

Fertilizer and Commercial Thin (FERT-THIN) Responses of Three Douglas-fir Stands on Three Soil Strata Types in Northern Idaho

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FERT-THIN Objectives and Concepts

Fertilization

- *Improves stand health and vigor*
- *Increases tree size*
- *Accelerates stand development*
- *Shortens rotation*

Thinning

- *Reduces competition for site resources*
- *Reduces competition induced mortality*
- *Redistributes growth to individual "Crop Trees"*
- *Increases individual tree size*
- *Accelerates stand development*
- *Shortens rotation*

FERT-THIN Objectives and Concepts

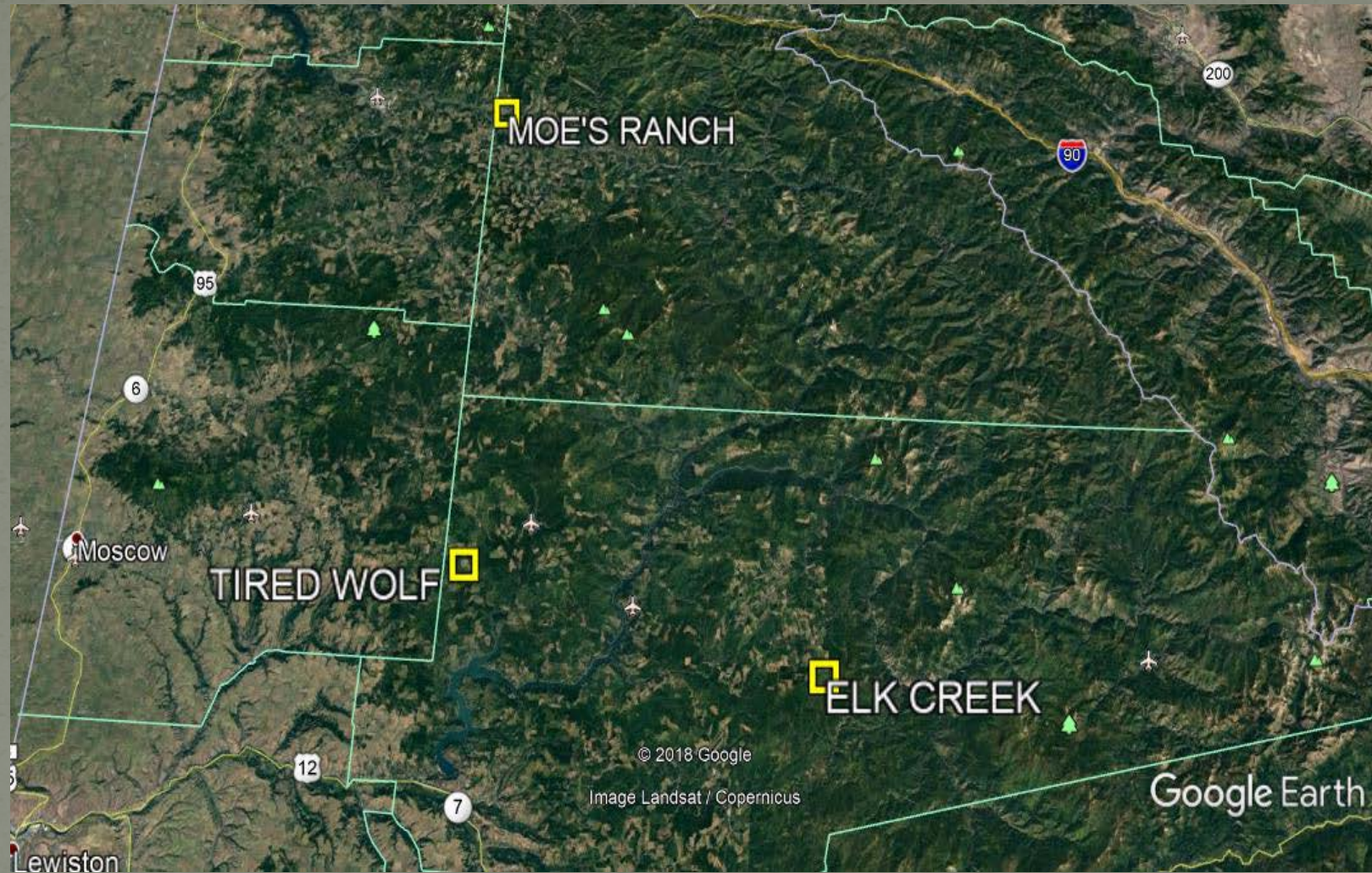
- *Objectives*

- *Timber Supply Strategy – Improve Size and Timing*
 - *Addresses age-class imbalances*
 - *Increases long-term harvest levels*
- *Optimize combination of fert and thin regimes by site types*

- *Concepts*

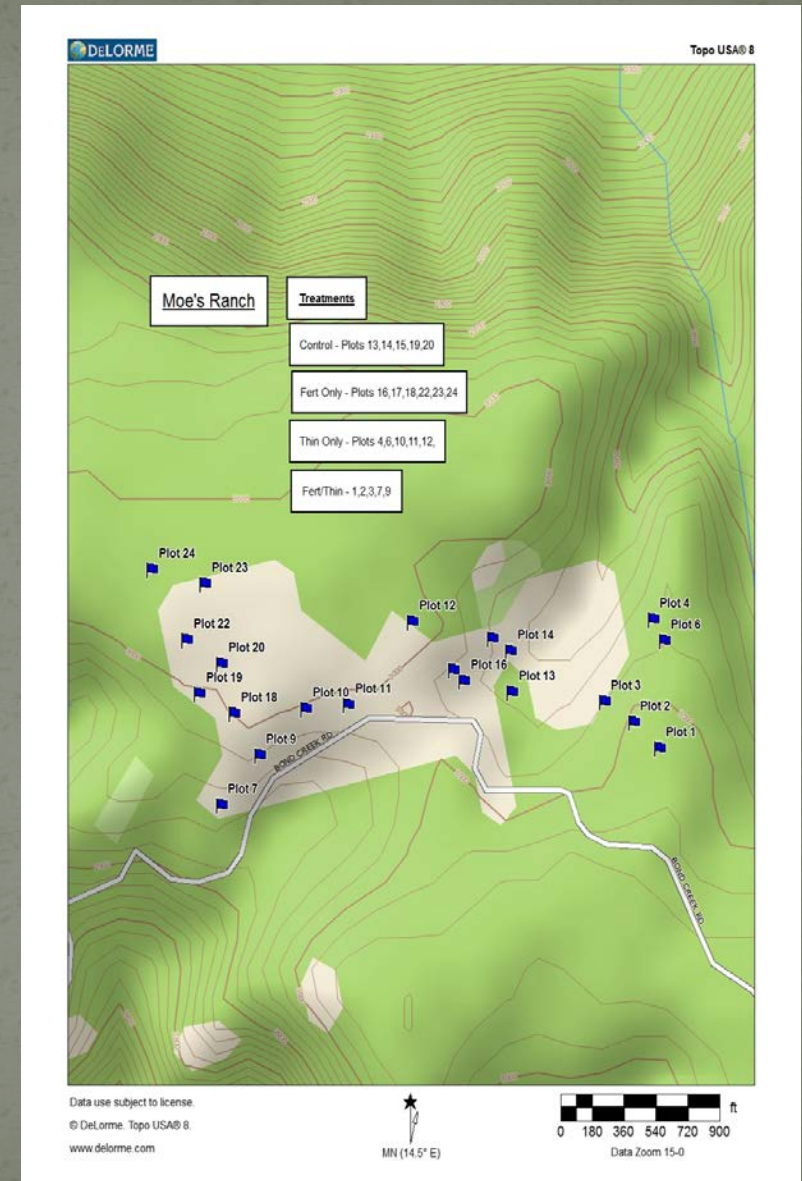
- *Stand & tree growth cannot be simultaneously maximized*
- *Compromise b/t max production per acre and individual tree size*
- *Fertilization can partially compensate volume loss due to thinning*

FERT-THIN SITE LOCATIONS



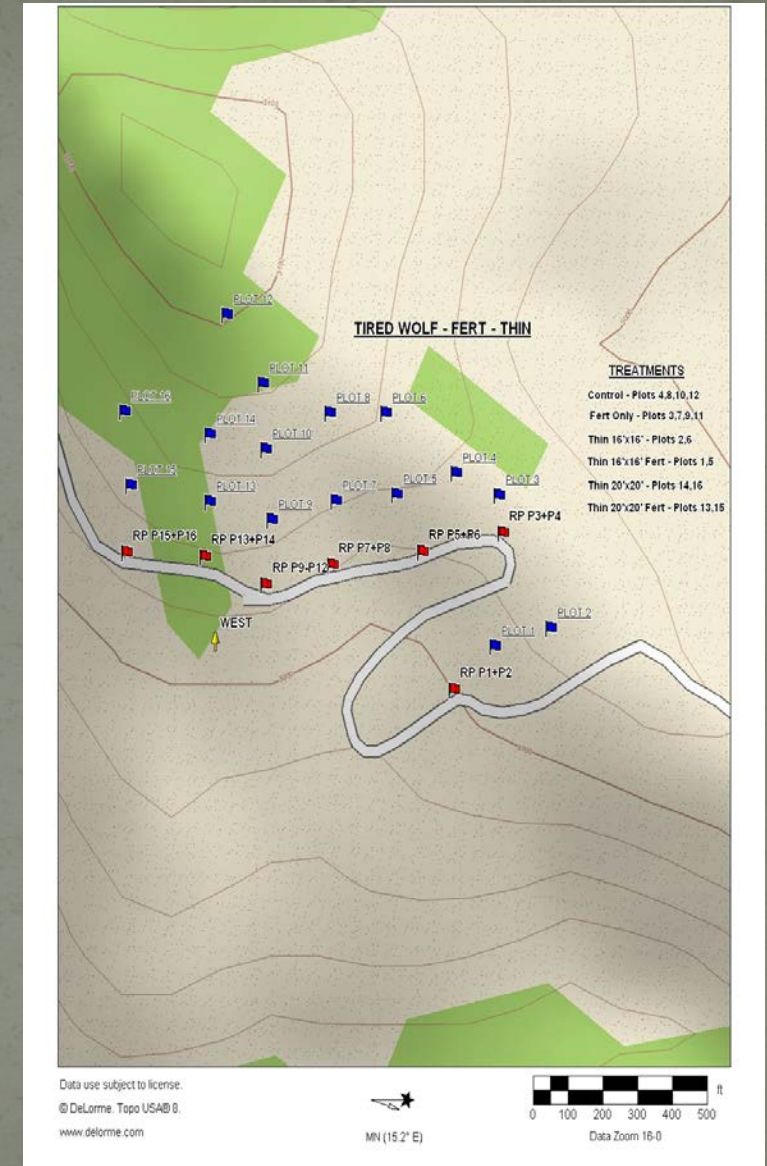
FERT-THIN SITE LOCATIONS

Moe's Ranch



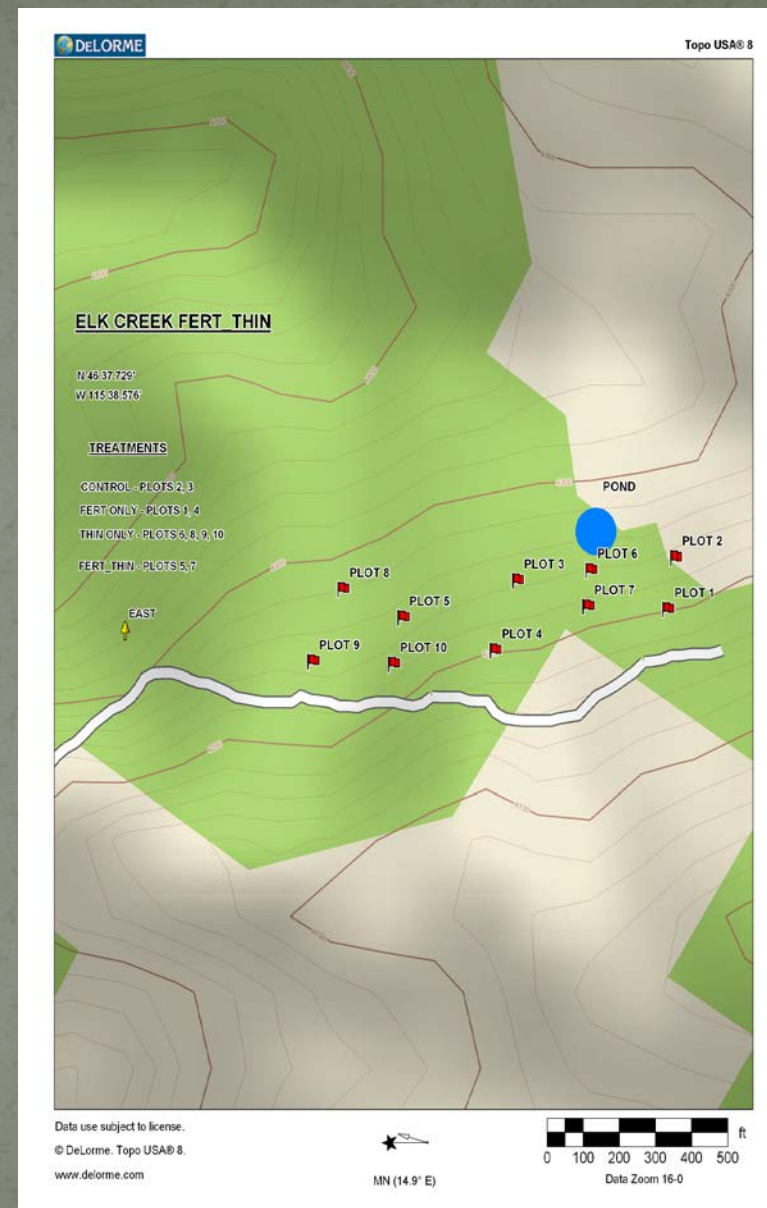
FERT-THIN SITE LOCATIONS

Tired Wolf



FERT-THIN SITE LOCATIONS

Elk Creek



FERT-THIN - Site Characteristics

- **All Sites:**
 - ~25 YO @ study est.
 - Cedar vegetation series; temp_moist (warm_wet)
 - 90%+ DF (%BA species comp)
 - Commercial Thin
- **Each Site:**
 - **Soil Strata**
 - Moe – Ash/Tertiary Sediment/Basalt (variable)
 - Tired Wolf – Ash/Basalt (good)
 - Elk Creek – Ash/Granitic (moderate)
 - **Elevation:**
 - Moe – 3,018'
 - Tired Wolf – 3,000'
 - Elk Creek – 4,220'

FERT-THIN

Stand Metric Characteristics No-Thin at Est.

| METRIC | MOE | TIRED WOLF | ELK CREEK |
|---|-------|------------|-----------|
| Quadratic Mean Diameter (QMD) | 6.3" | 6.4" | 8.5" |
| Site Height | 48' | 47' | 50' |
| Trees Per Acre (TPA) | 767 | 663 | 500 |
| Basal Area (BA - ft ² ac ⁻¹) | 163 | 148 | 197 |
| Volume (ft ³ ac ⁻¹) | 2,926 | 2,594 | 3,626 |
| Relative Density (RD - Curtis DF ^{0.5}) | 65 | 58 | 68 |
| Stand Density Index (SDI-IFC DF ^{1.449}) | 366 | 324 | 385 |
| Max Stand Density Index (maxSDI-IFC) | 352 | 357 | 377 |

FERT-THIN Treatments

| Site | Fert Mix* | FERTILIZER* | THINNING | TRT CODE |
|-------------------|-----------------|-------------|------------------|--------------|
| Moe | N+K+S+B | MOE | | |
| Tired Wolf | N+P+K+S+B+Cu+Mg | No-Fert | No-Thin | NFNT |
| | | Fert | No-Thin | FNT |
| Elk Creek | N+K+S+B | No-Fert | Thin 17' | NFT17 |
| | | Fert | Thin 17' | FT17 |
| TIRED WOLF | | | | |
| | | No-Fert | No-Thin | NFNT |
| | | Fert | No-Thin | FNT |
| | | No-Fert | Thin 16' and 20' | NFT16 and 20 |
| | | Fert | Thin 16' and 20' | FT16 and 20 |
| ELK CREEK | | | | |
| | | No-Fert | No-Thin | NFNT |
| | | Fert | No-Thin | FNT |
| | | No-Fert | Thin 14' | NFT14 |
| | | Fert | Thin 14' | FT14 |

- LBS. ACRE*
- 200 Nitrogen (N)
- 100 Phosphorus (P)
- 170 Potassium (K)
- 90 Sulfur (S)
- 3 Boron (B)
- 10 Copper (Cu)
- 10 Magnesium (Mg)

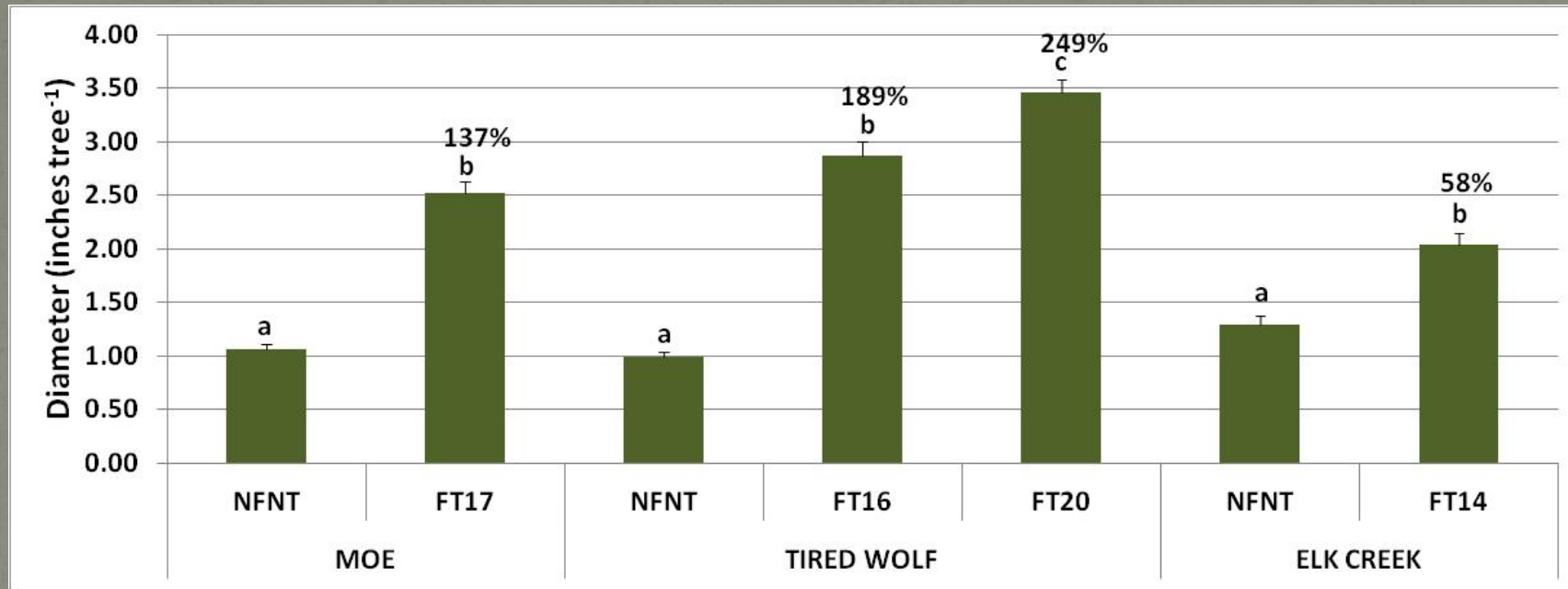
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| | | Fert | Thin 17' | FT17 |
| TIRED WOLF | | | | |
| | | No-Fert | No-Thin | NFNT |
| | | Fert | No-Thin | FNT |
| | | No-Fert | Thin 16' and 20' | NFT16 and 20 |
| | | Fert | Thin 16' and 20' | FT16 and 20 |
| ELK CREEK | | | | |
| | | No-Fert | No-Thin | NFNT |
| | | Fert | No-Thin | FNT |
| | | No-Fert | Thin 14' | NFT14 |
| | | Fert | Thin 14' | FT14 |

- LBS. ACRE*
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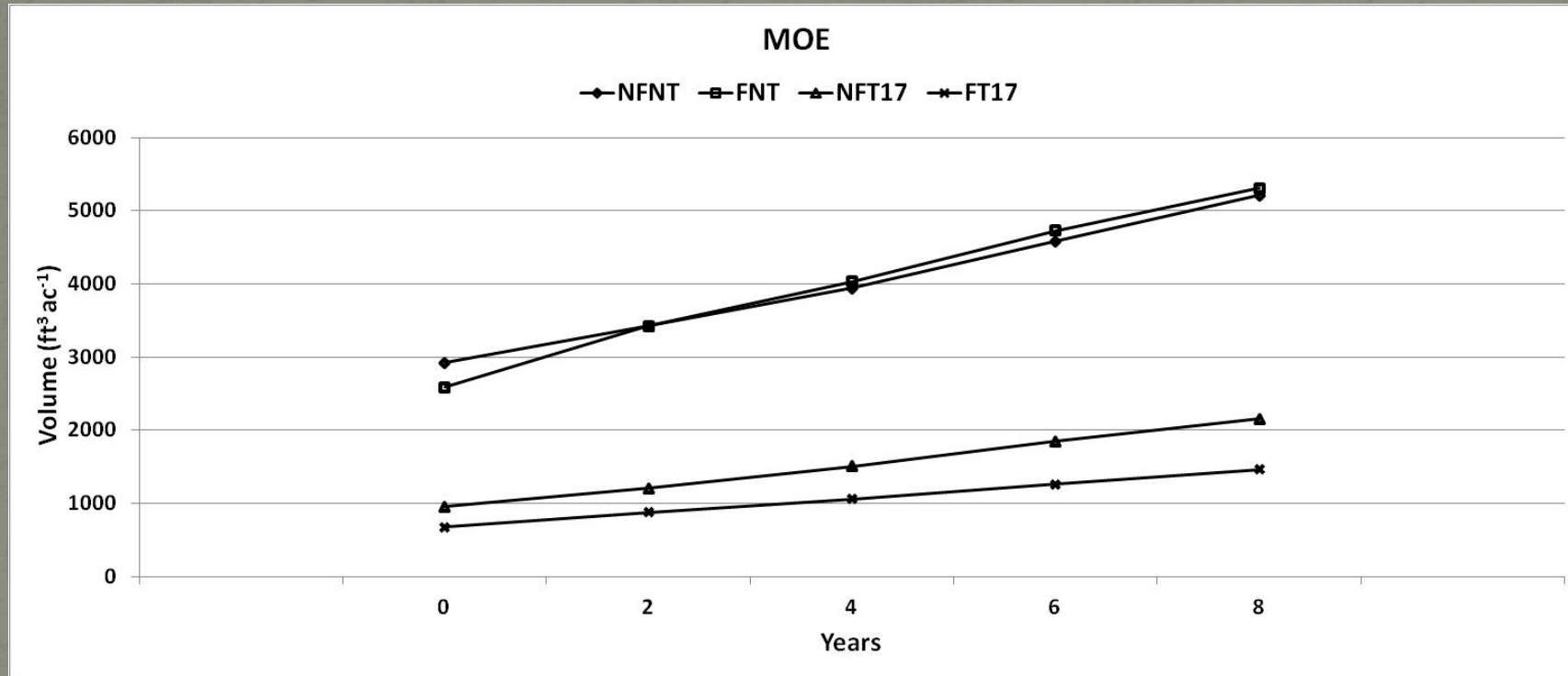
Individual Tree:

8YR Diameter Combined Diameter Response



- *FERT-THIN*
 - Additive effect @ Tired Wolf FT16 and Elk Creek FT14; Moe combined effect FT17 declined relative to thin alone
 - Accelerate Stand Development??

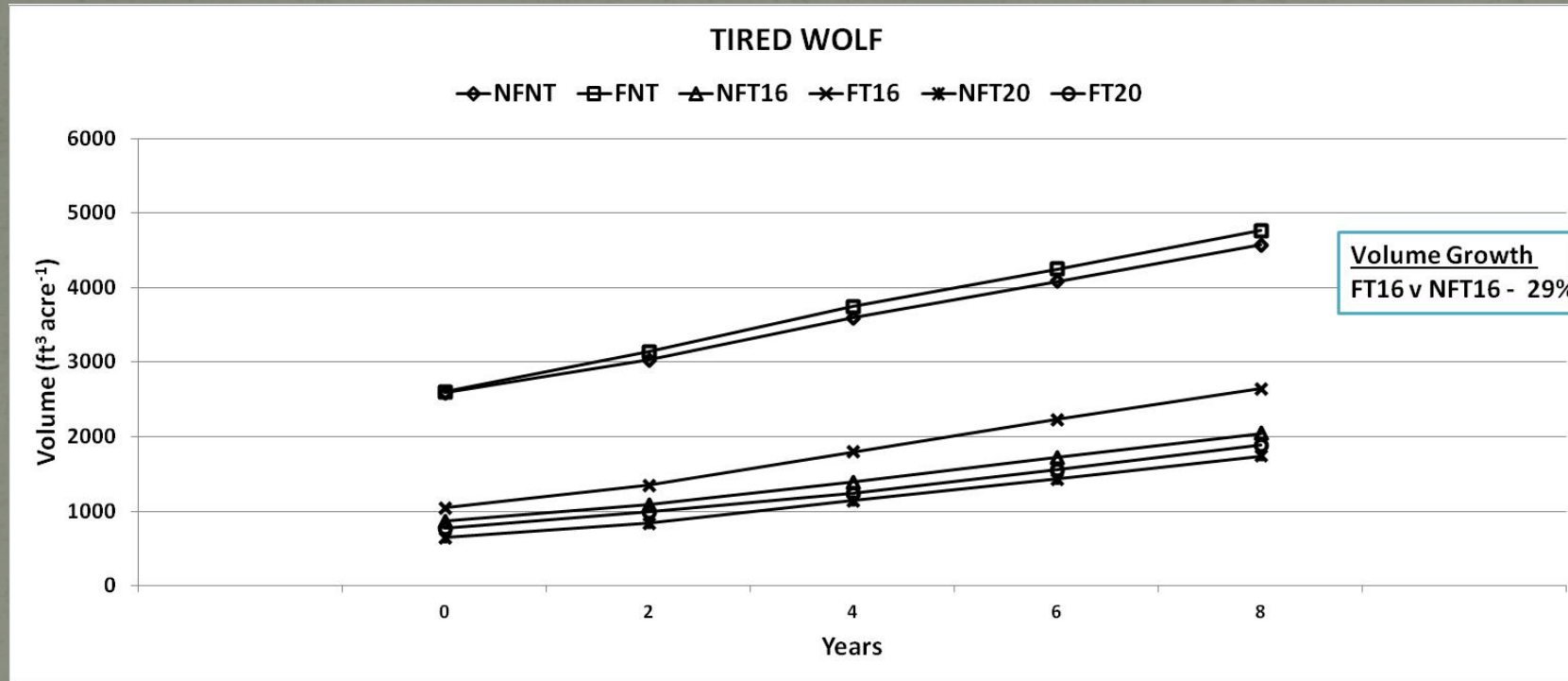
Whole-Stand: 8YR Volume Trends at Moe



- *Stand Trends*
 - *High density treatments have steeper growth trend lines*
 - *High density treatments carry more per acre volume over time than low density (cost of thinning)*
 - *No “positive” fertilizer effect (high or low density)*

Whole-Stand:

8YR Volume Trends at Tired Wolf

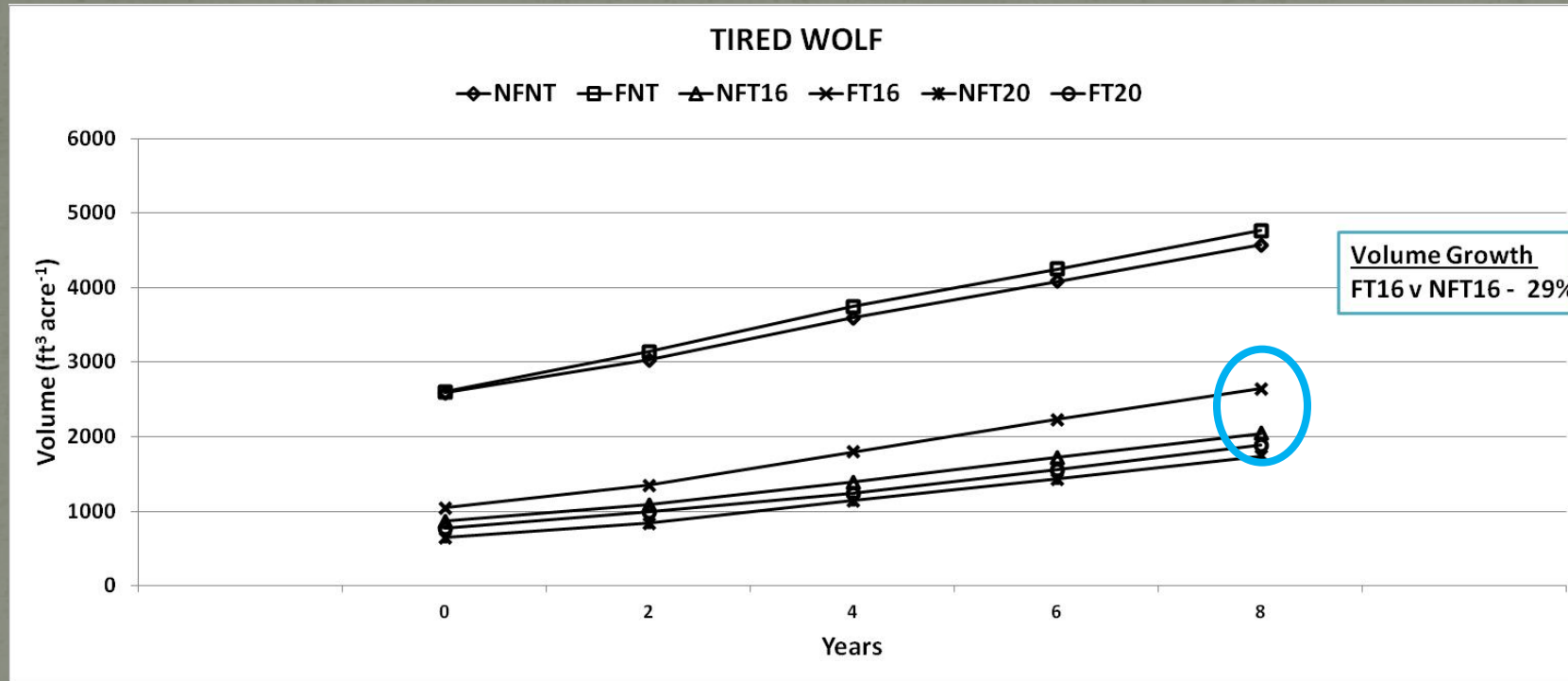


- *Stand Trends*

- *High density treatments have steeper growth trend lines*
- *High density treatments carrying more volume over time*
- *Fertilizer effect on all densities; Strong effect on FT16*
- *Ash/Basalt soil strata at Tired Wolf a “good” fert responder*

Whole-Stand:

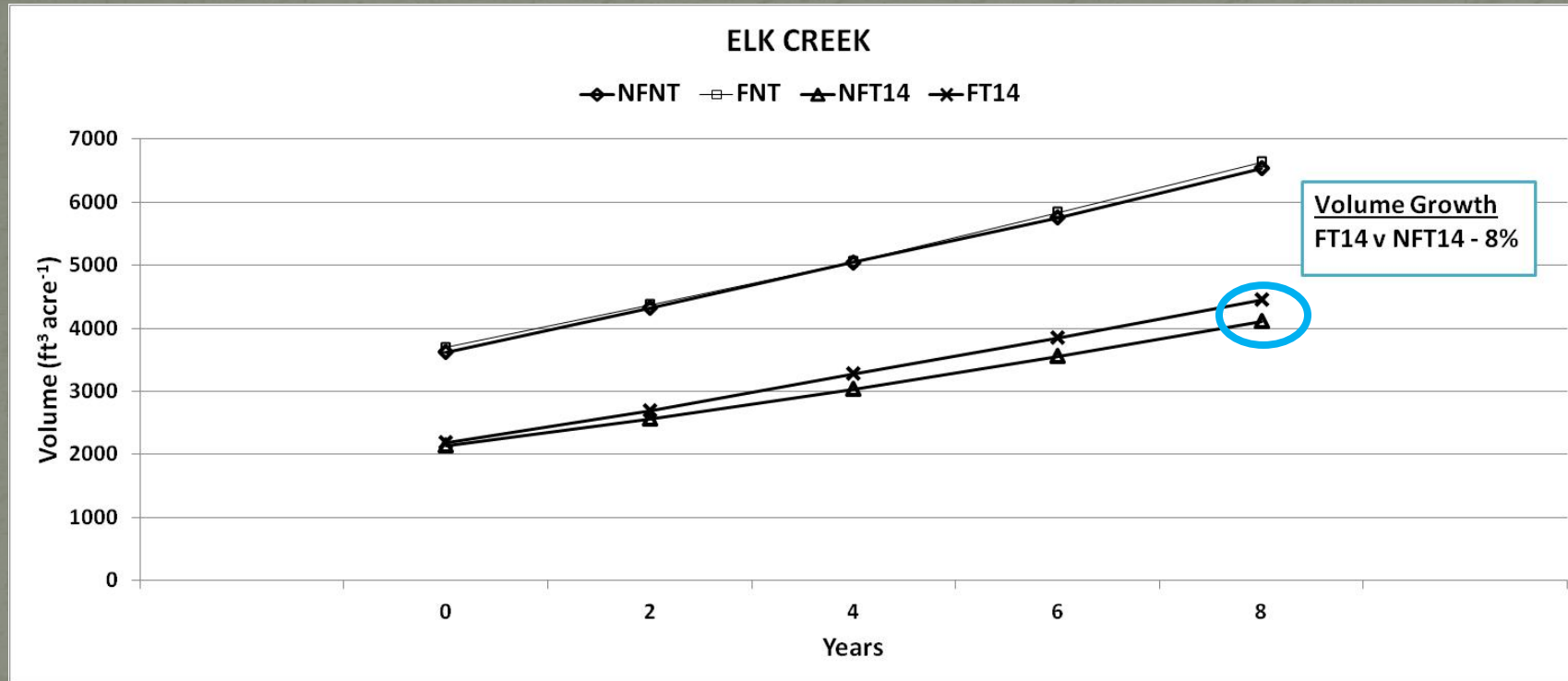
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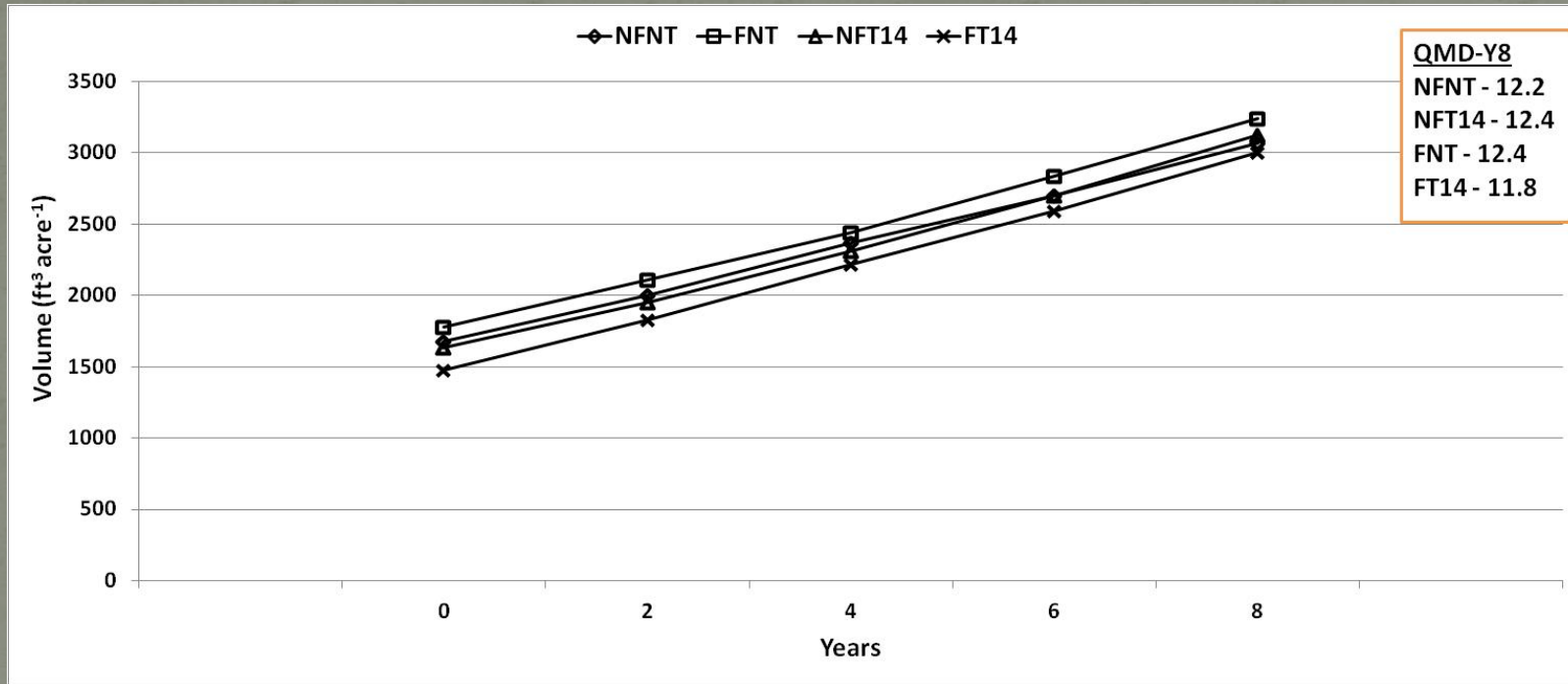
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Whole-Stand: 8YR Volume Trends at Elk Creek



- *Stand Trends*
 - *Again, high density treatments have steeper growth trend lines*
 - *Again, high density treatments carrying more volume over time*
 - *Small fertilizer effect for the FT14*

Crop-Tree (Largest 150 TPA): Volume Trends at Elk Creek

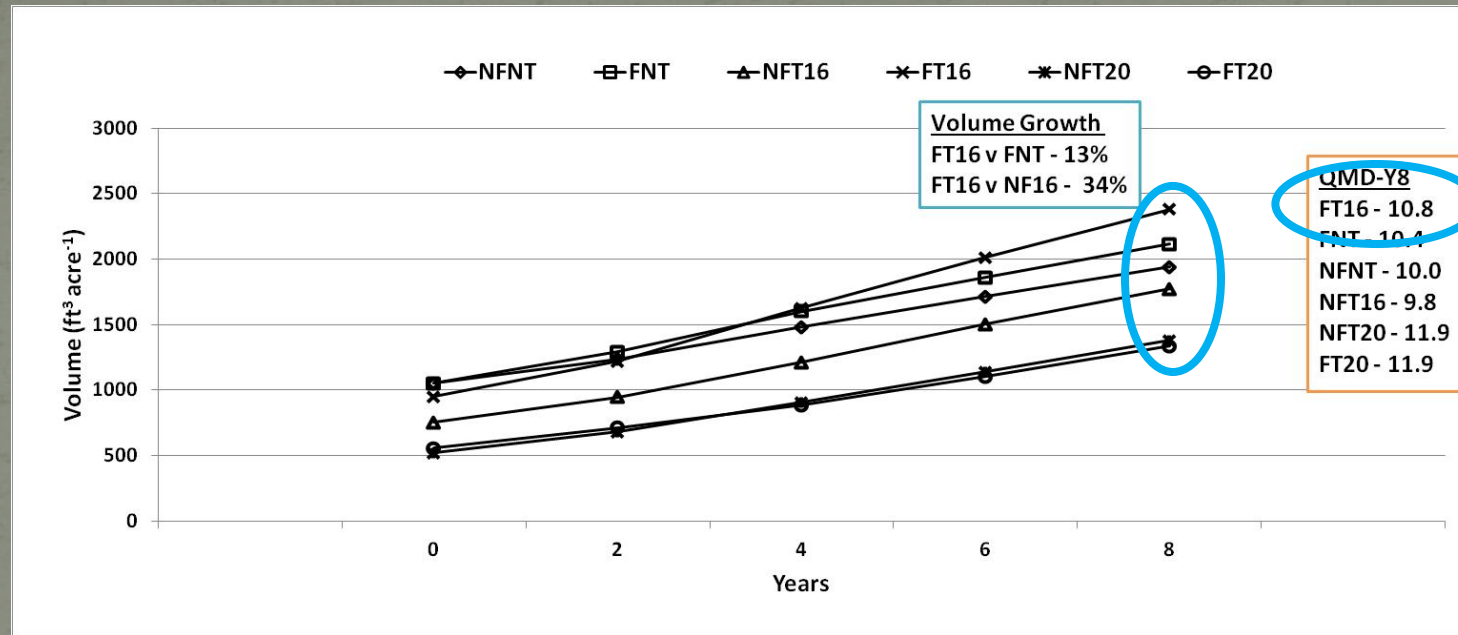


- *Crop Tree Trends*
 - *Crop-Tree high density & low density treatments have similar growth trend lines, 8YR volumes and 8YR QMDs*
 - *Similar crop tree trend line relationships were shown for Moe*
 - *These results beg the question: Should stands similar in stand development, as Moe and Elk Creek when treated, be commercially thinned or don't treat and remove all at harvest.*

Commercial Thin at Elk Creek and Moe cont.

- Key Management Talking Points
 - Probably missed the PCT window
 - Commercial thin must be financially viable
 - Managing for Crop Trees at end of rotation?
 - However, short time period until final harvest if CT
 - If not CT, additional stand volume in non-crop trees at harvest

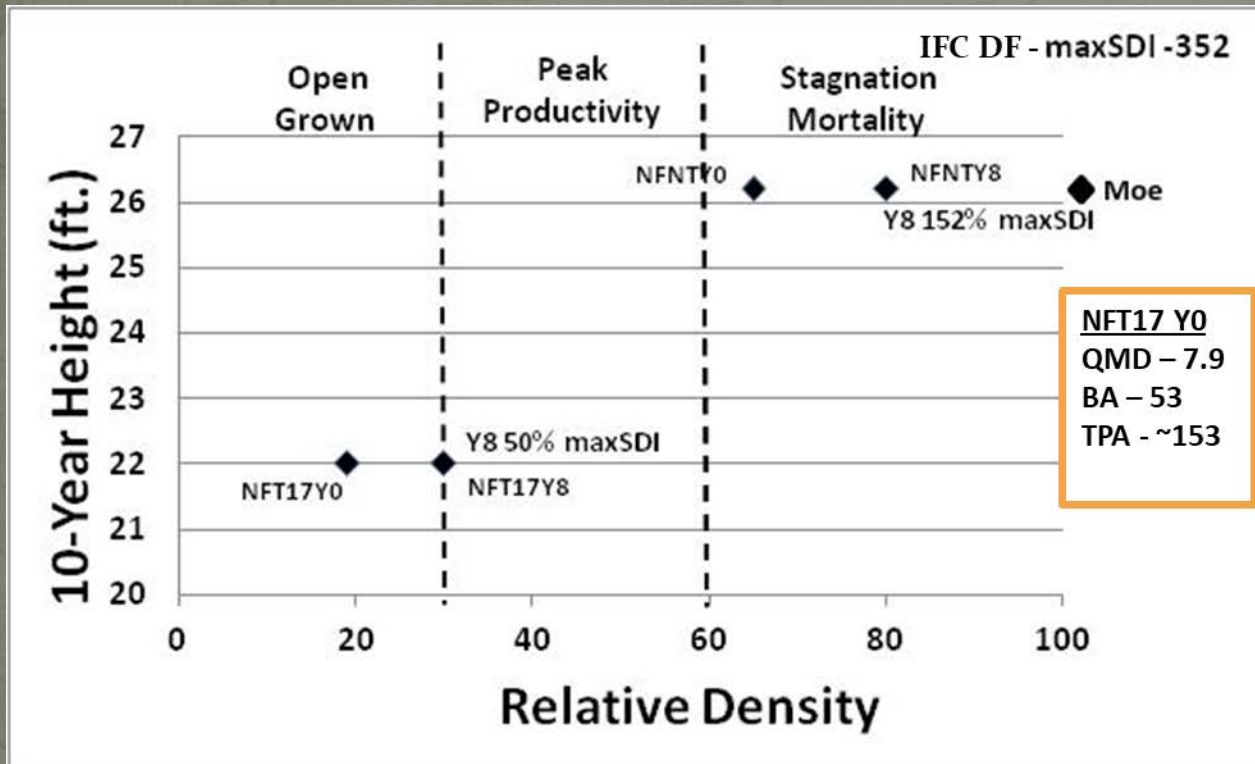
Crop-Tree (Largest 150 TPA): Volume Trends at Tired Wolf



- *Crop Tree Trends*
 - *Crop-Tree FT16 has highest 8YR volume and largest 8YR QMD*
 - *Crop-Tree FT16 “crossed over” NFNT and FNT*
 - *Crop-Tree FT16 steeper trend line than all treatments*
 - *Crop-Tree NFT16 steeper trend line than NFNT*
 - *Is fertilization partially compensating volume loss due to thinning? Absolutely!*

Whole-Stand:

Relative Density Growth Phase at Moe

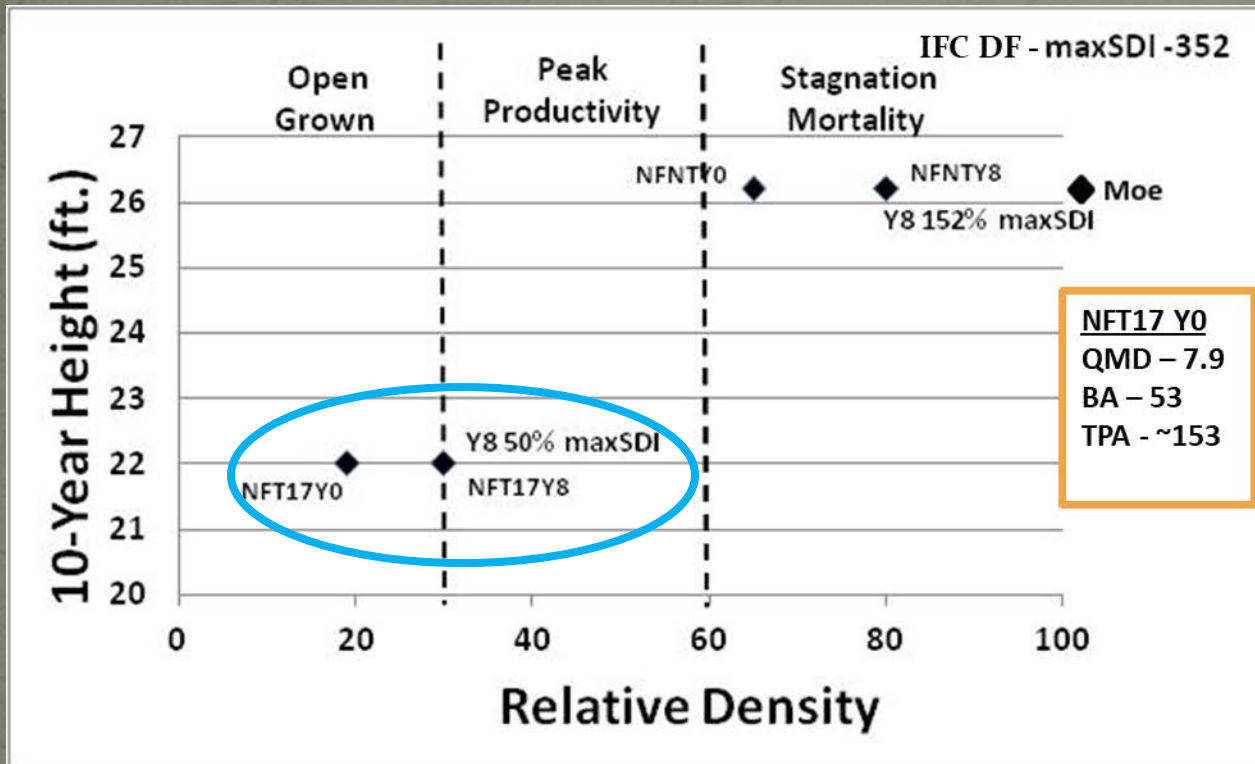


- *Stand Development:*

- *NFNT in “Stagnation/Mortality” RD phase, 8YR 152% maxSDI*
- *NFT17 always in “Open Grown” all eight years after treatment, 50% maxSDI, not fully utilizing site growth potential*
- *The commercial thin leave stand at Moe did not capture the full growth potential of the site*

Whole-Stand:

Relative Density Growth Phase at Moe

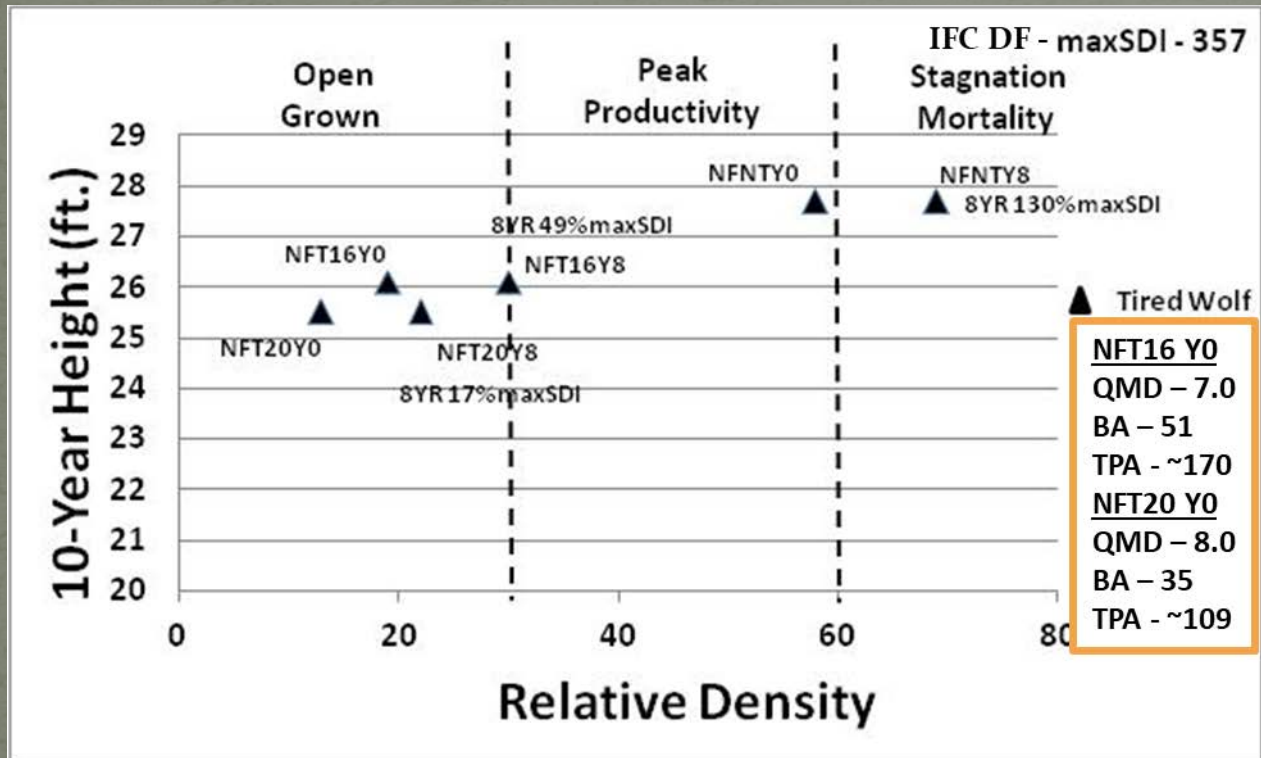


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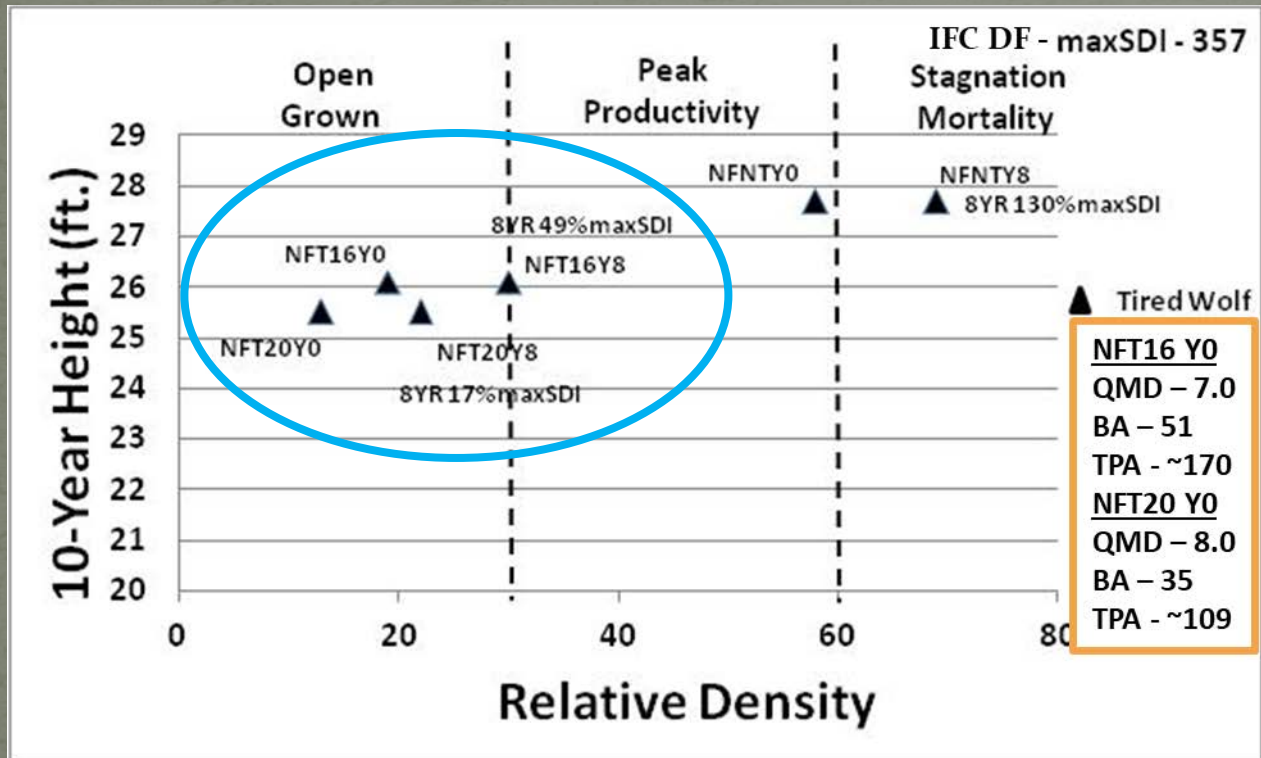
Relative Density Growth Phase at Tired Wolf



- *Stand Development:*
 - *NFNT in “Stagnation/Mortality” RD phase, 8YR 130% maxSDI*
 - *NFT16 always in “Open Grown” phase all eight years after treatment, 49% maxSDI, not fully utilizing site growth potential*
 - *NFT20 always in “Open Grown” phase, 17% maxSDI, way underperforming*
 - *The thin-leave stands at Tired Wolf do not utilize the full site growth potential*

Whole-Stand:

Relative Density Growth Phase at Tired Wolf

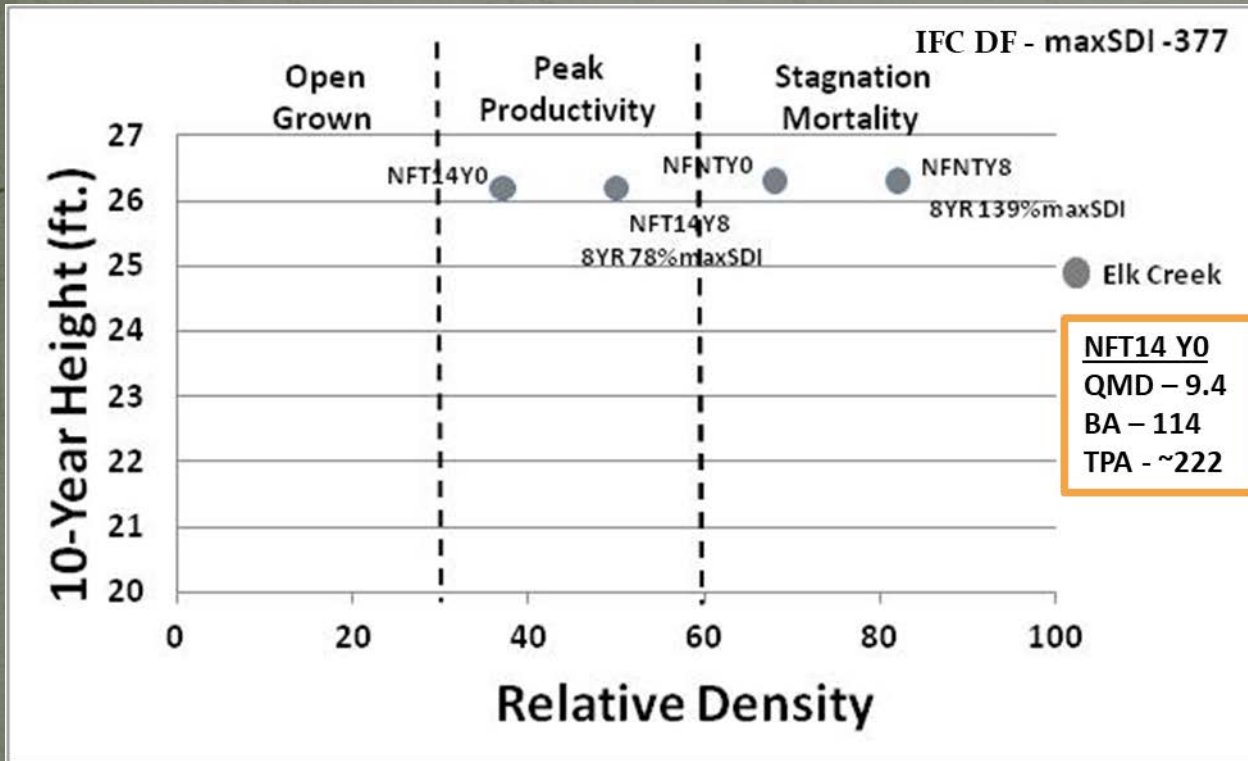


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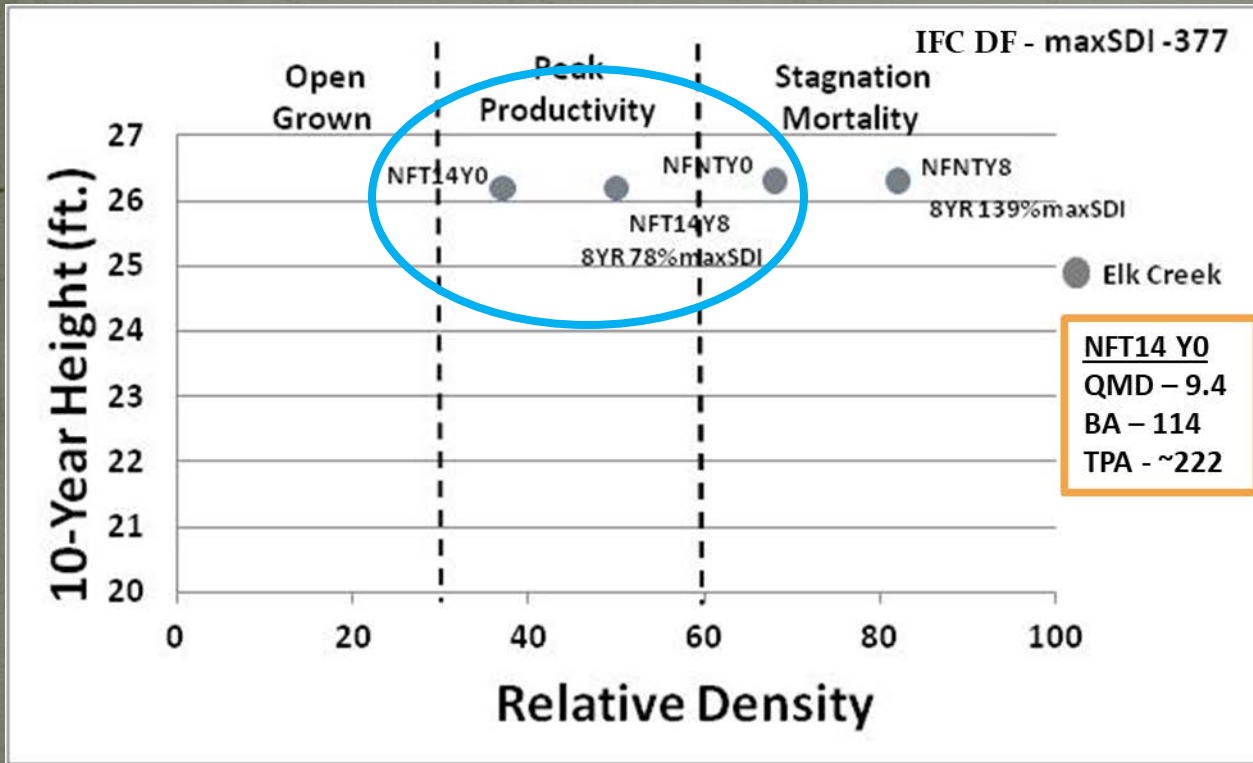
Relative Density Growth Phase at Elk Creek



- *Stand Development:*
 - *NFNT in “Stagnation/Mortality” RD phase, 8YR 139% maxSDI*
 - *NFT14 always in “Peak Productivity” phase, fully utilizing site potential*
 - *78% maxSDI agrees with RD “Peak Productivity” phase*
 - *Poster Child!!!! The commercial thin leave stand at Elk Creek did capture the full growth potential of the site*

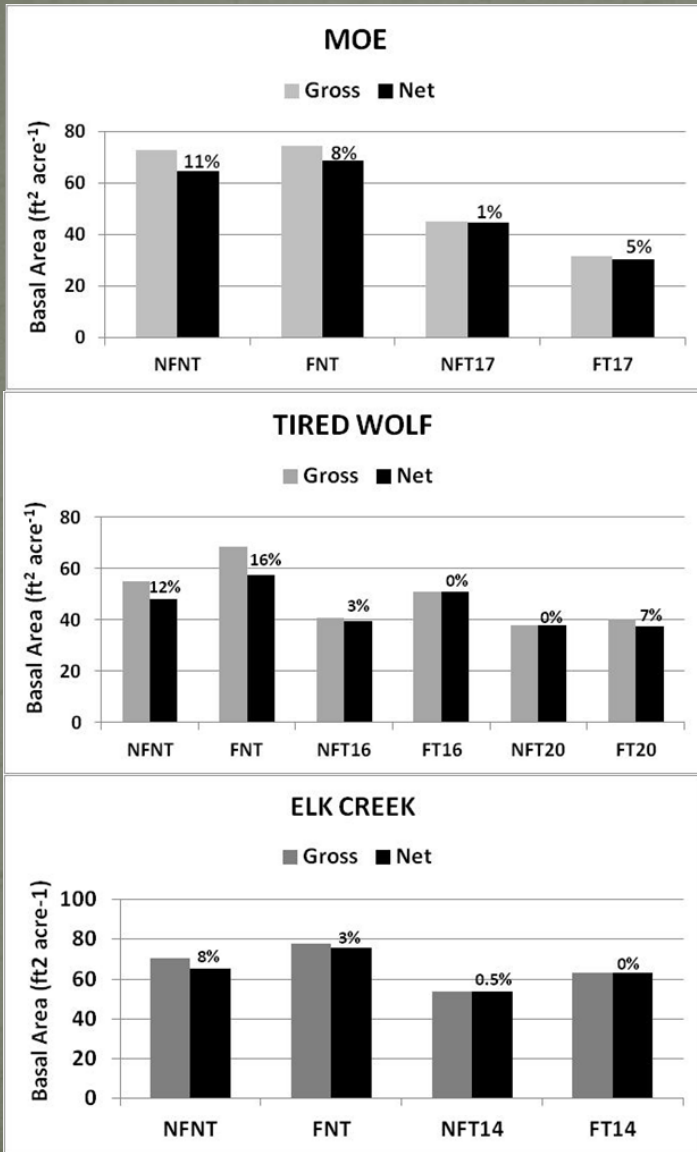
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FERT-THIN Gross and Net Stand BA Growth



- *Stand Mortality:*

- *Overall BA mortality low*

- *Not surprisingly, mortality higher for the high density treatments*

- *Highest BA Annual: Moe ~ 1.4%, Tired Wolf ~ 2.0% and Elk Creek ~ 1.0%*

- *No strong relationship b/t fertilization and mortality*

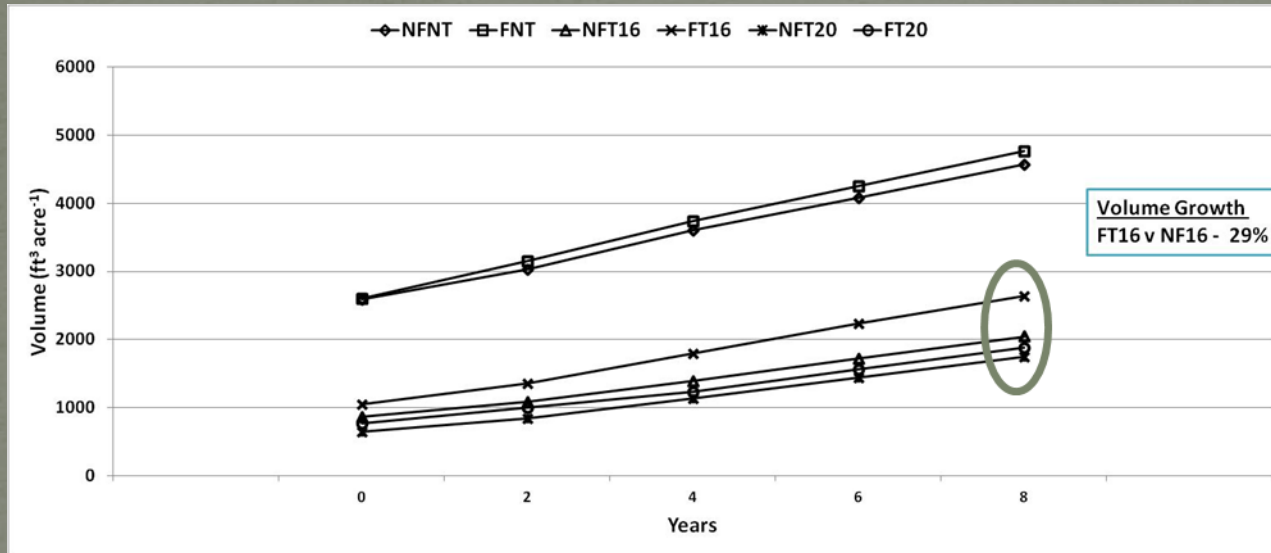
FERT-THIN Summary

- **Stand Growth Trends:**
 - *FERT-THIN Highly Dependent on site and density*
 - *Stand fert response – Tired Wolf > Elk Creek > Moe*
 - *Stand no-thin always higher yields*
 - *Crop Tree 8YR trend lines, volumes and QMDs were similar b/t density treatments*
 - *Fertilization response for the FT16 treatment at Tired Wolf compensated for stand volume losses due to thinning*
- **Stand Growth Phases:**
 - *Timing of stand entry, as it relates to stand development, is crucial in capturing full site growth potential after treatment*
- **Stand Mortality:**
 - *Low annual mortality*
 - *Higher on high density plots*



FERT-THIN Summary

– *WHAT IF: site types similar to Tired Wolf were fertilized*



– *and thinned to similar stand metrics and timing as Elk Creek*

| METRIC – NFT ₁₄ YO | ELK CREEK |
|--|-----------|
| Quadratic Mean Diameter (QMD) | 9.4" |
| Trees Per Acre (TPA) | ~222 |
| Basal Area (ft ² ac ⁻¹) | 114 |

*MAXIMUM
PRODUCTIVITY!!!!*