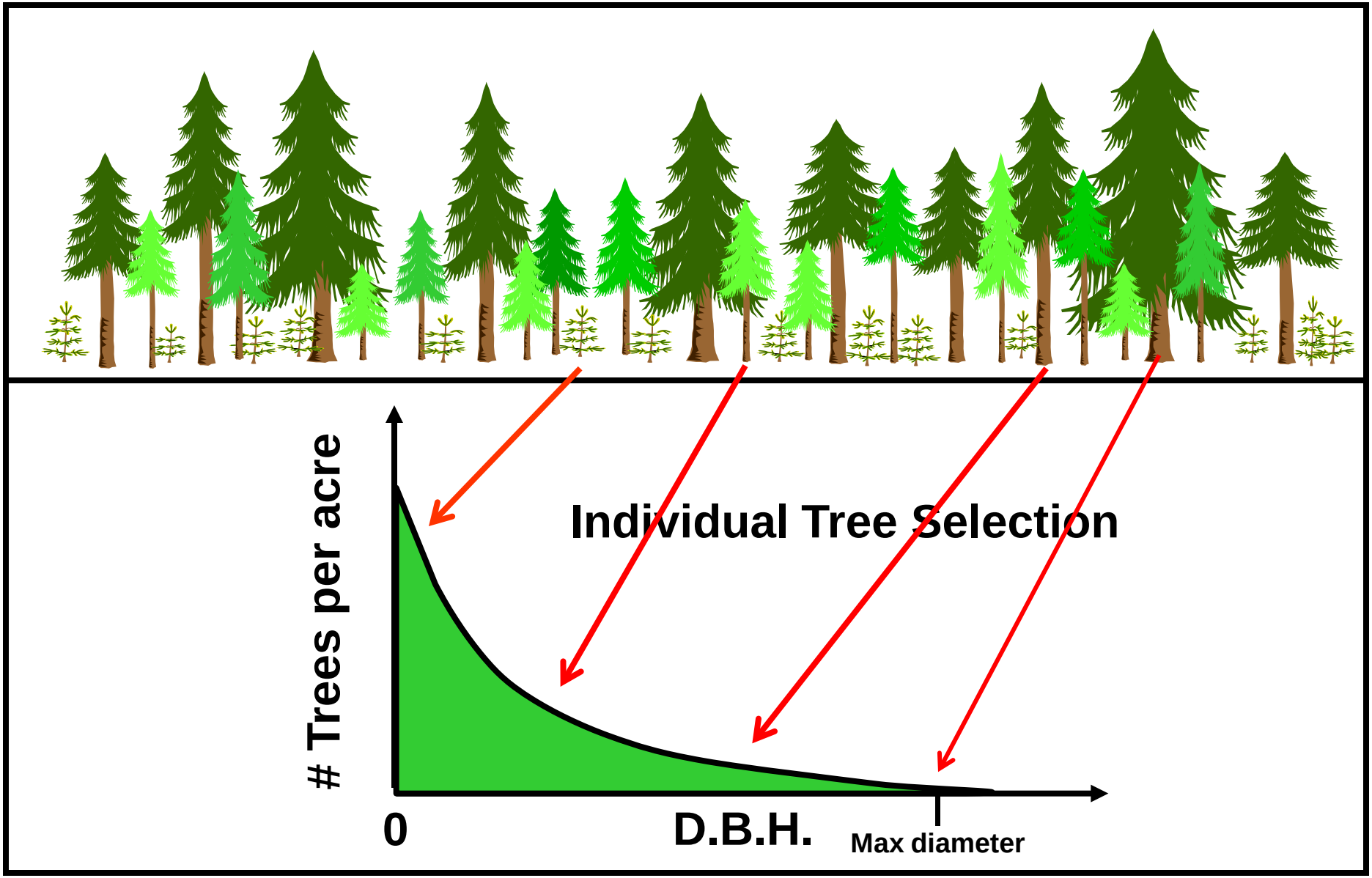


Overview of UEM

- Defined as having 3 or more age classes
- Methods include:
  - Individual Tree Selection
  - Group Selection
  - Free Selection
- Periodic entries to create/ maintain age classes
- Tree thinning occurs throughout the entire diameter range.

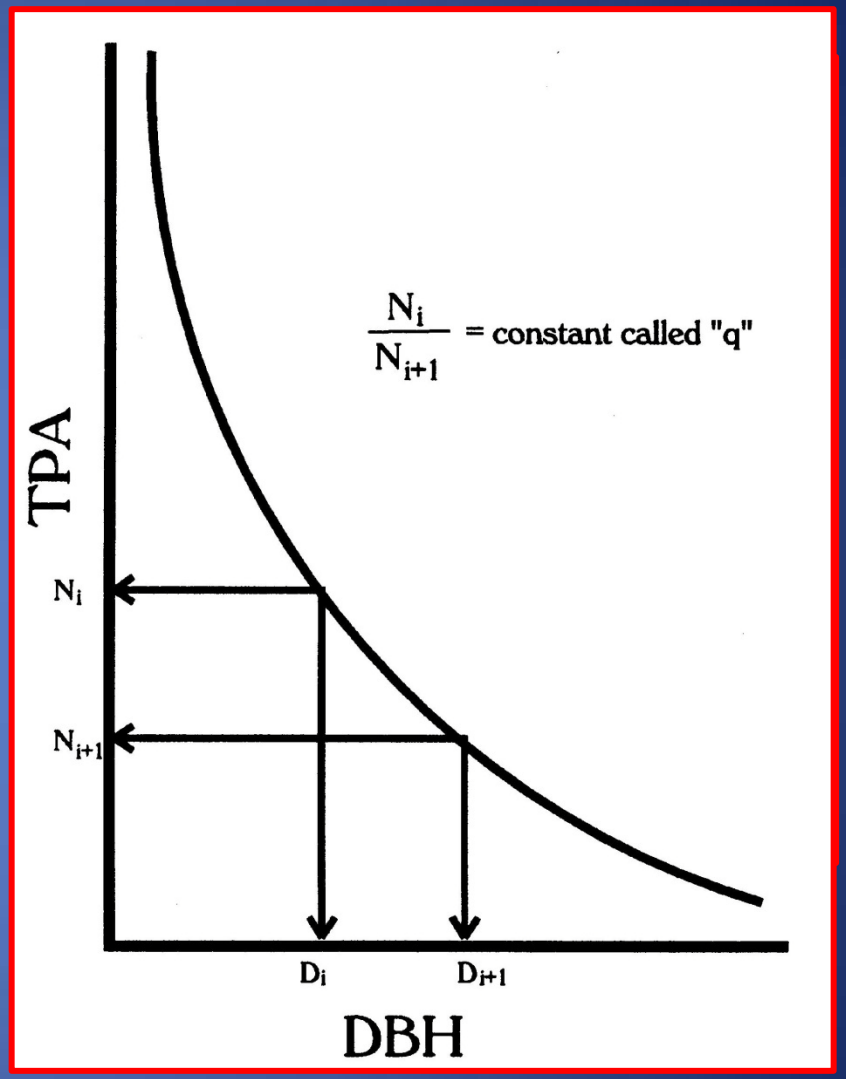


UEM on the North Kaibab Ranger District


Individual Tree Selection
Trees per acre
0
D.B.H.
Max diameter

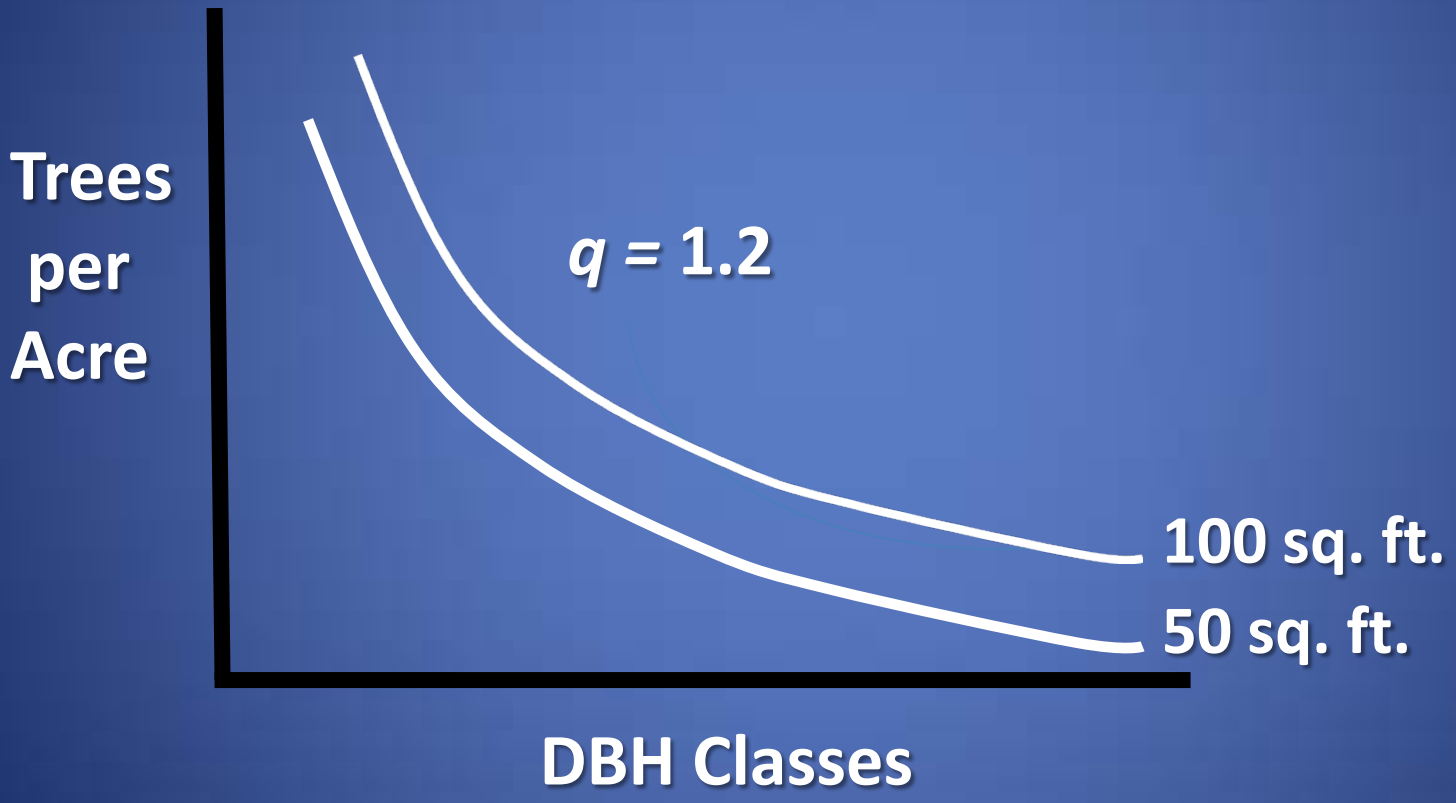
Overview of UEM

- "Reverse-J" shape curve
- Negative exponential probability function
- Ratio of the number of trees in succeeding DBH classes (*q*-factor)



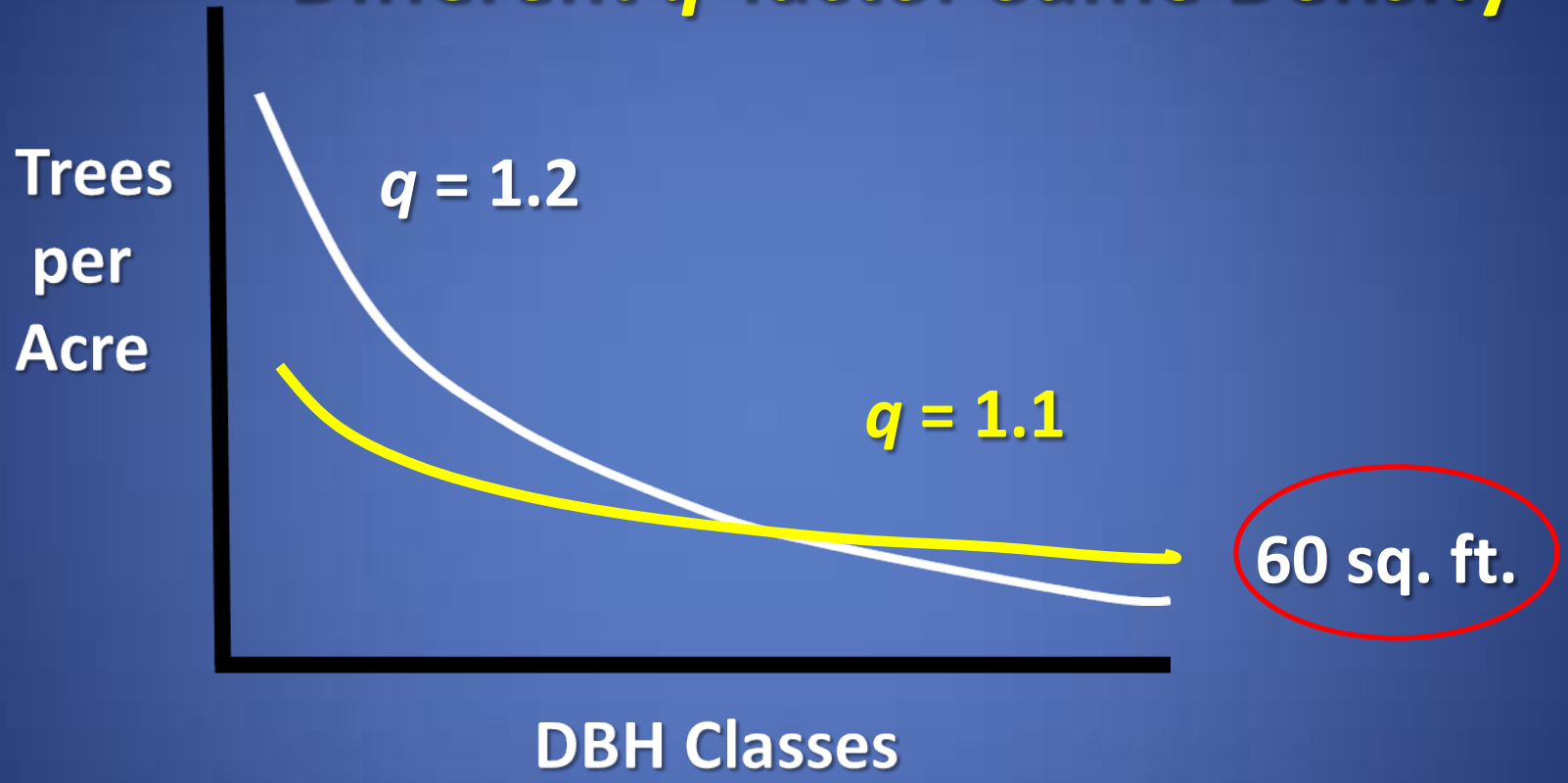
Overview of UEM

Same *q*-Factor Different Densities



Overview of UEM

Different *q*-factor Same Density

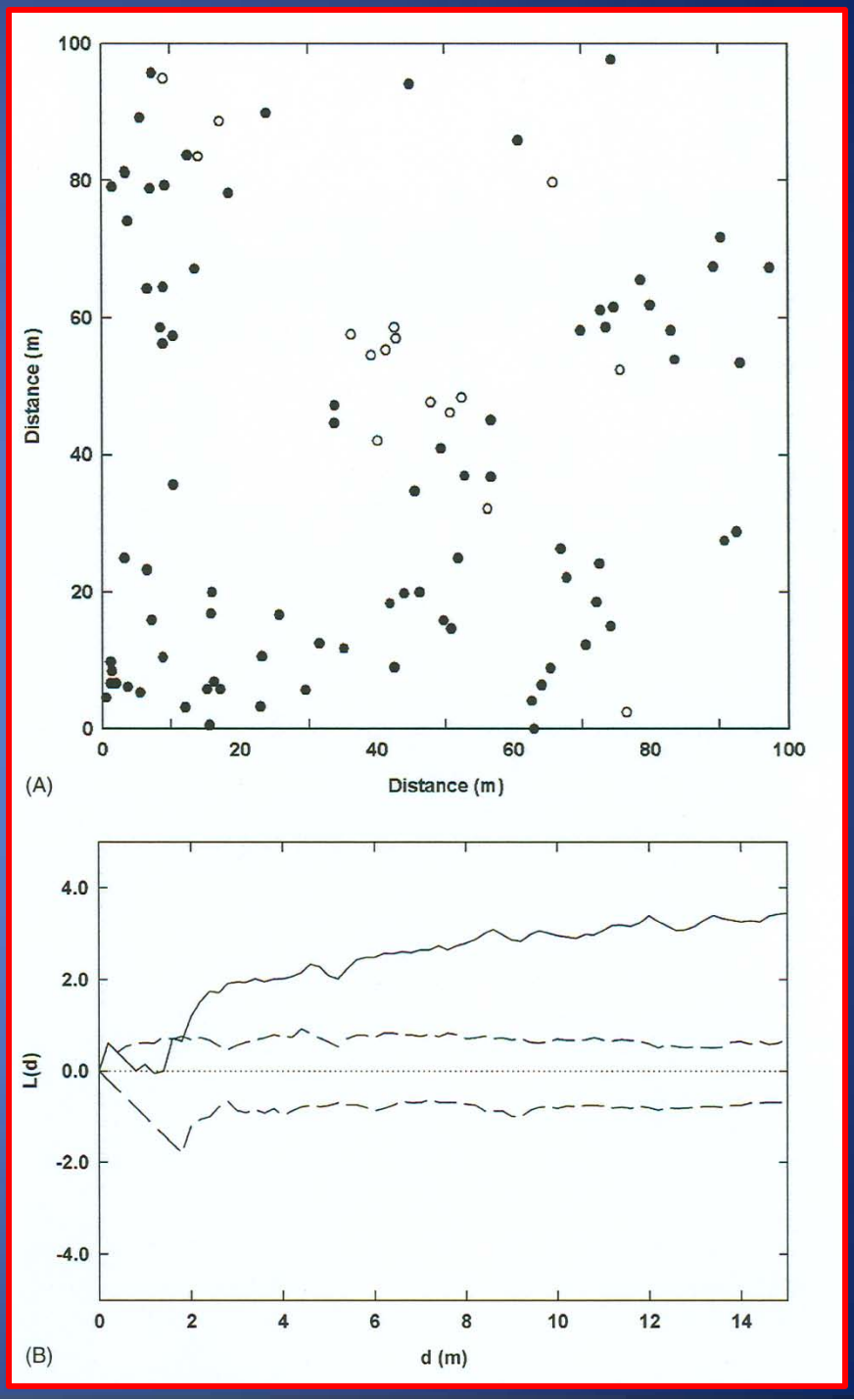


Historic Stand Structure

Historic Stand Structure

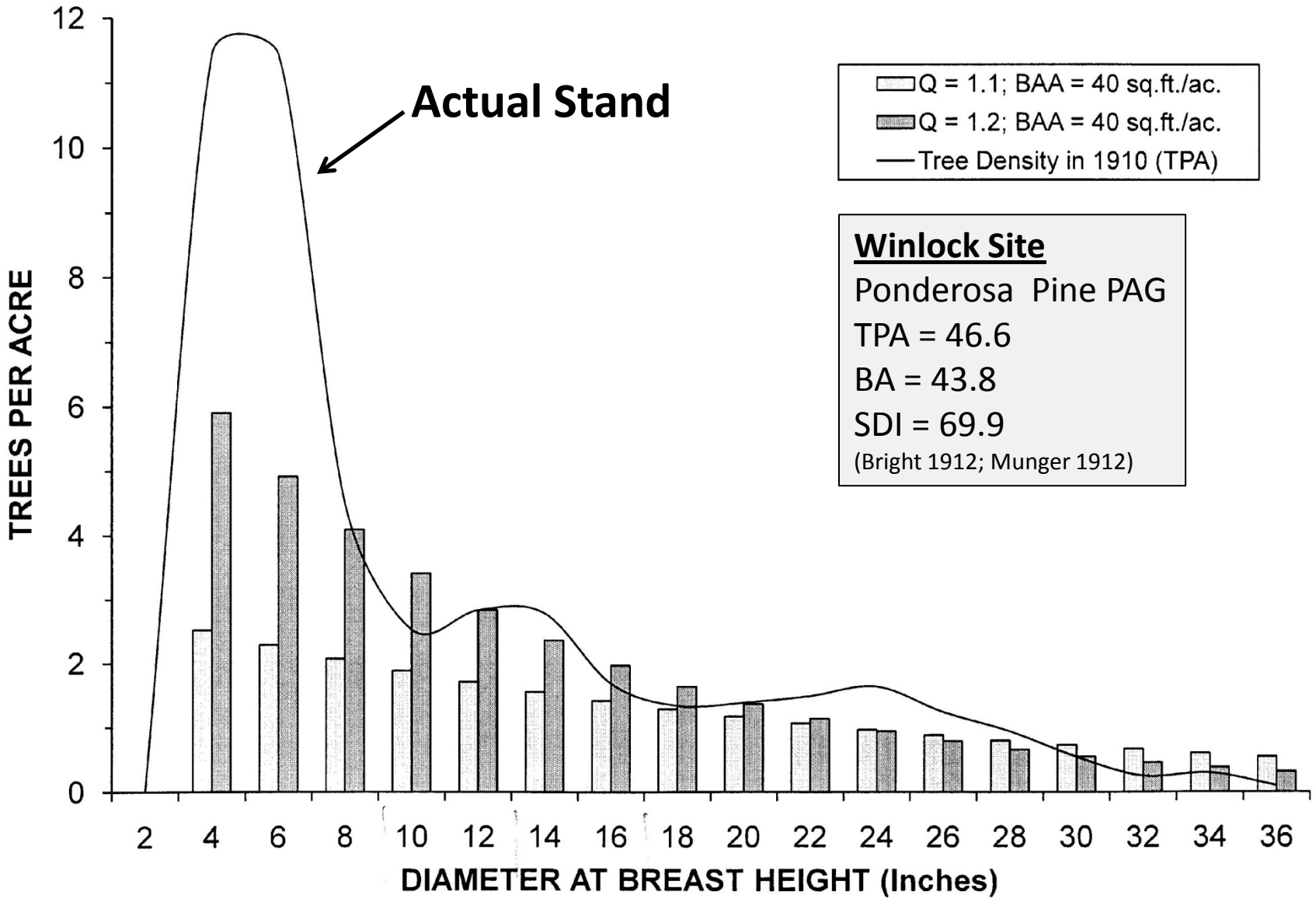
- Large diameter trees
- Widely spaced within clumps
- Numerous openings of varying size

(Youngblood et *al.* 2004)



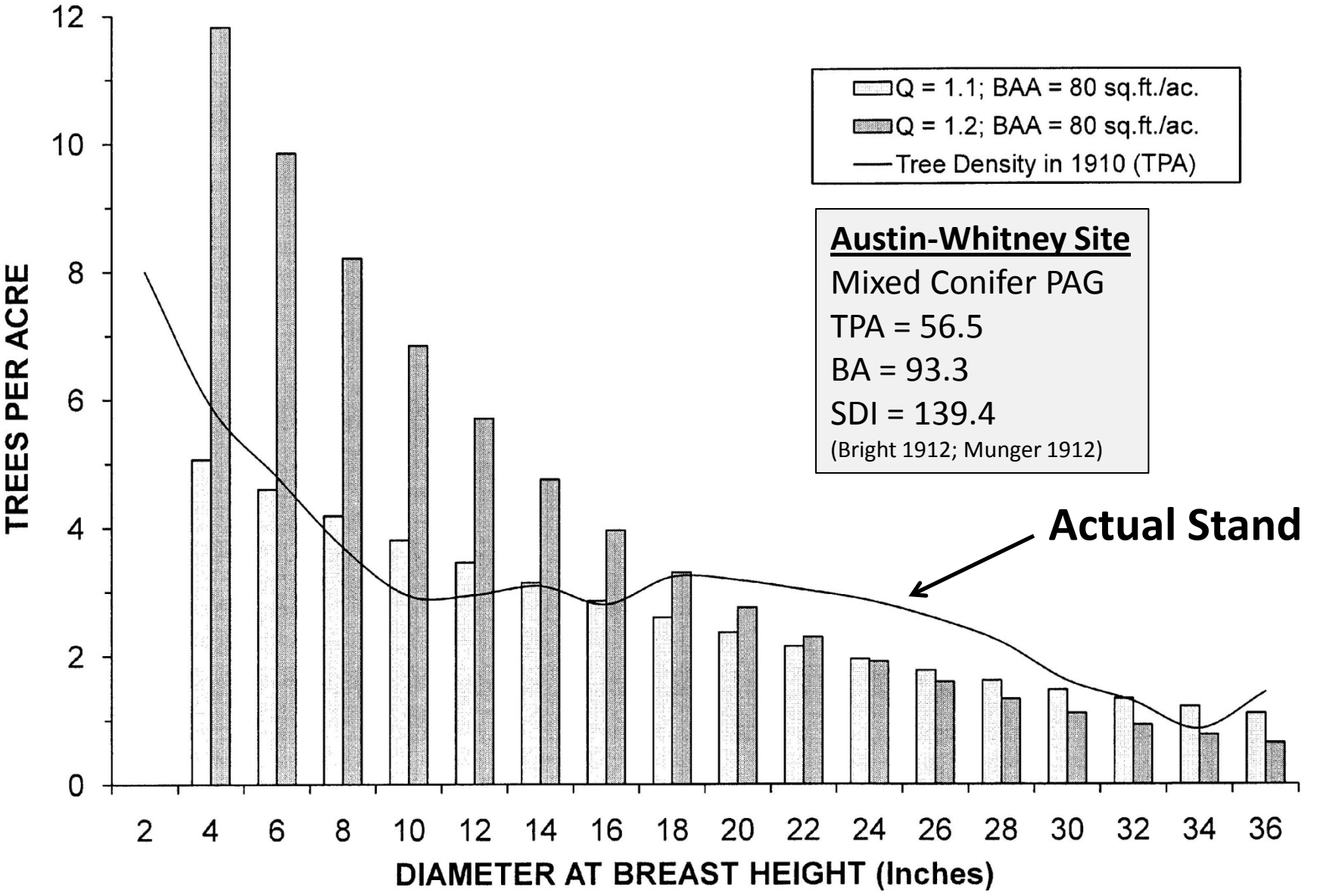
Historic Stand Structure

(Adapted from Powell 2010)



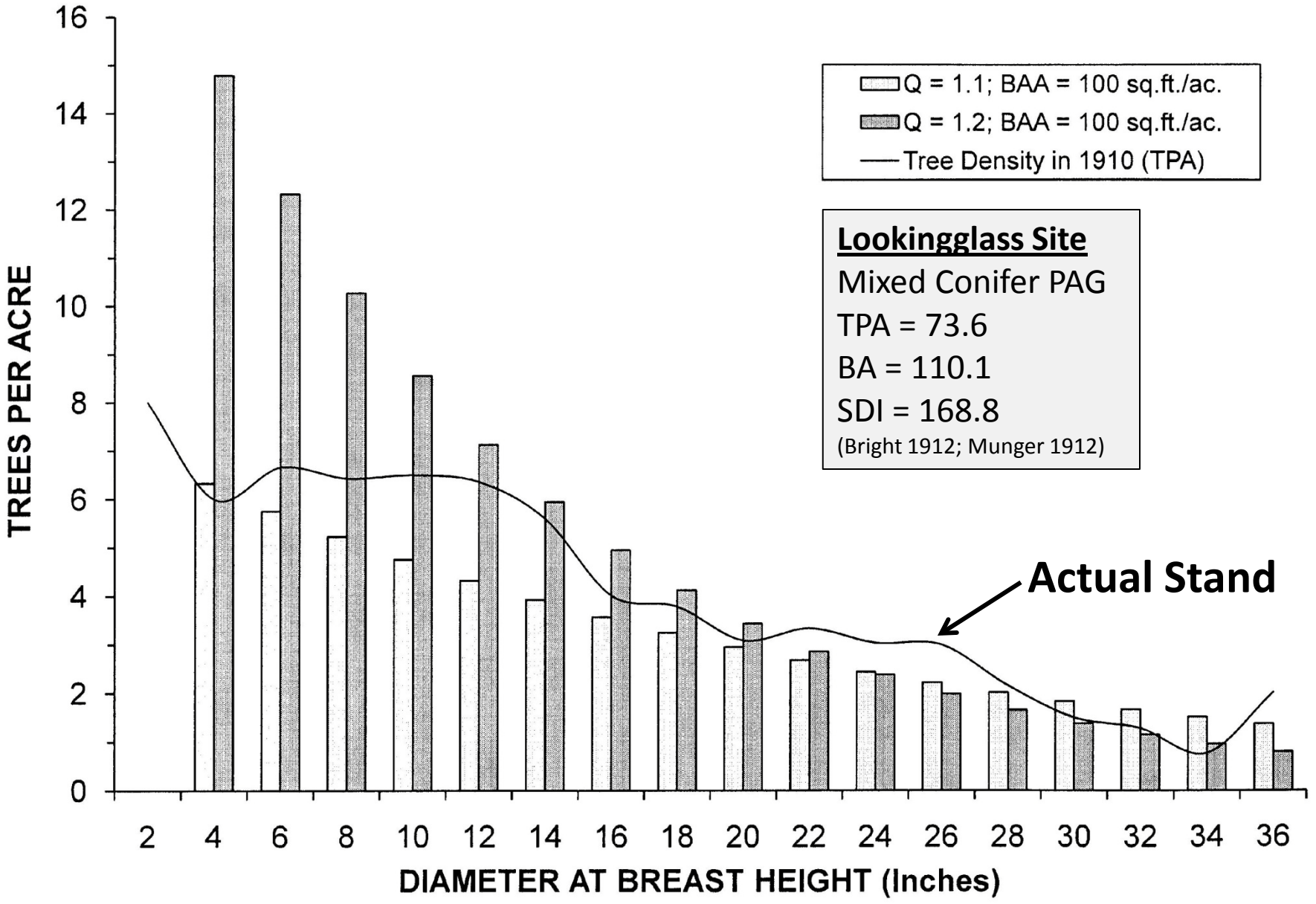
Historic Stand Structure

(Adapted from Powell 2010)



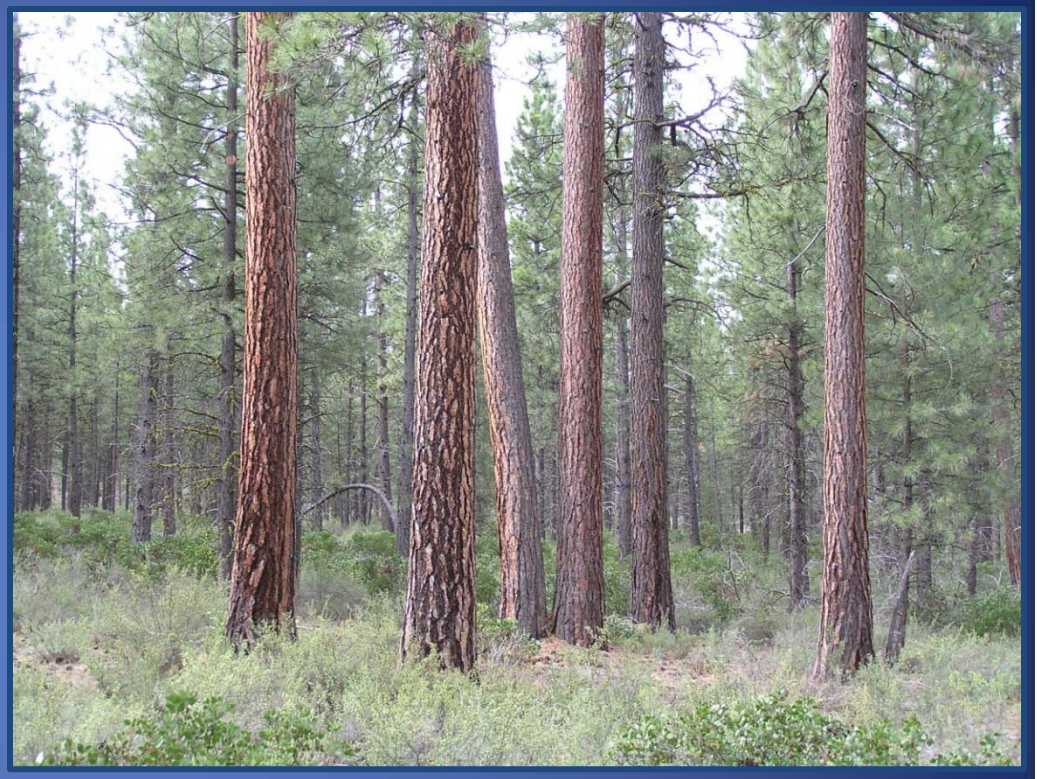
Historic Stand Structure

(Adapted from Powell 2010)



Example in Second-Growth Pine

- Desire to rebuild fire-resilient forests
- Re-create open, multi-aged stands dominated by large trees.
- Where sustainable long-term timber harvest is an important objective
- Few pre-settlement trees present



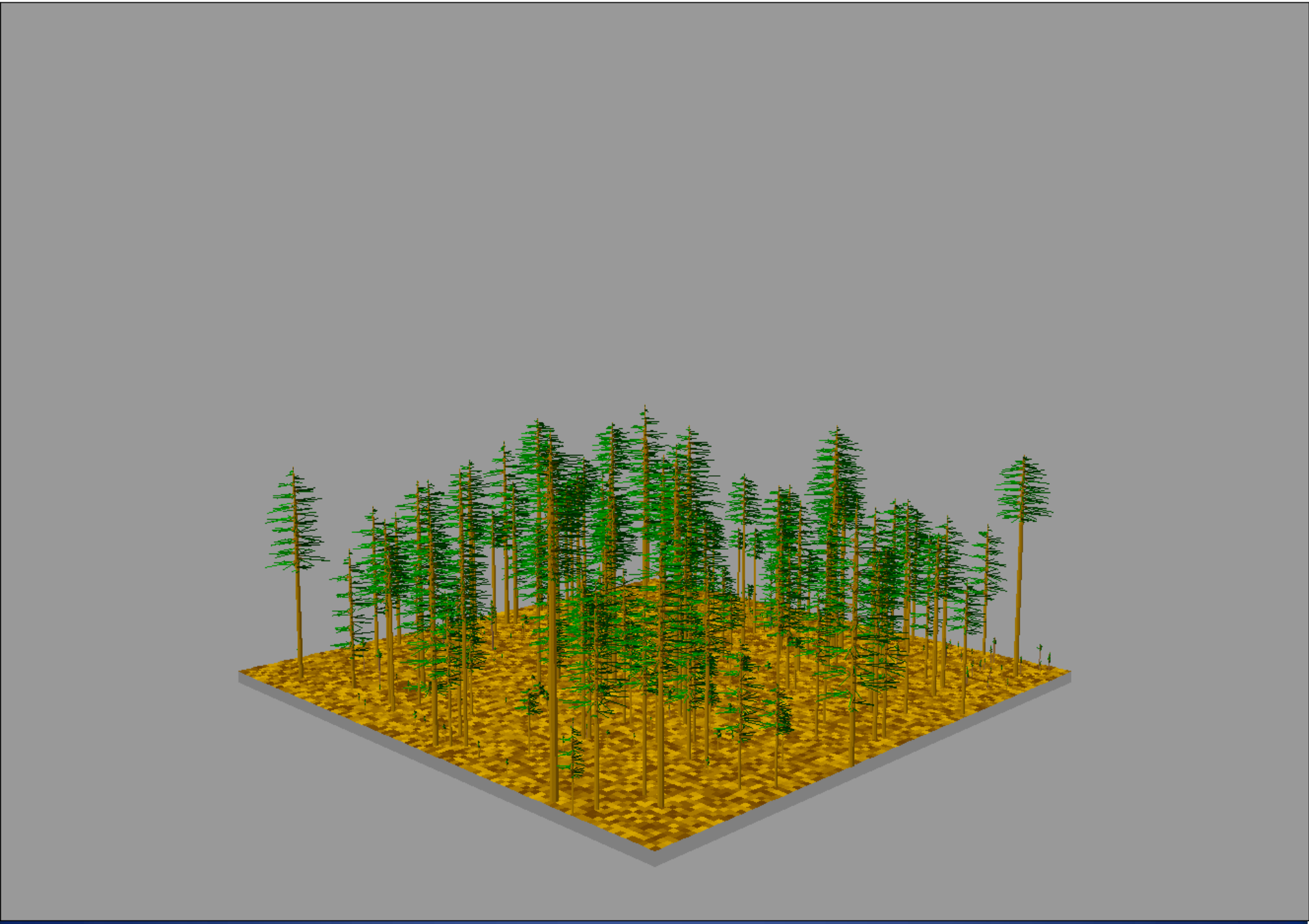
Initial Stand Conditions

- OZ Research Site (700+ acres)
  - Control
  - Wide thin (from below)
  - Thin + group openings
  - Uneven-aged
- Even-aged with a few, scattered larger trees
- 80-90 years old
- Ponderosa pine/bitterbrush/fescue PAG
- TPA = 124.5 (> 4”)
- BA = 111.5 sq. ft.
- SDI = 189

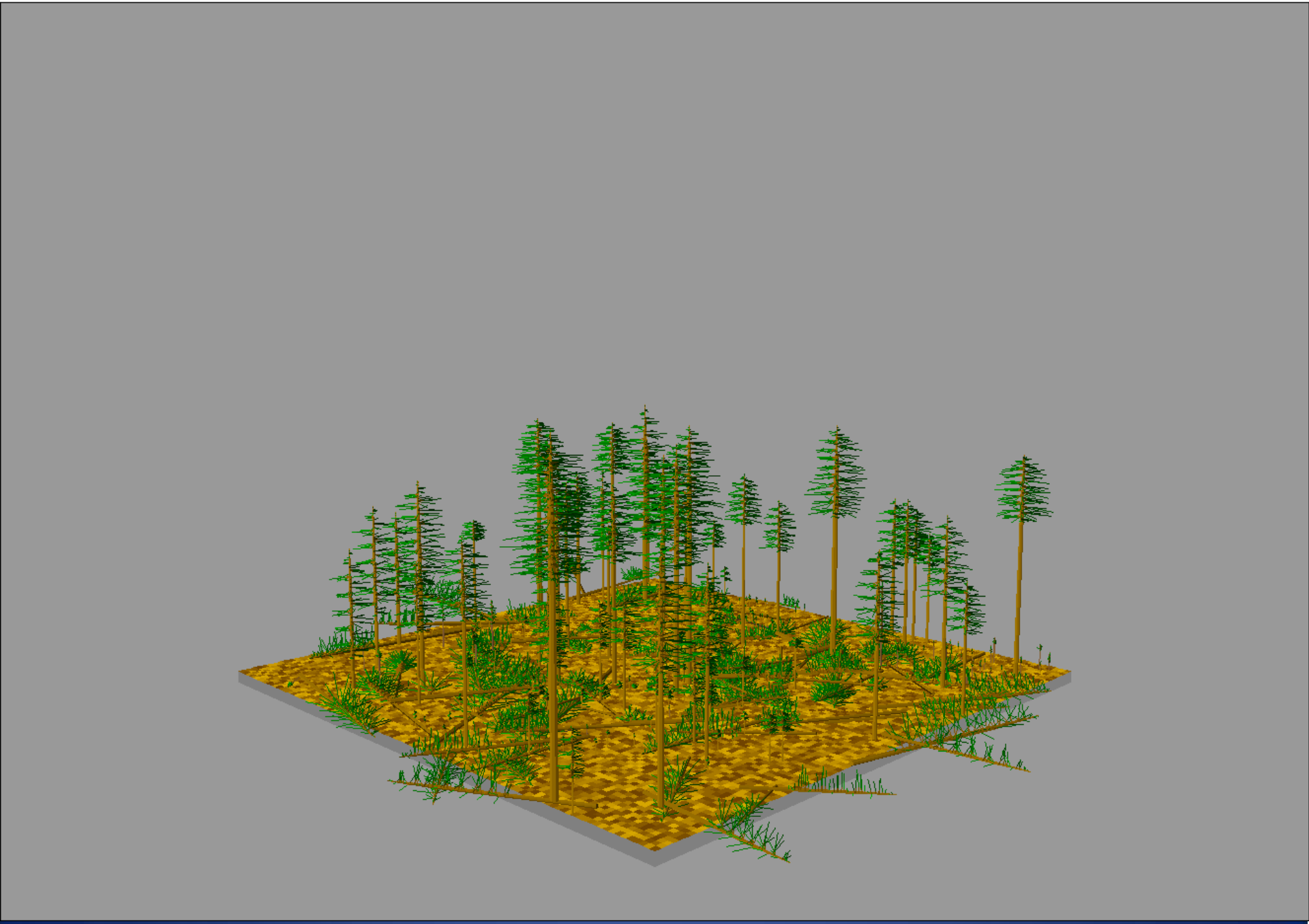
UEM Treatment & Simulation

- Stand Treatment (2008-09)
  - Conversion thinning (thin from above & below) in 2008.
  - Open the stand up to allow regeneration to establish & grow to promote subsequent age classes over time.
- Simulation Treatment
  - Thin every 20 years to the pre-determined target structure
  - Regeneration invoked (75 seedlings every 20 yrs.).
  - Max SDI = 365
  - Simulation time: 2008-2168 (160 yrs.)
- Questions
  - How long does it take to grow into the historic diameter distribution given the current stand structure?
  - At what age does the stand reach some consistent wood production?
  - What is the long-term sustainable wood production?
  - What kind of mortality might we expect?

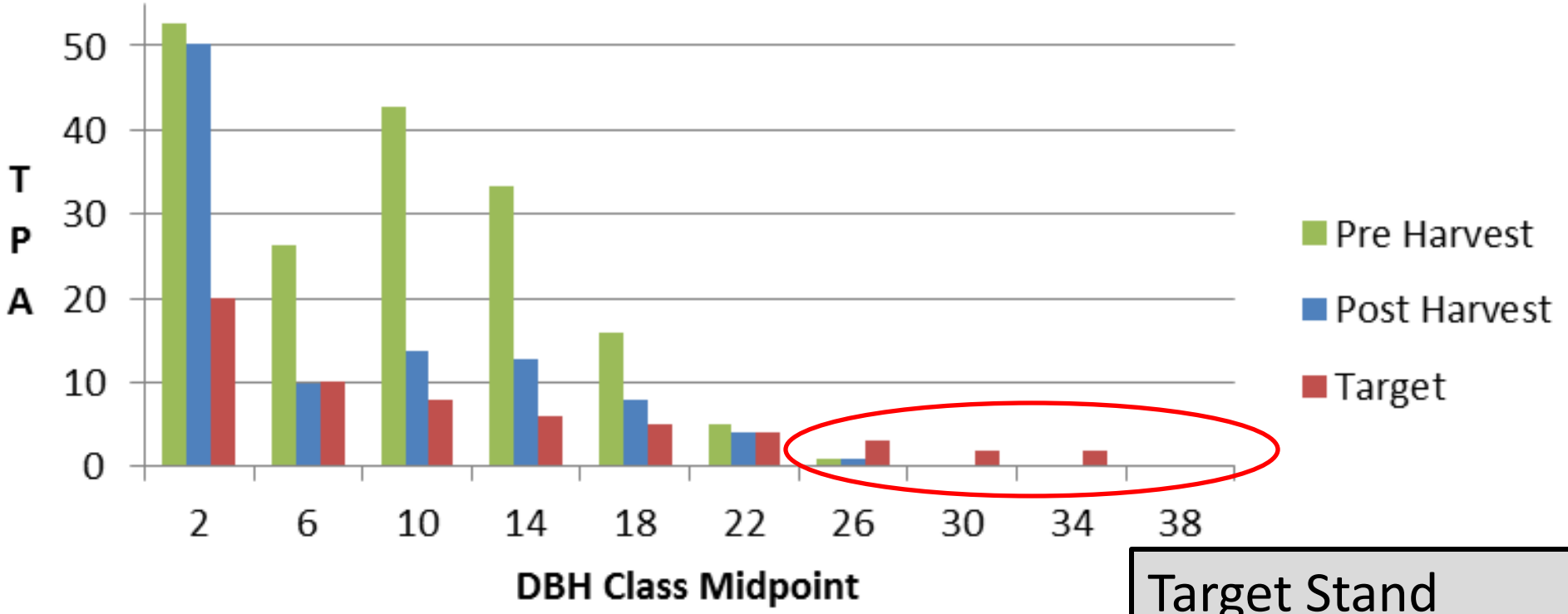
Stand=lavaU Year=2008 Inventory conditions



Stand=lavaU Year=2008 Post cutting



Lava -DBH Distribution - 2008 Post-harvest (20-yr cycle)

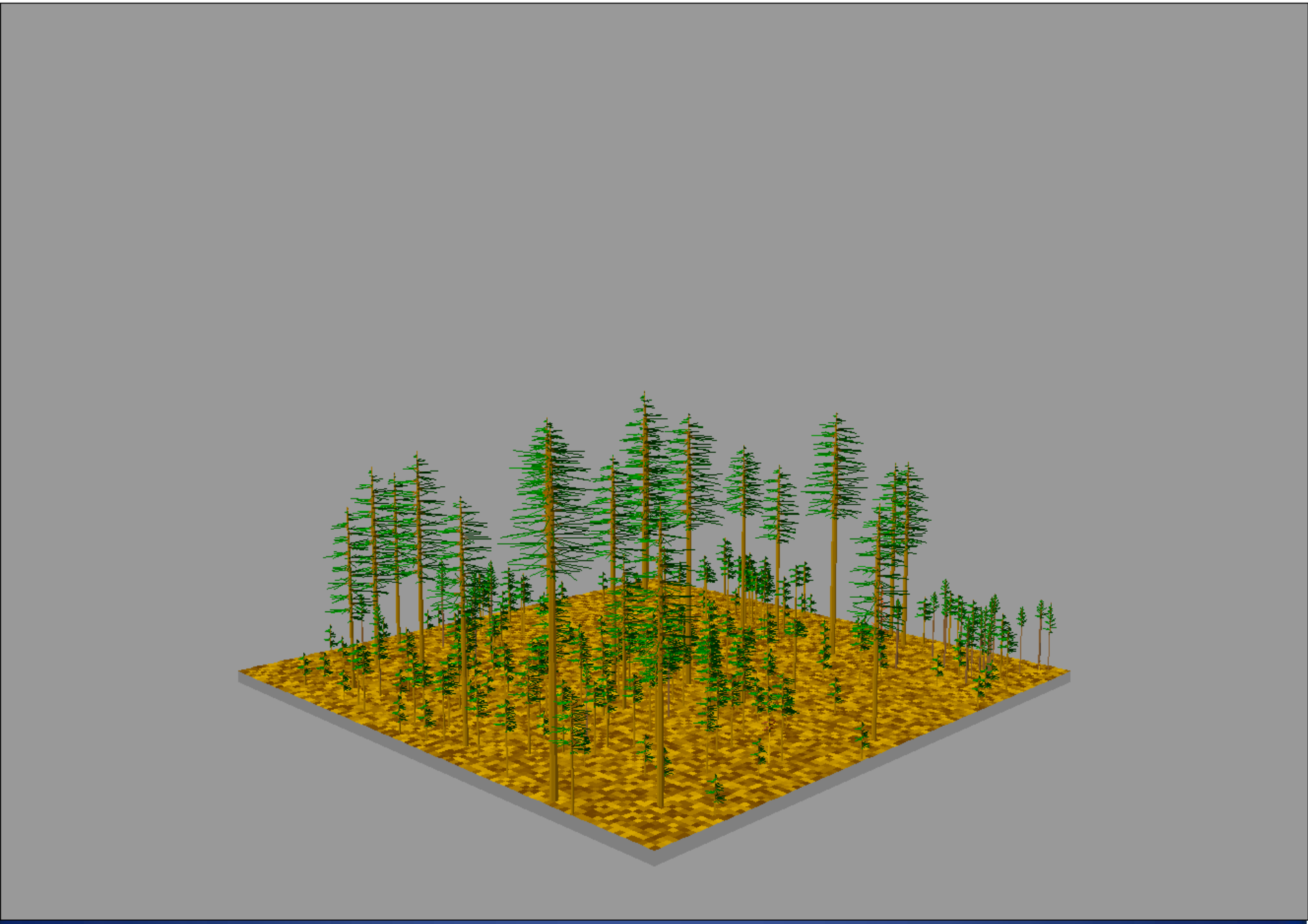


Pre Harvest Stand
TPA = 177.25 (> 4" 125.5)
BA = 111.6
SDI = 189

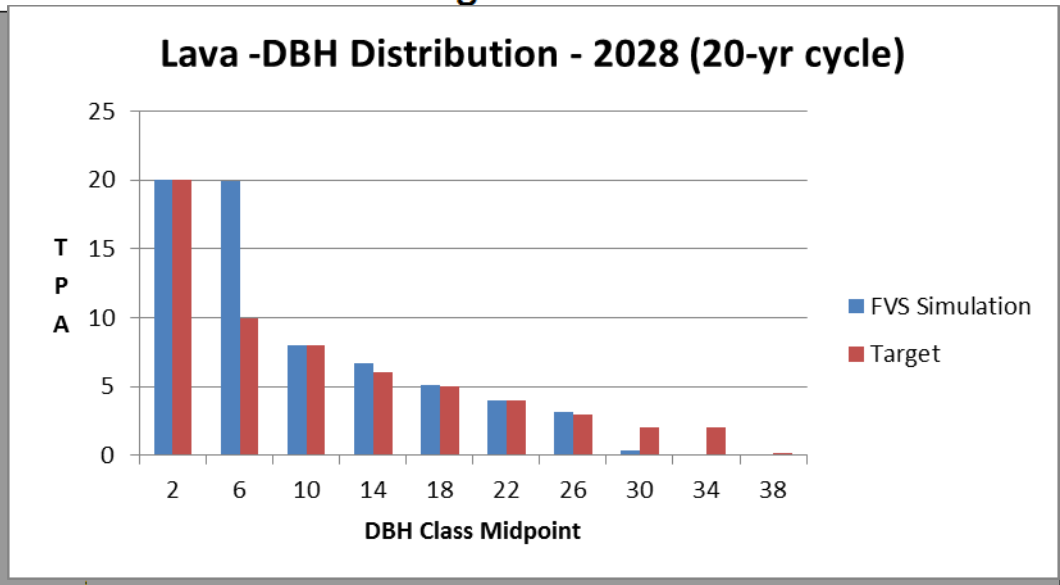
Post Harvest Stand
TPA = 99.5 (>4" 49.5)
BA = 53.8
SDI = 112

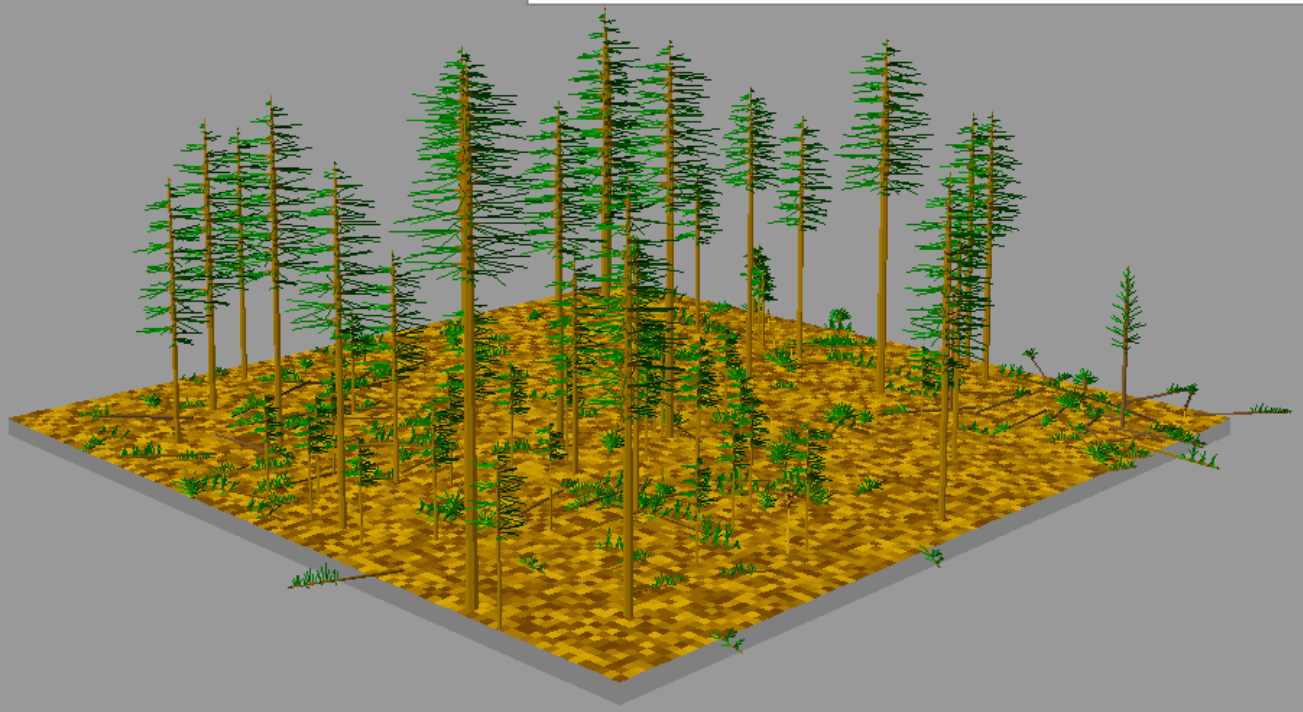
Target Stand
TPA = 60.2
Range = 1 to 40"
BA = 67.6
SDI = 104

Stand=lavaU Year=2028 Beginning of cycle

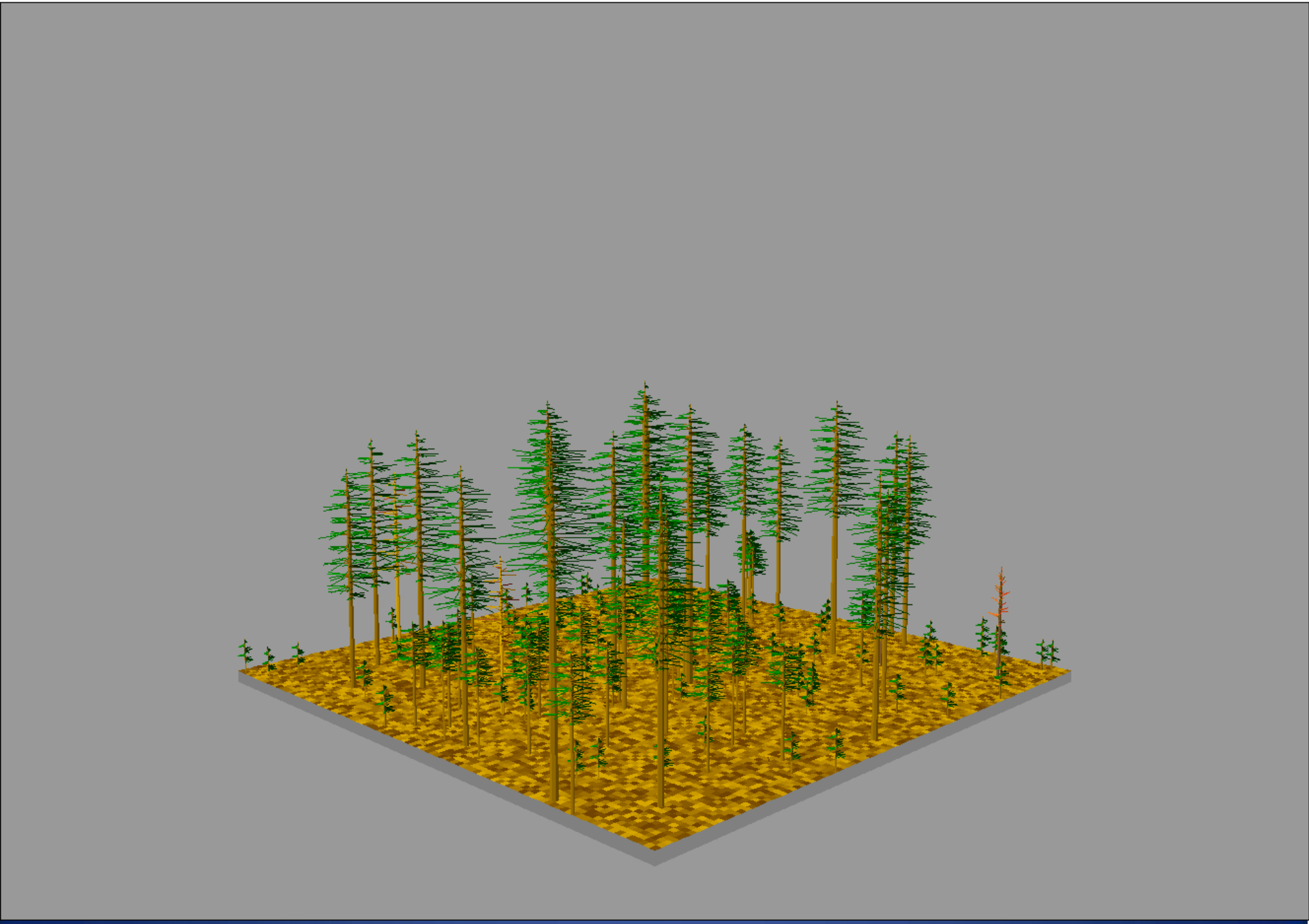


Stand=lavaU Year=2028 Post cutting

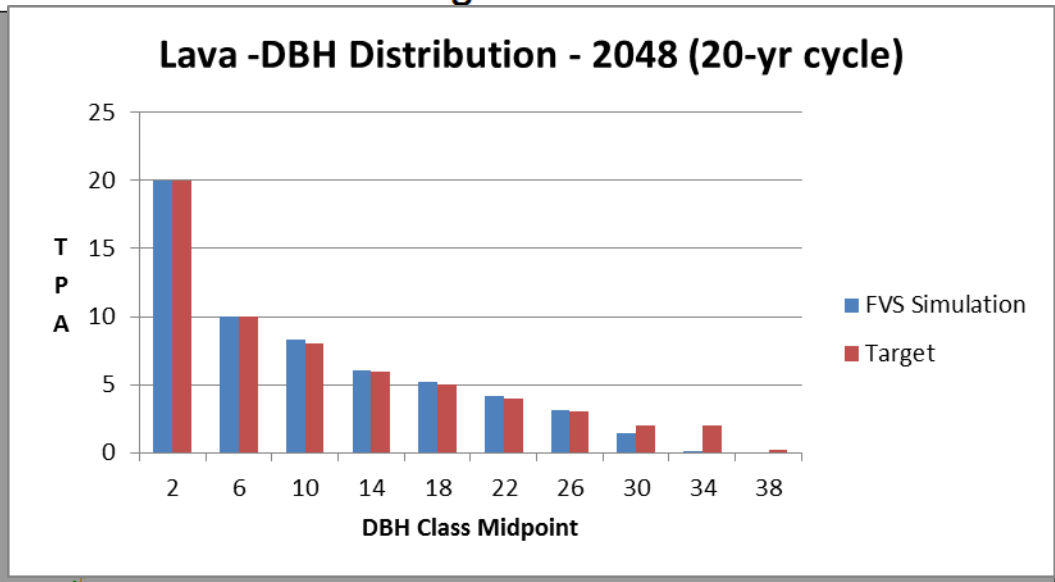


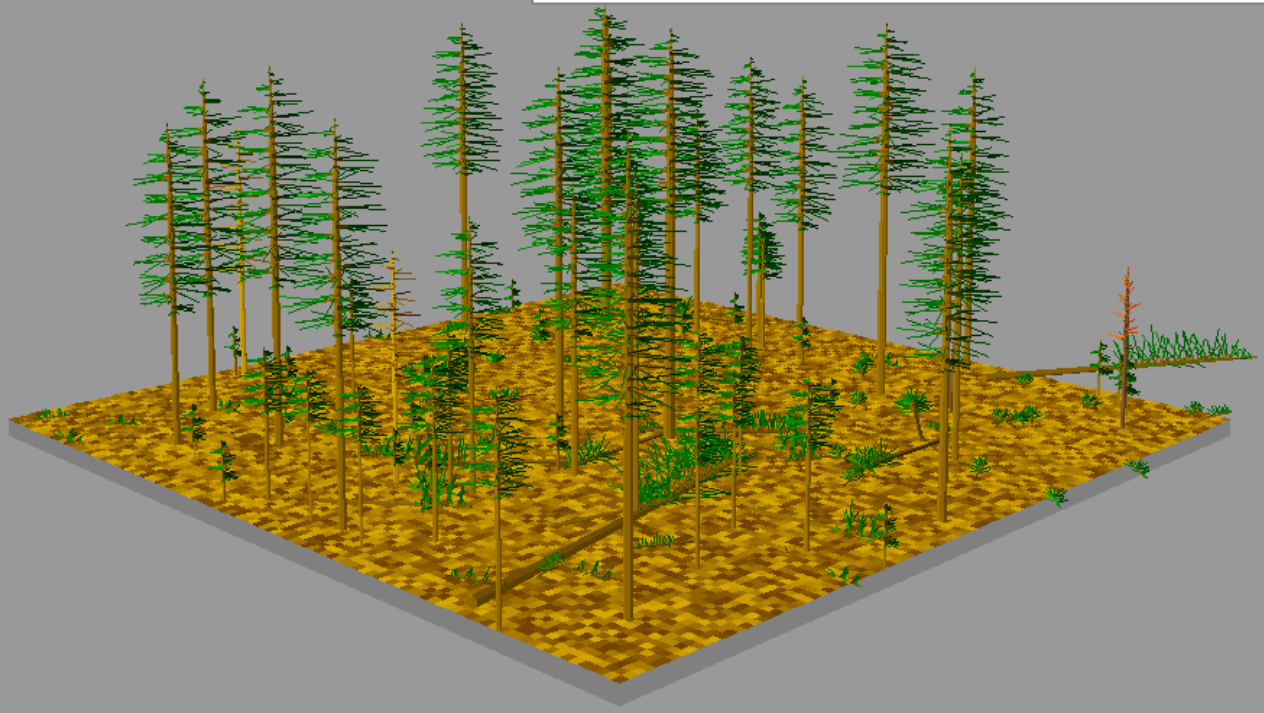


Stand=lavaU Year=2048 Beginning of cycle

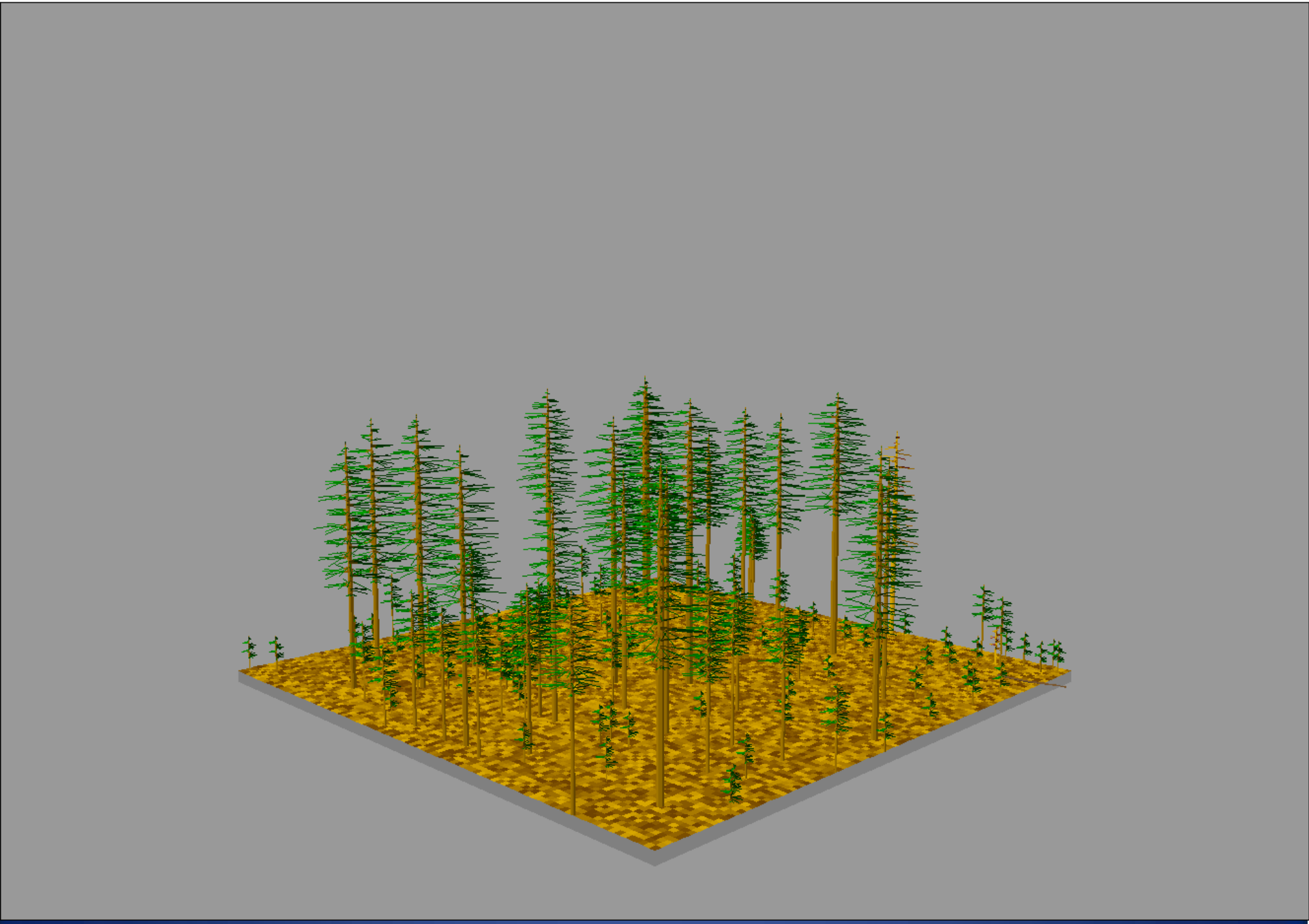


Stand=lavaU Year=2048 Post cutting

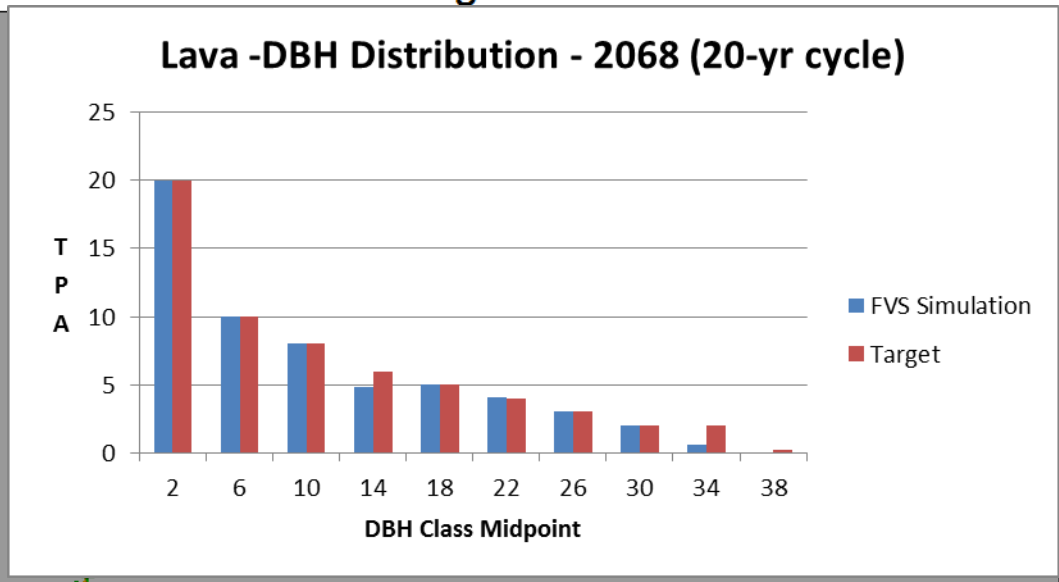


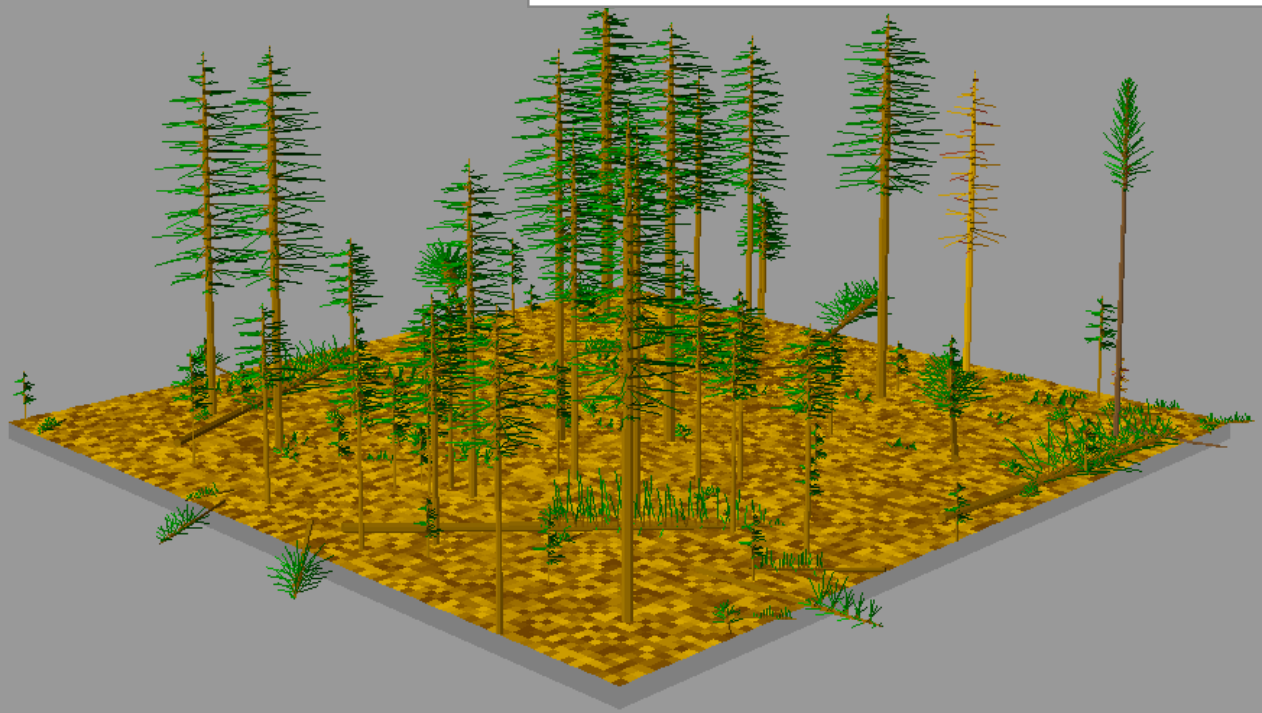


Stand=lavaU Year=2068 Beginning of cycle

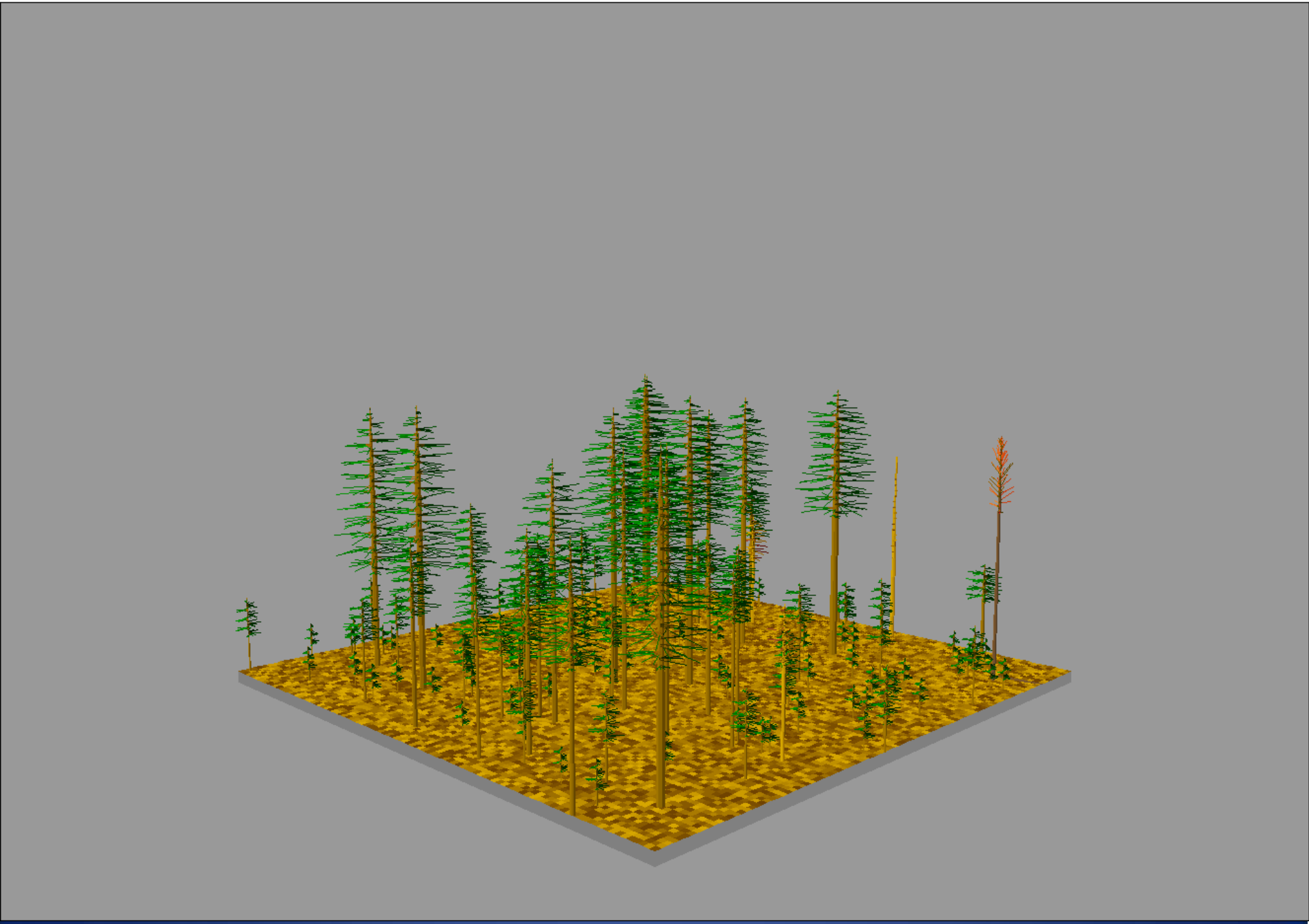


Stand=lavaU Year=2068 Post cutting

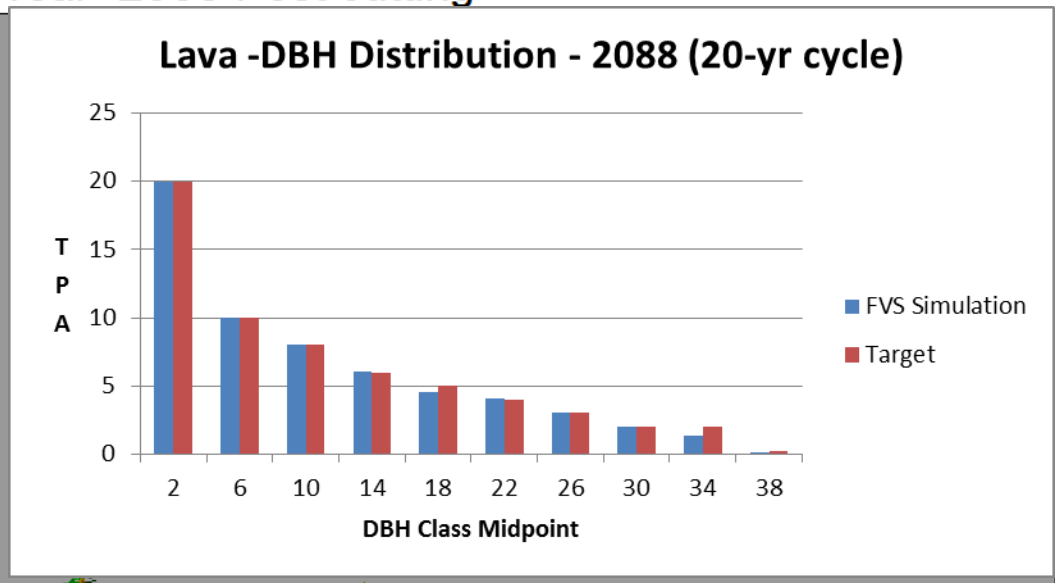


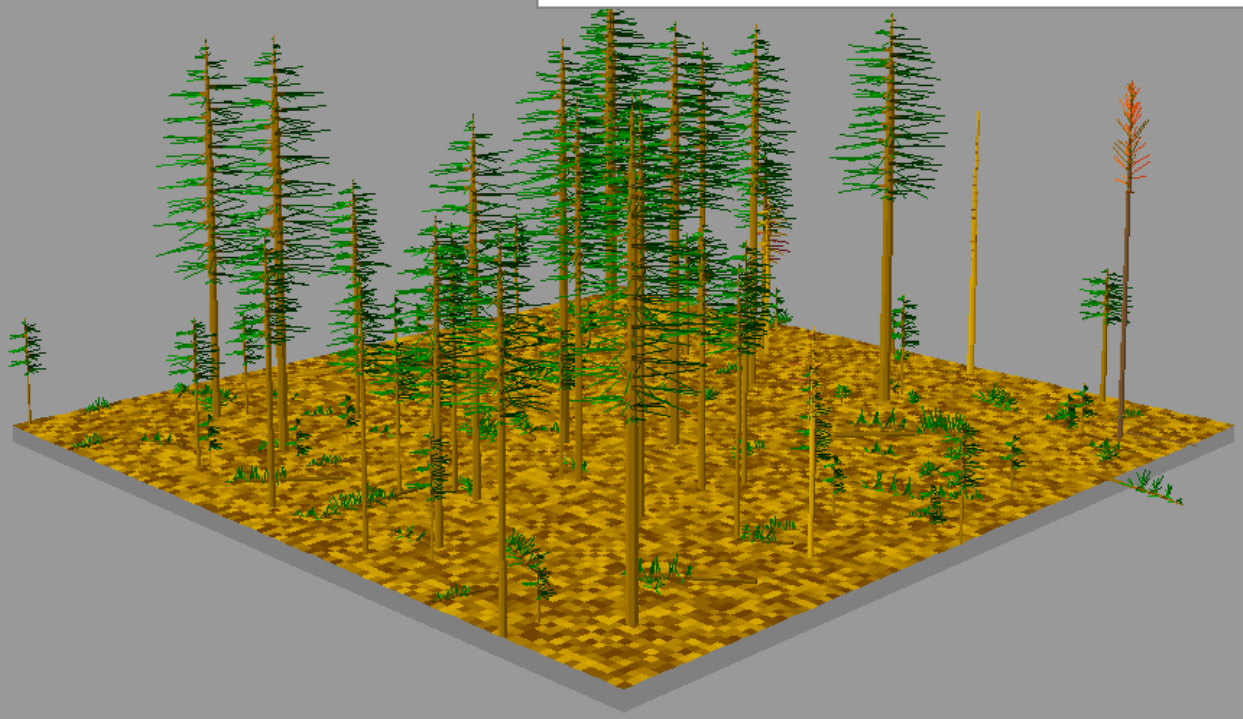


Stand=lavaU Year=2088 Beginning of cycle

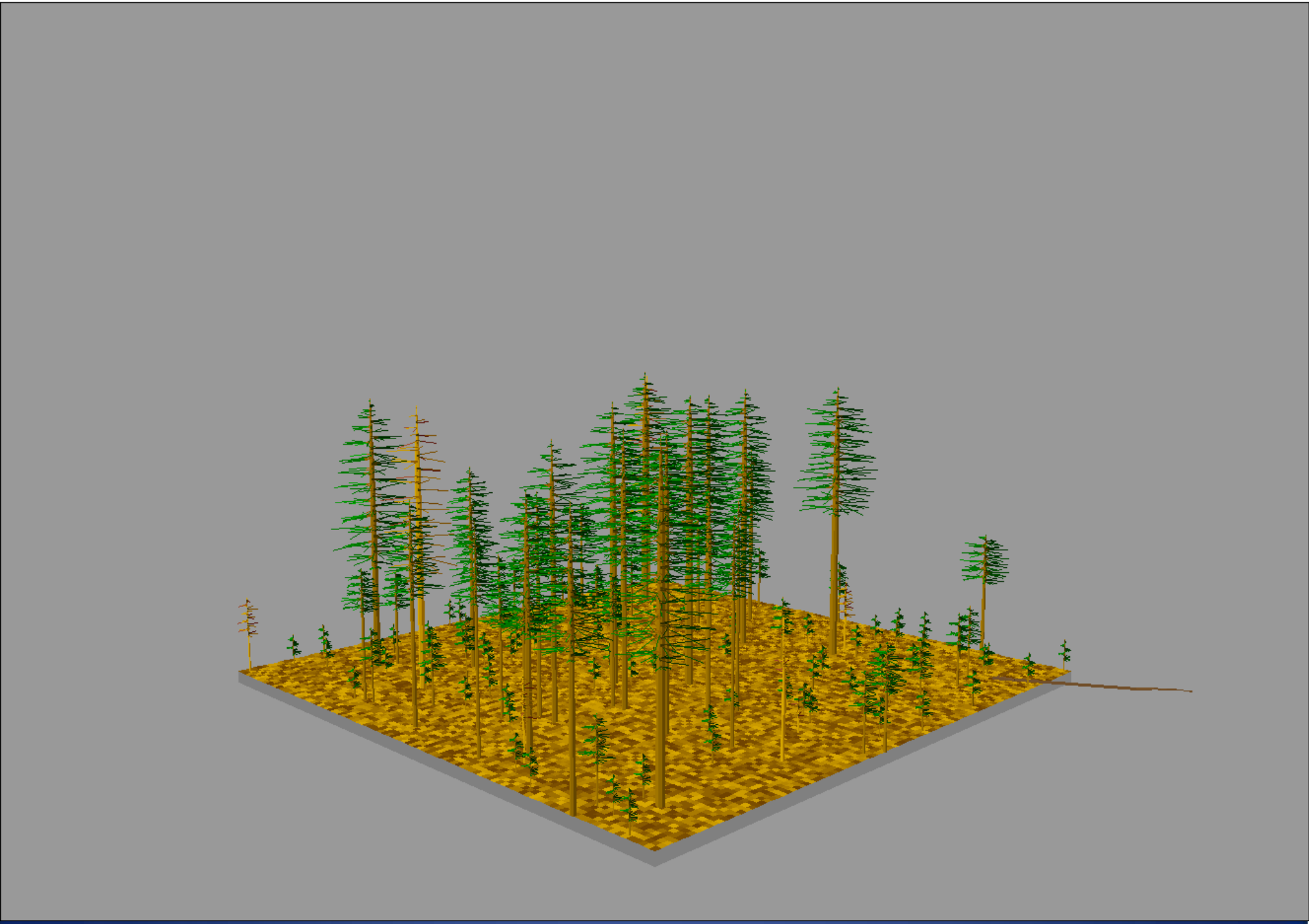


Stand=lavaU Year=2088 Post cutting

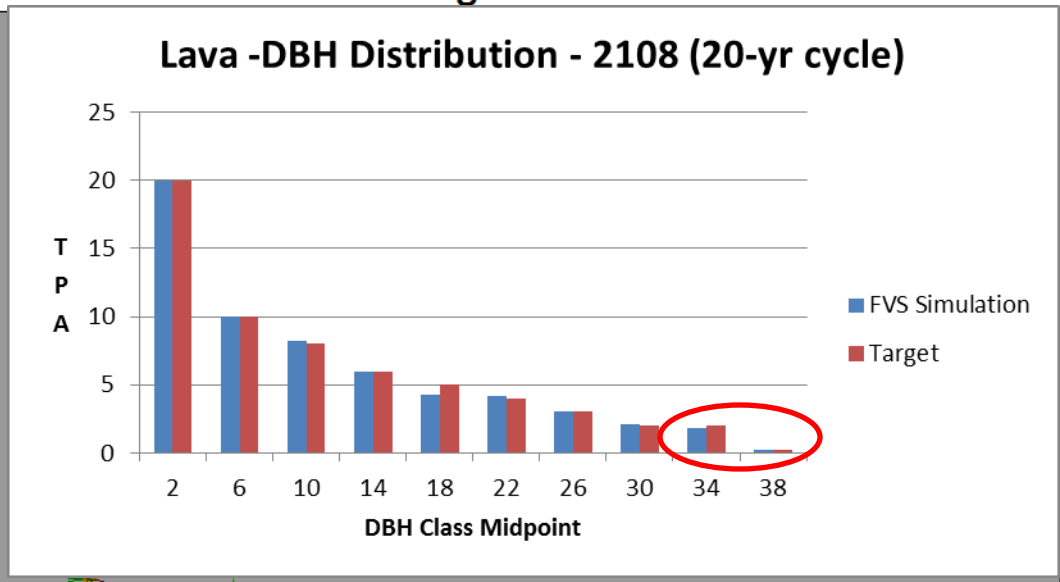


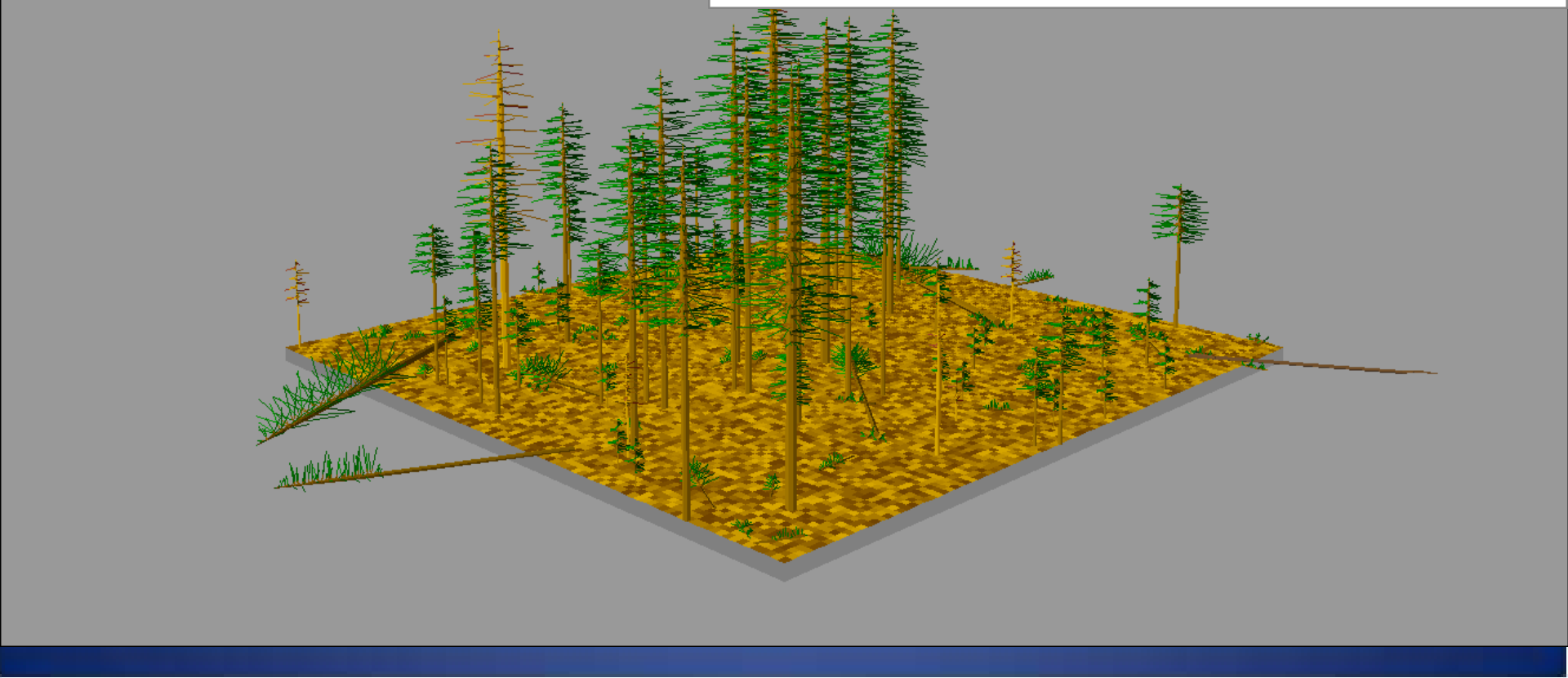


Stand=lavaU Year=2108 Beginning of cycle

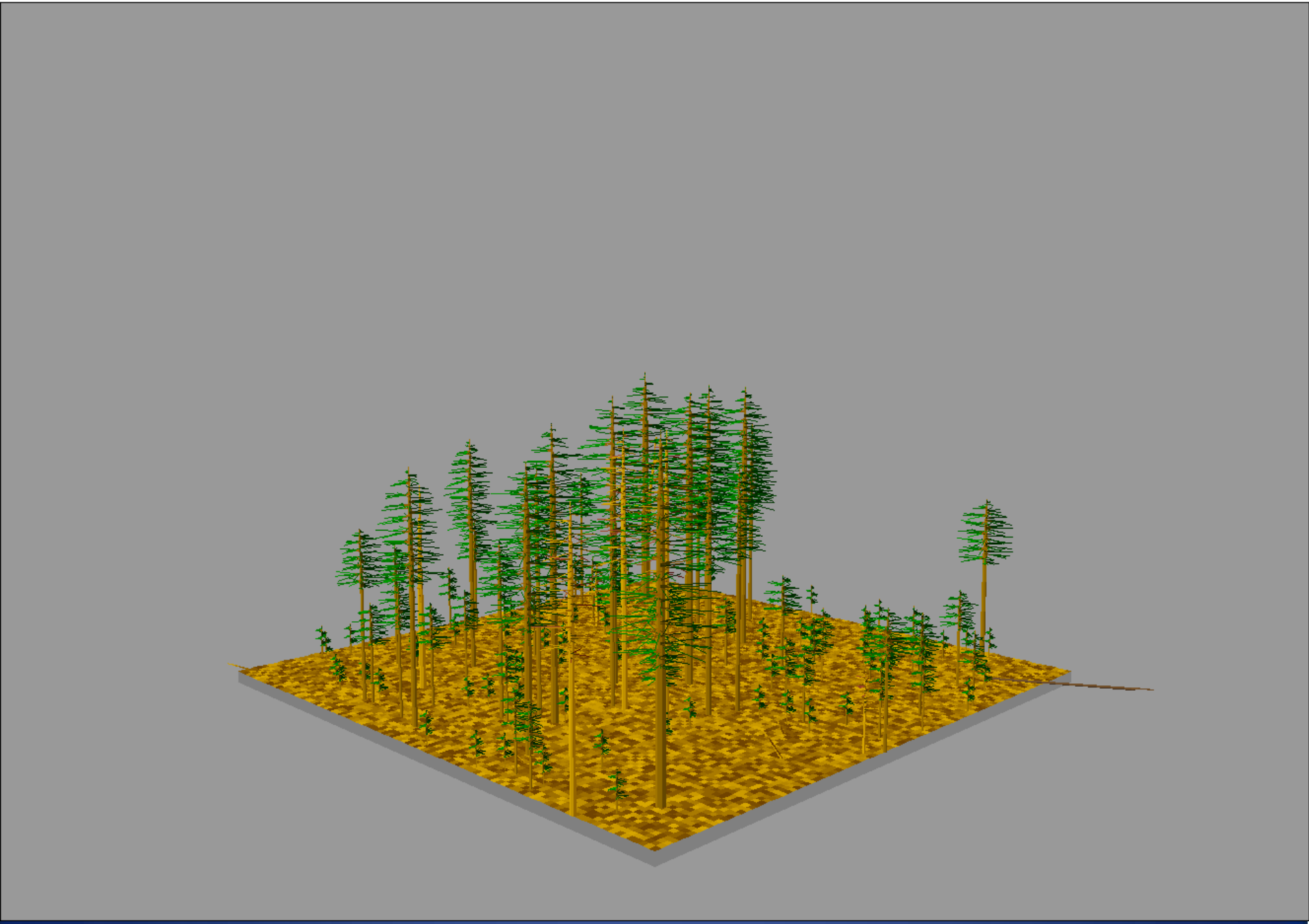


Stand=lavaU Year=2108 Post cutting

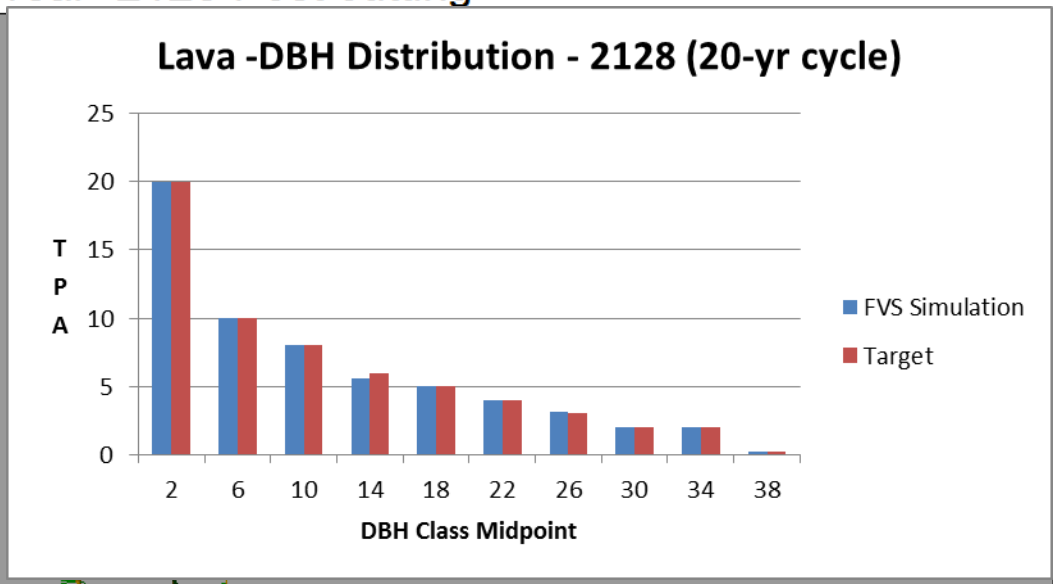


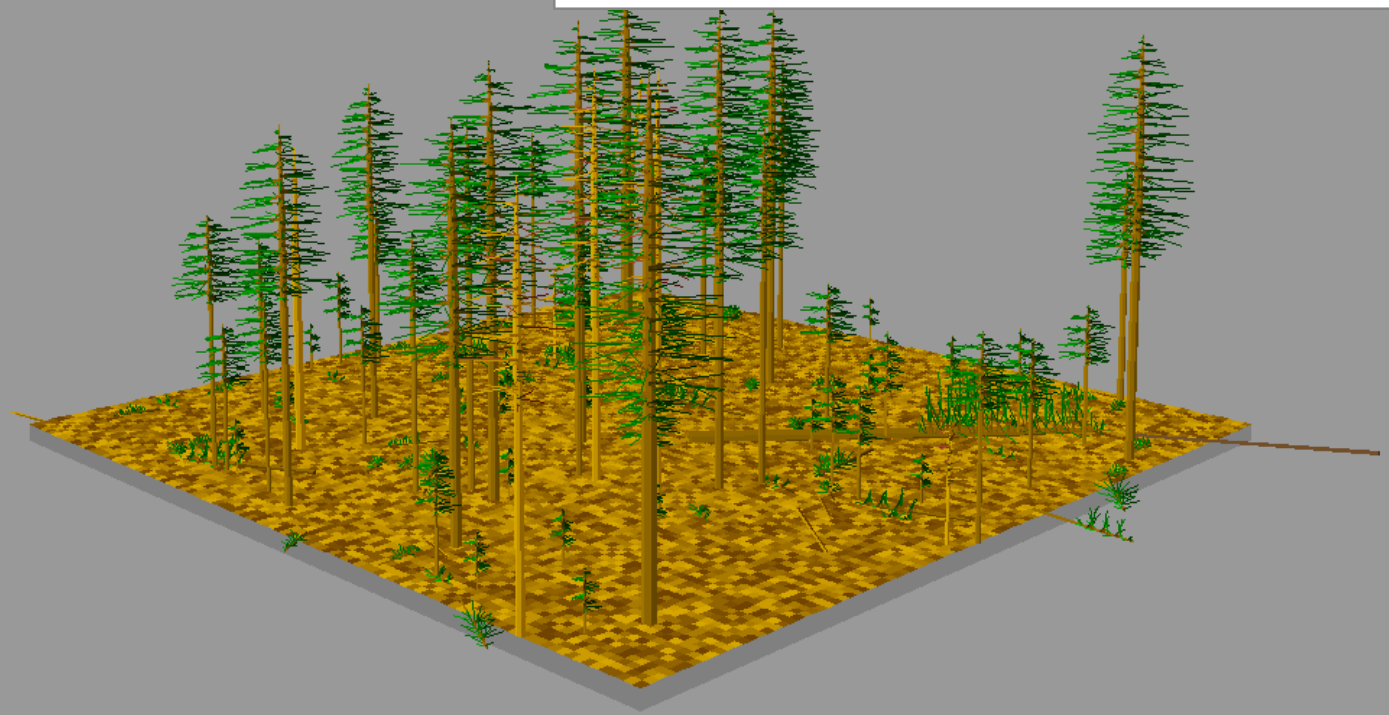


Stand=lavaU Year=2128 Beginning of cycle

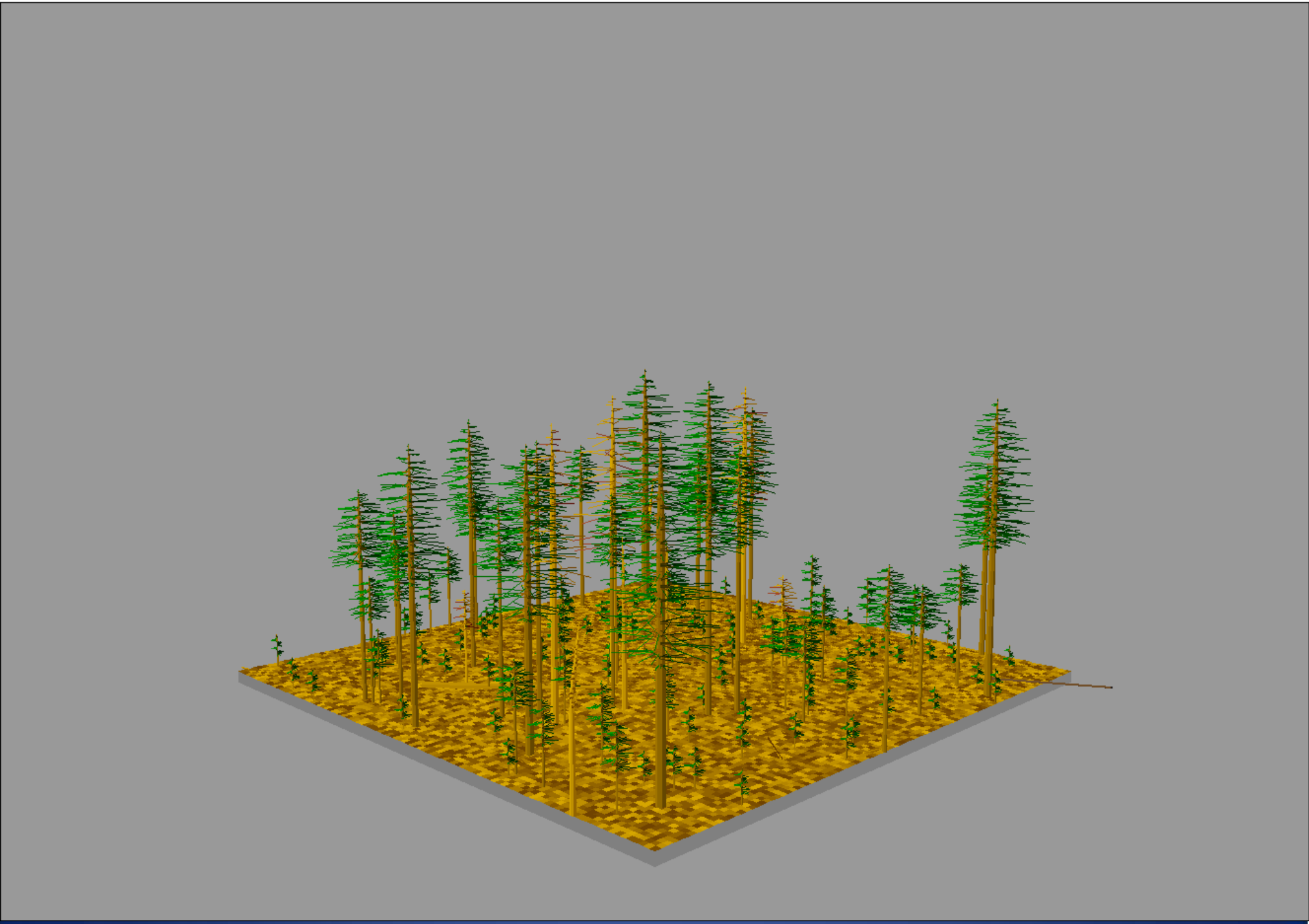


Stand=lavaU Year=2128 Post cutting

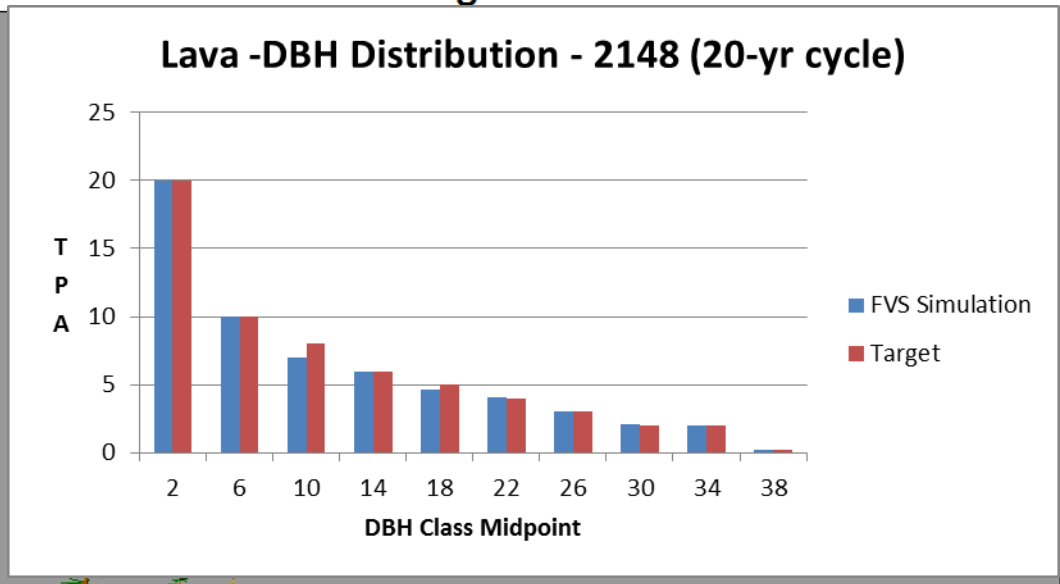


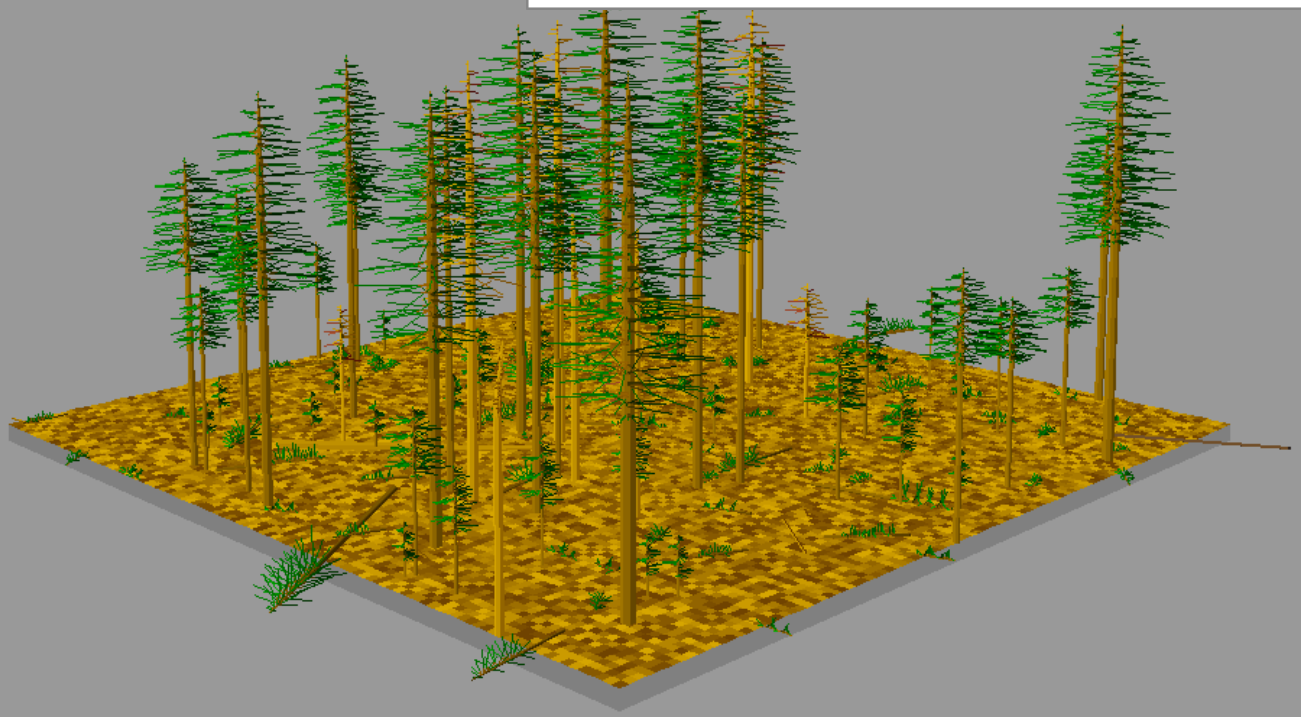


Stand=lavaU Year=2148 Beginning of cycle

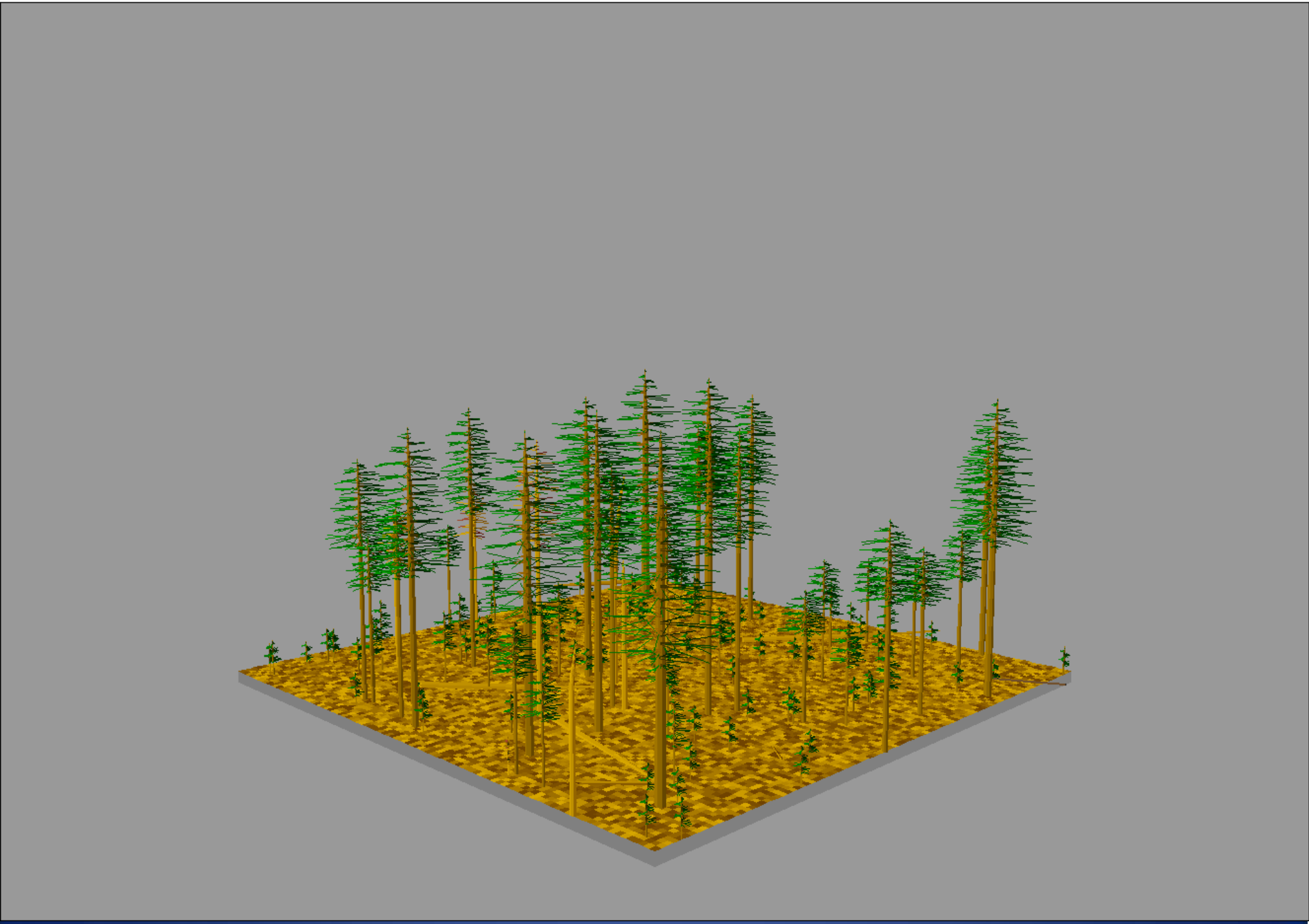


Stand=lavaU Year=2148 Post cutting

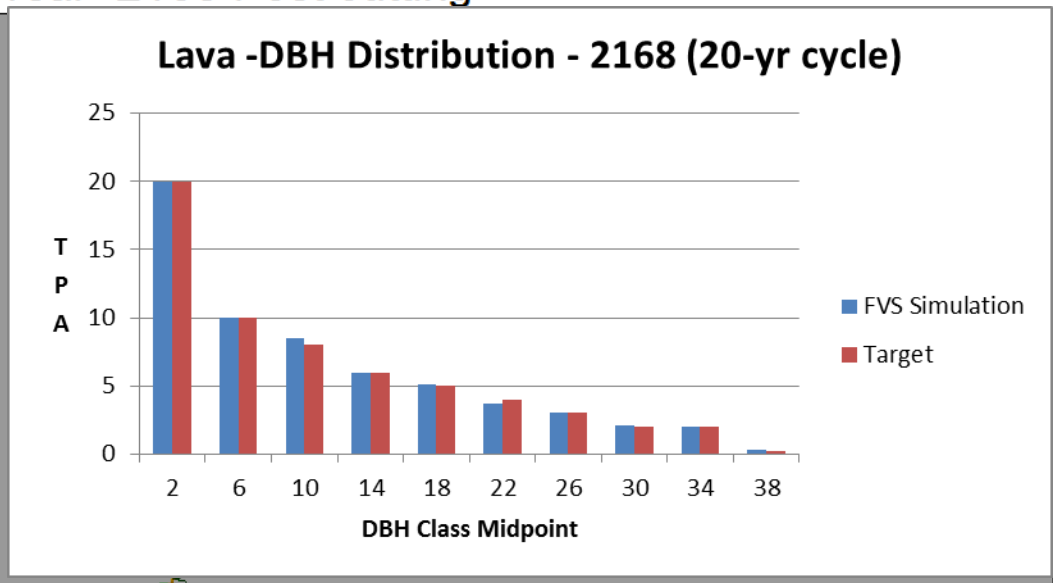


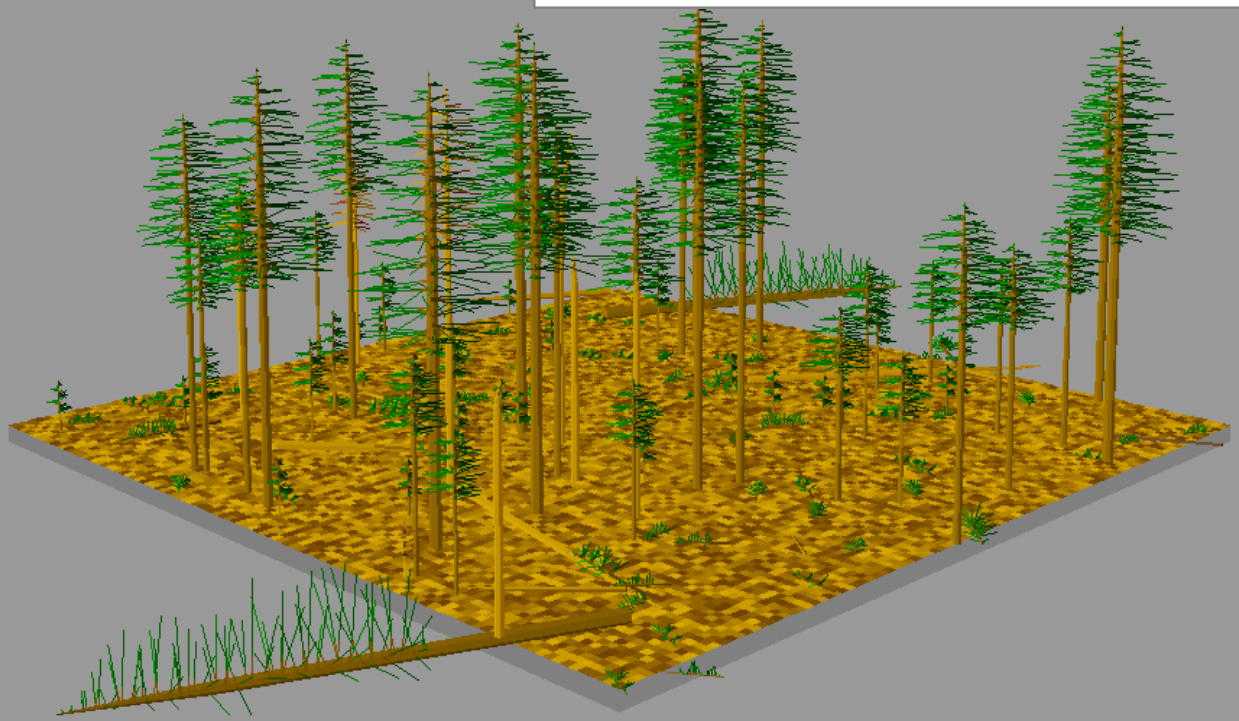


Stand=lavaU Year=2168 Beginning of cycle



Stand=lavaU Year=2168 Post cutting





Simulation Results – Stand Conditions

	BEFORE				AFTER				Rem.
Year	TPA	BA	SDI	Vol.	TPA	BA	SDI	QMD.	Vol.
2008	249	106	204	10624	174	50	104	7.3	4864

The QMD of cut trees (>=10”) increases from 14” (2008) to 26” (2168).

Summary

- Converted a more or less even-aged stand to an uneven-aged stand.
- It took 100 yrs. to achieve the historic density and structure after the initial conversion thinning treatment.
- It appears that 2100 to 2500 bd. ft. per acre could be removed every 20 years to maintain the desired stand structure and provide sustainable stream of wood products.
- Model predicted mortality of 1 to 2 trees (snags) per acre per 20-year period.

Summary

- UEM is potentially well suited for the rebuilding and long-term management of ponderosa pine & dry mixed conifer forests:
  - It emulates small but frequent disturbances (low severity fire & insects) that created and maintained these forests by the removal of individual and groups of trees on a periodic basis.
  - Maintains trees of different ages, which could potentially buffer stands from insects, disease, and climate fluctuations.
  - Maintains open stands that emulate historic habitat for wildlife species requiring these conditions.
  - Provides small to large sawlog timber that can be produced over the long haul on a sustainable basis.

Summary

- Appropriate residual stand densities for UEM:
  - Ponderosa Pine PAGs: 30-70 sq. ft.
  - Dry Mixed Conifer PAGs: 70-110 sq. ft.
- Historic diameter distributions can be described by a *q*-factor between 1.1 and 1.2. But I'm not advocating foresters manage to some strict *q*-factor whatsoever.
- Although not simulated, understory fire could be used to reduce shrubs and fuel, promote regeneration establishment, but also be used to subsequently thin and remove excess regeneration over time.

Application of UEM: Gilchrist State Forest

Historic vs. Current Landscape Conditions

- Historic stand conditions were primarily uneven-aged with patches of even-aged ponderosa pine within originating from smaller and less frequent stand replacement events.
- Today, our ponderosa pine forest landscapes are in novel conditions. Vast acreages (entire landscapes) are even-aged, with implications for insect, disease and stand-replacing fire.


Thank You!