

Pre-treatment Stand Structure
Within CFLRP Projects on the
Pike and Arapaho-Roosevelt
National Forests.

Arapaho-Roosevelt Projects

- Stands located within six project areas
- Eighty-seven total stands
 - Eleven distinct species cover types
 - Four major cover types
 - Ponderosa pine N=42
 - Douglas-fir N=19
 - Ponderosa pine / Douglas-fir N=6
 - Lodgepole pine N=11
 - All other cover types had one to three stands each

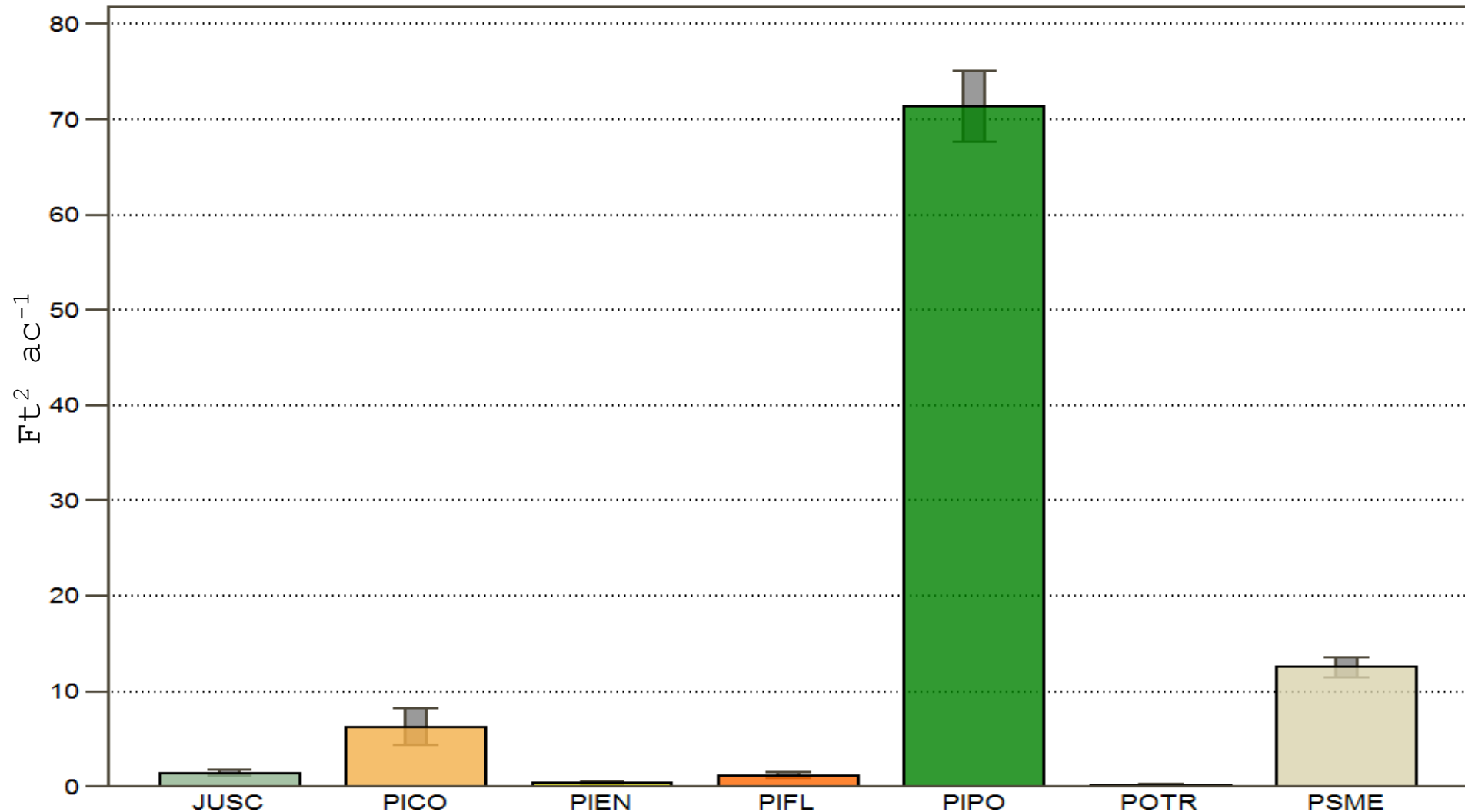
Arapaho-Roosevelt Projects

- Lodgepole pine cover type BA was significantly different ($p=0.0029$) between Estes Valley and Thompson River projects.
 - Thompson River was significantly lower than Estes Valley
 - These project areas reported separately
- No significant differences between projects within all other cover types.
 - All cover types apart from lodgepole pine summarized across all project areas
- No differences between cover types with regard to BA and TPA summarized over all projects.

Ponderosa Pine

- Forty-two stands with ponderosa pine as the dominant cover type species.
- Six pure ponderosa pine stands
- Average BA: $93\text{ft}^2\text{ ac}^{-1}$ (SE 6.6)
 - Minimum = 9.8 (10 stands $<60\text{ ft}^2$)
 - Maximum = 205.3
- Average TPA: 342 trees ac^{-1} (SE 34)

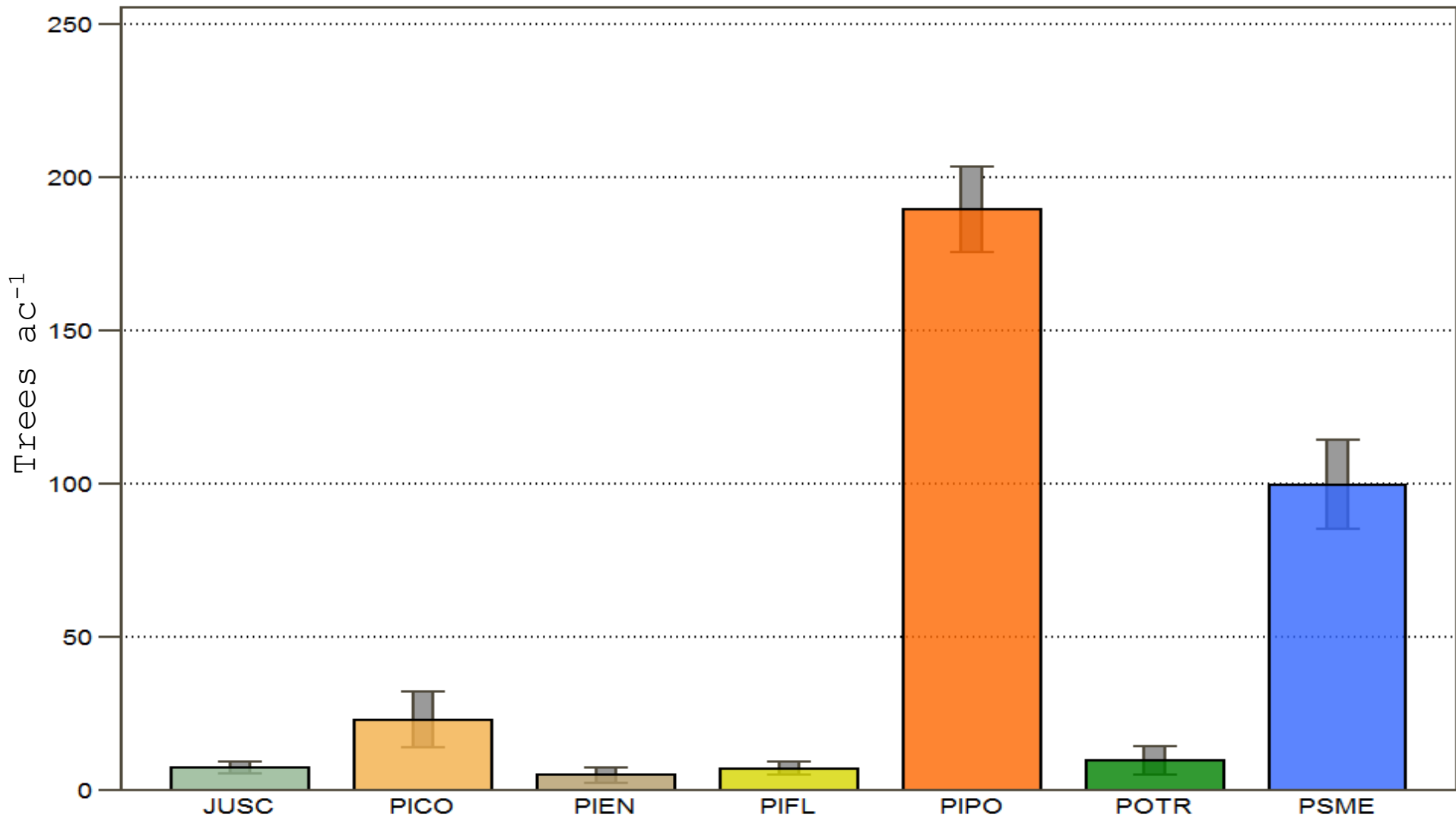
Basal Area by Species for Ponderosa Pine Cover Type



Species Composition by Basal Area:

PIPO = 77% PSME = 13% PICO = 7% JUSC = 2% PIFL = 1%
PIEN/POTR < 1 % each

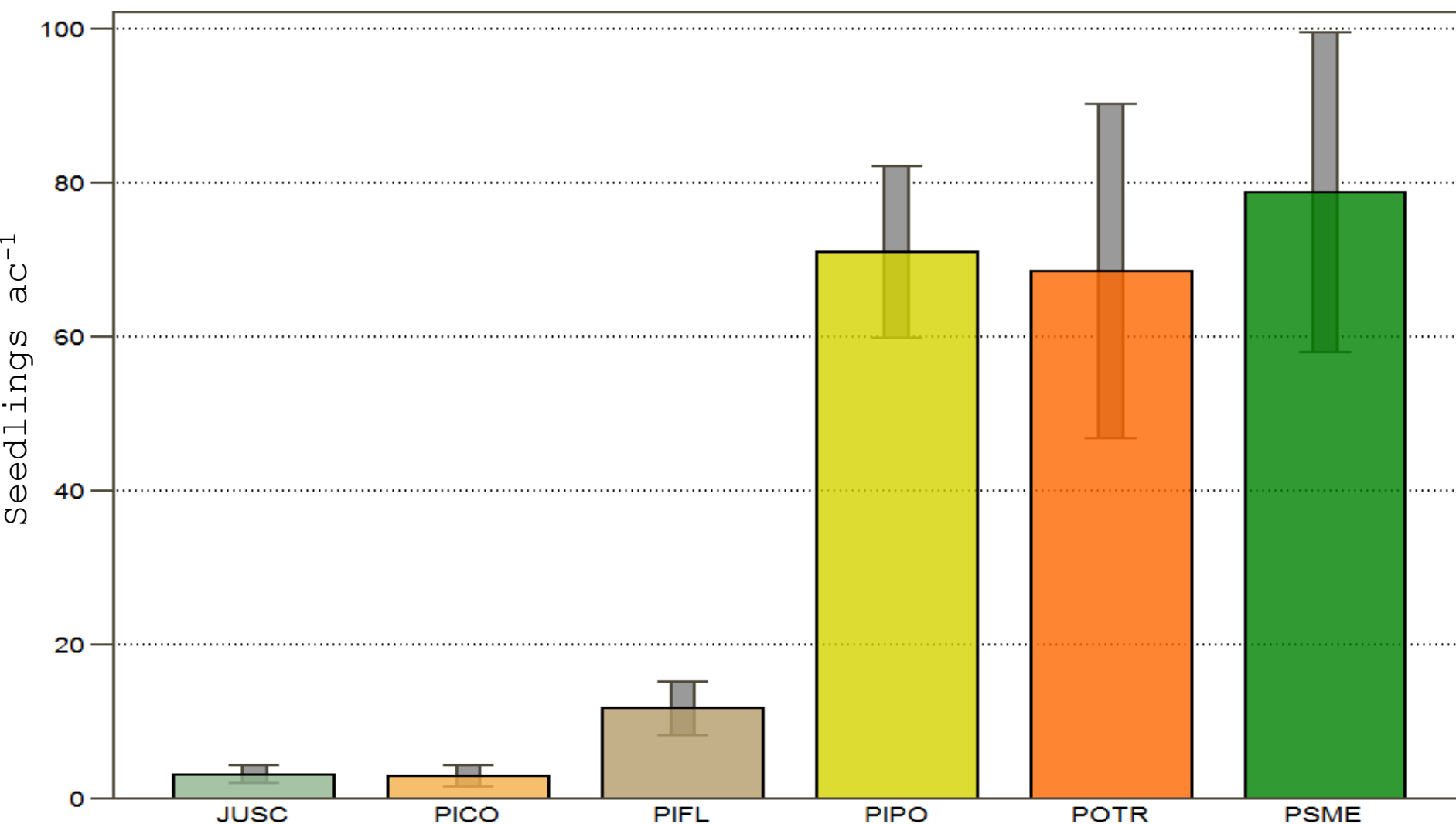
Trees per Acre by Species for Ponderosa Pine Cover Type



Species Composition by Trees per Acre:

PIPO = 55% PSME = 29% PICO = 7% POTR = 3%
JUSC/PIFL/PIEN = 2%

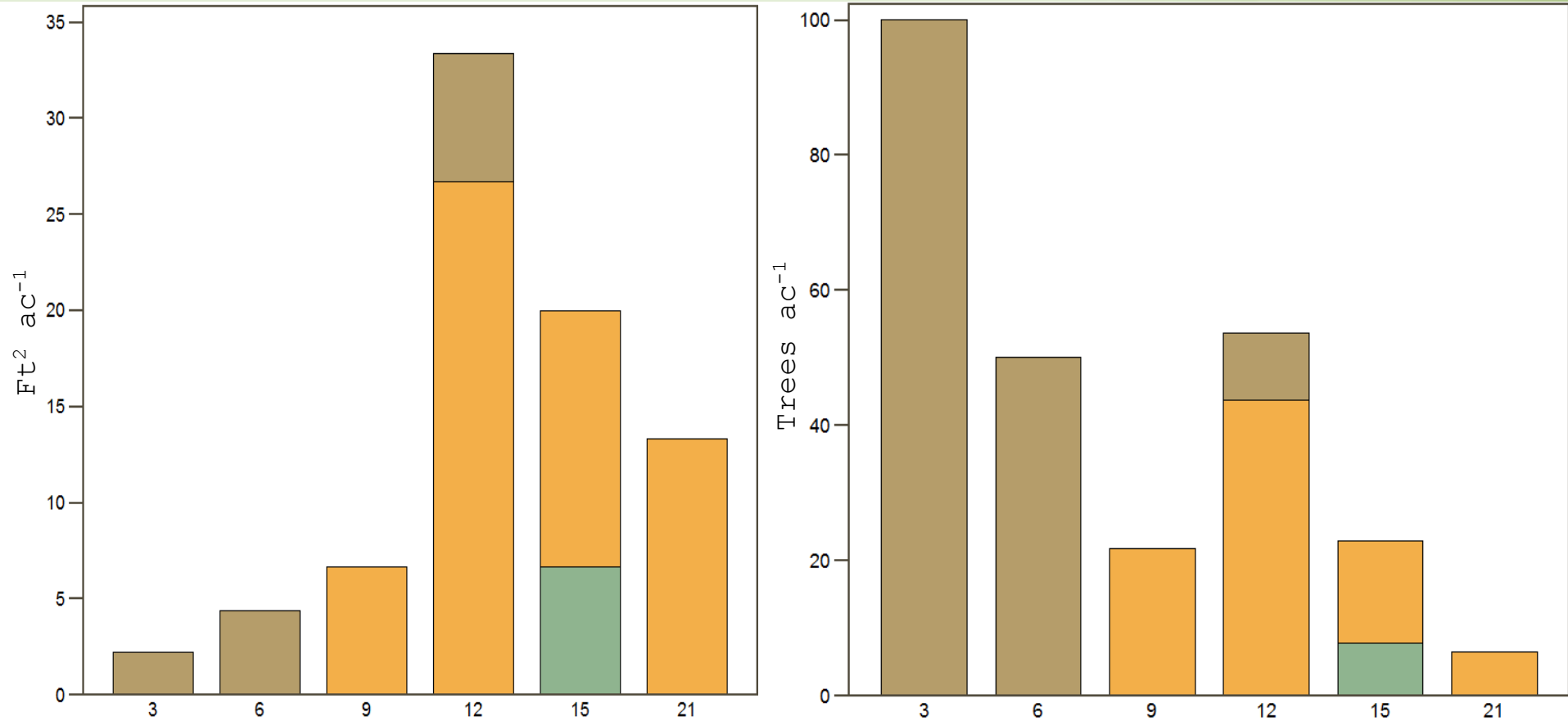
Regeneration by Species for Ponderosa Pine Cover Type



Seedling Regeneration by Species:
PIPO = 30% PSME = 33% PIFL = 5% POTR = 29%
PICO/JUSC = 1% each

Ponderosa Pine

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PIPO = 60.0 ft² (75%)

PSME = 13.2 ft² (17%)

PICO = 6.7 ft² (8%)



Trees per Acre:

PSME = 160 (63%)

PIPO = 87 (34%)

PICO = 8 (3%)

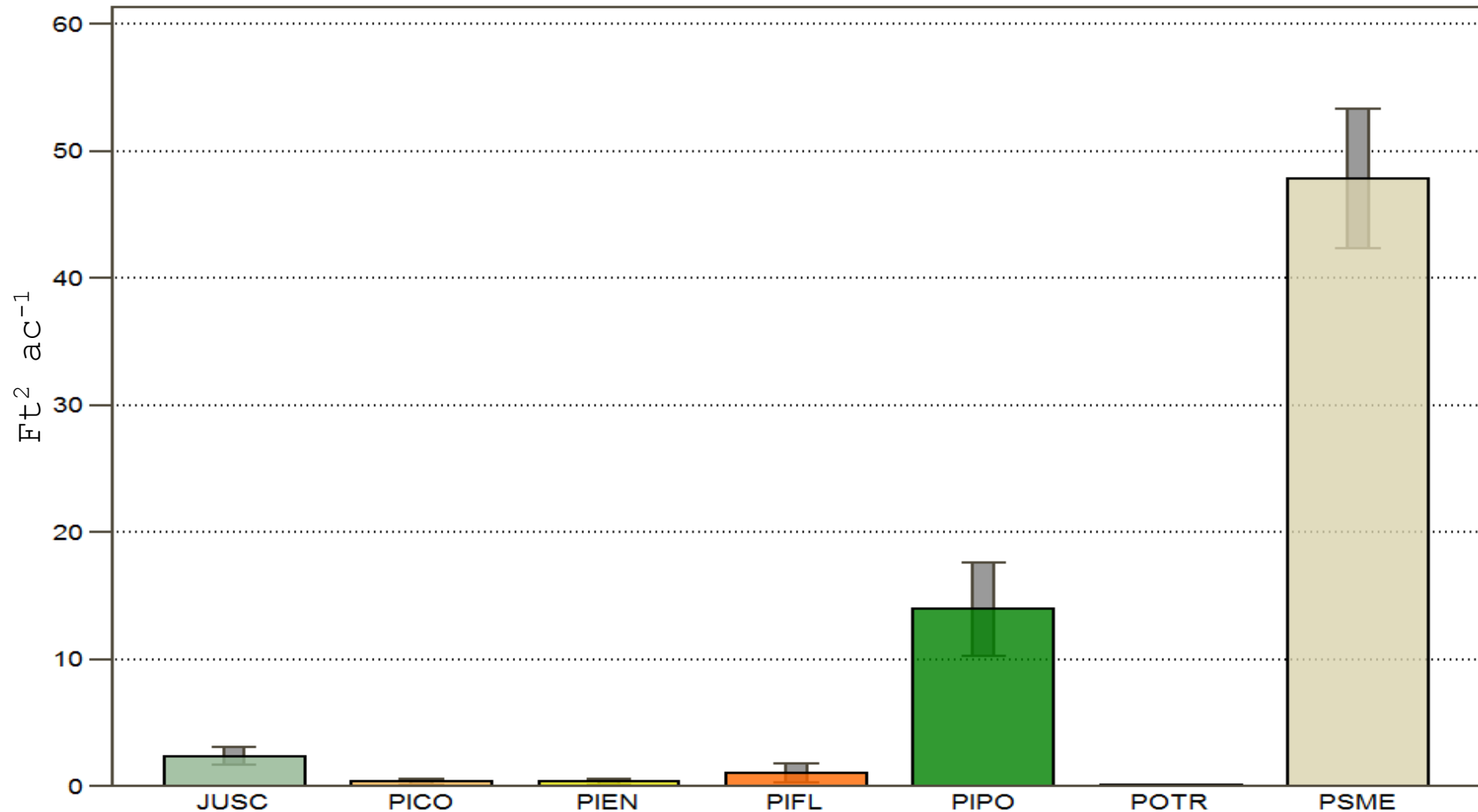
Ponderosa Pine

- Stands are overgrown
 - High BA (goal = 40-60 BA)
 - High TPA
- Successful ponderosa pine regeneration, but light
 - No regeneration detected in some stands
 - Variable between and within stands
 - Competition from other coniferous and deciduous spp
- Fire Behavior (85°F, fall seasonality)
 - No fuels sampling completed
 - Using FVS system defaults
 - Torching Indices variable – 9 to conditional crowning
 - Crowning Indices 15-35 mph

Douglas-fir

- Nineteen stands with Douglas-fir as the dominant cover type species.
- Average BA: $66 \text{ ft}^2 \text{ ac}^{-1}$ (SE 12.9)
- Average TPA: $376 \text{ trees ac}^{-1}$ (SE 66)

Basal Area by Species for Douglas –fir Cover Type

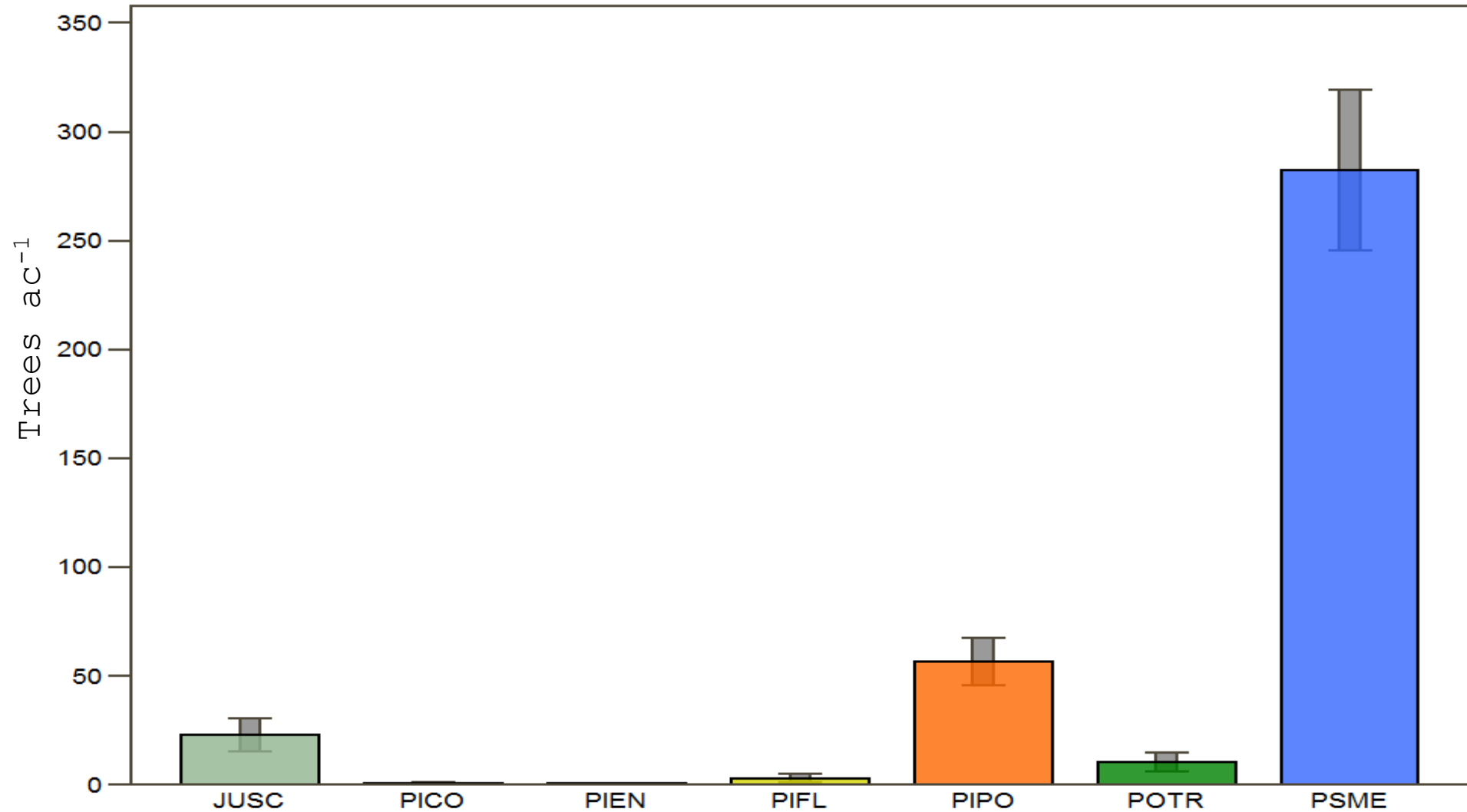


Species Composition by Basal Area:

PSME = 72% PIPO = 21% JUSC = 4% PIFL = 2%

PICO/PIEN/POTR <1 % each

Trees per Acre by Species for Douglas –fir Cover Type

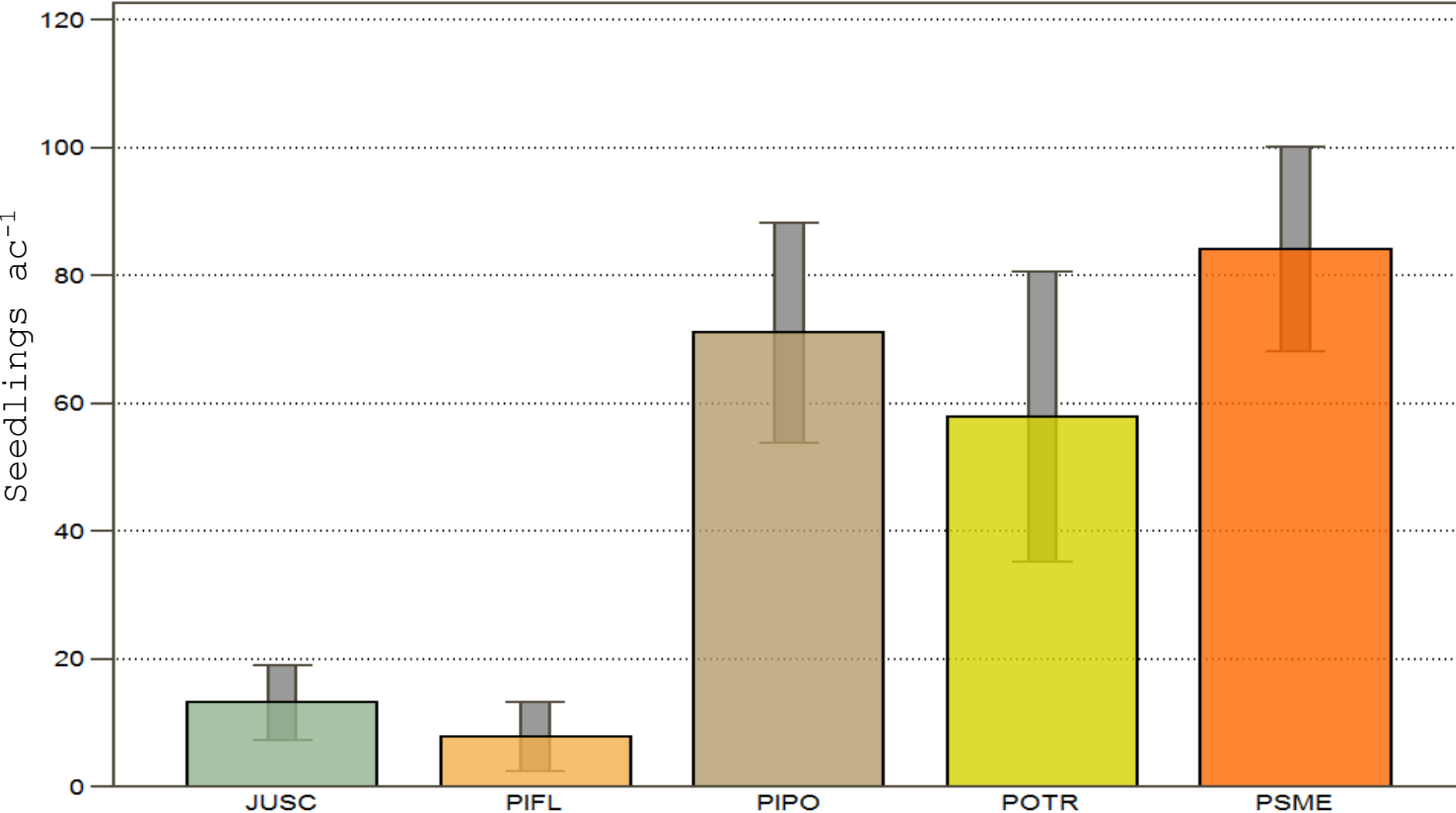


Species Composition by Trees per Acre:

PIPO = 15% PSME = 75% JUSC = 6% POTR = 3%

PICO/PIEN/PIFL <1 % each

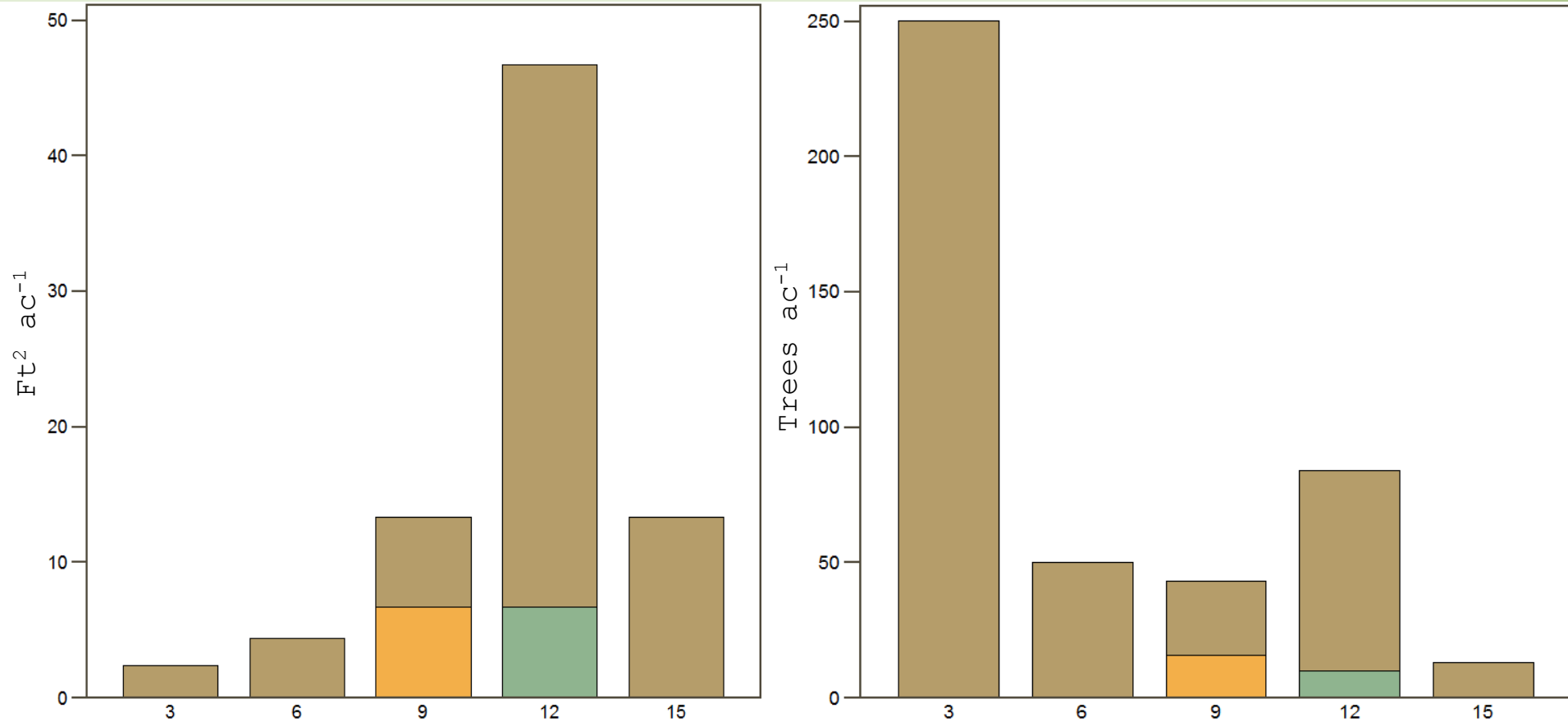
Regen per Acre by Species for Douglas –fir Cover Type



Seedling Regeneration by Species :
PSME = 36% PIPO = 30% POTR = 25% JUSC = 6% PIFL = 3%

Douglas-fir

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PSME = 66.8 ft² (83%)

PIPO = 6.7 ft² (8%)

JUSC = 6.7 ft² (8%)

Species

JUSC2

PIPO

PSME

Trees per Acre:

PSME = 414 (94%)

PIPO = 16 (4%)

JUSC = 10 (3%)

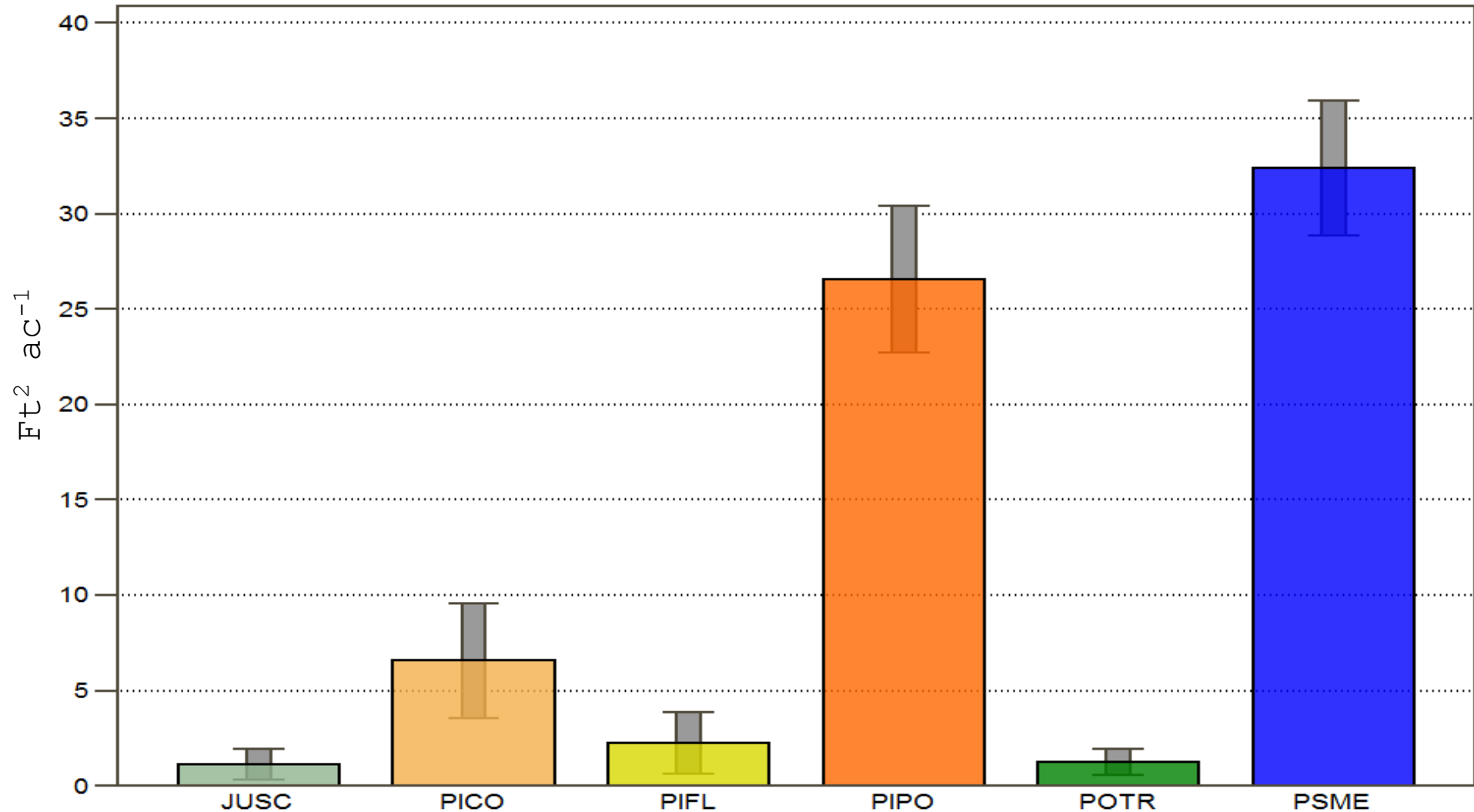
Douglas-fir

- Dense stands
 - Approximately same BA as ponderosa stands
- Successful regeneration in the understory
 - Near even mix of Douglas-fir, ponderosa pine, and aspen
- Fire Behavior (85°F, fall seasonality)
 - No fuels sampling completed
 - Using FVS defaults
 - Torching Indices variable from 1 to cond. crown
 - Crowning Indices 16-34 mph (20 ft windspeed)

Ponderosa Pine / Douglas-fir

- Six stands with ponderosa pine and Douglas-fir as co-dominant cover type species.
- Average BA: $70.1 \text{ ft}^2 \text{ ac}^{-1}$ (SE 9.7)
- Average TPA: $760 \text{ trees ac}^{-1}$ (SE 233)
 - Attributed to POTR regeneration

Basal Area by Species for PIPO / PSME Cover Type



Species Composition by Basal Area:

PSME = 46%

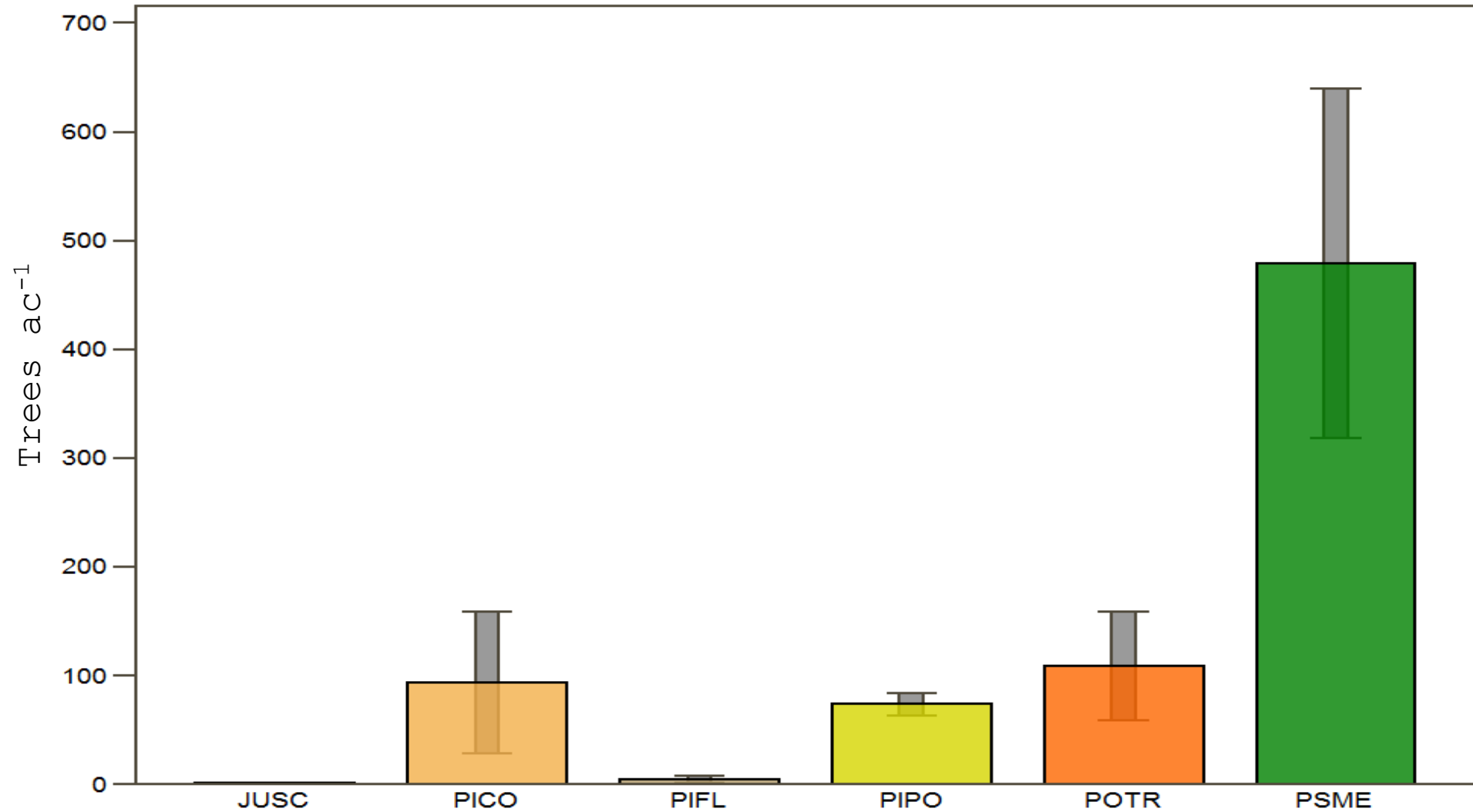
PIPO = 38%

PICO = 9%

PIFL = 3%

POTR/JUSC = 2% each

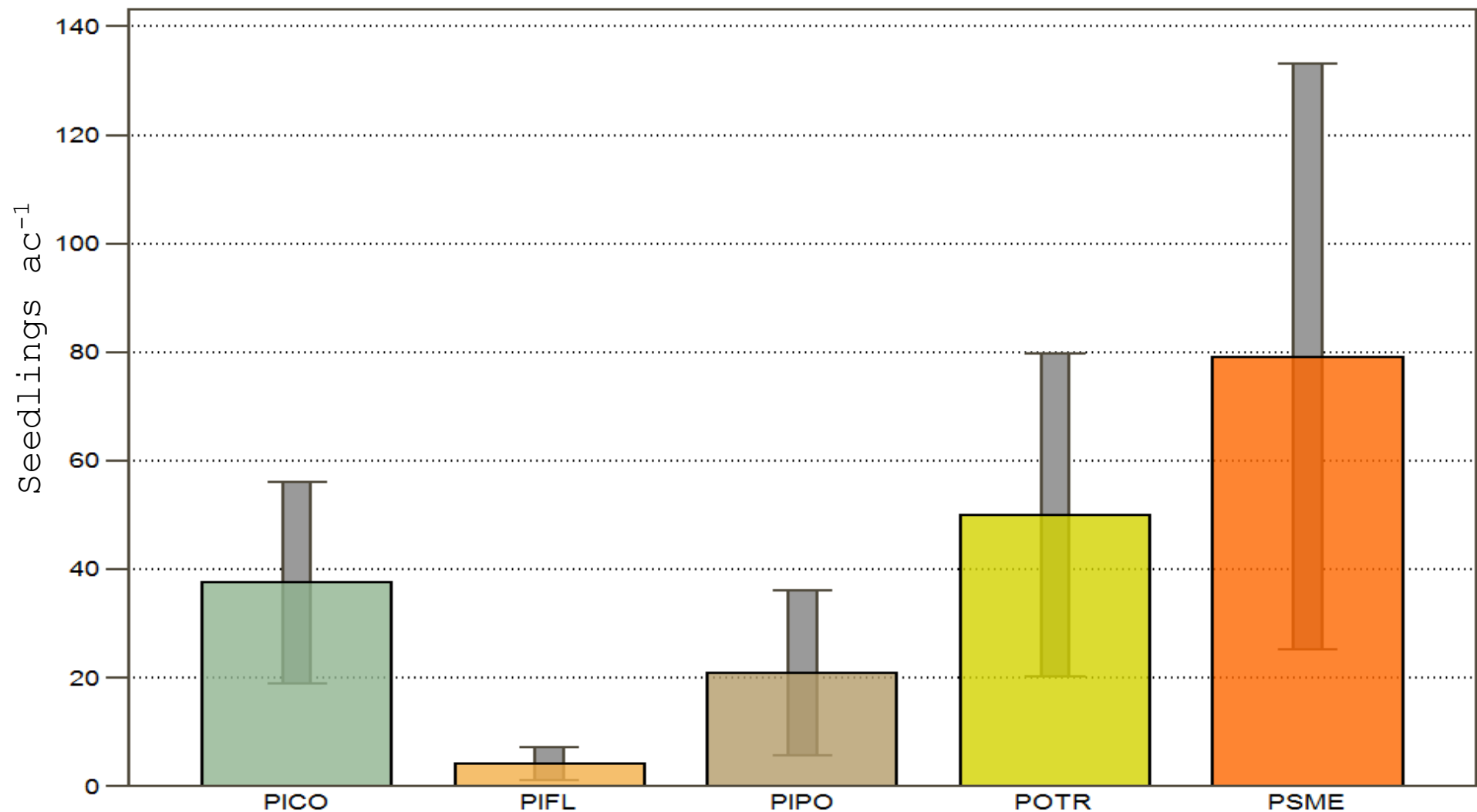
Trees per Acre by Species for PIPO / PSME Cover Type



Species Composition by Basal Area:

PSME = 63% POTR = 14% PIPO = 10% PIPU = 8% PICO = 12%
PIFL/JUSC <1 each

Regen per Acre by Species for PIPO / PSME Cover Type



Species Composition by Basal Area:

PSME = 41%

POTR = 26%

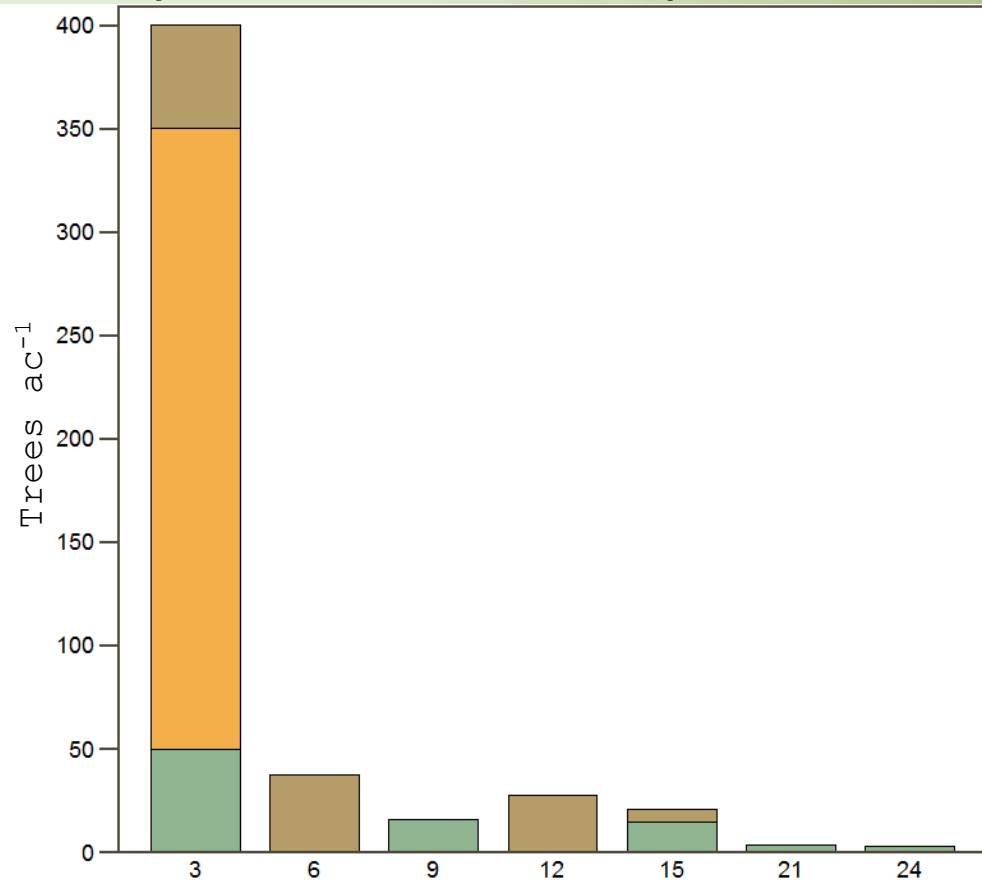
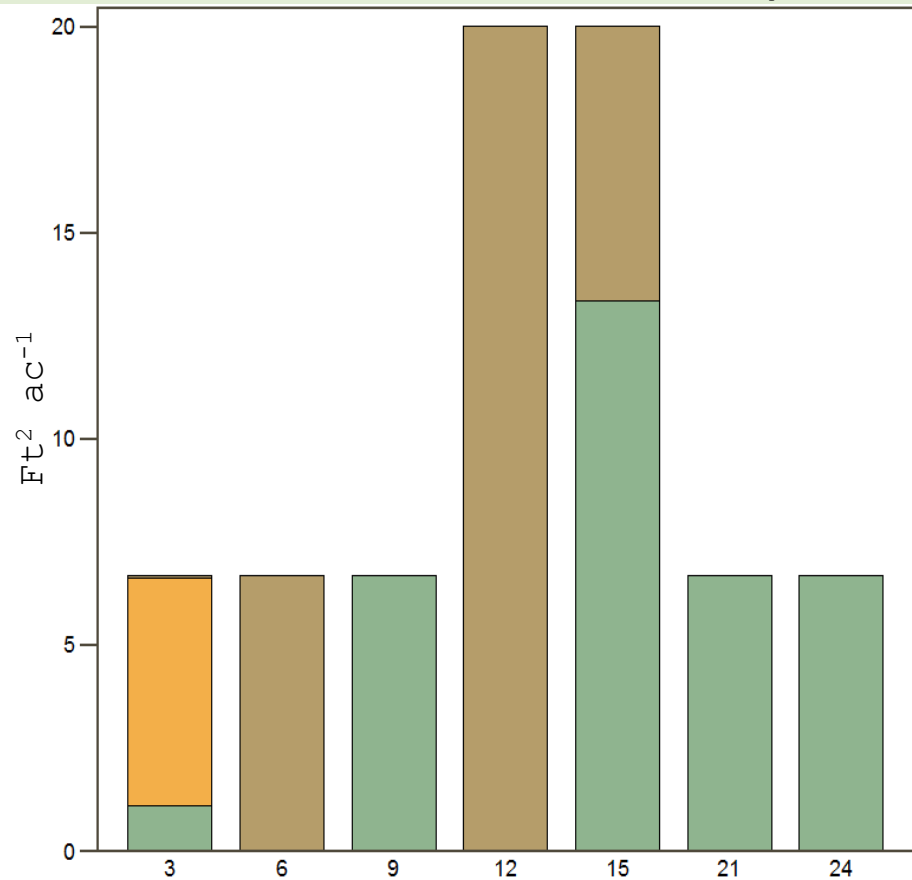
PICO = 20%

PIPO = 11%

PIFL = 3%

Ponderosa Pine/Douglas-fir

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PIPO = 34.4 ft² (47%)

PSME = 33.4 ft² (46%)

POTR = 5.5 ft² (8%)

Species



Trees per Acre:

POTR = 300 (59%)

PSME = 122 (24%)

PIPO = 86 (17%)

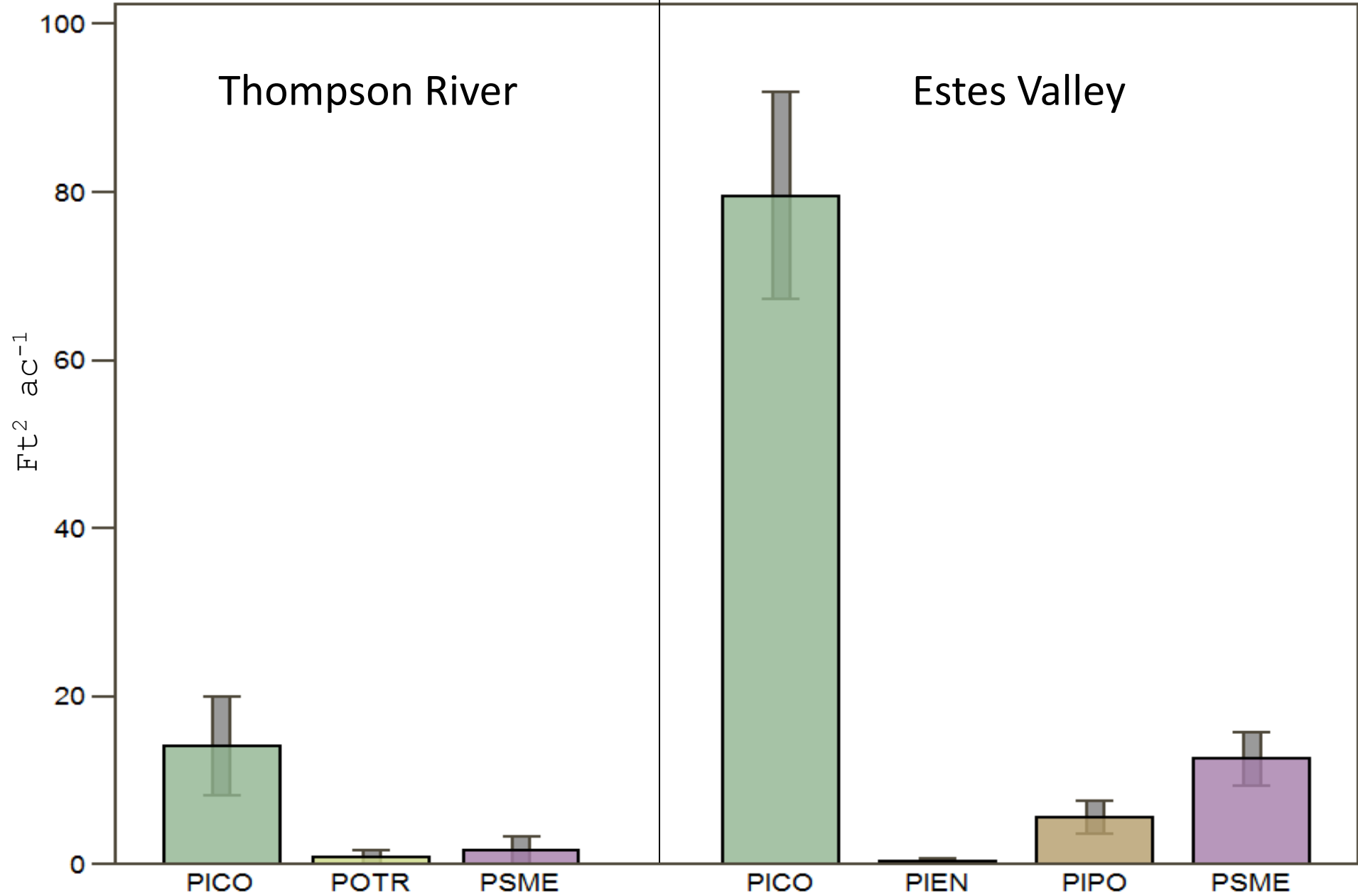
Ponderosa Pine / Douglas-fir

- Dense stands
 - Near equal distribution of BA and TPA in larger diameter classes between PIPO and PSME
- Regeneration
 - Variable between and within stands
 - Douglas-fir regen dominates, but is relatively light
- Fire Behavior (85°F, fall seasonality)
 - No fuels sampling completed
 - Using FVS defaults
 - Torching Indices variable from 9 to cond. crown
 - Crowning Indices 15-41 mph (20 ft windspeed)

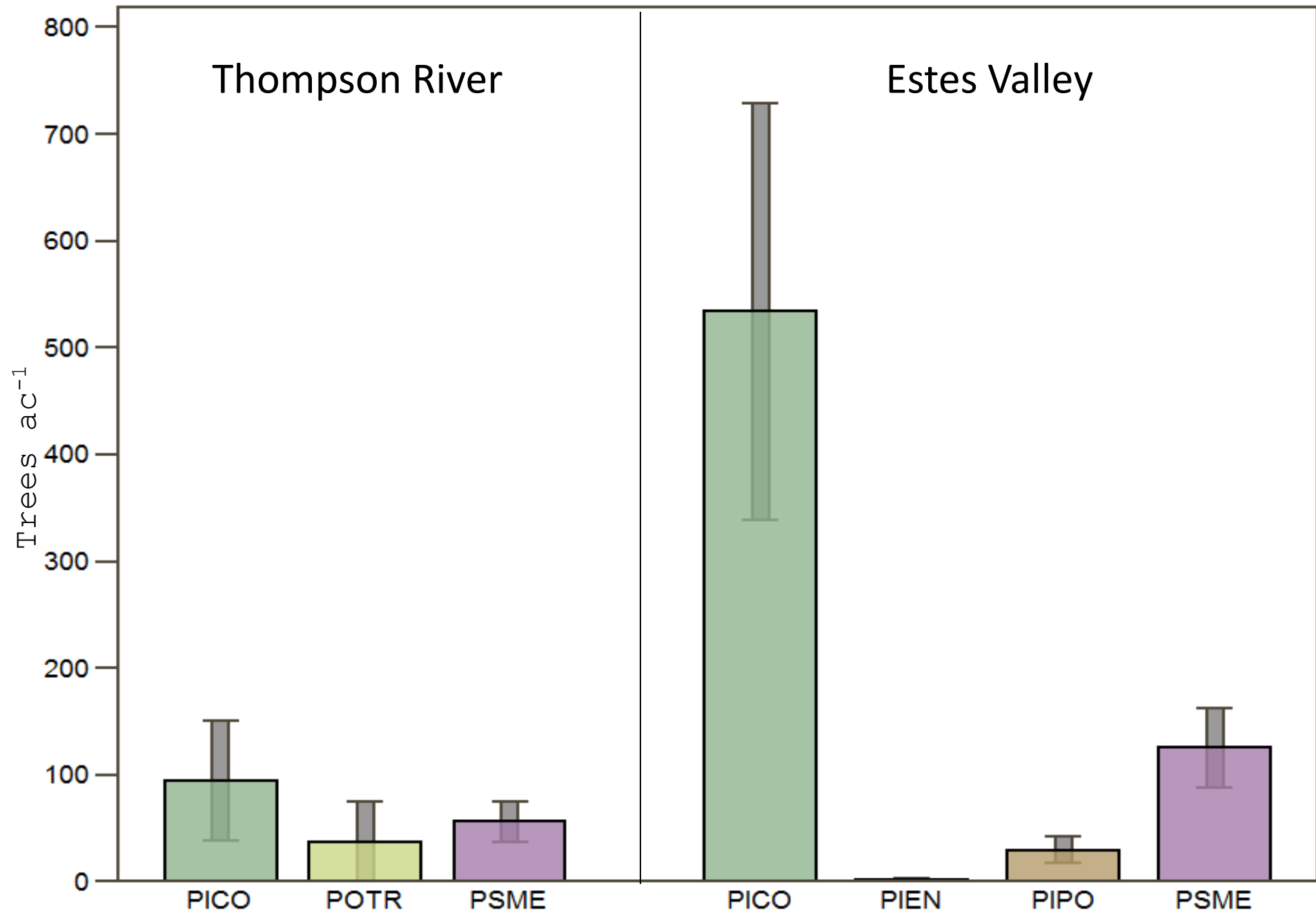
Lodgepole Pine

- Eleven stands with lodgepole pine as the dominant cover type species.
- Estes Valley and Thompson River significantly different
 - Displayed separately

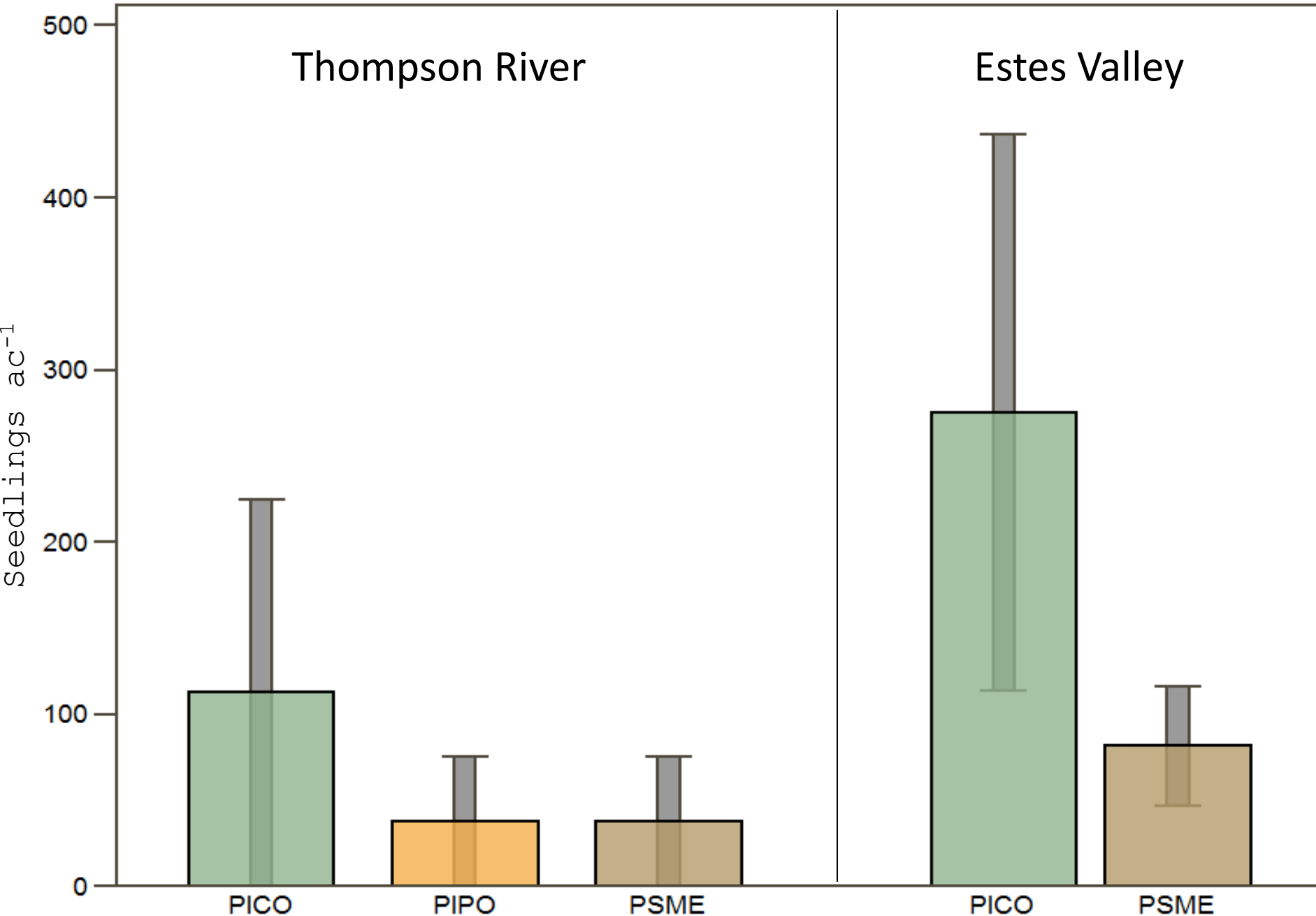
Basal Area by Species for Lodgepole Pine Cover Type



Trees per Acre by Species for Lodgepole Pine Cover Type

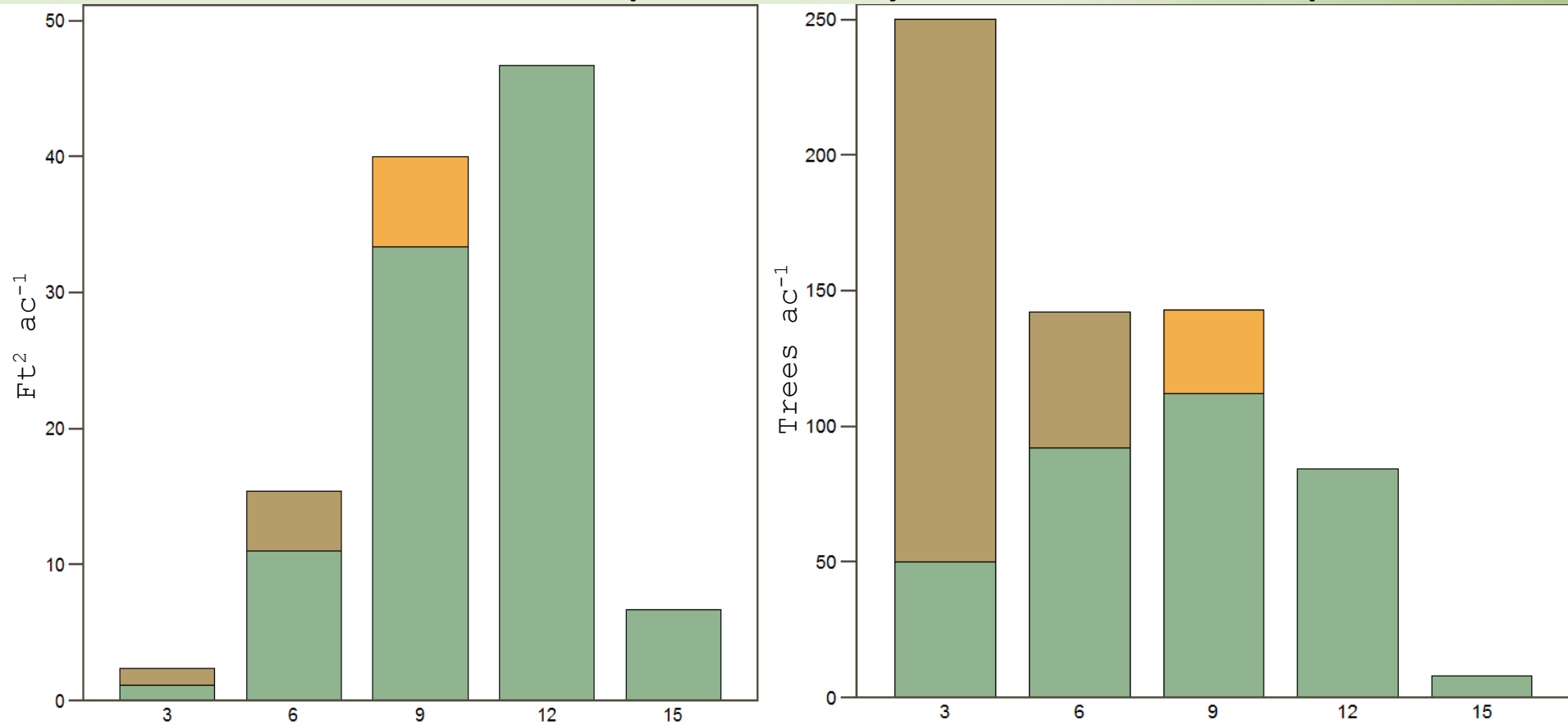


Regen per Acre by Species for Lodgepole Pine Cover Type



Lodgepole Pine

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PICO = 59.3 ft² (89%)

PIEN = 4.0 ft² (6%)

PSME = 3.4 ft² (5%)

Species



Trees per Acre:

PICO = 346 (55%)

PSME = 250 (40%)

PIEN = 31 (5%)

Lodgepole Pine

- Density
 - Basal area variable between stands and projects
 - Cause of decreased BA is unknown (at this time)
 - Trees per acre variable within species
- Regeneration
 - Highly variable
 - Lodgepole pine successfully regenerating in understory
- Fire Behavior (85°F, fall seasonality)
 - No fuels sampling completed
 - Using FVS defaults
 - Estes Valley
 - Torching Indices variable from 0 to cond. crown
 - Crowning Indices 9-28 mph (20 ft windspeed)
 - Thompson River
 - Torching Indices 20 – 26
 - Crowning Indices 27 - 52

Phantom Creek Project Areas

Pike National Forest

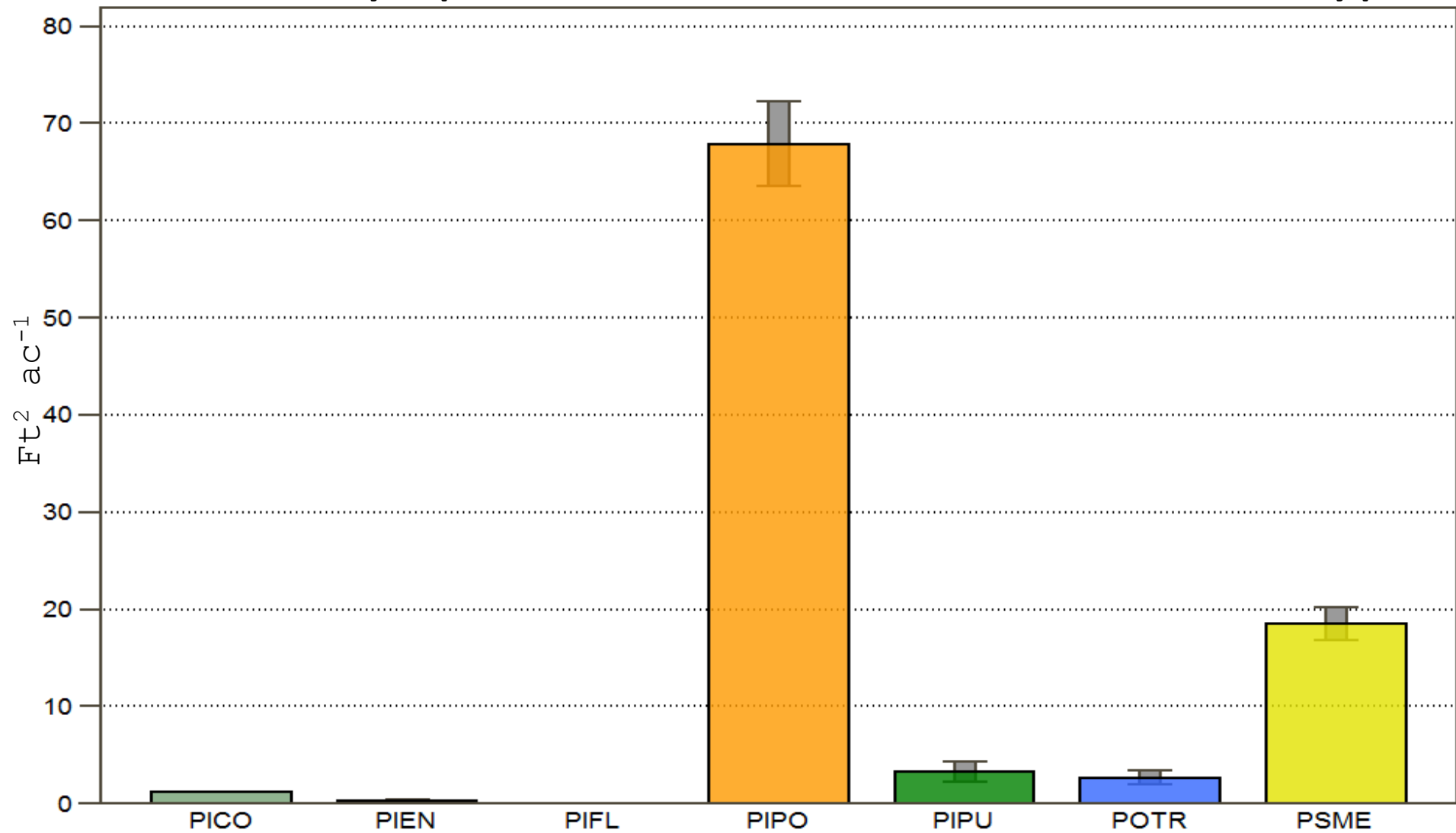
Phantom Creek Projects

- Total of 36 stands within four projects
- Stand type classified by basal area of dominant overstory species
 - Ponderosa pine (N=16)
 - Douglas-fir (N=6)
 - Ponderosa/Doug-fir (N=11)
 - One stand each of blue spruce, Engelmann spruce, and one stand already harvested when measured
- Basal area was not different between stand type ($p=0.88$)
- Douglas-fir stand type had significantly more trees ac^{-1} than ponderosa pine ($p=0.017$)

Ponderosa Pine

- Sixteen stands with ponderosa pine as the dominant cover type species.
- Only one pure ponderosa pine stand
 - All other stands had a component of Douglas-fir
- Average BA: $92.74 \text{ ft}^2 \text{ ac}^{-1}$ (SE 4.57)
- Average TPA: $261 \text{ trees ac}^{-1}$ (SE 37.9)

Basal Area by Species for Ponderosa Pine Cover Type

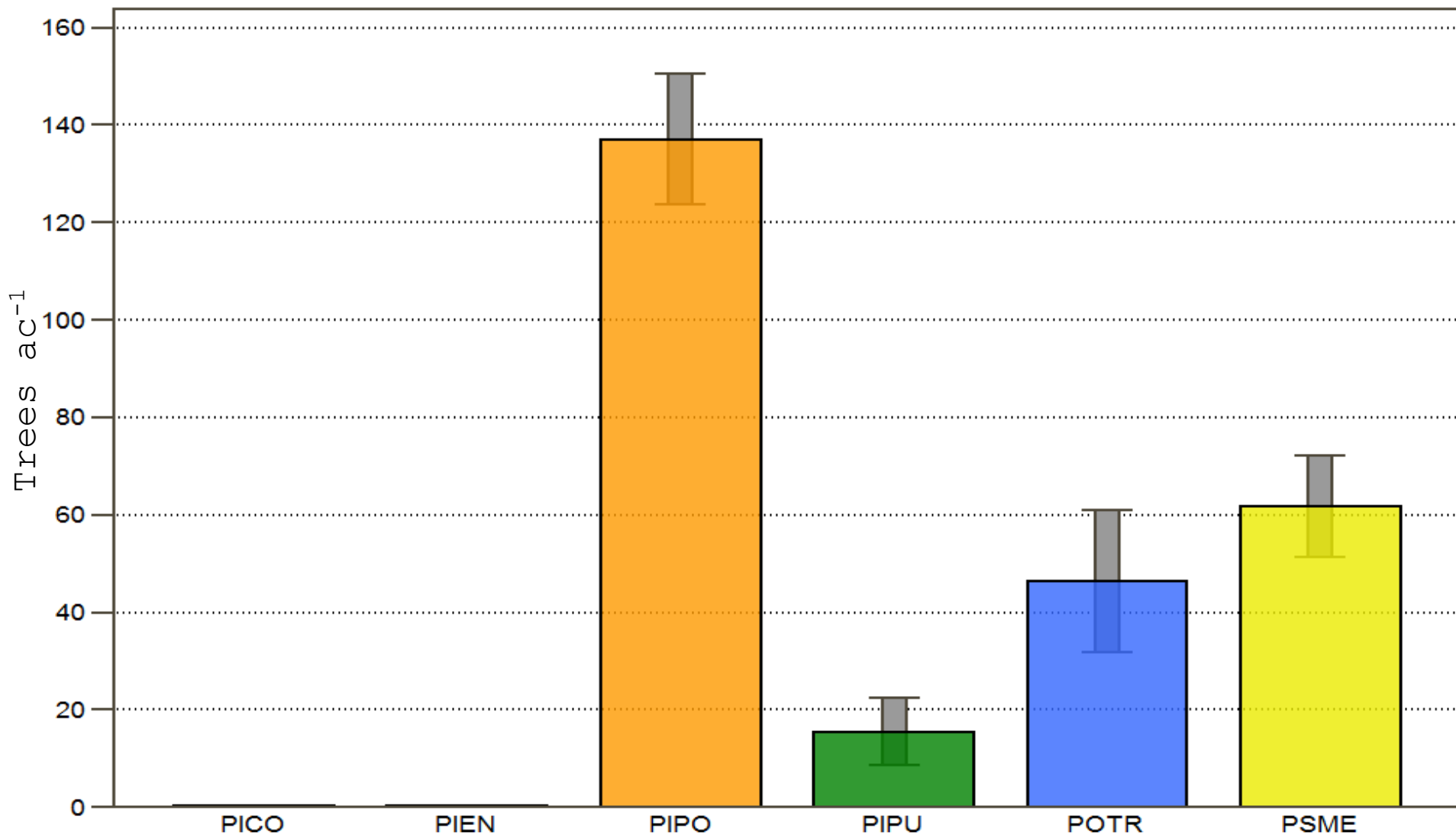


Species Composition by Basal Area:

PIPO = 73.2% PSME = 19.9% PIPU = 3.6% POTR = 2.9%

PICO/PIEN <1% each

Trees per Acre by Species for Ponderosa Pine Cover Type

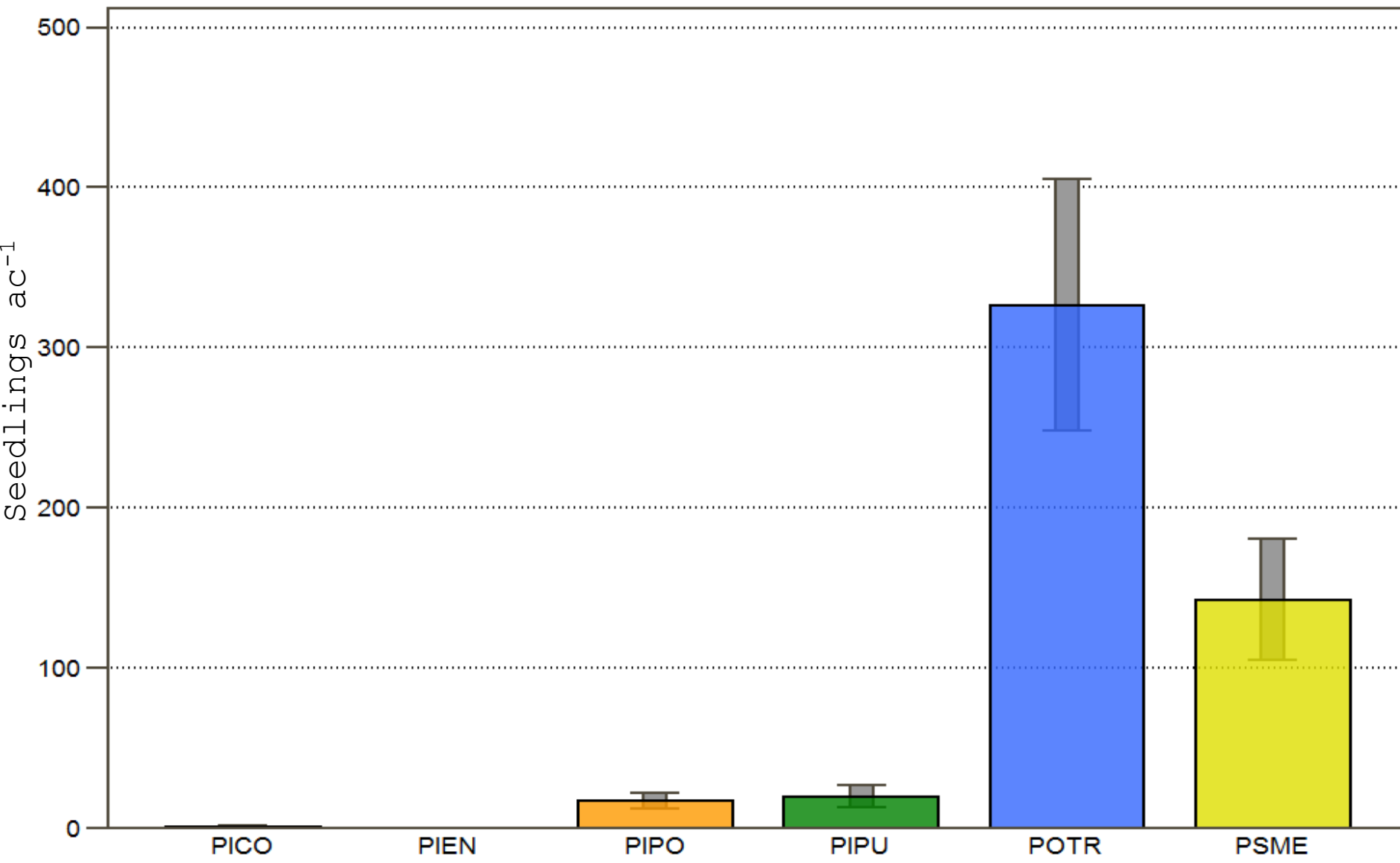


Species Composition by Trees per Acre:

PIPO = 53% PSME = 24% POTR = 18% PIPU = 6%

PICO/PIEN <1% each

Regeneration by Species for Ponderosa Pine Cover Type

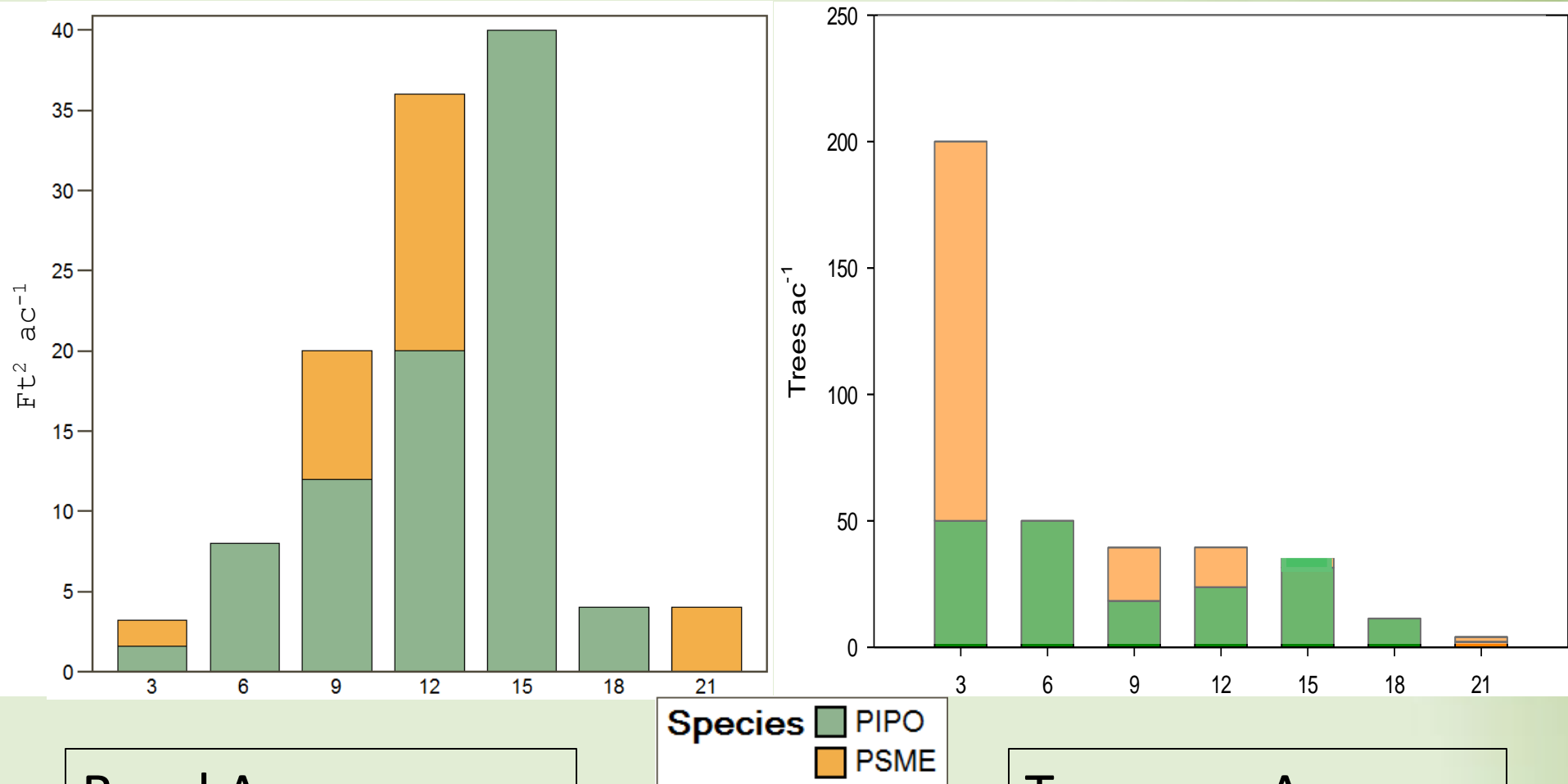


Seedling Regeneration by Species:

POTR = 64% PSME = 28% PIPU = 4% PIPO = 3% PICO <1 %

Ponderosa Pine

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PIPO = 85.6 Ft² (74%)

PSME = 29.6 Ft² (26%)

Trees per Acre:

PIPO = 186.9 (49%)

PSME = 192.7 (51%)

Ponderosa Pine

Standing Dead and Woody Fuels

- Woody Fuels (tons ac⁻¹):
 - Fine Woody Debris (FWD) = 2.3 (SE 0.28)
 - Coarse Woody Debris (CWD) = 4.3 (SE 0.78)
- Standing Dead :
 - Basal Area = 9.8 Ft² ac⁻¹ (SE 2.9)
 - PIPO = 4%
 - PSME = 96%
 - Snags = 21.3 ac⁻¹ (SE 7.9)
 - PIPO = 2.4%
 - PSME = 97.6%
 - Potential for additions to fuels complex
 - FWD = 0.77 tons ac⁻¹ (SE 0.22)
 - CWD = 1.18 tons ac⁻¹ (SE 0.33)

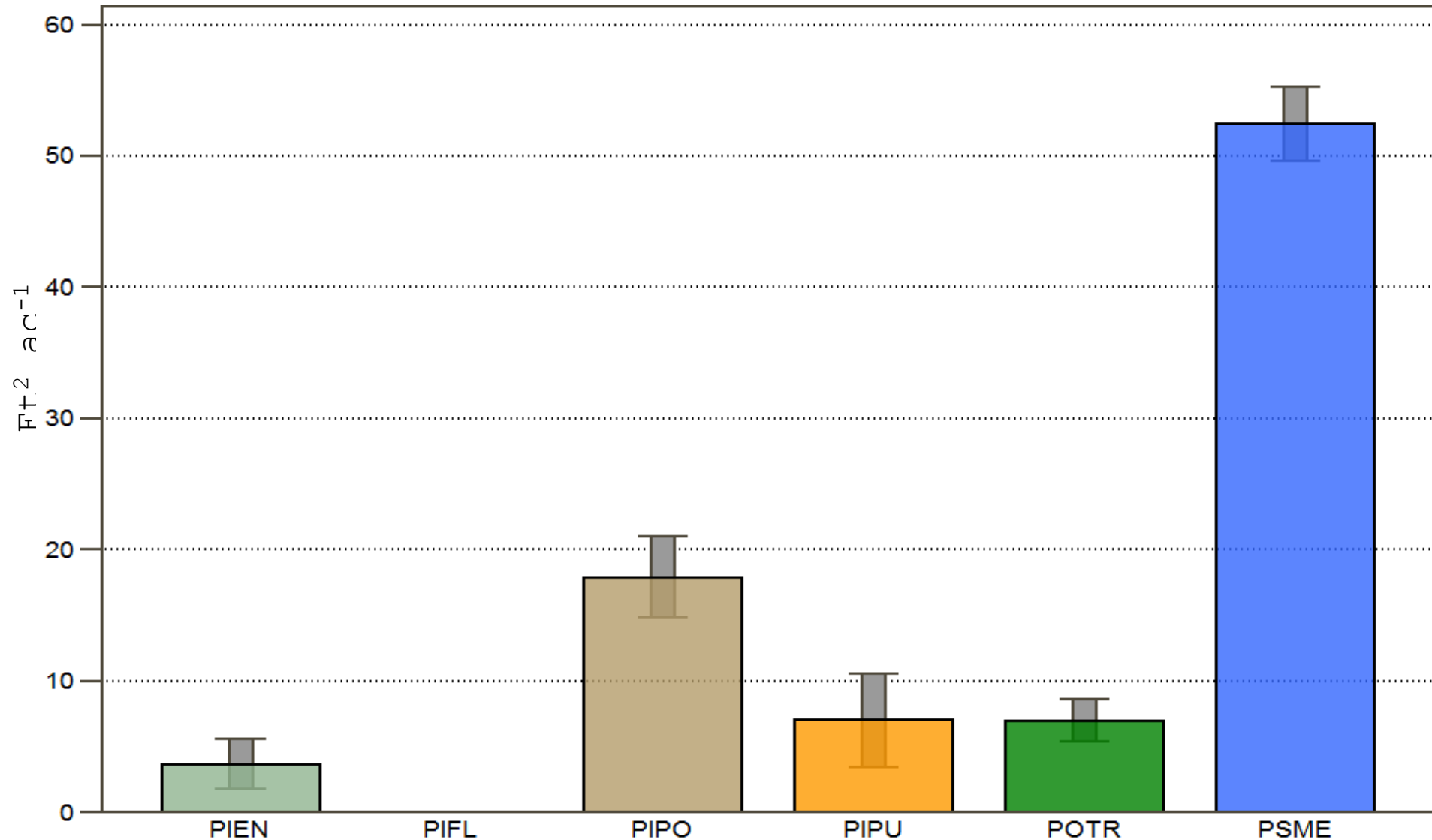
Ponderosa Pine

- Stands are overgrown
 - High BA (goal = 40-60 BA)
 - High TPA
- Ponderosa pine regeneration is lacking
 - No regeneration detected in some stands
 - Other stands generally dominated by aspen and Douglas-fir
- Fire Behavior (85°F, fall seasonality)
 - Relatively light surface fuels present
 - Torching Indices variable – many conditional crowning
 - Crowning Indices 19-28 mph (20 ft windspeed)

Douglas-fir

- Six stands with Douglas-fir as the dominant cover type species.
- No pure Douglas-fir stands
 - All stands had a component of ponderosa pine with additions of basal area from other species
- Average BA: $86.6 \text{ ft}^2 \text{ ac}^{-1}$ (SE 8.33)
- Average TPA: $495 \text{ trees ac}^{-1}$ (SE 30.1)

Basal Area by Species for Douglas –fir Cover Type



Species Composition by Basal Area:

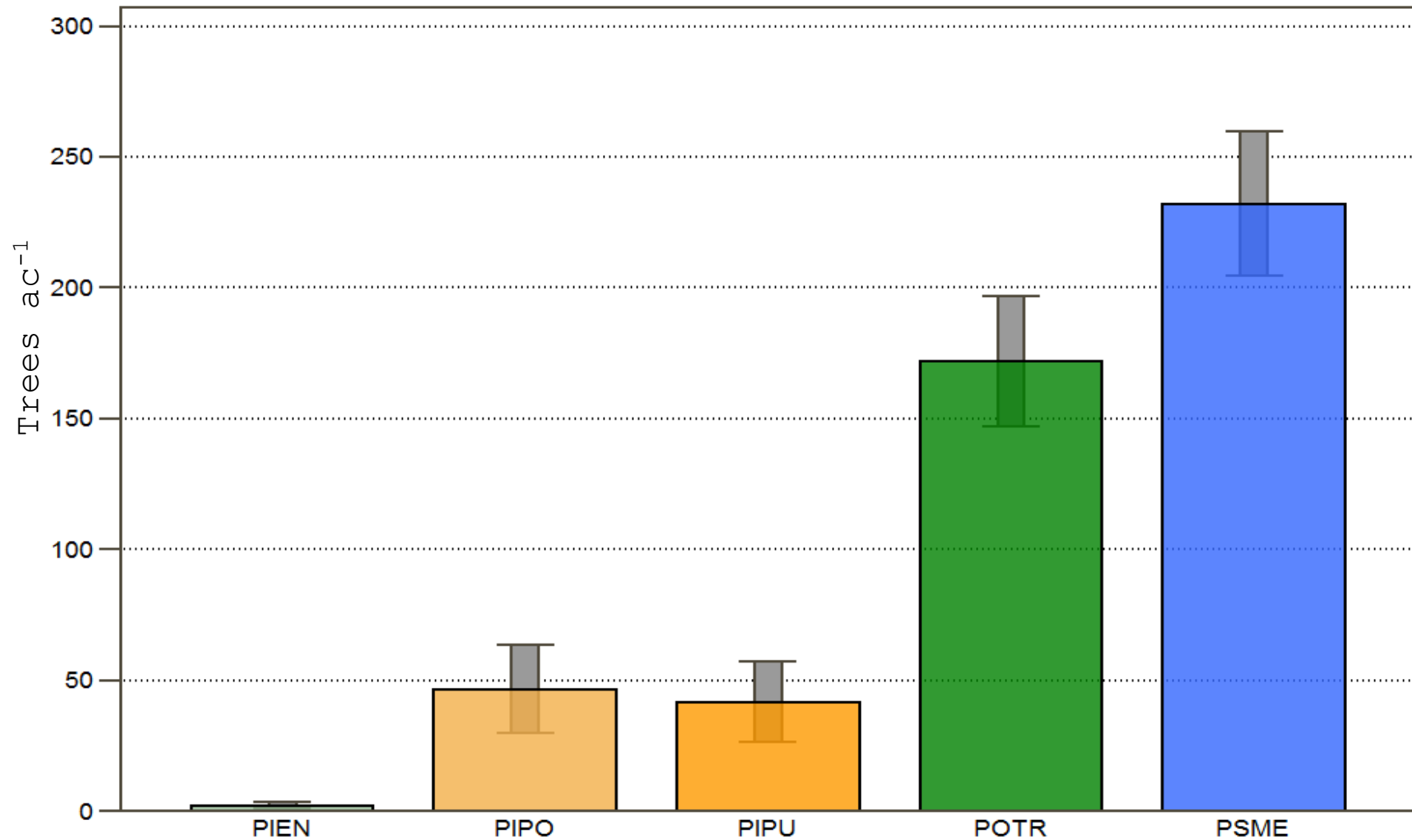
PIPO = 19%

PSME = 66%

PIEN = 10%

POTR = 5%

Trees per Acre by Species for Douglas –fir Cover Type



Species Composition by Trees per Acre:

PSME = 47%

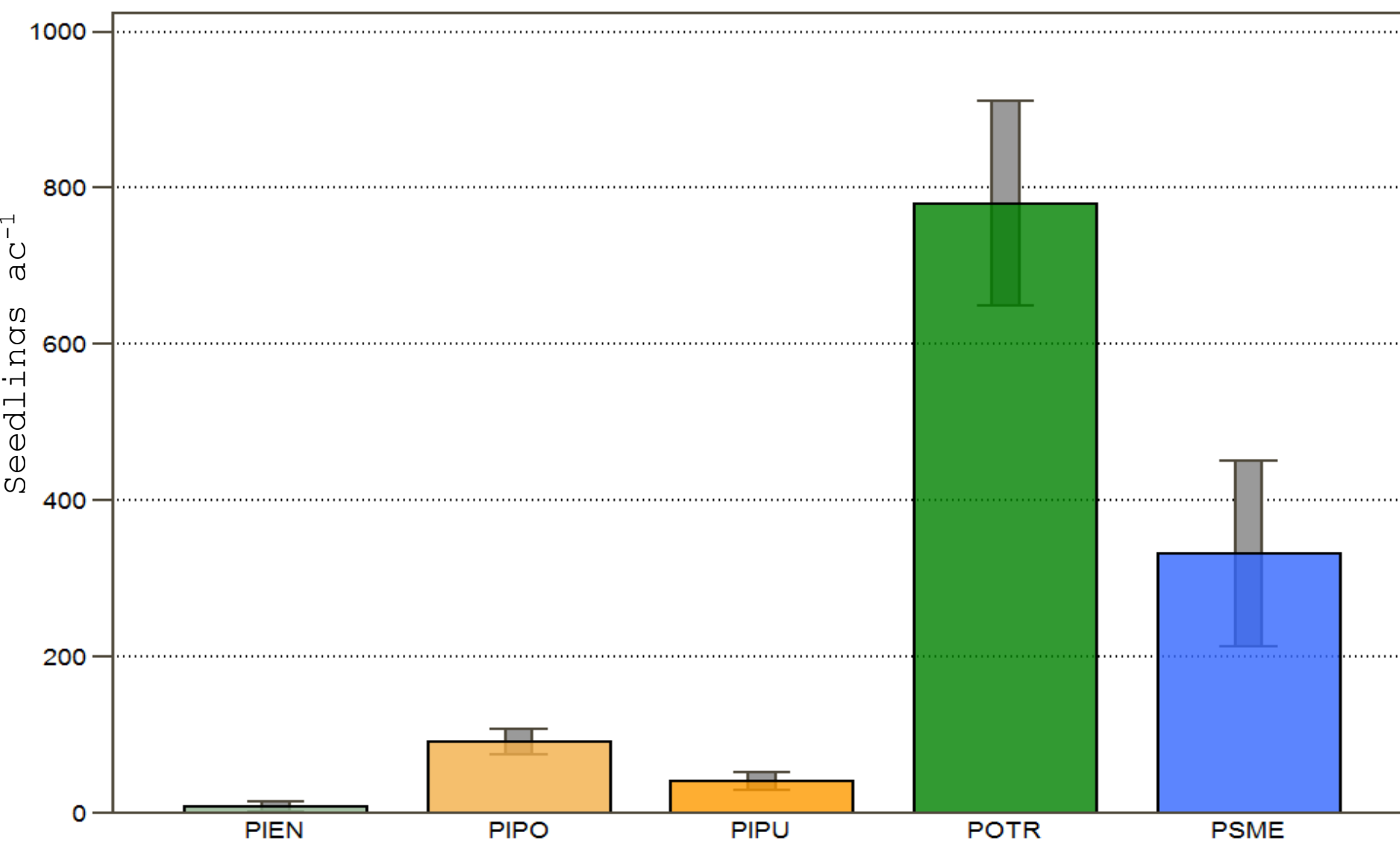
POTR = 35%

PIPO = 9%

PIPU = 8%

PIEN <1%

Regen per Acre by Species for Douglas –fir Cover Type

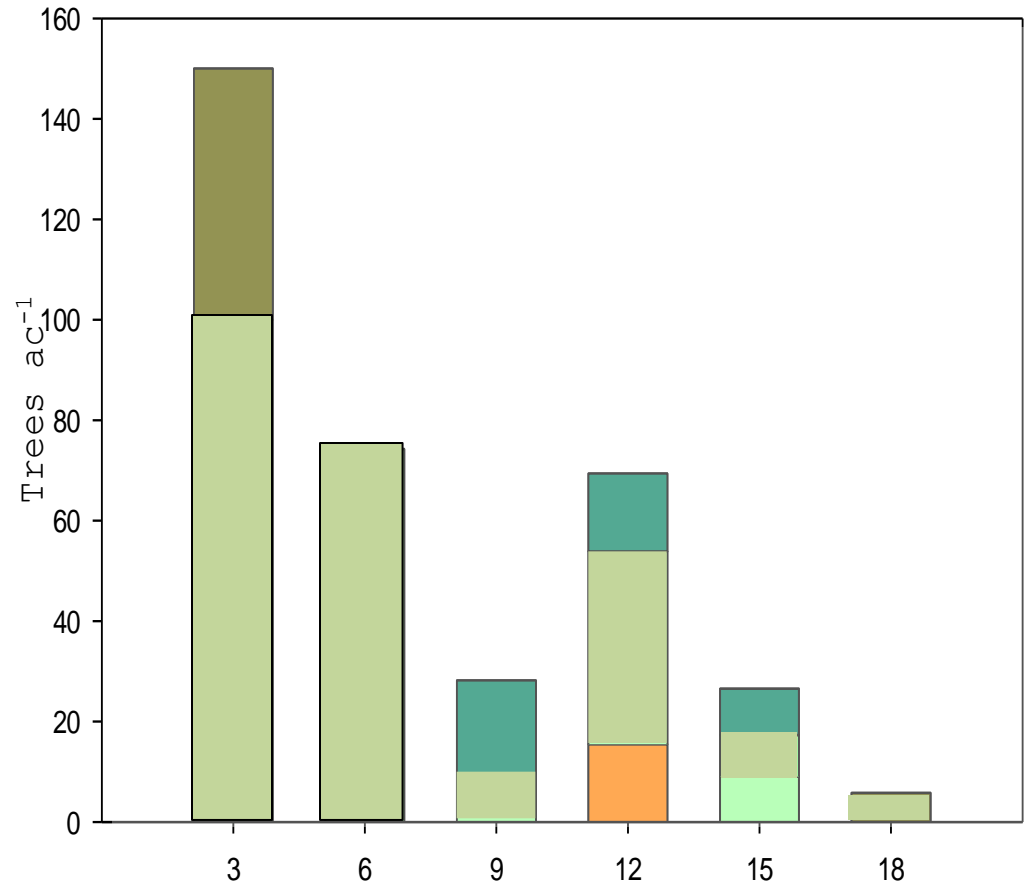
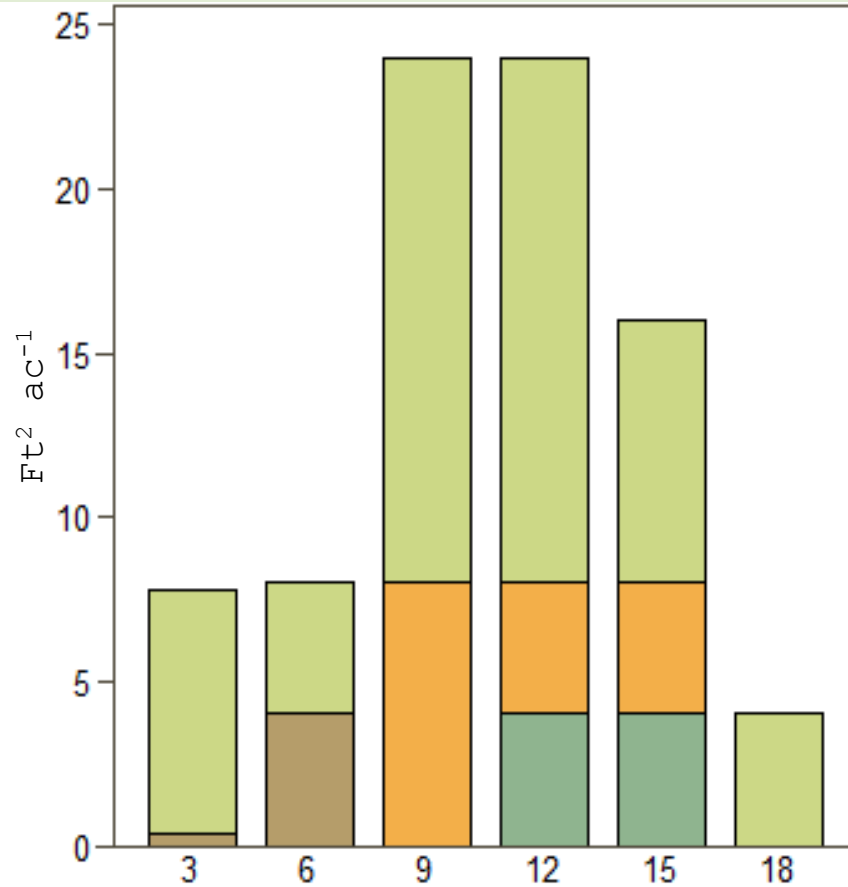


Seedling Regeneration by Species :

POTR = 62% PSME = 27% PIPO = 7% PIPU = 3% PIEN <1%

Douglas-fir

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PSME = 55.4 Ft^2 (66%)

PIPO = 16.0 Ft^2 (19%)

PIEN = 8.0 Ft^2 (9%)

POTR = 4.4 Ft^2 (5%)

Species



Trees per Acre:

PSME = 236 (70%)

POTR = 69 (20%)

PIPO = 25 (7%)

PIEN = 8 (2%)

Douglas-fir

Standing Dead and Woody Fuels

- Woody Fuels (tons ac⁻¹):
 - Fine Woody Debris (FWD) = 4.2 (SE 0.8)
 - Coarse Woody Debris (CWD) = 6.9 (SE 2.2)
- Standing Dead :
 - Basal Area = 21.2 Ft² ac⁻¹ (SE 4.4)
 - PIPO = 6%
 - PSME = 94%
 - Snags = 40 ac⁻¹ (SE 7.6)
 - PIPO = 2%
 - PSME = 98%
 - Potential for additions to fuels complex
 - FWD = 1.6 tons ac⁻¹ (SE 0.33)
 - CWD = 2.6 tons ac⁻¹ (SE 0.59)

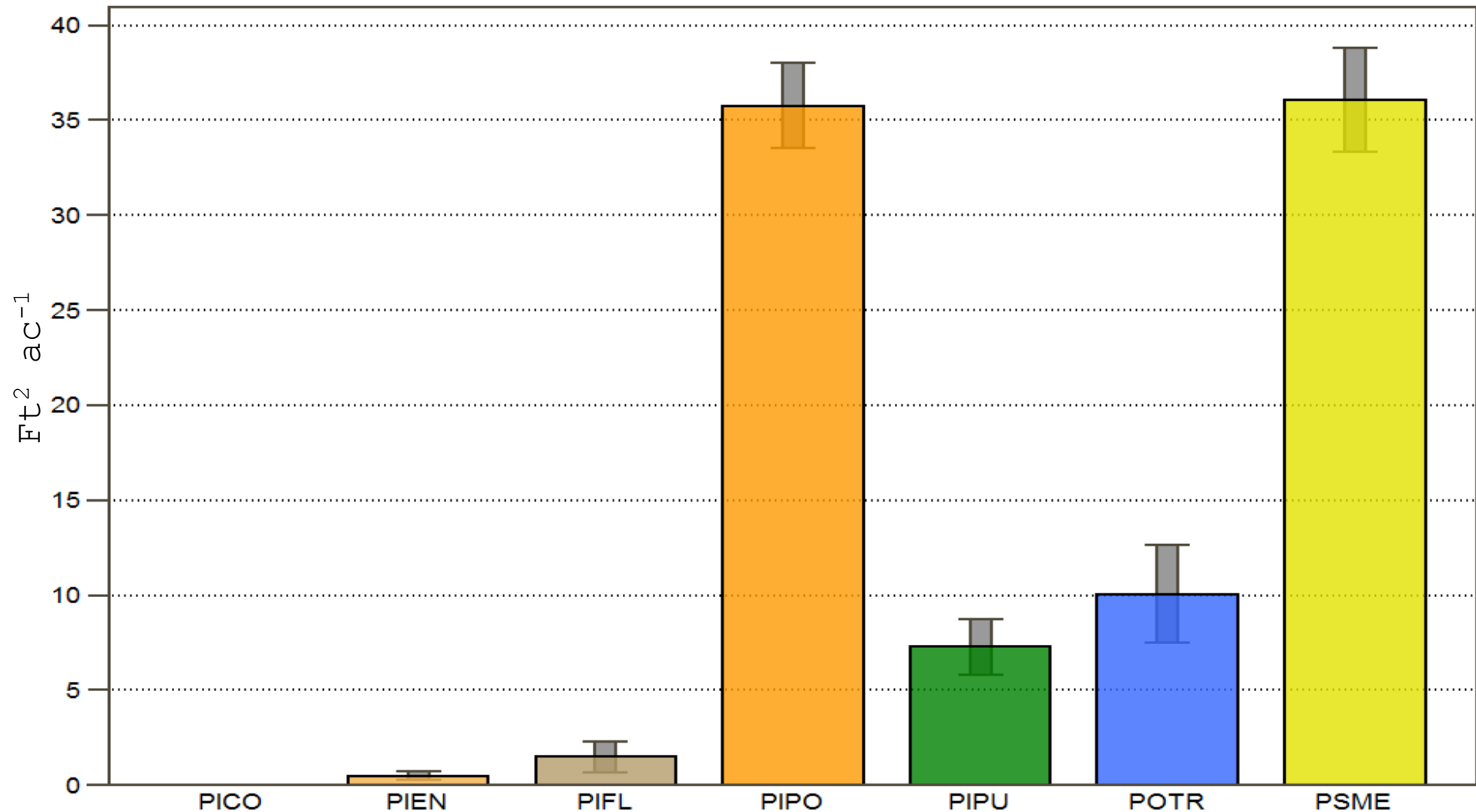
Douglas-fir

- Dense stands
 - Approximately same BA as ponderosa stands
 - Significantly greater TPA
- Successful regeneration in the understory
 - Most regeneration is Douglas-fir and aspen
- Fire Behavior (85°F, fall seasonality)
 - Relatively light surface fuels present
 - Torching Indices variable from 1 to cond. crown
 - Crowning Indices 16-47 mph (20 ft windspeed)

Ponderosa Pine / Douglas-fir

- Eleven stands with ponderosa pine and Douglas-fir as co-dominant cover type species.
- No stands with either species 50% or more BA
 - BA occupied by PIPO and PSME separated by <10 percent in all stands (most <5 %)
- Average BA: $90.6 \text{ ft}^2 \text{ ac}^{-1}$ (SE 9.33)
- Average TPA: $472 \text{ trees ac}^{-1}$ (SE 93.6)

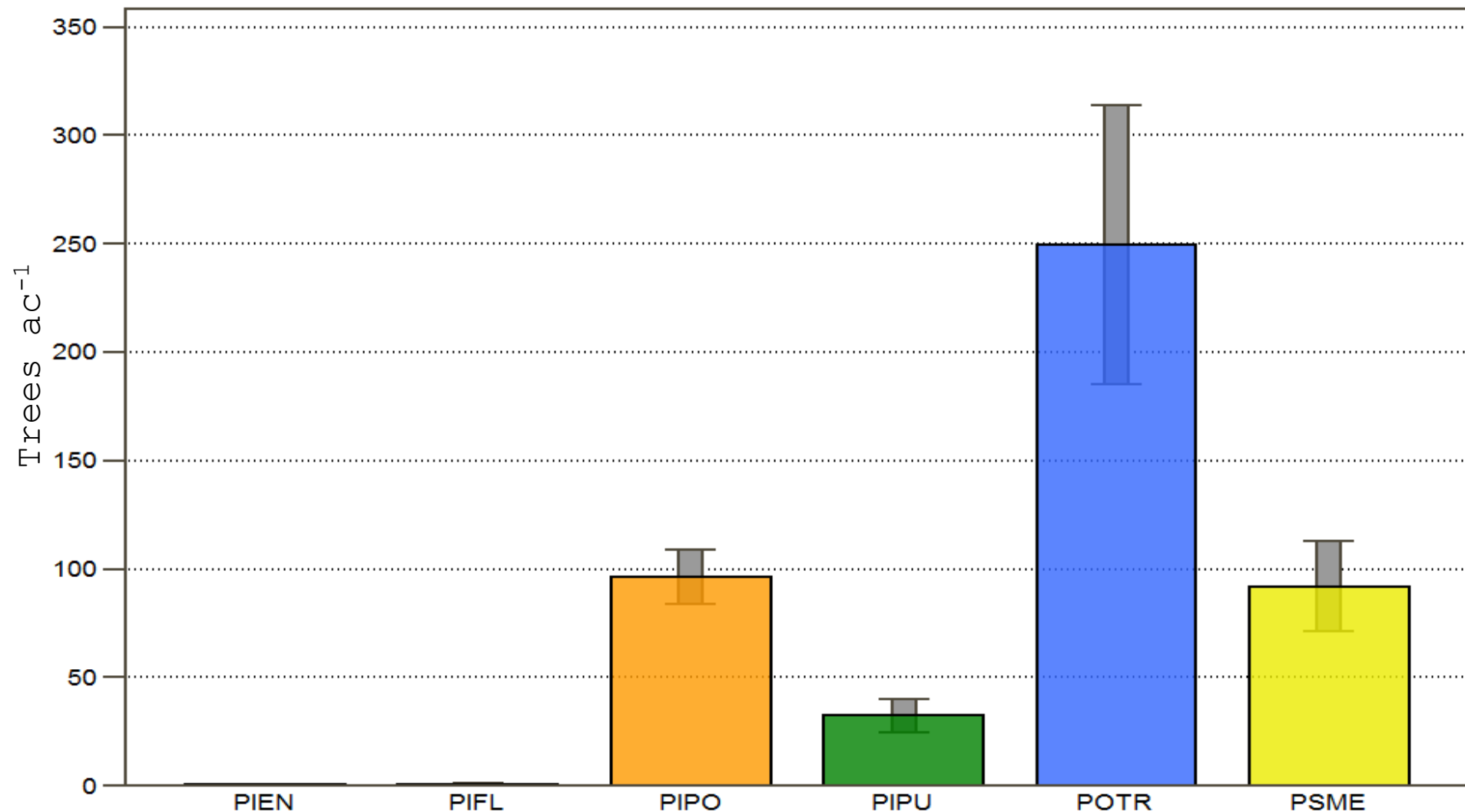
Basal Area by Species for PIPO / PSME Cover Type



Species Composition by Basal Area:

PSME = 39.8% PIPO = 39.5% POTR = 11.1% PIPU = 8.0%
PICO/PIEN/PIFL <1 % each

Trees per Acre by Species for PIPO / PSME Cover Type

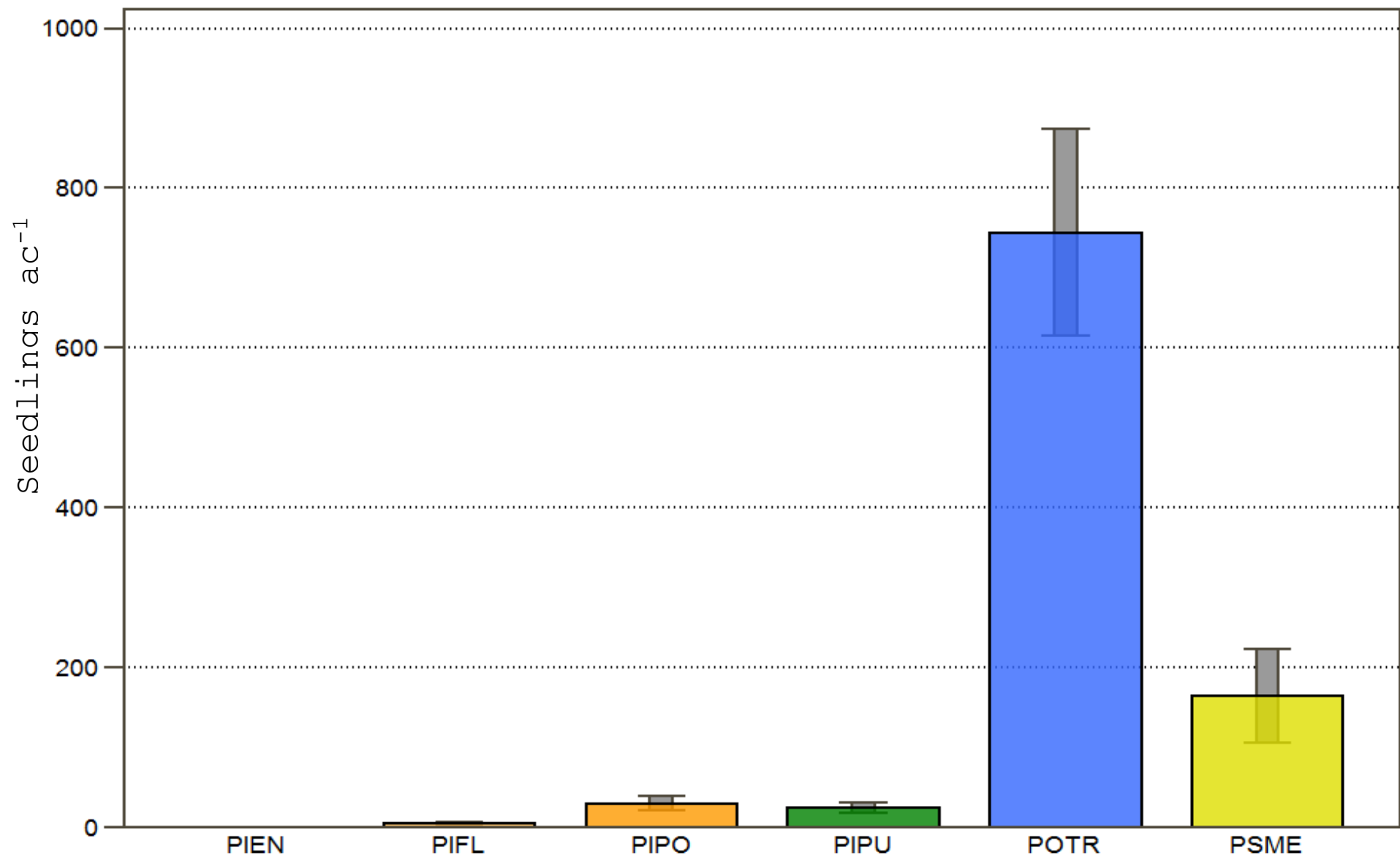


Species Composition by Basal Area:

PIPO = 20% PSME = 20% PIPU = 69% POTR = 53%

PIFL/PIEN <1% each

Regen per Acre by Species for PIPO / PSME Cover Type



Species Composition by Basal Area:

POTR = 77%

PSME = 17%

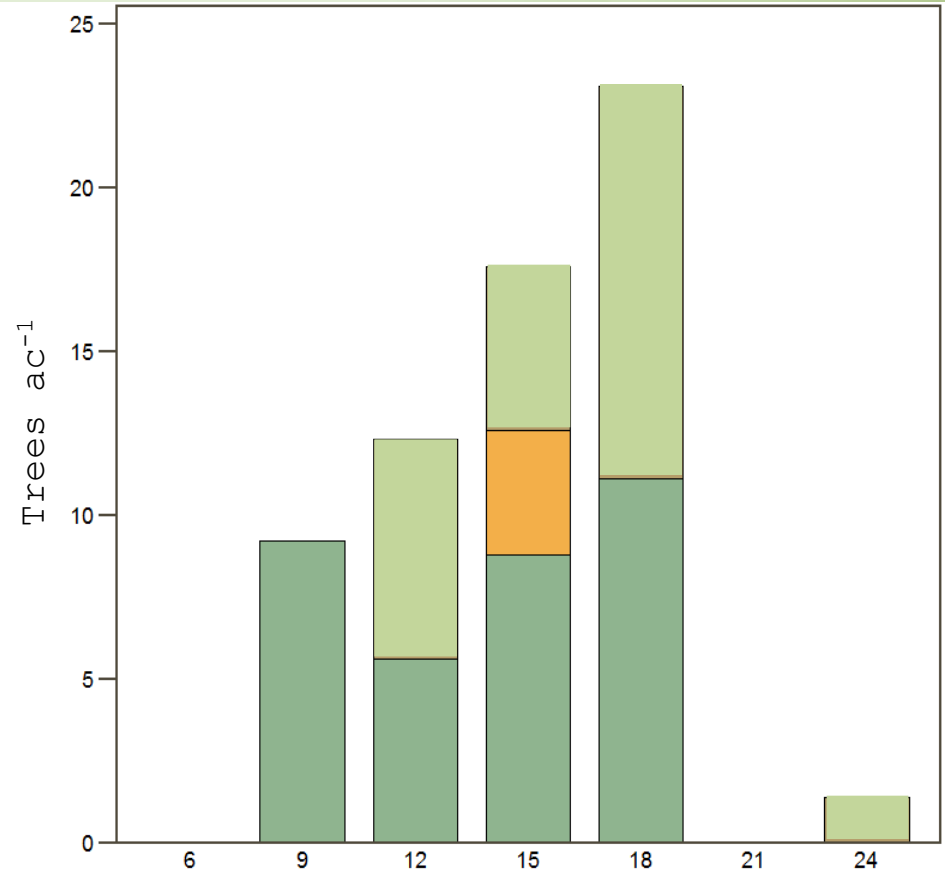
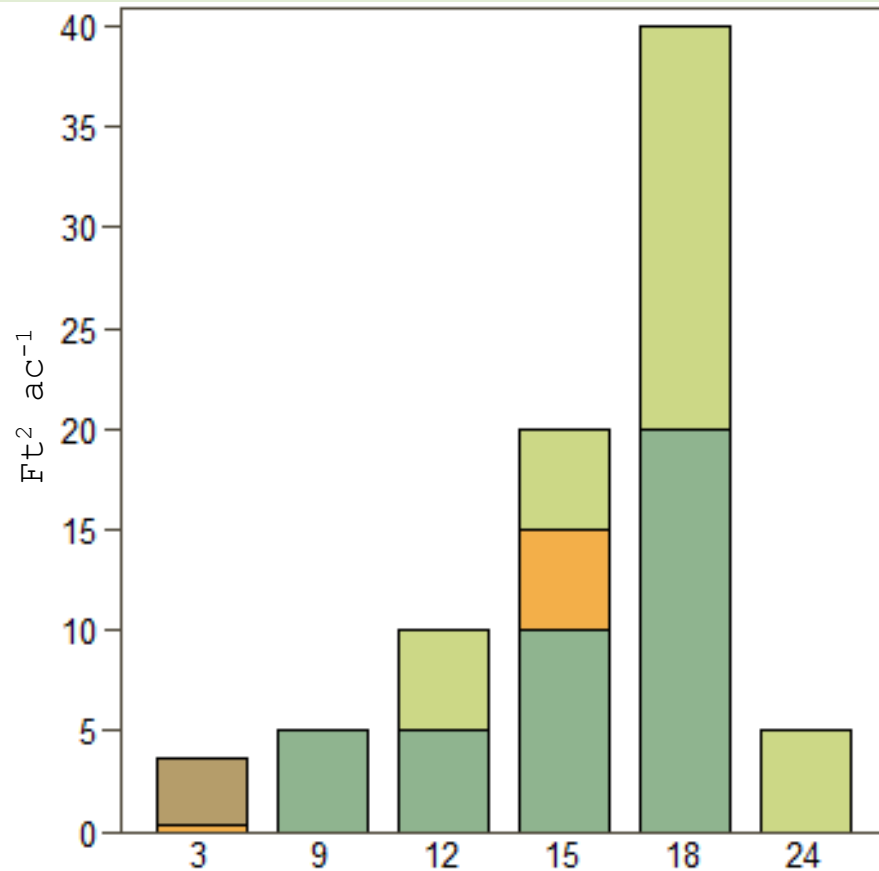
PIPO = 3%

PIPU = 3%

PIFL <1%

Ponderosa/Douglas-fir

Basal Area and Trees per Acre by Diameter and Species



Basal Area:

PIPO = 40.0 Ft² (48%)
PSME = 36.0 Ft² (43%)
PIPU = 5.3 Ft² (6%)
POTR = 3.3 Ft² (4%)



Trees per Acre:

POTR = 500 (73%)
PIPO = 97 (14%)
PIPU = 66 (10%)
PSME = 25 (4%)

Ponderosa Pine / Douglas-fir

Standing Dead and Woody Fuels

- Woody Fuels (tons ac⁻¹):
 - Fine Woody Debris (FWD) = 2.4 (SE 0.38)
 - Coarse Woody Debris (CWD) = 4.7 (SE 0.94)
- Standing Dead :
 - Basal Area = 10.3 Ft² ac⁻¹ (SE 4.0)
 - PSME = 92%
 - PIPU = 8%
 - Snags = 24 ac⁻¹ (SE 11.7)
 - PSME = 94%
 - PIPU = 6%
 - Potential for additions to fuels complex
 - FWD = tons ac⁻¹ 0.81 (SE 0.34)
 - CWD = tons ac⁻¹ 1.14 (SE 0.47)

Ponderosa Pine / Douglas-fir

- Dense stands
 - Near equal distribution of BA and TPA in larger diameter classes between PIPO and PSME
 - Regeneration concentrated in aspen with moderate Douglas-fir and light ponderosa pine regeneration
- Fire Behavior (85°F, fall seasonality)
 - Relatively light surface fuels present
 - Torching Indices variable from 1 to cond. crown
 - Crowning Indices 21-44 mph (20 ft windspeed)

Future Considerations

- Number of plots sampled
 - Many stands between one and three
 - Produces weak statistical comparisons
 - Before/After treatment comparisons
 - Comparisons between stands
- Regeneration
 - Produces high degree of error
 - Scaling factor of 250 (per acre) for each occurrence
 - Plot size and location not capable of capturing natural variability
 - $1/250^{\text{th}}$ acre (7.4ft radius)
 - Many stands failed to detect any regeneration

Future Considerations

- Overstory
 - Majority of stands sampled with 20 BAF
 - Post-treatment sampling in stands ~ 40 ft² may pull very few trees with 20 BAF
 - Switching to a 10 BAF will include/measure trees that were not included in the original sample
- Surface Fuels
 - Single 50ft Brown's transect per plot
- Improved sampling protocols incur increased costs
 - How concerned are we with certain aspects of sampling?
 - Present method and FSveg output is FVS ready