Reducing Crown Fire Potential at Mount Rushmore N.M. using Mechanical Treatments

Dan Swanson, NPS, Northern Great Plains Fire Mgmt
Cody Wienk, NPS, Midwest Regional Office

Contents

- Historical Fire Regime and Stand Structure
- 2003 – 2009 Mechanical Treatment Projects
- 2010 Hazardous Fuel Reduction Project
- Monitoring Results
  - Tree Density, Fuel Loading, Crown Base Height, and Crown Fire Potential

Historical Fire Regime at MORU

- Low severity surface fires with occasional patches of passive crown fire
- Fire frequency: 17 years
- Historical Range of Variability: 3-39 years
- Approximately 3% of burned area was from crown fire
- 22 landscape fires fire years between 1529 and 1893

Brown et al., 2008

Fire & Forest History at Mount Rushmore

Historical Forest Stand Structure

- Structural heterogeneity ranging from open to dense stands of trees
- Stand density approximately 113 TPA
- Crown base height: 6.1 m
- Most of the basal area in the large diameter trees

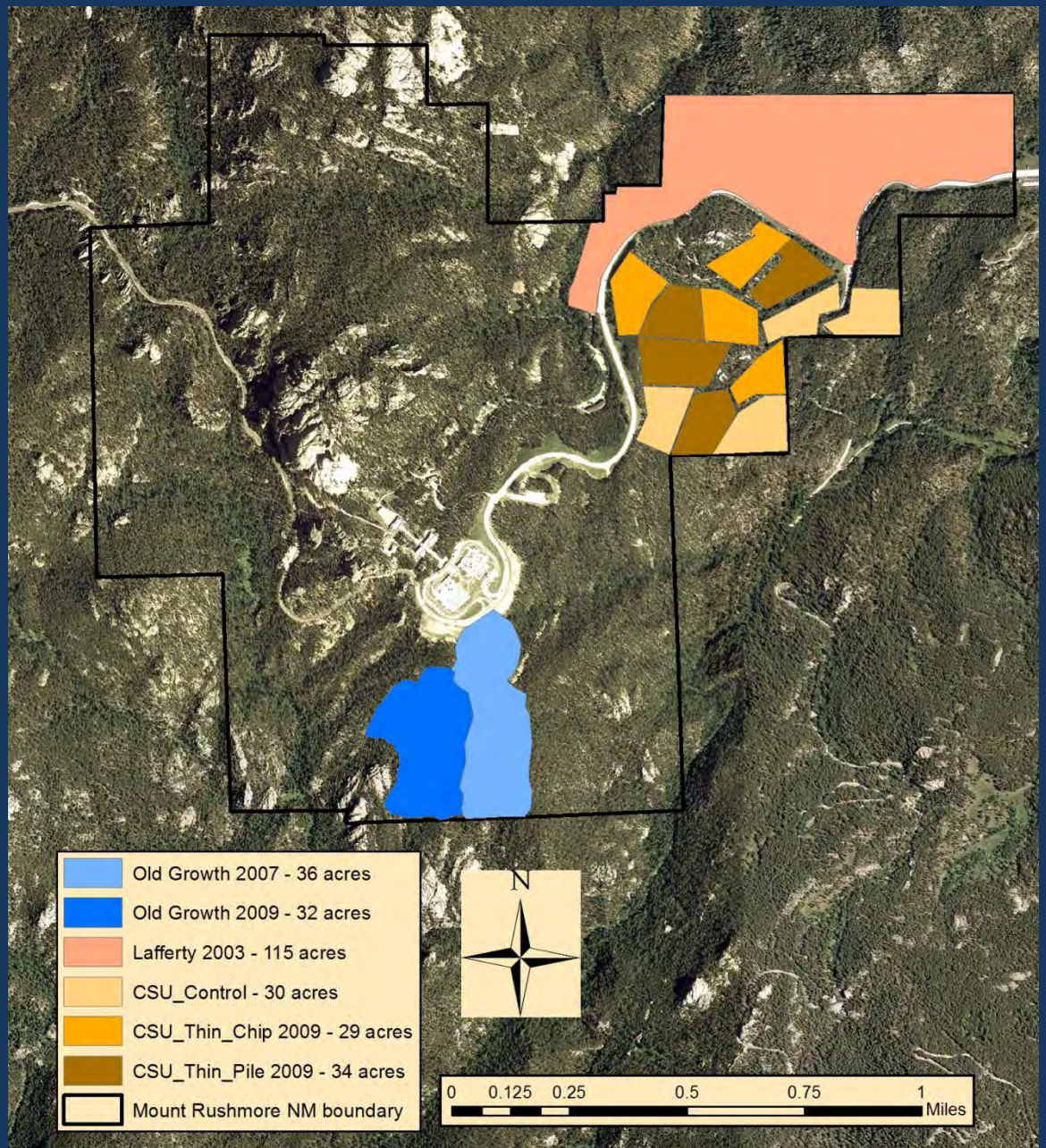
Brown et al., 2008
Fire & Forest History at Mount Rushmore

Fire Regime at MORU Pretreatment

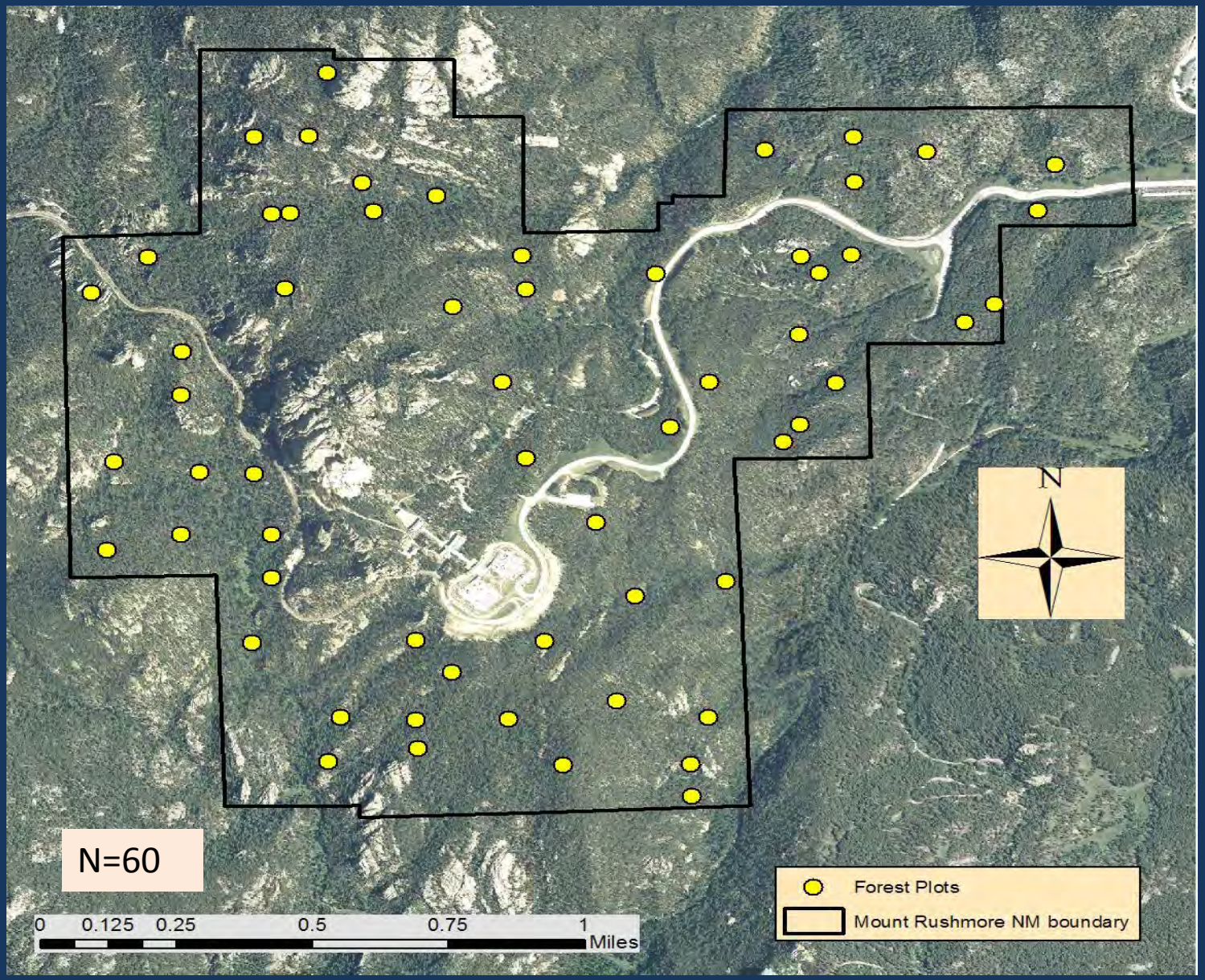
- Surface fires ceased after 1893 due to domestic livestock grazing
- High density of trees and low crown base heights significantly increased risk of passive and active crown fires

Hazardous Fuel Reduction Projects and Monitoring Results

Mechanical Treatment Projects 2003 - 2009

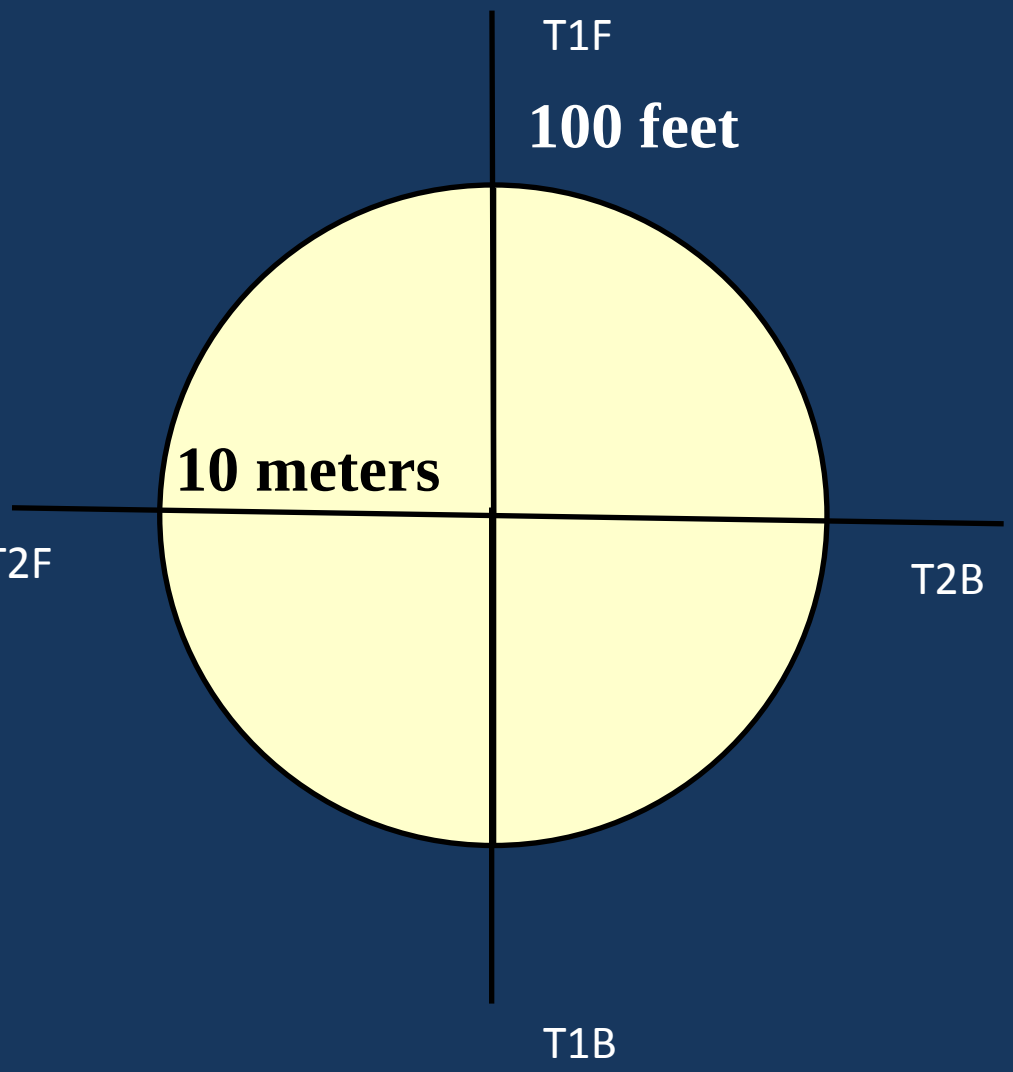


I&M Forest Structure and Fuel Plots - 2010



Methods – Forest Structure Plots

- Circular plot
- 10m Radius
- 2 fuels transects (100 ft long)
- Trees, seedlings, & tall shrubs were measured and recorded
- At least 1 tree, tall shrub, or woody fuels present within 38 m of plot center
- 60 plots installed and read by NGP I&M and Fire Effects Programs in 2010.
- 60 plots reread in 2012 following hazardous fuel reduction project.



Forest Stand Structure - 2010

- Relatively closed stands with high densities of slow growing and crowded younger trees
- Stand density approximately 641 TPH (5.5 x ↑)
- Crown base height: 3.9 m
- Most of the basal area is in small to medium size trees
- High potential for passive and active crown fires

MORU Hazardous Fuel Reduction Project Summer / Fall 2010

Background

544 acres were thin & piled or thin & chipped during the summer / fall 2010.

Piles burned under wet conditions or snowcover

Objective

Fuels treatment done to reduce the risk of crownfire

Mount Rushmore Hazardous Fuel Reduction Project

Contract Specifications

Thin & Pile - all Ponderosa pine 5 feet tall and < 6” DBH

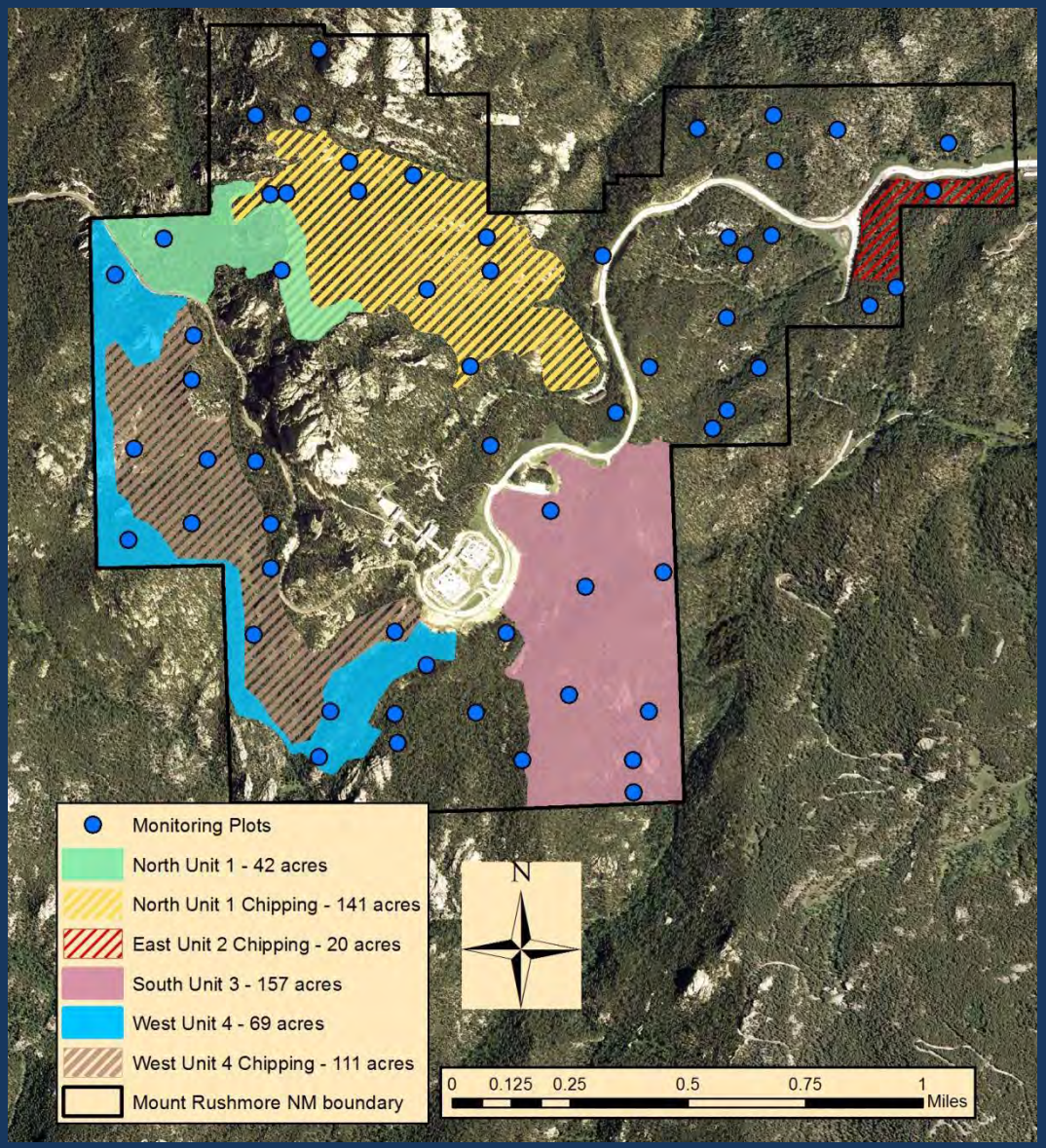
Dead / Down > 5 feet long and < 6” diameter

Thin & Chip – all Ponderosa pine 5 feet tall and < 10” DBH

Dead / Down > 5 feet long and < 10” diameter

Cut all regeneration between 1 and 5 feet tall

Chipped depths < 10”



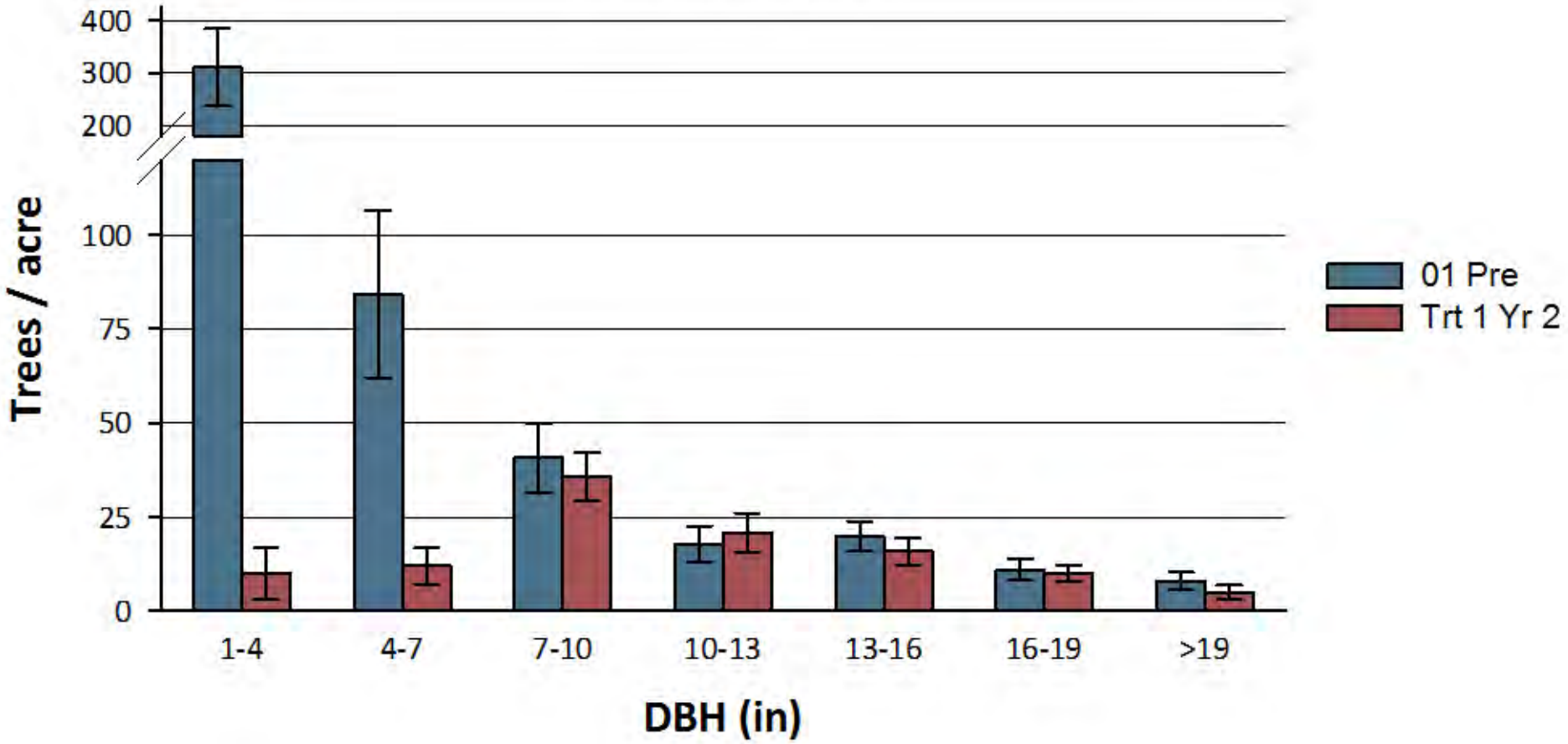
Thin & Pile Treatment 2010

Thin & Pile Treatment 2012

Thin & Chip Treatment 2010

Thin & Chip Treatment 2012

Thin & Pile Ponderosa Pine Density by Size Class



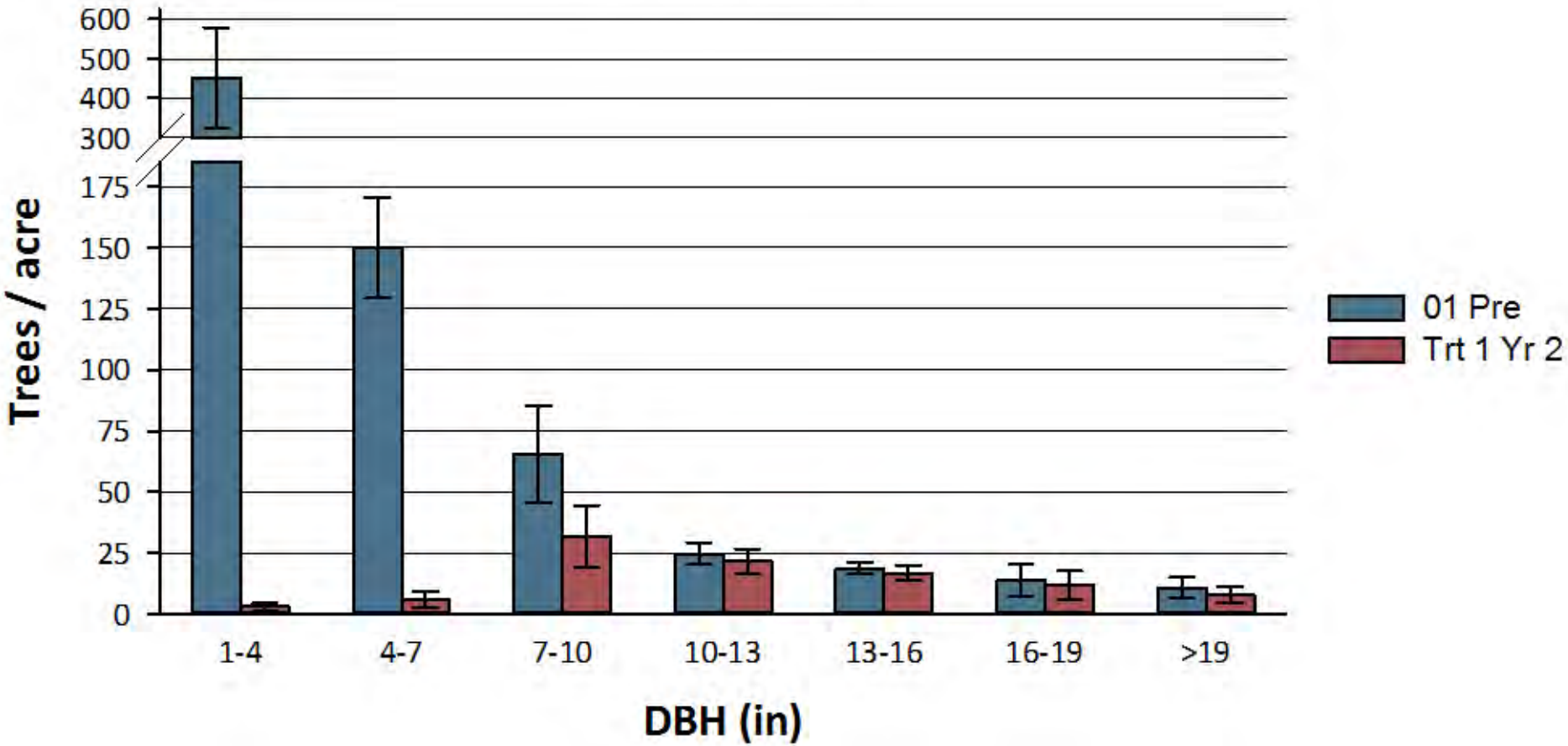
Results (80% Confidence Level)

1-4” dbh 97% decrease; LB = 91%, UB = 99%

4-7” dbh 86% decrease; LB = 74%, UB = 93%

7-10” dbh 12% decrease; LB = 0%, UB = 30%

Thin & Chip Ponderosa Pine Density by Size Class

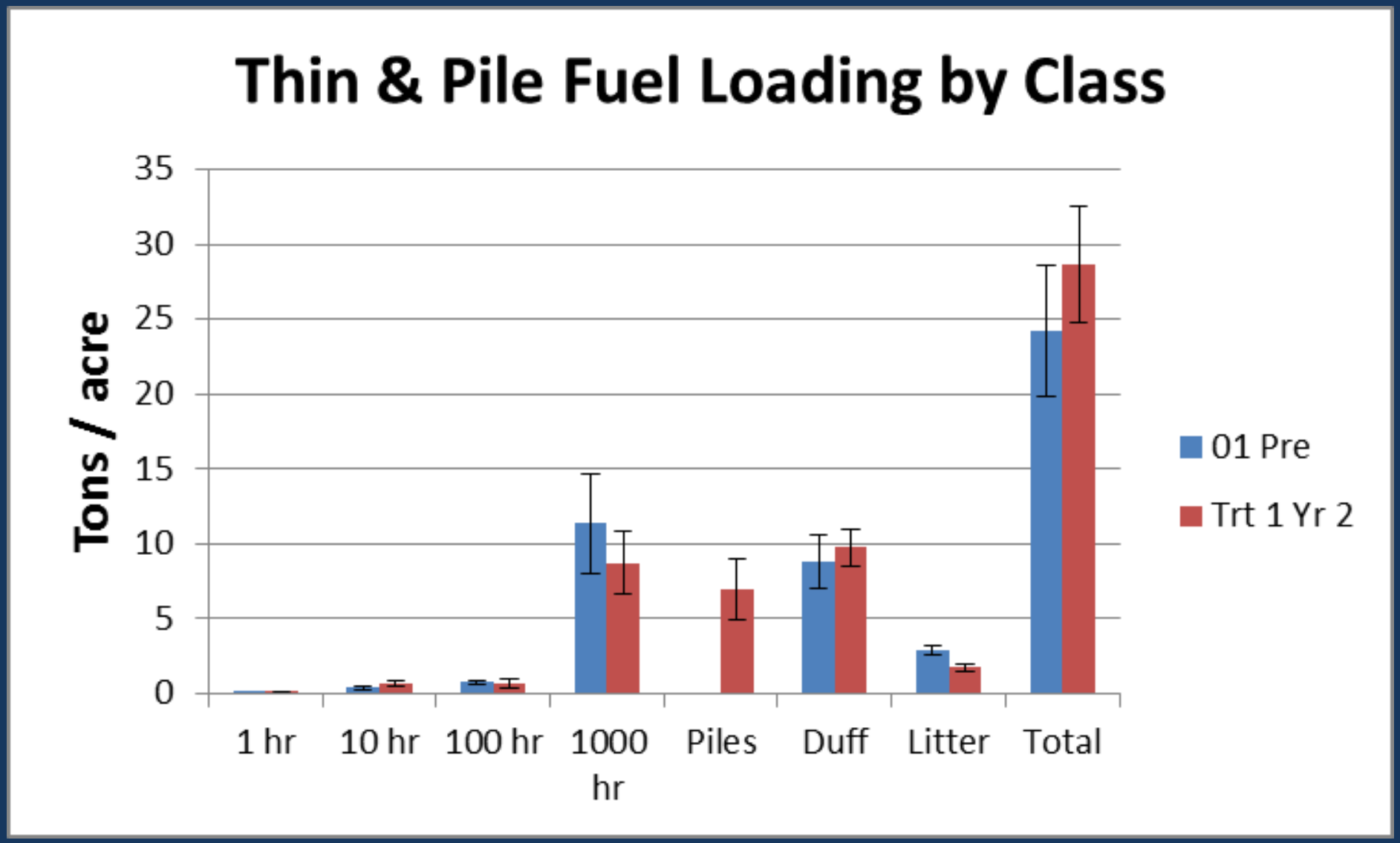


Results (80% Confidence Level)

1-4” dbh 99% decrease; LB = 99%, UB = 100%

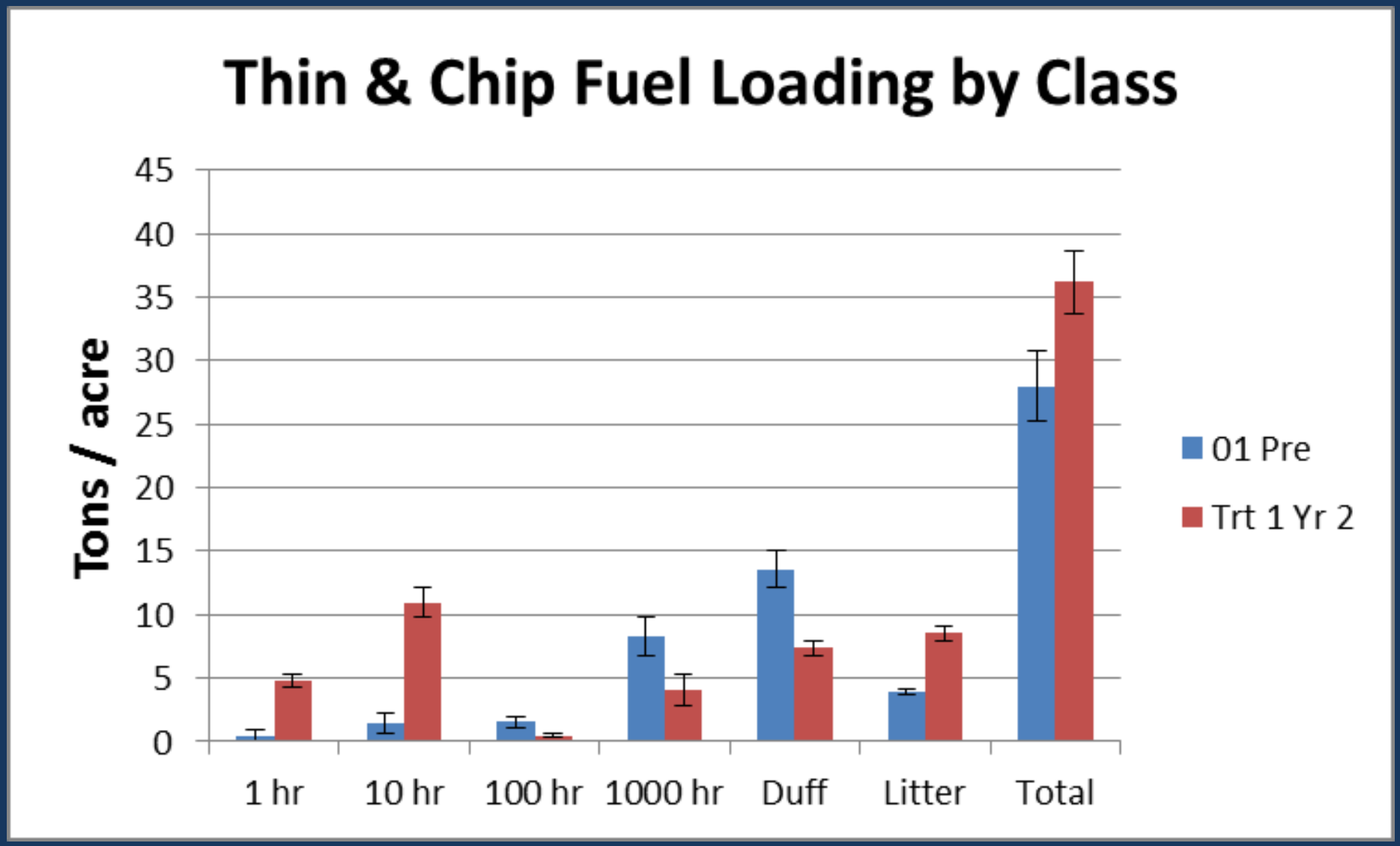
4-7” dbh 96% decrease; LB = 93%, UB = 98%

7-10” dbh 52% decrease; LB = 33%, UB = 68%



Results (80% Confidence Level)

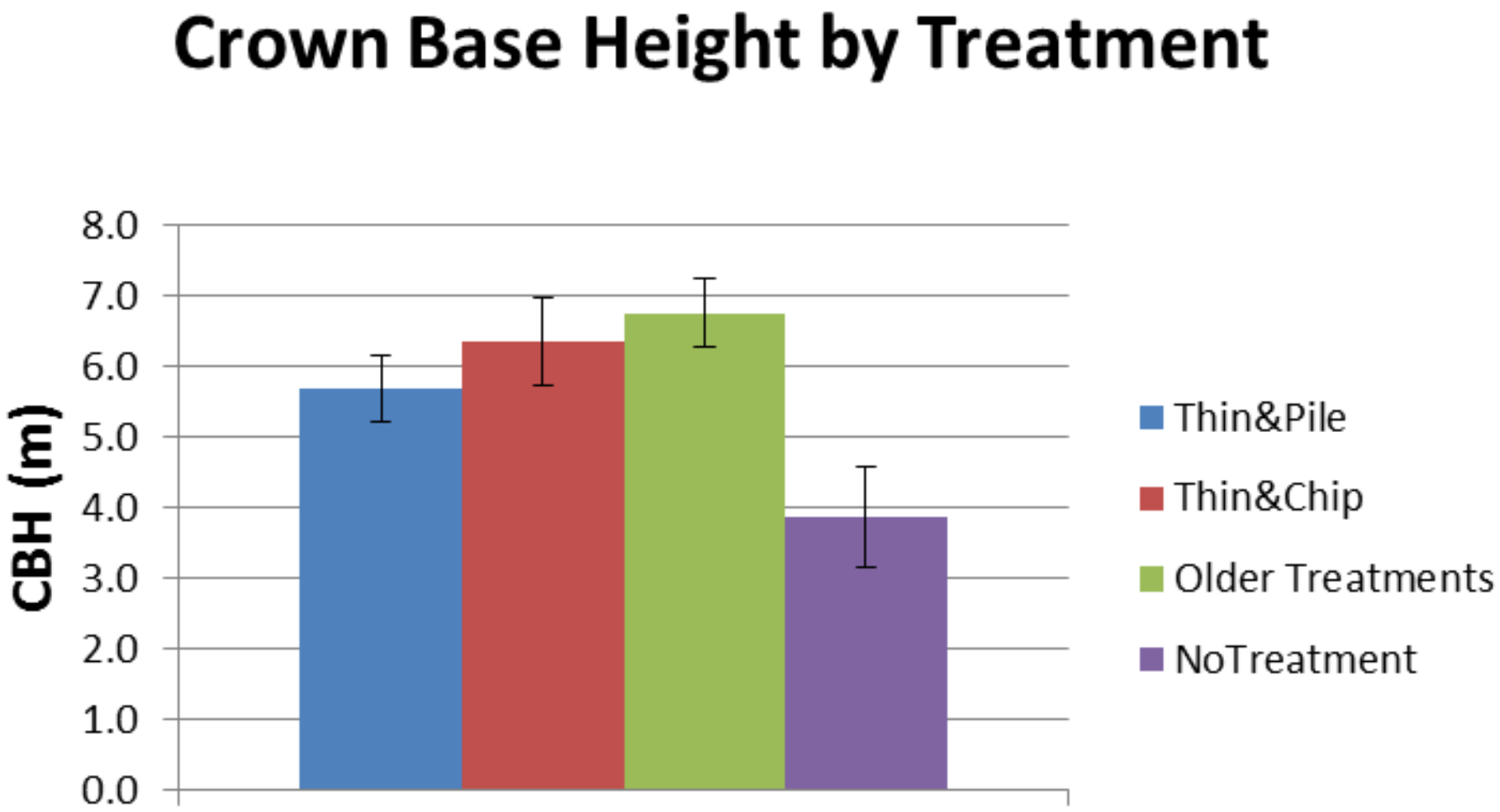
Total fuel loading 18% increase; LB = 6%, UB = 34%



Results (80% Confidence Level)

Total fuel loading 29% increase; LB = 17%. UB = 42%

2012


Crown Base Height by Treatment
CBH (m)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Thin&Pile
Thin&Chip
Older Treatments
NoTreatment

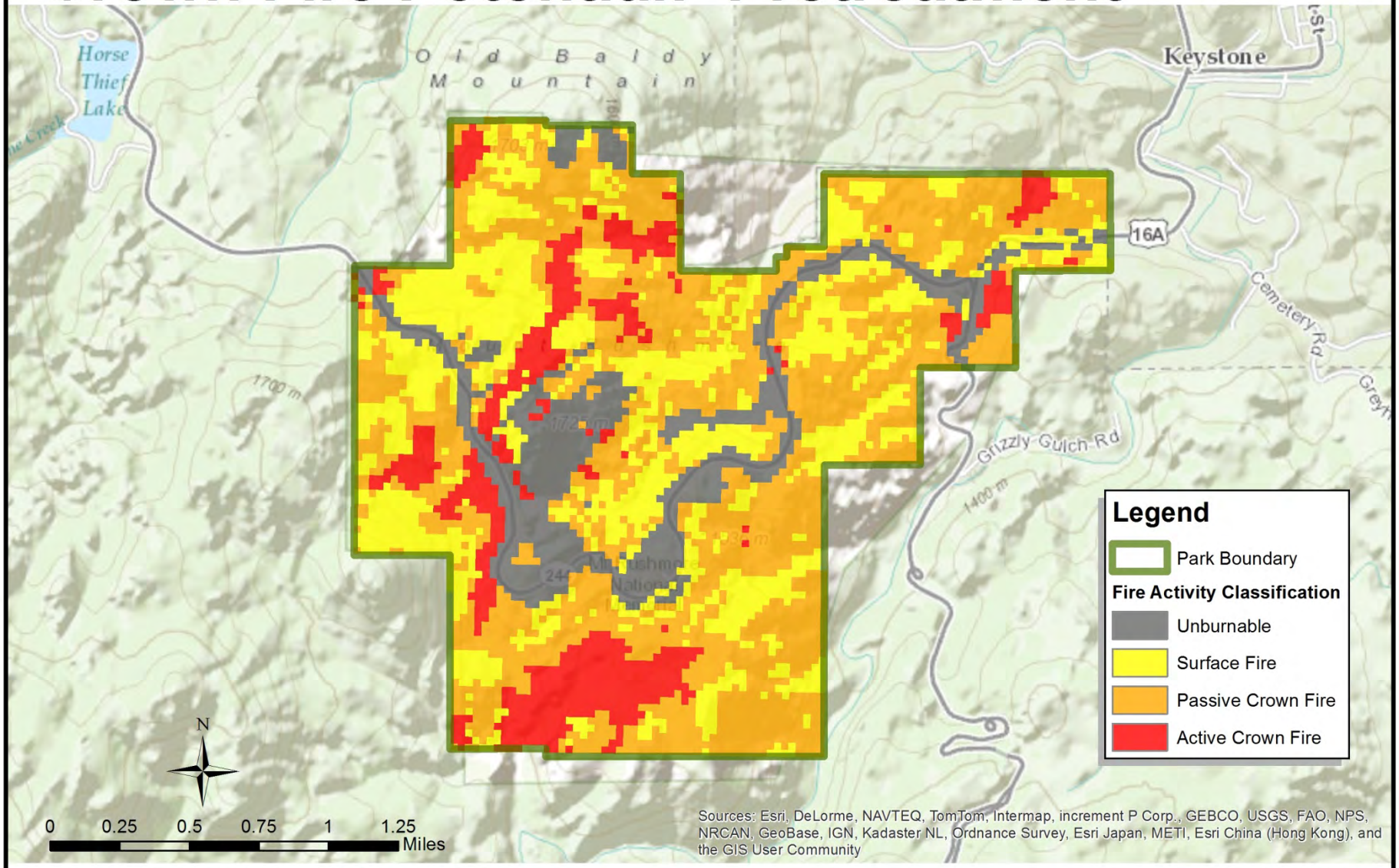
Modeling Crown Fire Potential

- FlamMap v. 5
- LANDFIRE National 2001 used as base vegetation map
- Inputs: canopy cover, stand height, crown base height, canopy bulk density, fuel model, fuel / foliar moisture, temp, RH, wind speed, elevation, slope, aspect

Mount Rushmore National Memorial
South Dakota

National Park Service
U.S. Department of the Interior

Crown Fire Potential: Pretreatment



Produced by Midwest Region Fire Management

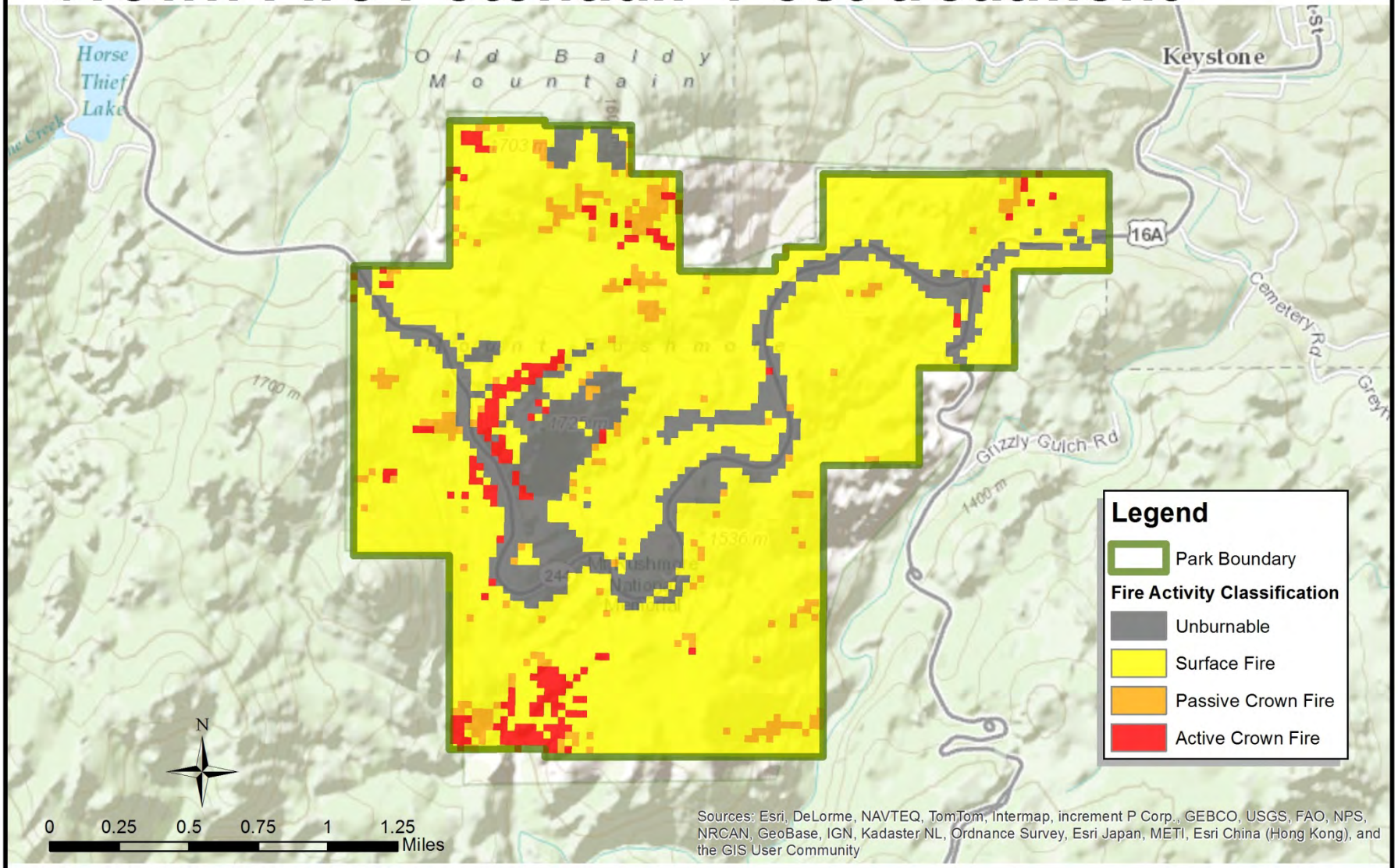
March 2013

FILE: 20130301_MORUFuelsTreatmentCrownFireActivity.mxd

Mount Rushmore National Memorial
South Dakota

National Park Service
U.S. Department of the Interior

Crown Fire Potential: Post-treatment



Produced by Midwest Region Fire Management

March 2013

FILE: 20130301_MORUFuelsTreatmentCrownFireActivity.mxd

Changes in Crown Fire Potential

Fire Activity Class	Pre-treatment	Post-treatment	Relative Change
Unburnable	15%	15%	---
Surface Fire	29%	77%	166% ↑
Passive Crown Fire	44%	4%	91% ↓
Active Crown Fire	13%	4%	69% ↓

Conclusions

- Approximately 62% of the park has been mechanically thinned since 2003.
- Passive and active crown fire potential has been reduced from 57% to < 10% of the park.
- Forest structure in treated areas is similar to historical conditions.
- Broadcast-pile and pile burning will continue to reduce fuel loading on the ground.