Estimating Woody Biomass Supply from Treatments to Reduce Fire Hazard in the U.S. West

Collaborators

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Results from
National Fire Plan Research Project
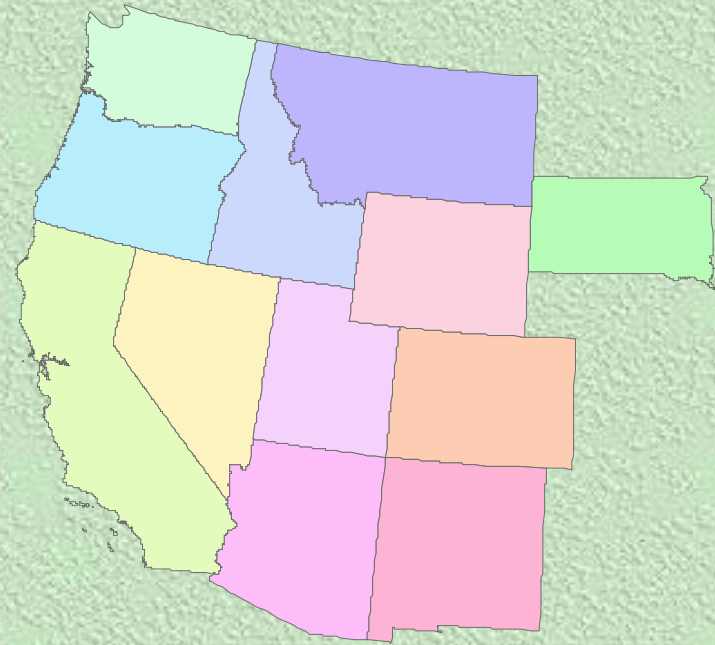02.FPL.C.1

FTM-West Model
(FTM = Fuel Treatment Model)

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Estimating woody biomass supply - Topics

- **Objectives**

- **Methods/ data**

- **Controversial decisions**

- **Findings**

- **Wood supply for FTM-West market model**

Objectives

❖ Identify areas in Western States where thinning would substantially reduce fire hazard

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❖ Provide substantial and sustainable revenue from wood products to offset treatment costs

Data, methods, and analysis tools

- Data – FIA plot data for 12 states in the West (about 37,000 plots)
- Methods – Web Tool – Fuel Treatment Evaluator 3.0
  - Design advice – Denver 2004 workshop of FS experts
  - Screen plots to identify eligible acres
    - Fire hazard, only surface and mixed severity fire regimes, not roadless, exclude certain counties west of Cascades in OR, WA
  - Apply simulated silvicultural treatments to eligible plots
    - Un Even aged - Leave trees of all ages (also referred to as SDI)
    - Even aged   (thin from below)
    - Special treatment for high severity fire regime forest types in WUI
  - Report results
    - Acres treated/ biomass removed by dbh class
    - Change in fire hazard
    - Harvest costs
    - Biomass revenue
    - Net revenues
    - Maps of locations of treatments

Methods
Fire Hazard Screens
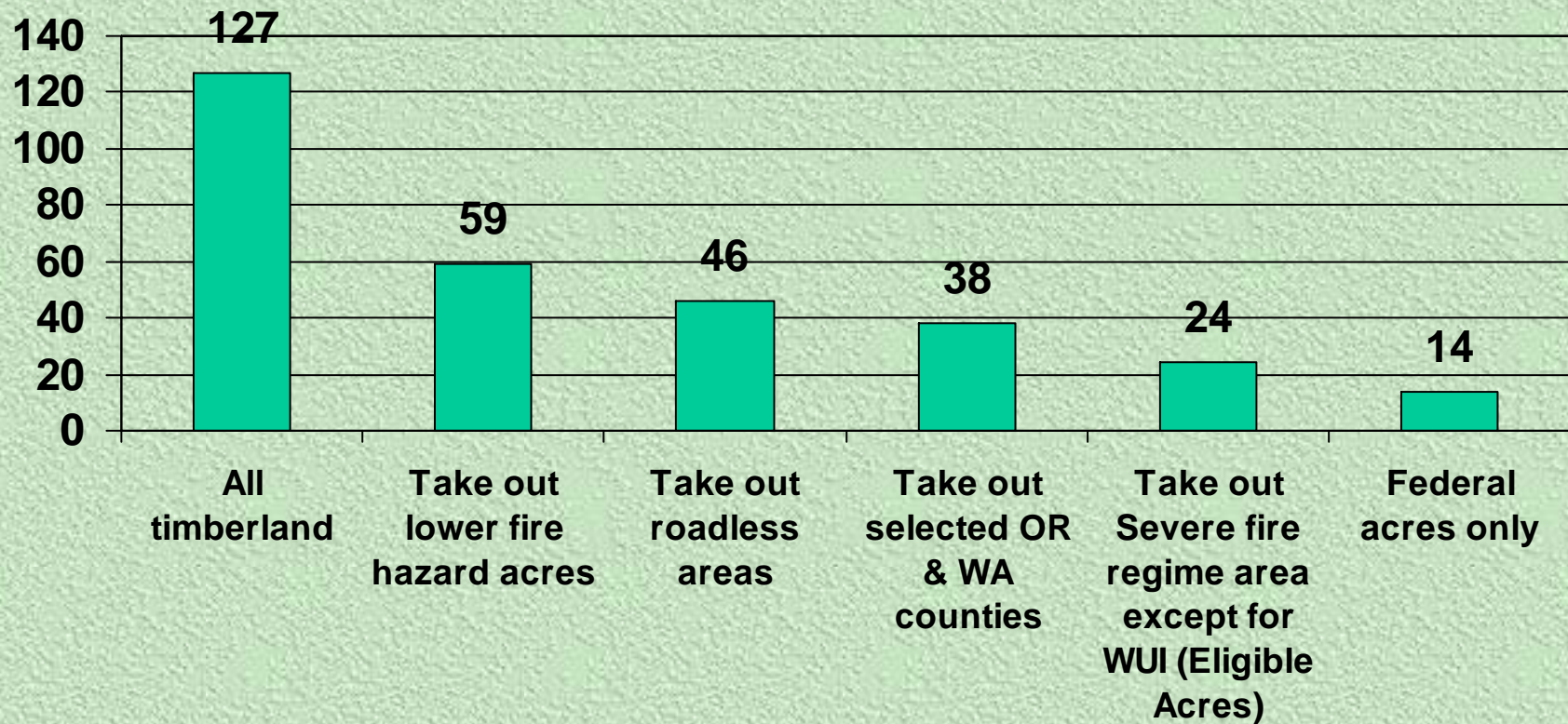## *Select plot if*

OR

**Torching Index
(TI) < 25 mph and
(CI) < 40 mph**

**Crowning Index
(CI) < 25 mph**

Results –
Effect of Screens to identify area eligible for treatment (million acres)
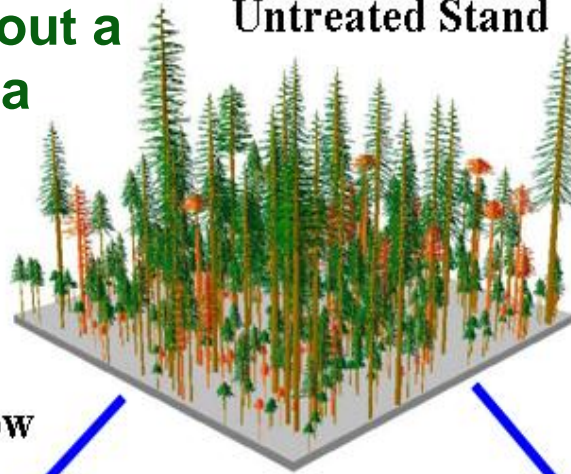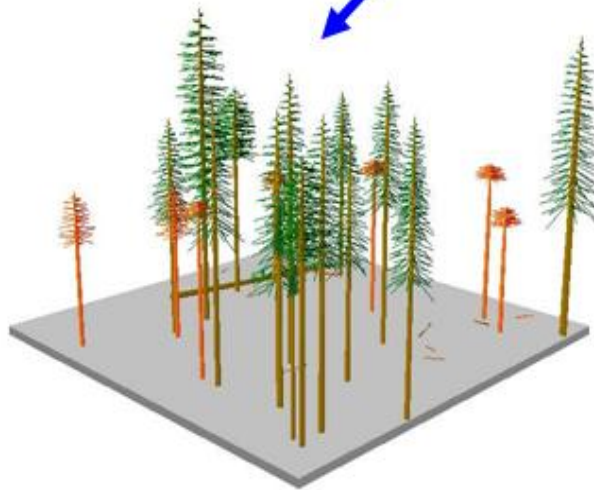
Basic Silvicultural Prescriptions
Even Aged & Uneven Aged

With and without a 50% basal area removal limit
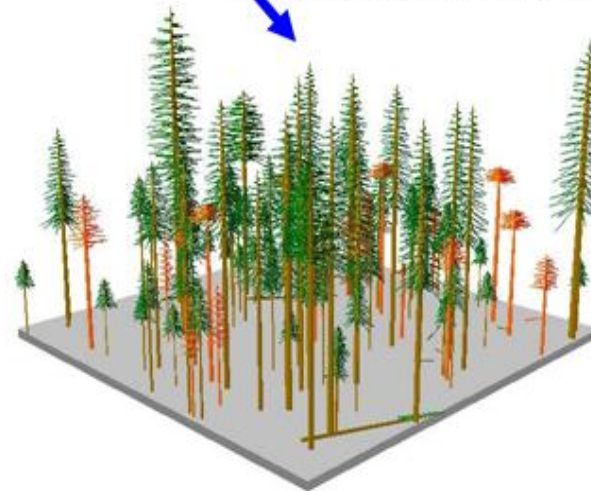
Untreated Stand

Thin from Below

Proportional Thin Across Diameters

Even-Aged

Uneven-Aged

Methods
Fire Hazard reduction targets

&

**Torching Index
(TI) > 25 mph**

**Crowning Index
(CI) > 25 mph**

Or CI > 40 mph

Some treatments have a 50% basal area removal limit

Methods
Treatment screen

❖ **Exclude from treatment**

  ❖ Plots that do not yield at least **300 cubic feet**
    (~ 4 tons) of merchantable volume / acre

(merchantable volume is main stem of trees with 5" dbh or more)

WUOA Analysis
Four Controversial Decisions

- Do not treat high severity fire regime forest types **except** in Wildland Urban Interface

- Do not treat selected counties in Washington and Oregon

- Do not treat plots with removals less that 300cf/ac merchantable wood (~4 od tons)

- Allowing Uneven aged treatments that cut many large trees

Results – Acres thinned and biomass removed
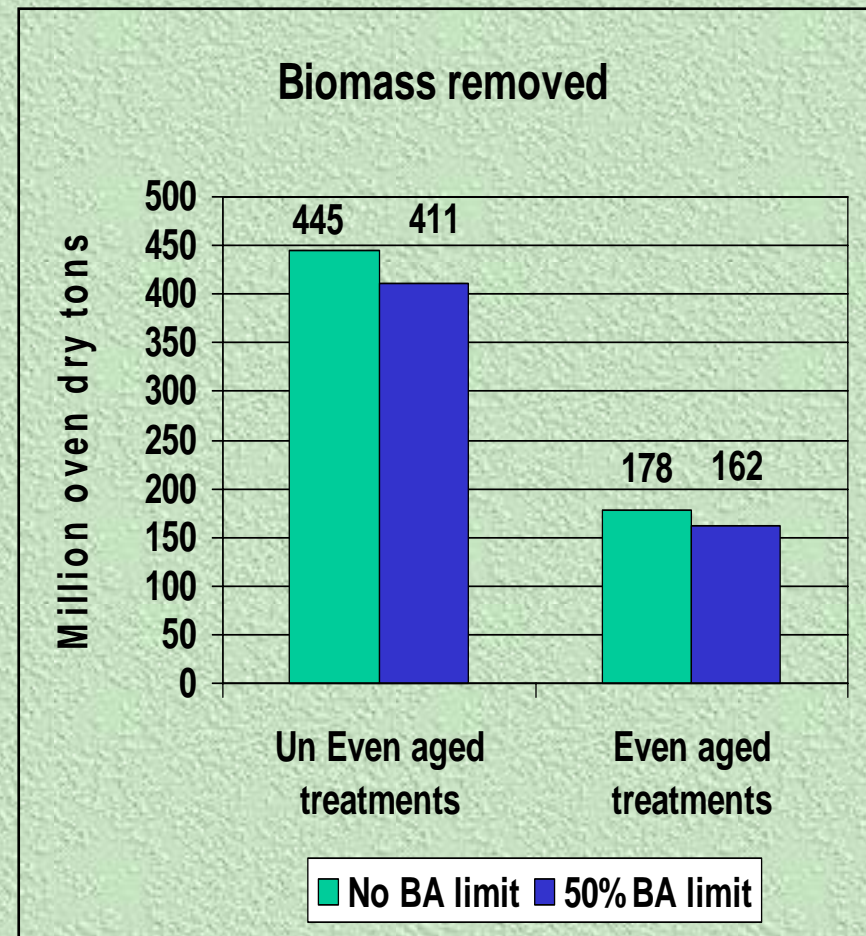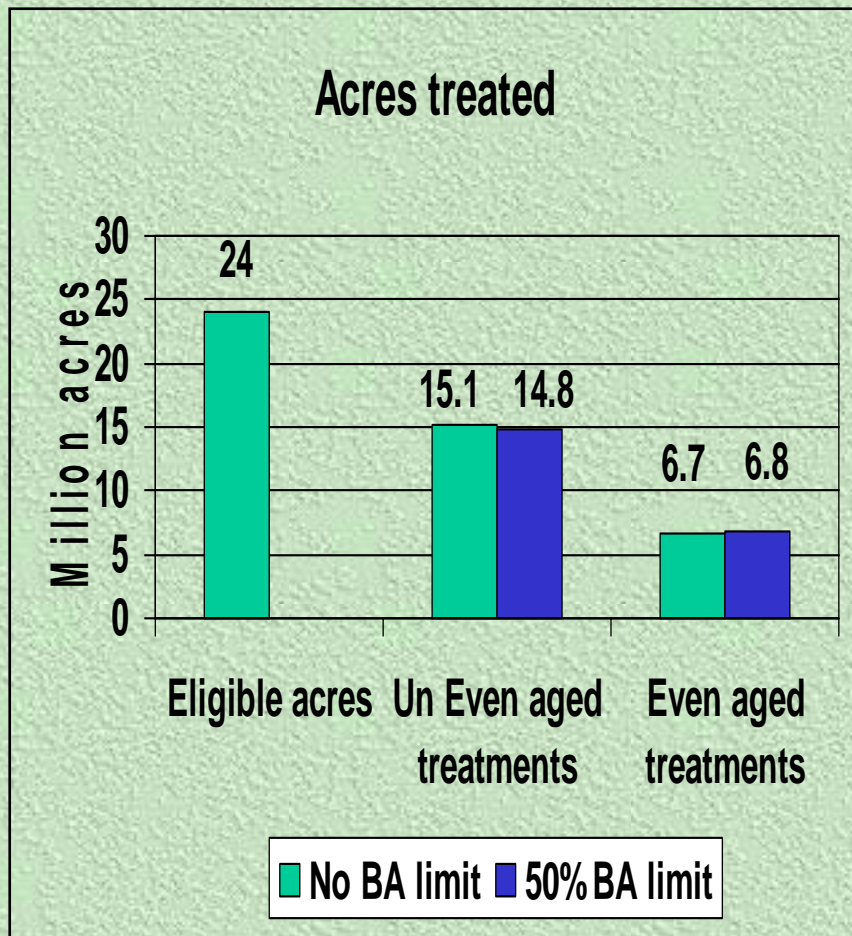
Results – Biomass removed / acre by tree dbh

Figure 15 - Biomass removals for Uneven aged treatments 2A, 2B by dbh class (tons / acre)

30-31% of biomass in trees below 9 inches dbh
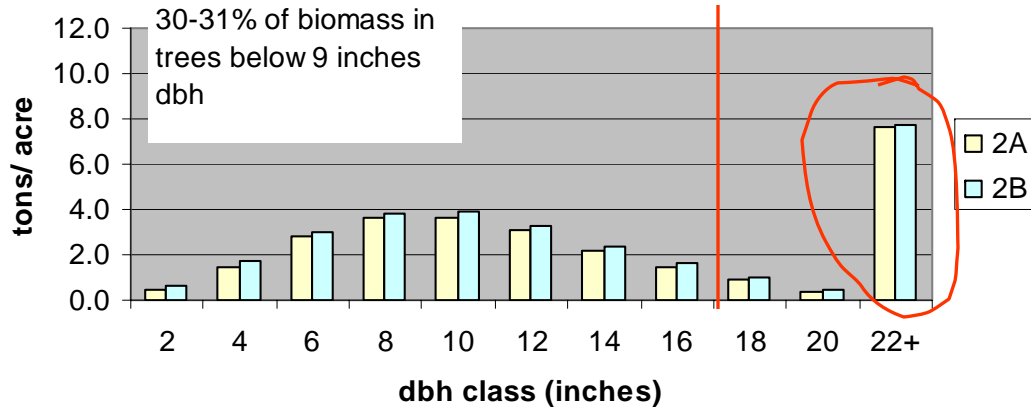
Uneven aged treatments

Figure 16 - Biomass removals for Even aged treatments 3A, 3B by dbh class (tons / acre)

57-58% of biomass in trees below 9 inches dbh

Even aged treatments
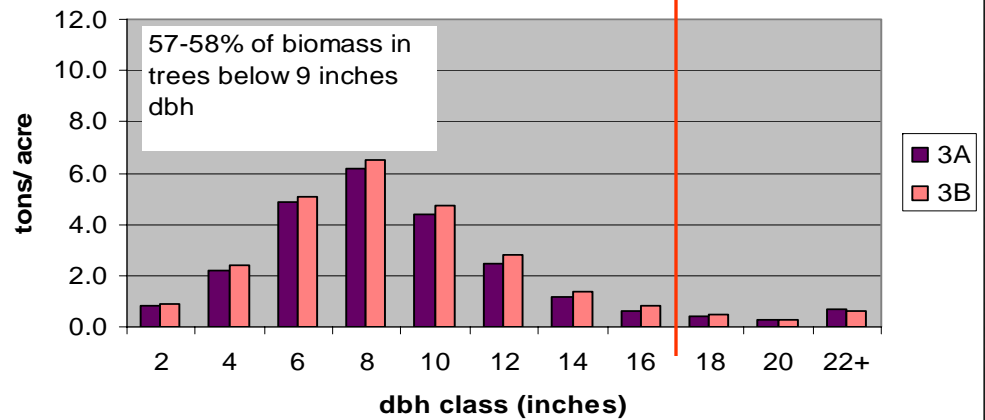
Results – Attainment of hazard reduction goals as a percent of eligible acres (24 million acres)

- **Medium - CI > 40** (blue)
- **High - TI & CI > 25** (red)

30%   62%   7%   28%

Y-axis: Percent of eligible acres (0, 20, 40, 60, 80, 100)

X-axis categories:
- Uneven aged - w BA limit
- Uneven aged wo BA limit
- Even aged w BA limit
- Even aged wo BA limit
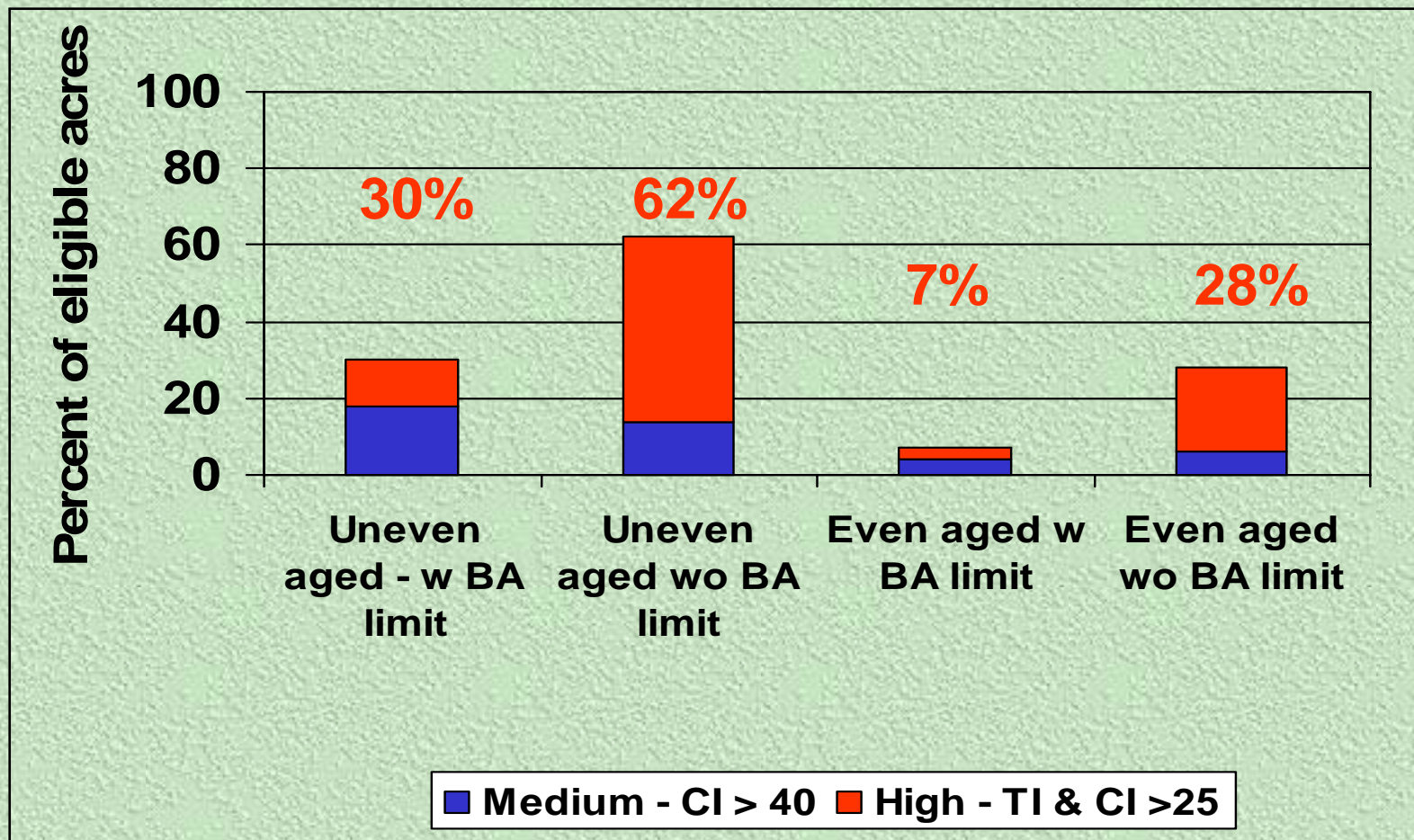
Average Net Revenue
Uneven Aged Management 2B

Dollars per Acre

1500
1200
900
600
300
0
300

Slope <40%   Slope > 40%

☐ No Subsidy ☐ $20 per green ton chip Subsidy
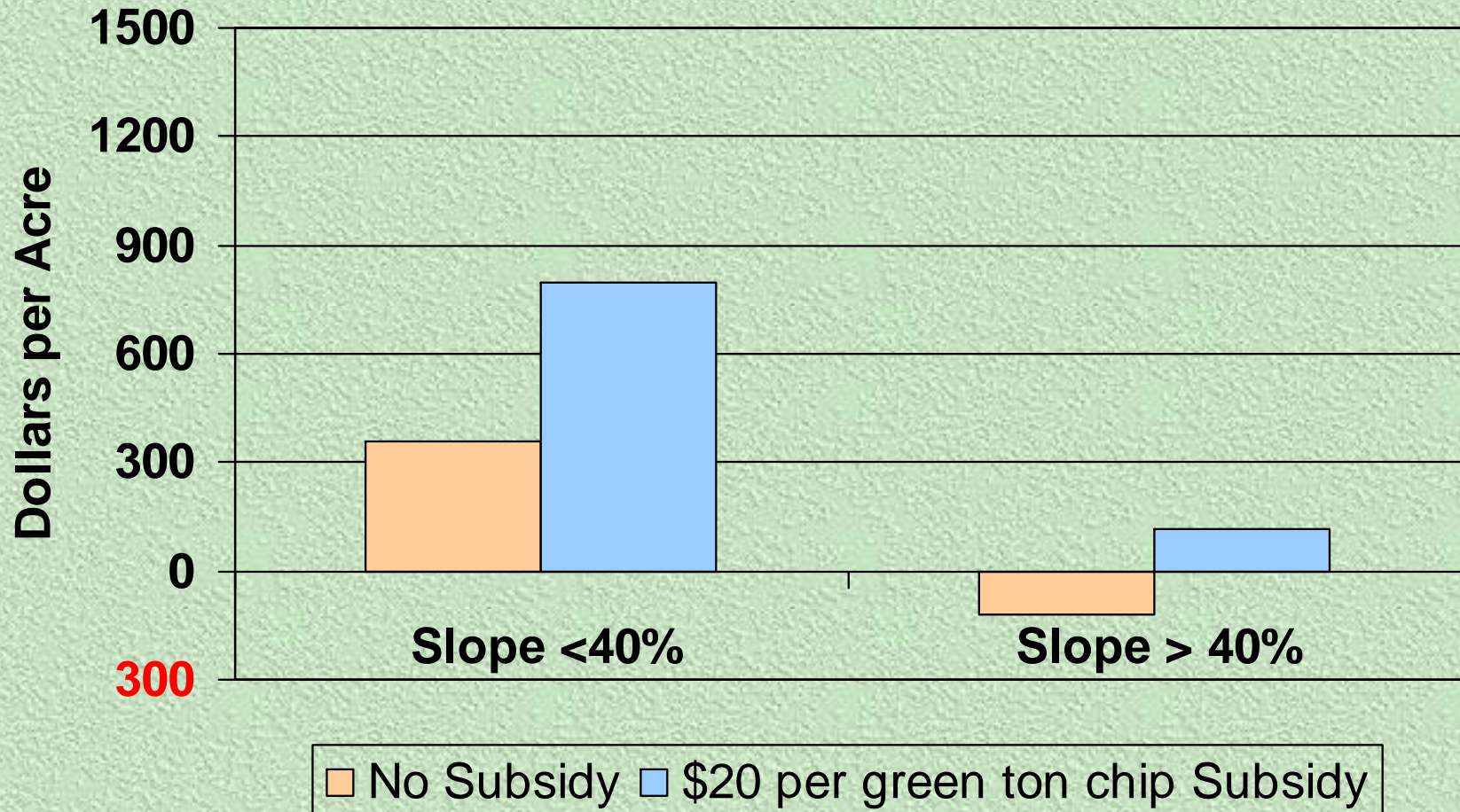
Delivered sawlog value -- $290/mbf; delivered chip value -- $30/ od ton; transport cost -- $0.35/ od ton; haul distance 100 miles

Average Net Revenue
Even Aged Management 3B

Dollars per Acre

1500
1200
900
600
300
0
300
600
900

Slope <40%

Slope > 40%

☐ No subsidy ☐ $20 per green ton chip Subsidy
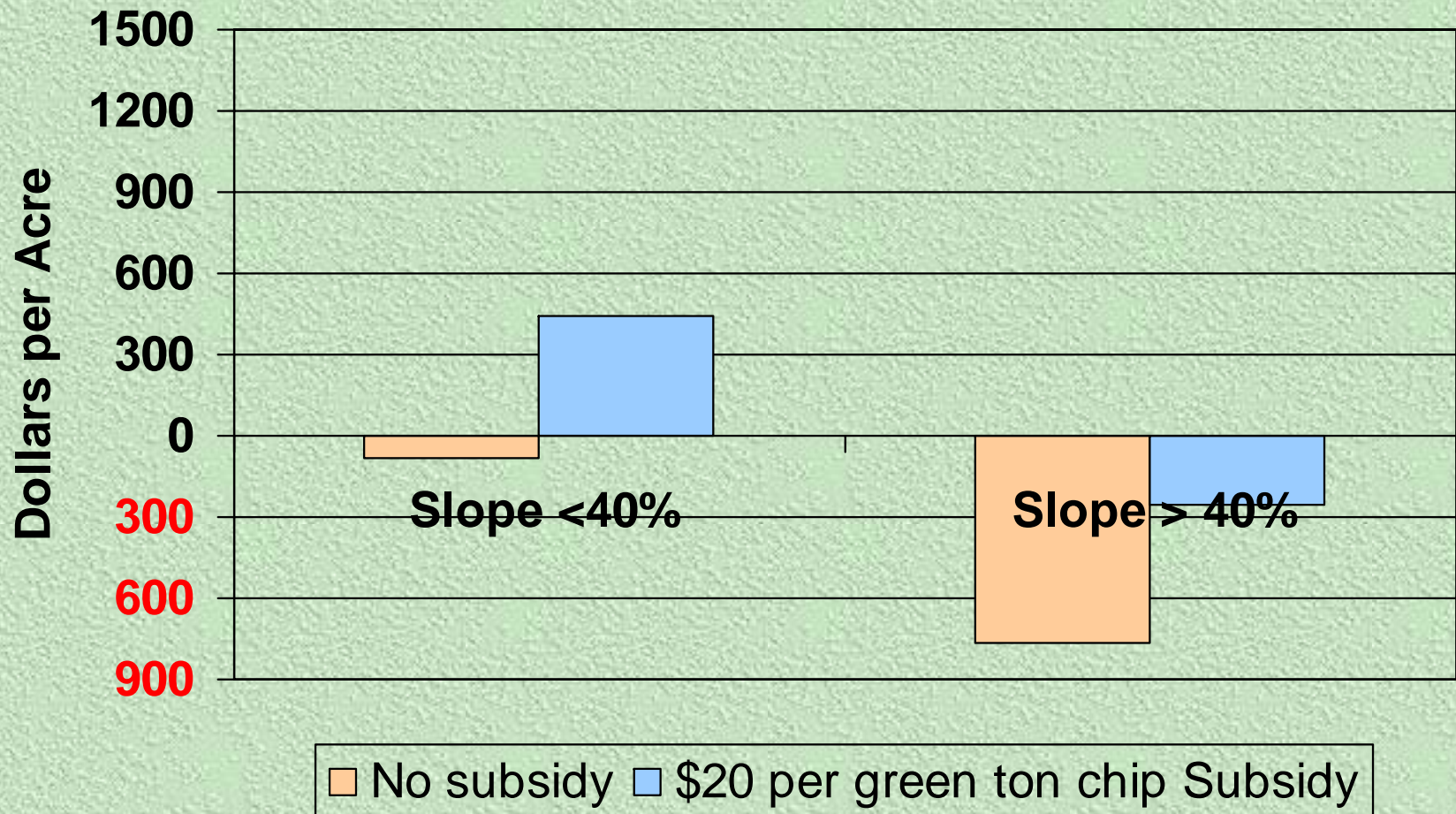
Uneven aged treatment (1A)
<u>**Total tons**</u> per 160,000 hexagon
17.1 m acres
548 m od tons

Treatment 1A.
All Live Dry Biomass Tons Removed.

<= 25,000	500,001 - 750,000
25,001 - 50,000	750,001 - 1,000,000
50,001 - 75,000	1,000,001 - 2,500,000
75,001 - 100,000	2,500,001 =>
100,001 - 250,000	
250,001 - 500,000	
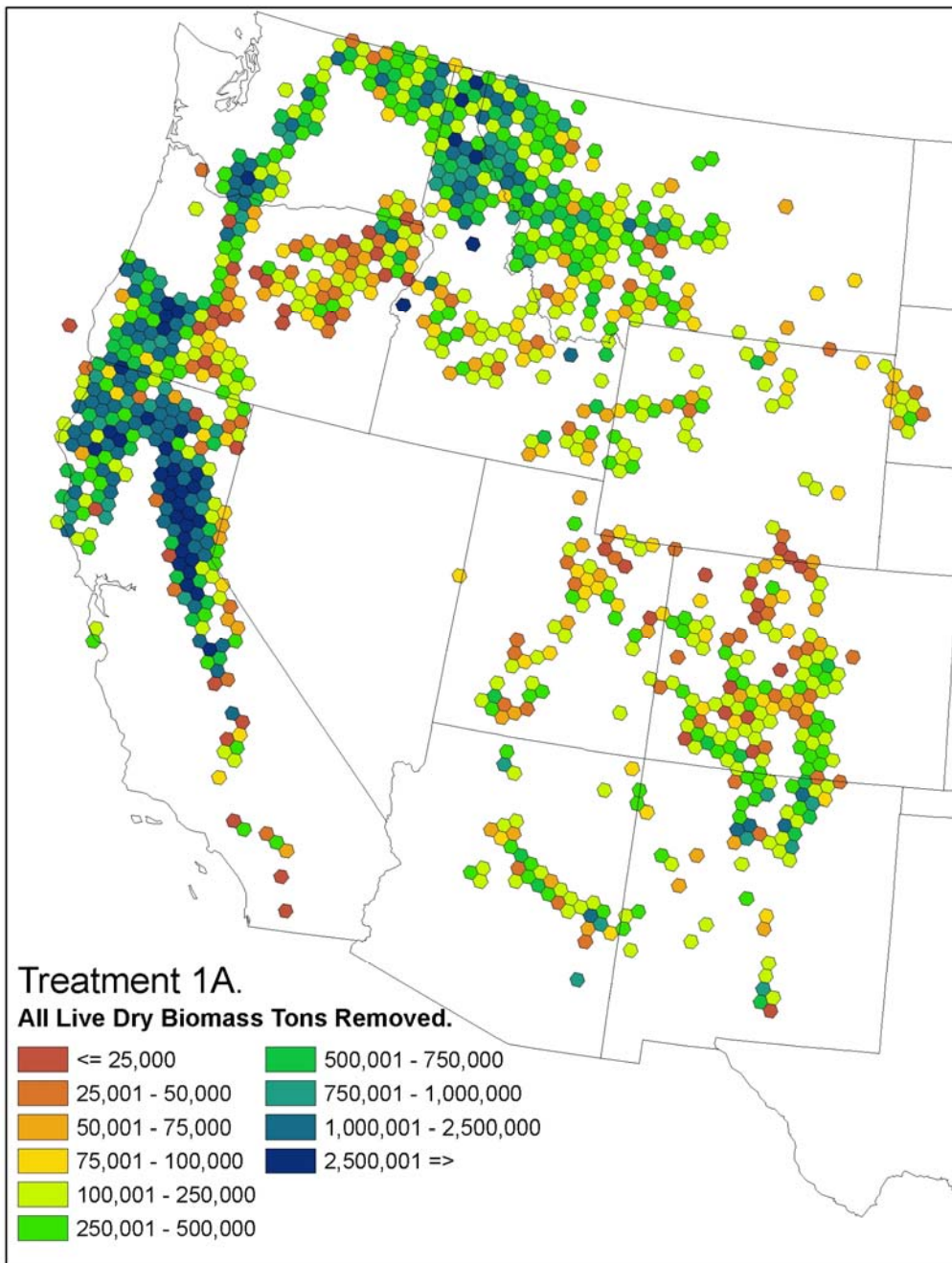
Even aged treatment (3A)
<u>Total tons</u> per 160,000 hexagon

6.7 m acres

162 m od tons

Treatment 3A.
All Live Dry Biomass Tons Removed.

■ <= 25,000	■ 500,001 - 750,000
■ 25,001 - 50,000	■ 750,001 - 1,000,000
■ 50,001 - 75,000	■ 1,000,001 - 2,500,000
■ 75,001 - 100,000	■ 2,500,001 =>
■ 100,001 - 250,000	
■ 250,001 - 500,000	
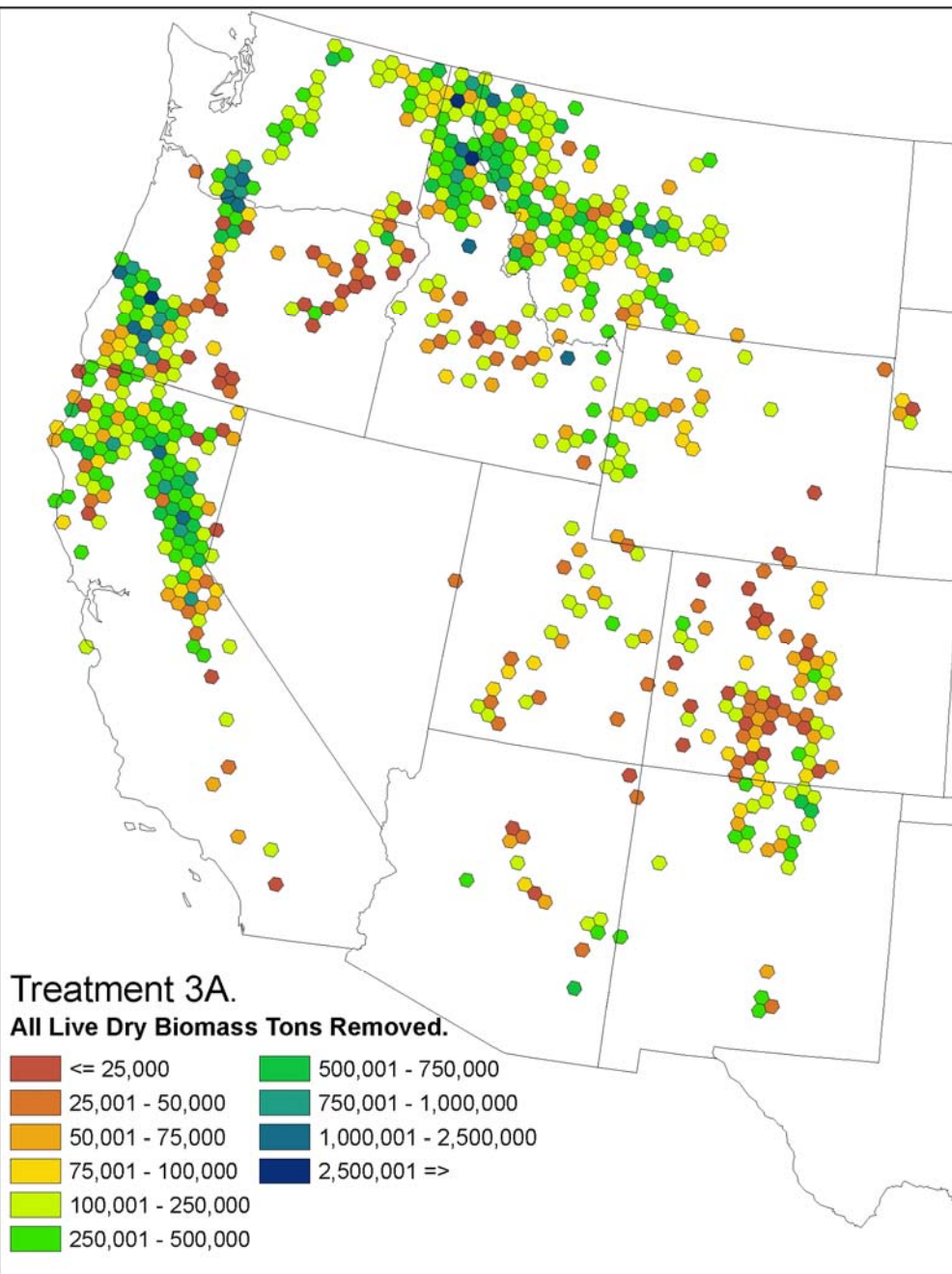
Biomass supply for FTM-West market model

Treatment	Eligible Federal area (million acres)	Treated area (million acres)	Biomass (million tons)	Biomass (billion cubic feet)	Harvest plus delivery cost per acre	Harvest plus delivery cost per 100 cubic feet
1A+4A uneven-aged (SDI)	14	10.9	347	23.2	$1531	$719
3A+4A even-aged (TFB)	14	5.6	148	9.9	$1420	$807

Key points/ Challenges

- Our treatments do not treat all acres with high hazard,
  - our treatments cover only 12 – 30 percent of high hazard acres

- Uneven aged treatments can reach hazard reduction targets on more acres given a need for
  - positive average net revenue and/ or
  - A limit on BA removed

- If uneven aged stands are wanted
  - can we reduce large tree removal and still attain goals by
    - Pruning trees
    - Reduce surface fuels

- If even aged treatments are wanted
  - Difficult to provide 300 cf /ac (and net positive revenue)
    - Provide subsidy?

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➢Regional structure . . .

FTM-West Supply/Production Regions:

- • 8 supply regions (sub-state, state, multi-state)

- •3 demand regions West, East, Export

The model includes tree volumes by *tree* diameter class (d.b.h.) and log volumes by *log* diameter class:

"Timber" volumes by diameter class T_L :

<5" dbh
5-6.9" dbh
7-8.9" dbh
9-10.9" dbh
11-12.9" dbh
13-14.9" dbh
>15" dbh
(MCF)

Conversion of timber and biomass volumes to chips and log volumes by diameter class

<4" top logs
4-5.9" logs
6-7.9" logs
8-9.9" logs
10-11.9" logs
12-13.9" logs
>14" logs
(MMLF)

Chips
Fuelwood
(MCF)

Production activities by product (e.g. lumber, plywood, poles, pulp, etc.):

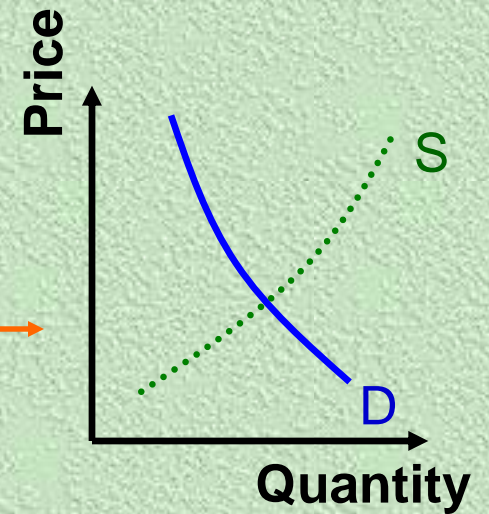Thinning volumes by diameter class B_L :

<5" dbh
5-6.9" dbh
7-8.9" dbh
9-10.9" dbh
11-12.9" dbh
13-14.9" dbh
>15" dbh
(MCF)

Product Demands

Lumber   **Poles**
Plywood   **Posts**
Fuelwood   **Hardboard**

Market Pulp
Paper (various grades)
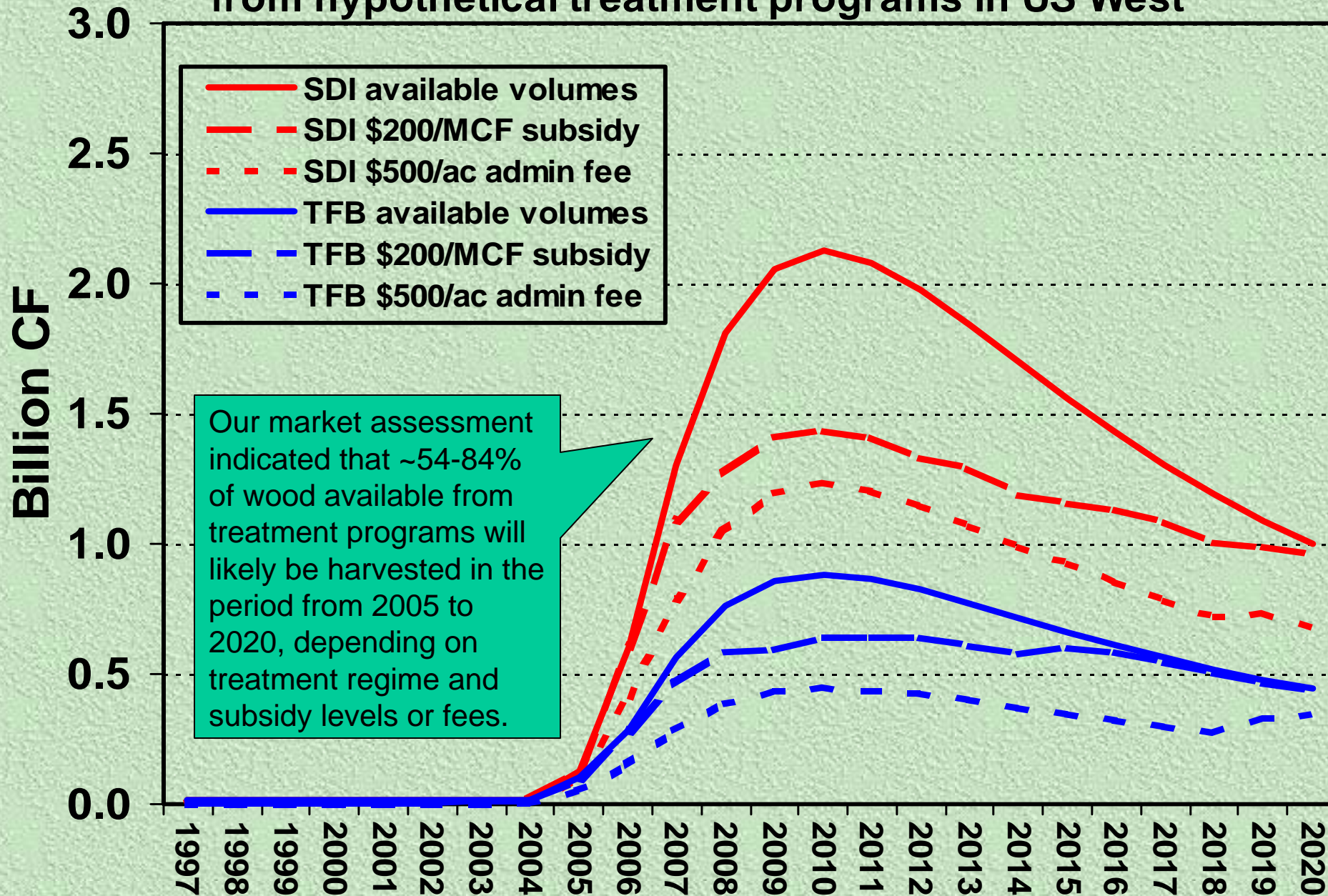**Paperboard (various grades)**

→ 2005 Delivered Wood Costs (West-wide avg., $/MCF) illustrating **value**, **harvesting cost**, and **policy** complexities as modeled in FTM-West:
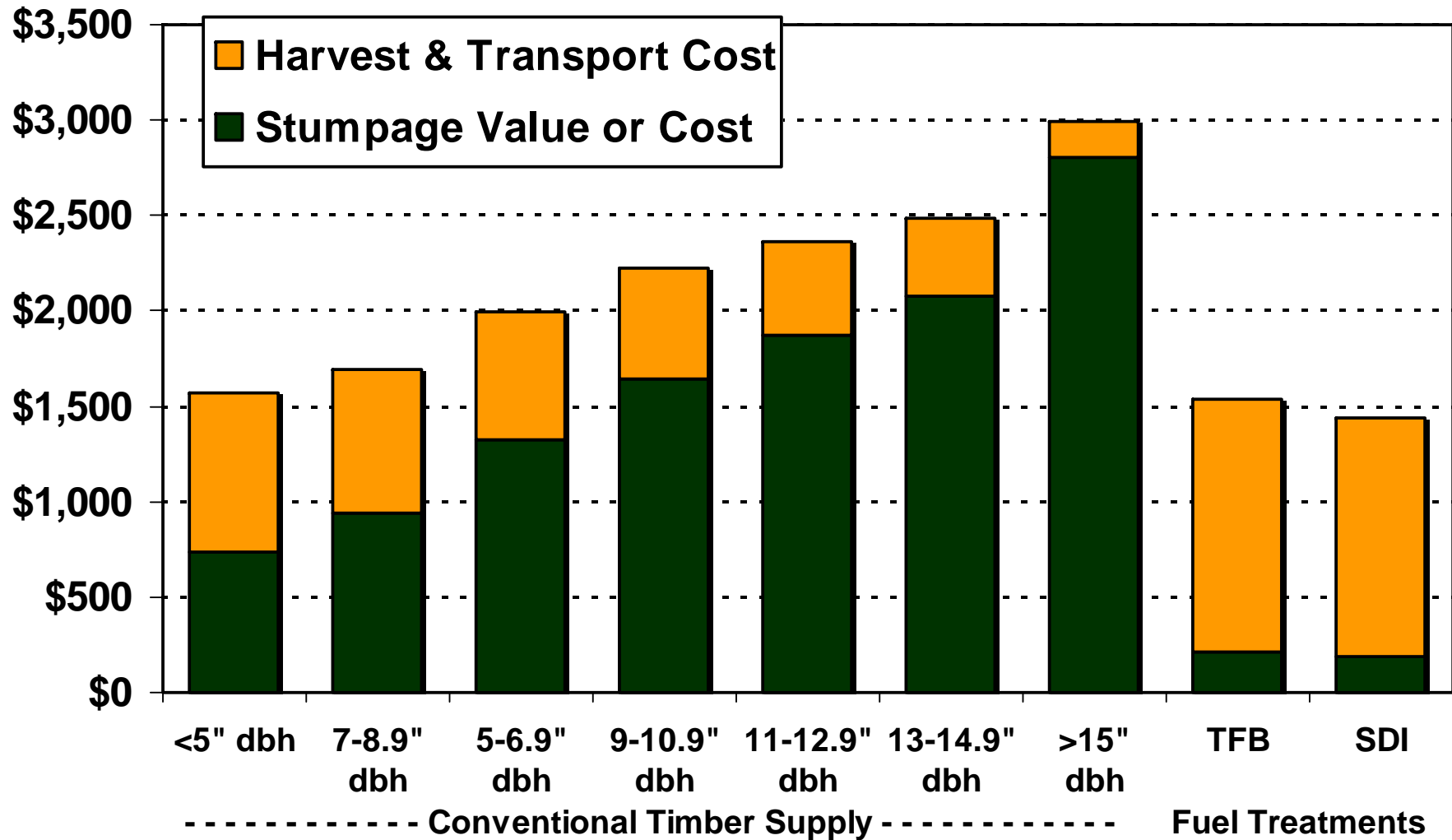
Maximum volume of wood made available annualy in the hypothetical thinning scenarios

A the volumes from FTE were fitted to a logarithmic-growth curve

SDI: 23.2 bil CF (10.9 mil acres)

TFB: 9.9 bil CF (5.6 mil acres)
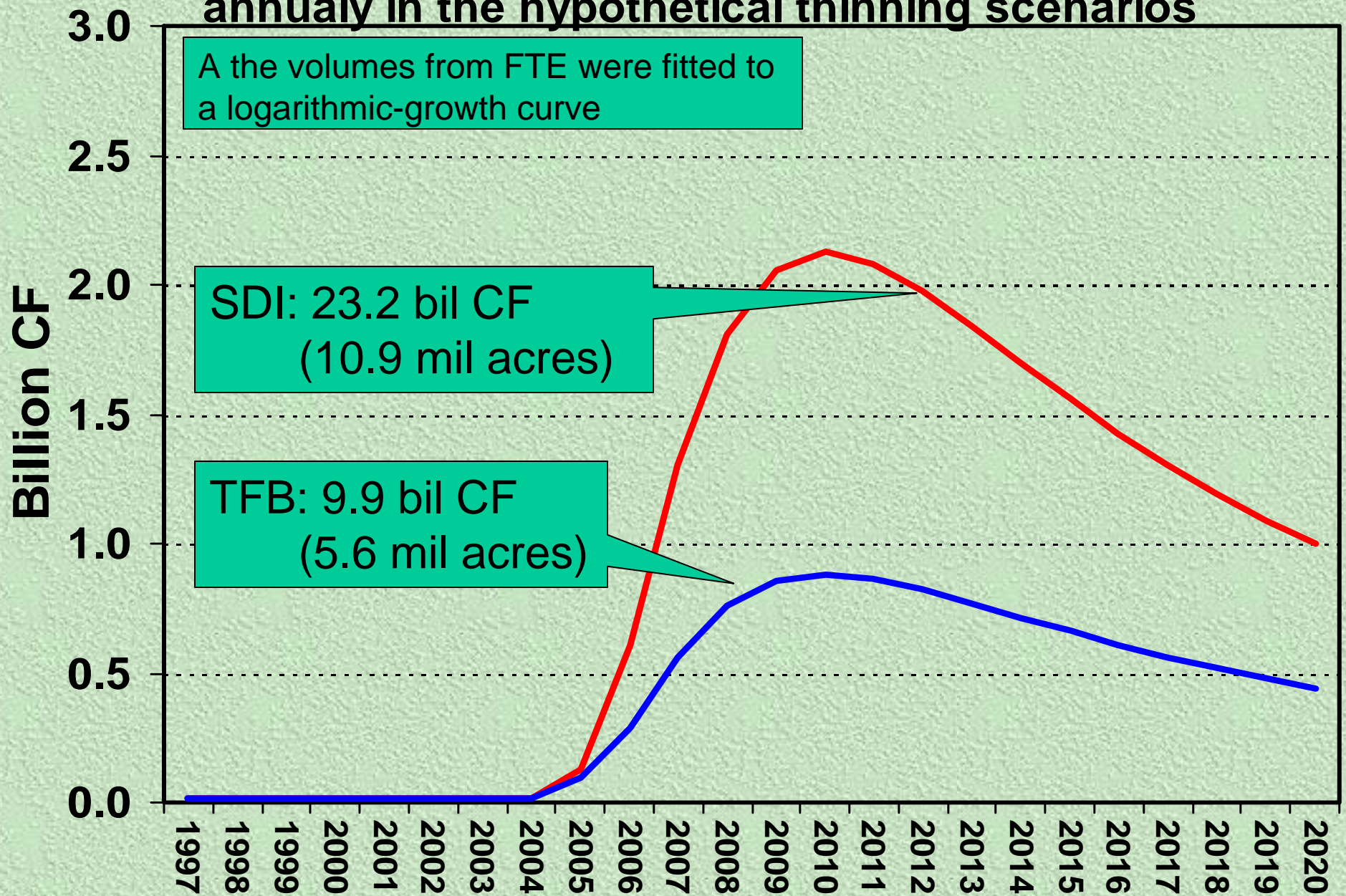
Available wood volumes and equilibrium harvests from hypothetical treatment programs in US West

Legend:
- SDI available volumes
- SDI $200/MCF subsidy
- SDI $500/ac admin fee
- TFB available volumes
- TFB $200/MCF subsidy
- TFB $500/ac admin fee

Y-axis: Billion CF (0.0 to 3.0)

X-axis: 1997 to 2020

Our market assessment indicated that ~54-84% of wood available from treatment programs will likely be harvested in the period from 2005 to 2020, depending on treatment regime and subsidy levels or fees.

Total volume of wood harvested in the US West (from conventional sources and fuel treatments)

Volume of wood harvested annually in the US West from conventional sources only

However, the wood from fuel treatments displaces significant amounts of conventional timber in the market.

Billion CF

- - - - TFB @ $500/acre logging fee
——— TFB @ $200/MCF subsidy (no fee)
- - - - SDI @ $500/acre logging fee
——— SDI @ $200/MCF subsidy (no fee)
——— Baseline - No treatment program

1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Projected Softwood Timber Price Impacts of SDI and TFB Treatment Programs & subsidies

Legend:
- Baseline - No treatment program
- TFB @ $500/acre logging fee
- TFB @ $200/MCF subsidy (no fee)
- SDI @ $500/acre logging fee
- SDI @ $200/MCF subsidy (no fee)

Y-axis: $/CF ($0, $1, $2, $3, $4)

X-axis: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020
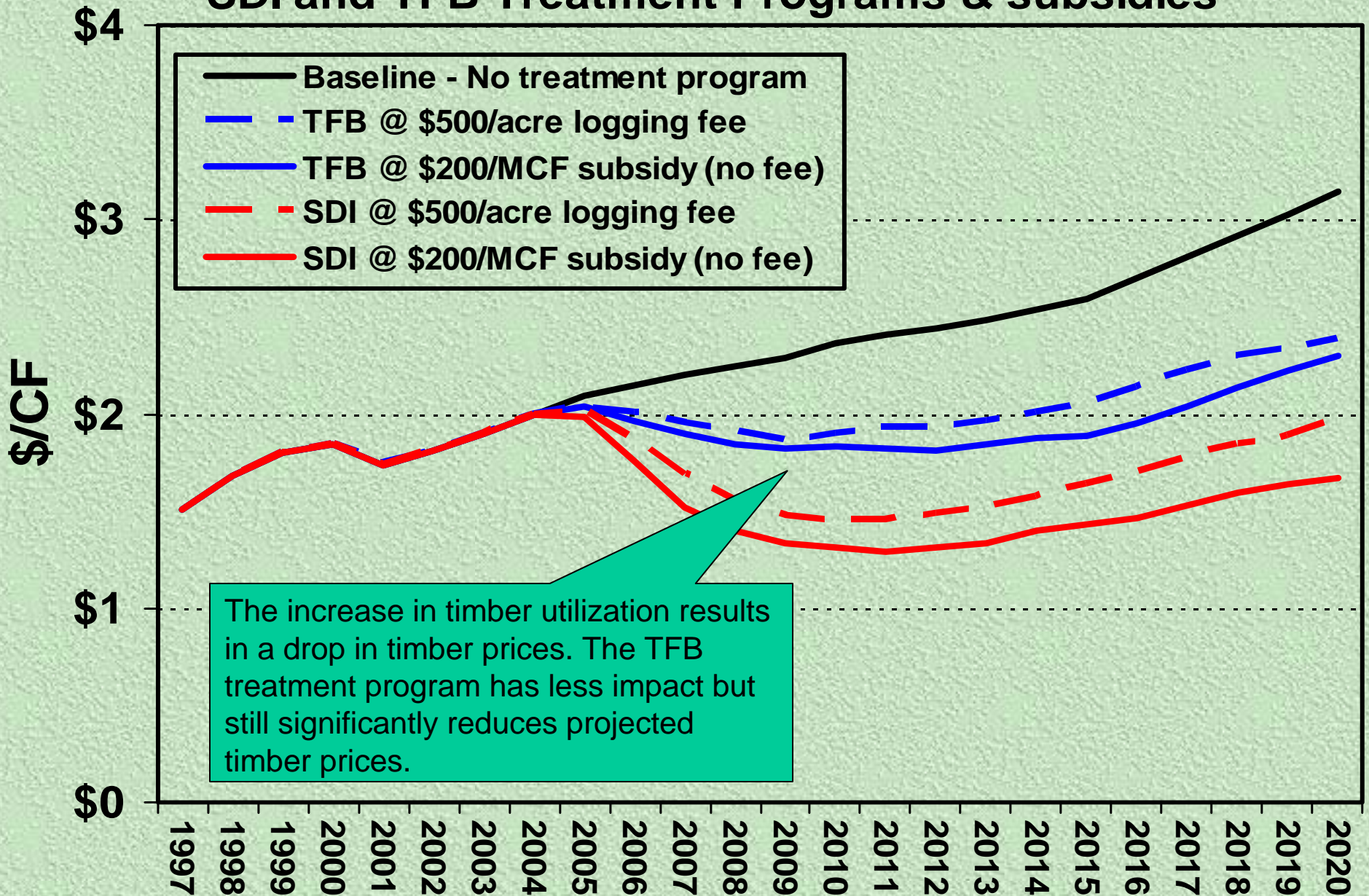
The increase in timber utilization results in a drop in timber prices. The TFB treatment program has less impact but still significantly reduces projected timber prices.

Cumulative Net Welfare (Consumer Surplus Gain minus Timber Revenue Loss) from Treatment Programs

Legend:
- SDI @ $500/acre logging fee (red dashed)
- SDI @ $200/MCF subsidy (no fee) (red solid)
- TFB @ $200/MCF subsidy (no fee) (blue solid)
- TFB @ $500/acre logging fee (blue dashed)

Y-axis: Billion $ (from -$10 to $8)

X-axis: 1997 through 2020
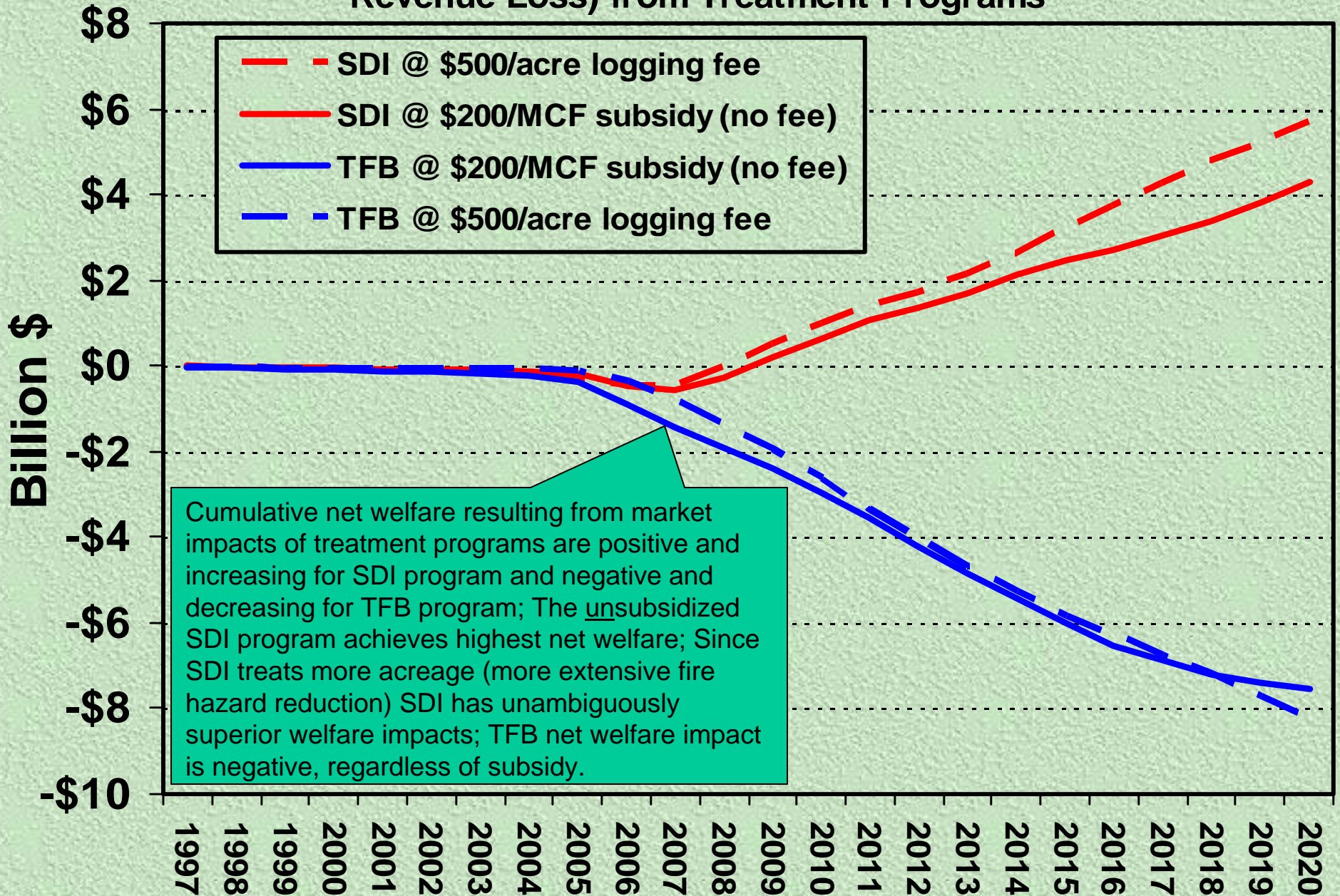
Cumulative net welfare resulting from market impacts of treatment programs are positive and increasing for SDI program and negative and decreasing for TFB program; The unsubsidized SDI program achieves highest net welfare; Since SDI treats more acreage (more extensive fire hazard reduction) SDI has unambiguously superior welfare impacts; TFB net welfare impact is negative, regardless of subsidy.

Key points

- Markets estimated to consume a fraction of potential biomass supply –
  - 50% to 60% when charging $500/ ac admin fee
  - 75% to 85% when providing $200/mcf subsidy ($13/odt)

- Markets support treatment of a fraction of 14 million eligible federal acres
  - Even aged (TFB) 17% to 32% of acres are treated
  - Uneven aged (SDI) 34% to 52% of acres are treated

- Softwood stumpage price lower than base projection by an average 40% to 50% with treatments

- Total consumption increases above base by 0.5% to 10% with treatments

- Conventional supply decreases below base by 10% to 20% with treatments

Questions?

**Link to
Fuel Treatment Evaluator 3.0**

http://ncrs2.fs.fed.us/4801/fiadb/rpa_tabler/

webclass_rpa_tabler.asp