FTM-West Model Results for Selected Fuel Treatment Scenarios

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***Abstract**—This paper evaluated potential forest product market impacts in the U.S. West of increases in the supply of wood from thinnings to reduce fire hazard. Evaluations are done using the Fuel Treatment Market–West model for a set of hypothetical fuel treatment scenarios, which include stand-density-index (SDI) and thin-from-below (TFB) treatment regimes at alternative levels of harvest administrative fees or subsidies. Results show that even with industry bearing the assumed administrative costs of thinning programs, substantial volumes of wood could be thinned, but more so in coastal regions than inland regions of the West. Also, replacing administrative fee assumptions with hypothetical removal subsidies increases the proportion of harvestable wood removed; a sensitivity observed primarily in the inland regions. Results show also that wood removals from fuel treatment programs could displace a large fraction of timber supply from conventional sources, reducing regional timber harvest and timber revenues that would otherwise be projected to increase for state and private timberland managers in the West. The SDI thinning regime can result in potential gains in forest product consumer surplus that more than offset losses in timber producer surplus, resulting in positive net market welfare, while the TFB regime can produce the opposite result (negative net market welfare).*

Introduction

The Fuel Treatment Market (FTM) model for the U.S. West, or FTM–West, is a dynamic partial equilibrium model of the markets for softwood timber and forest products produced in the western United States. The model projects the market for wood from fuel thinning treatments along with the market for timber from conventional sources in order to project the market impacts of fuel treatments (Ince and Spelter, this proceedings; Ince and others 2005). At the present time, only a small fraction of the fuel treatment acreage on federal lands in the U.S. West involves wood harvest (over 90% of the fuel treatment acreage involves prescribed burning or mechanical treatment without wood byproduct removal). This paper illustrates projected market impacts of hypothetical expanded fuel treatment programs involving thinning and wood removal on federal lands in the West.

Different scenarios can be run in the FTM-Westmodel with different hypothetical forest treatment programs or with no treatment program at all. The two hypothetical thinning regimes analyzed in this study were created using the Fuel Treatment Evaluator (FTE 3.0) model (Skog and others 2006) and the areas considered for treatment were NFS and other federal land (BLM, BIA, etc.). The thinning regimes were developed by a team of researchers whose objective was to identify places where the use of woody biomass from

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thinning can best help pay for hazardous fuel reduction treatments. The effort identified USDA Forest Service Forest Inventory and Analysis (FIA) plots on timberland in 12 western states—127 million acres—that passed screens excluding high severity fire regime forest types (where crown fires are normal), low fire hazard plots, plots in roadless areas, and plots in selected counties on Oregon and Washington where treatments would be done primarily for purposes other than fire hazard reduction. Twenty four million acres were identified as eligible for treatment, of which 14 million acres are on federal land. Eligible acres received simulated treatment by one of two silviculture treatment regimes to meet certain fire hazard reduction targets if the treatment would provide at least 300 ft^3/acre (~ 4 oven-dried tons/acre). The SDI treatment removed trees across all age classes to leave an uneven-aged stand. The TFB treatment removed trees beginning with the smallest to leave an uneven-aged stand. The paper by Skog and Barbour (this proceedings) explains the SDI treatment regime (a combination of treatments 2A and 4A) and the TFB treatment regime (a combination of treatments 3A and 4A).

Each regime was run with two different cost assumptions (making four total scenarios). In one scenario, administrative fees (stumpage fees) were levied on the wood available for treatment to pay for the estimated average cost per acre to the Forest Service to make the wood available ($500 per acre), whereas the other scenario eliminated the fee and instead offered a subsidy for the wood ($200 per MCF). The sensitivity of the volume of wood treated to the stumpage fee or subsidy was not intensely analyzed in this study, and therefore the cost assumptions are not assumed to maximize possible revenue to the Forest Service or the volume of wood treated under any constraints.

Scenario Inputs

Two different hypothetical forest treatment regimes were evaluated using the FTM-Westmodel, the inputs of which were obtained using the FTE model. In this paper they are referred to as SDI and TFB, respectively. The FTM-West required as input three different aspects of the scenarios: the volume distribution of available wood by d.b.h. class for each supply region (table 1), the volume of wood to be made available for treatment in each year for each supply region, and the weighted average cost of the wood from treatments, which includes harvest and transport costs and possibly an administrative cost or subsidy, also in each supply region. Most of the figures in this paper are aggregated for the whole U.S. West. As Skog and others (this proceedings) mention, the SDI scenarios consist of more (about twice as much) total wood

Table 1—Volume of wood by diameter at breast height class for two hypothetical thinning programs compared with 1997 estimates on conventionally harvested wood (Ward and others 2000; Larsen and others 2000). Rows might not add to 100% due to rounding.

	Wood by diameter at breast height class						
	<5	**5 to 6.9**	**7 to 8.9**	**10 to 11.9**	**12 to 13.9**	**14 to 15.9**	**>15**
	Inches						
TFB	9%	20%	15%	17%	12%	7%	20%
SDI	8%	10%	8%	10%	9%	6%	48%
Conventional (1997)	3%	8%	14%	18%	17%	14%	27%

and acres available than the TFB scenarios (figures 1 and 2). Also note that the FTE only gives the total amount of wood available for treatments in each region, so a logarithmic-growth function was used to smooth this amount over a 16-year period, 2005 to 2020. Each scenario was run once with an added $500 per acre administrative fee (equivalent to a stumpage fee) for wood available from forest treatments, which is estimated to cover the cost of making the wood available, and once with no fee and an unconstrained $200/MCF subsidy.

In all the effects discussed here (volume harvested, timber prices, producer and consumer surplus) except the change in net market welfare, the SDI scenarios had larger impacts compared with the TFB scenarios. Similarly, the scenarios where forest treatments were subsidized had larger effects when compared with the scenarios that required administrative fees.

Volume Harvested and Timber prices

In all four scenarios, more than half of the wood made available from forest treatments was utilized (table 2). Subsidizing the programs resulted in an additional 3.6 and 3 billion cubic feet representing 16% and 30% of the total FTE volume for the SDI and TFB programs, respectively. This additional wood treated was located exclusively in the interior region of the U.S. West because in every scenario 100% or nearly 100% of wood made available in the coastal region (Pacific Northwest and California coasts) was treated. For the

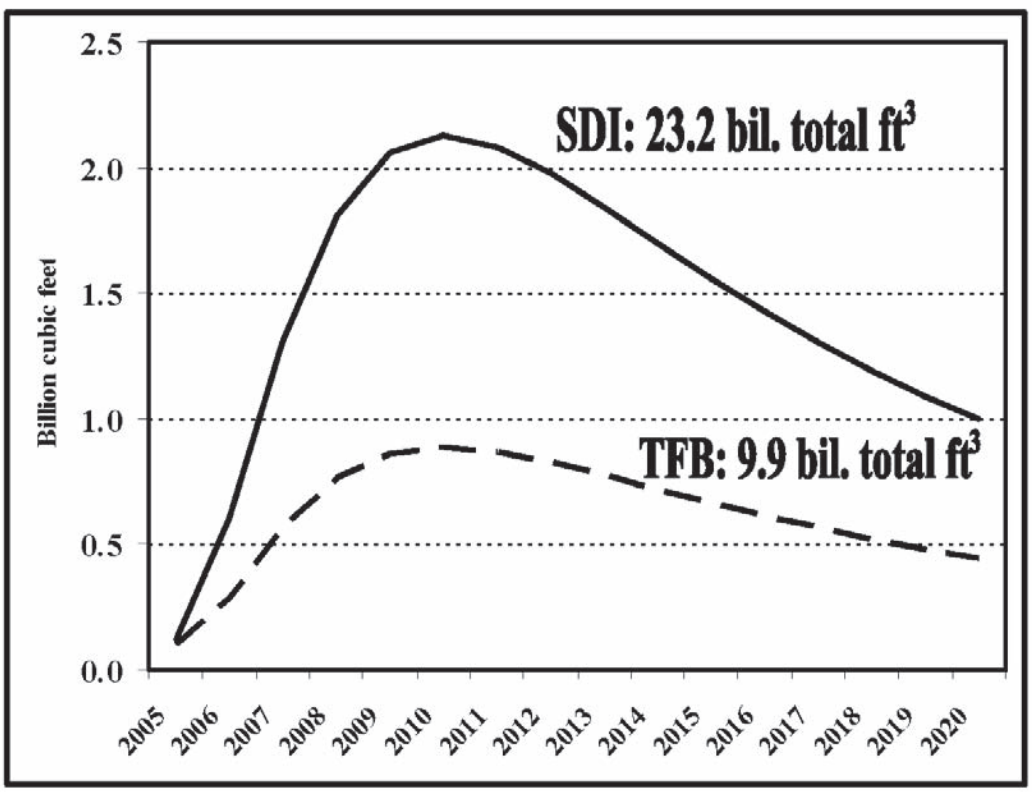

Figure 1—Maximum volume of wood made available annually. SDI, Stand Density Index; TFB, Thinning From Below.

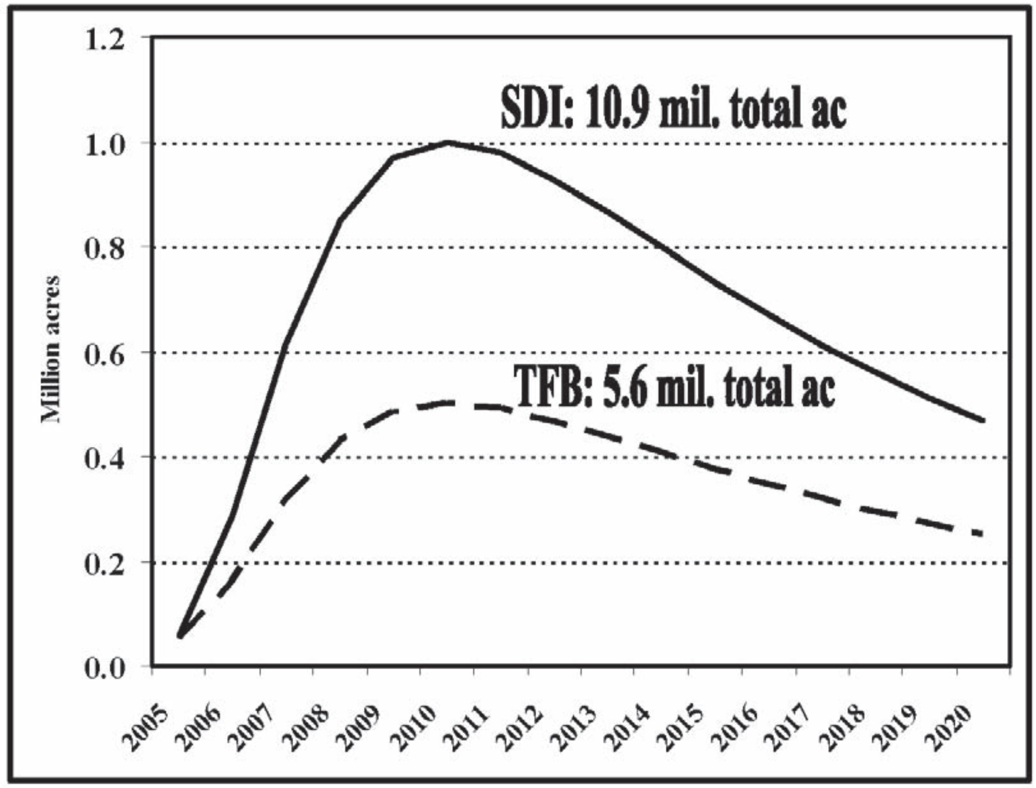

Figure 2—Acres made available annually assuming a constant average volume per acre.

Table 2—Billion cubic feet, million acres, and percentage of total wood available projected to be treated over the 16-year period, 2005 to 2020. SDI, Stand Density Index; TFB, Thinning From Below

Regime		$500/acre admin fee	$200/MCF subsidy
	Billion cubic feet	13.9	17.5
SDI	Million acres	4.7	7.3
	FTE volume (%)	60%	76%
	Billion cubic feet	5.3	8.2
TFB	Million acres	2.4	4.5
	FTE volume (%)	54%	84%

interior regions, this amounted to an increase from 5% to 42% of available wood treated and an average of 2.6 million acres for the SDI program, and 5% to 66% and an average of 2.1 million acres for the TFB program, as a result of dropping the administrative fee and adding the subsidy (figure 3).

In all four scenarios, the total harvest of wood increased when compared to a scenario with no wood available for treatment (figure 4). However, the additional utilization of wood from forest treatments displaced wood utilized from conventional sources (mostly state and private). This crowding out of conventional timber ranges from 5 to 12 billion ft^3 over the 16-year time period, depending on subsidy and thinning regime (figure 5). Over the time

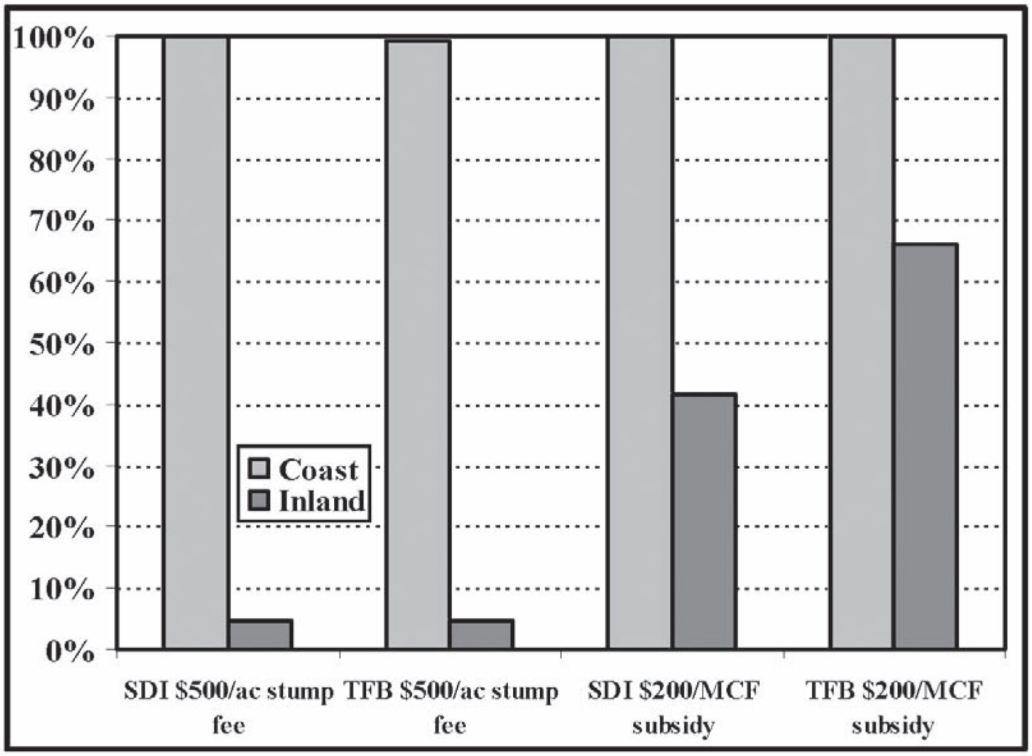

Figure 3—Percentage of available wood utilized. SDI, Stand Density Index; TFB, Thinning From Below.

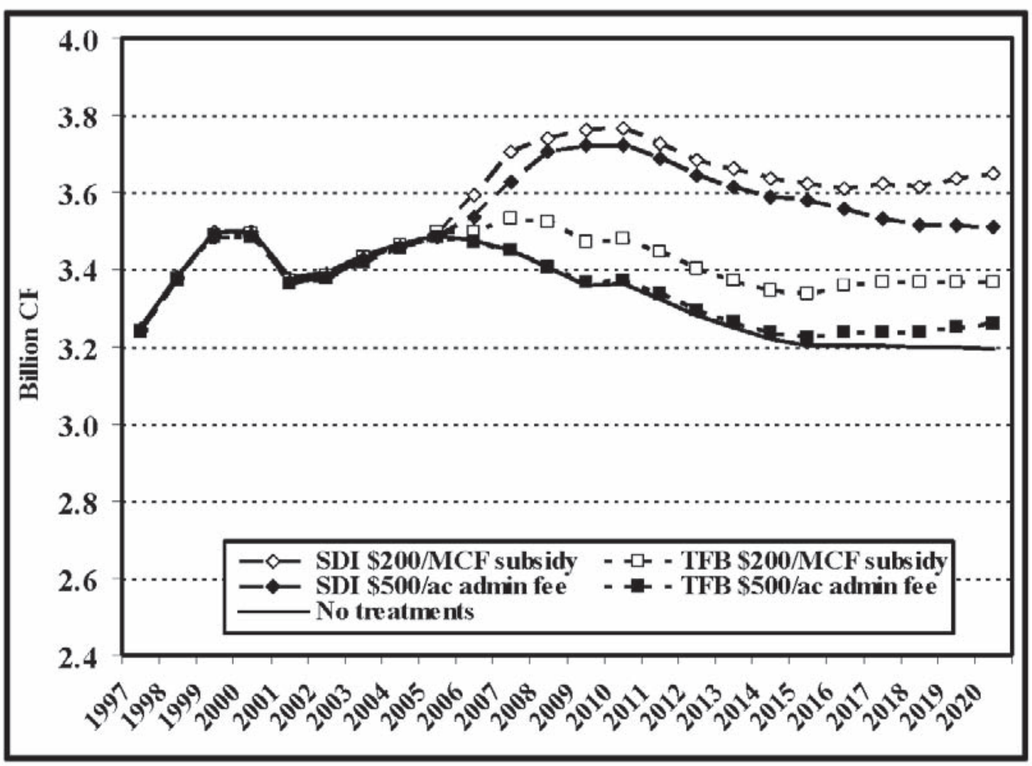

Figure 4—Total volume of wood harvested annually. SDI, Stand Density Index; MCF, per thousand cubic feet; ac, acre.

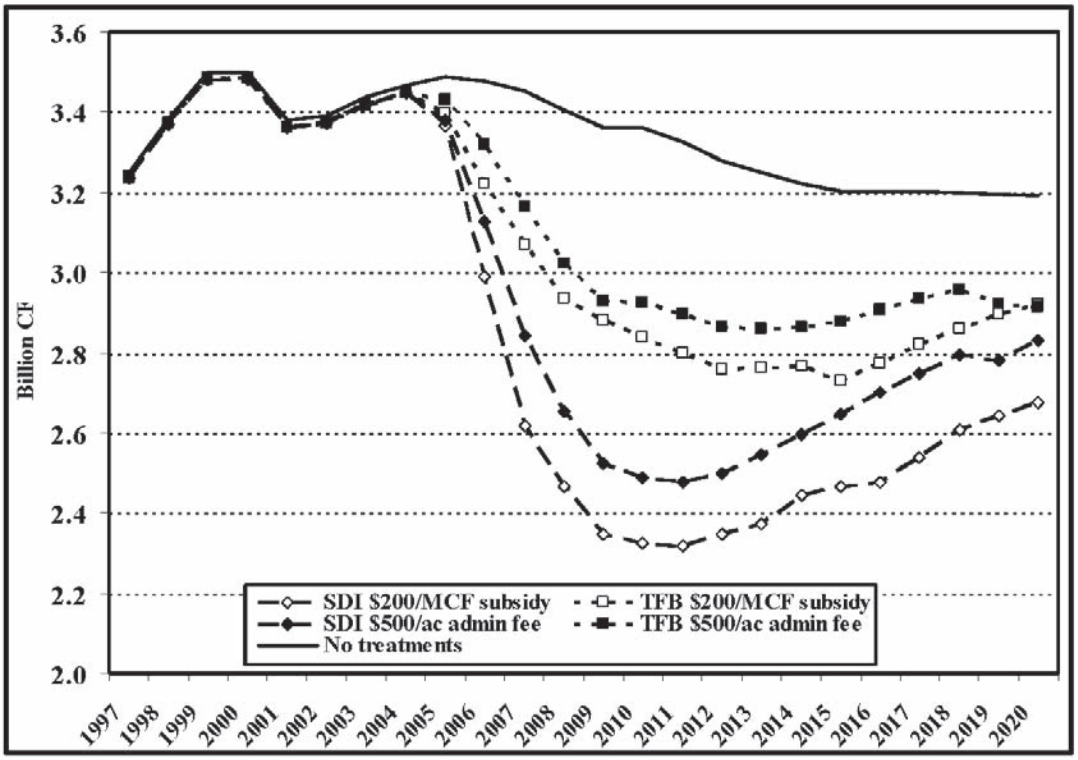

Figure 5—Volume of wood harvested from conventional sources. SDI, Stand Density Index; MCF, per thousand cubic feet; ac, acre.

period, the wood from treatments accounted for an average of 10% to 30% of the total volume of wood harvested, also depending on subsidy and thinning regime. Consequently, the boost in timber supply from thinning and reduction in harvest from conventional supply sources is projected to result in lower timber prices as well (figure 6).

Producer Surplus, Consumer Surplus and Net Welfare

All four scenarios project a decrease in potential revenue to conventional timber suppliers, a loss of producer surplus, which is a direct result of the decrease in regional timber prices and the volume of conventional timber harvested (as compared to a no-treatment scenario). The cumulative potential losses over the 16 year projection period (2005 to 2020) are quite significant, ranging from $34 billion to $70 billion (figure 7).

On the other hand, all four treatment scenarios projected lower wood product prices and increases in wood products consumption resulting in increases in forest product consumer surplus. Over the projection period the cumulative increases ranged from $26 billion to $74 billion (figure 8).

When we observe the changes in cumulative net welfare, defined as the change in producer surplus plus the change in consumer surplus, we see a deviation from the theme of the other results. Both TFB scenarios result in decreasing net welfare totaling as low as –$8.3 billion after 16 years with

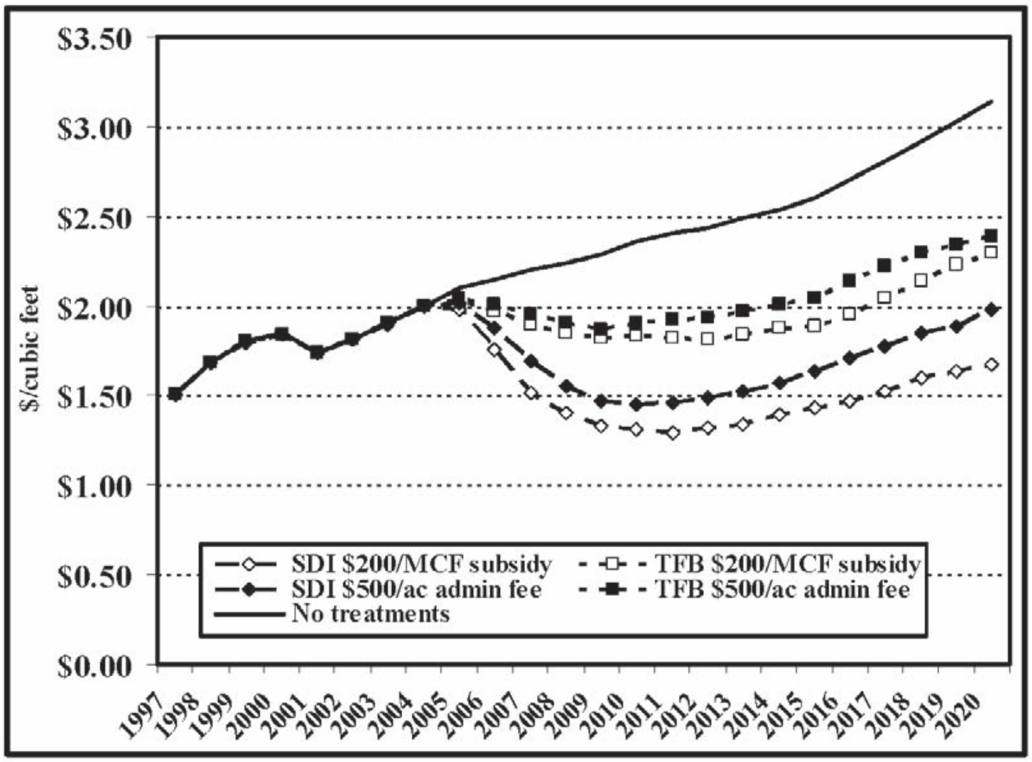

Figure 6—Weighted average softwood timber price in the U.S. West. SDI, Stand Density Index; MCF, per thousand cubic feet; ac, acre.

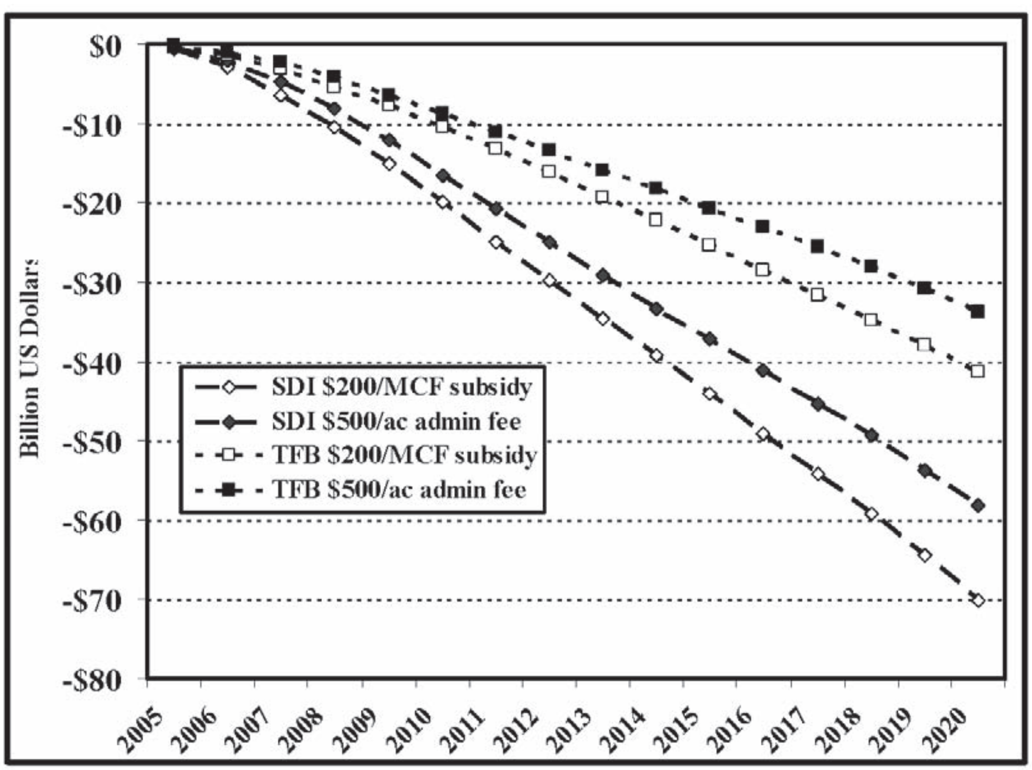

Figure 7—Cumulative change in producer surplus as compared to a no-treatment scenario. SDI, Stand Density Index; TFB, Thinning From Below.

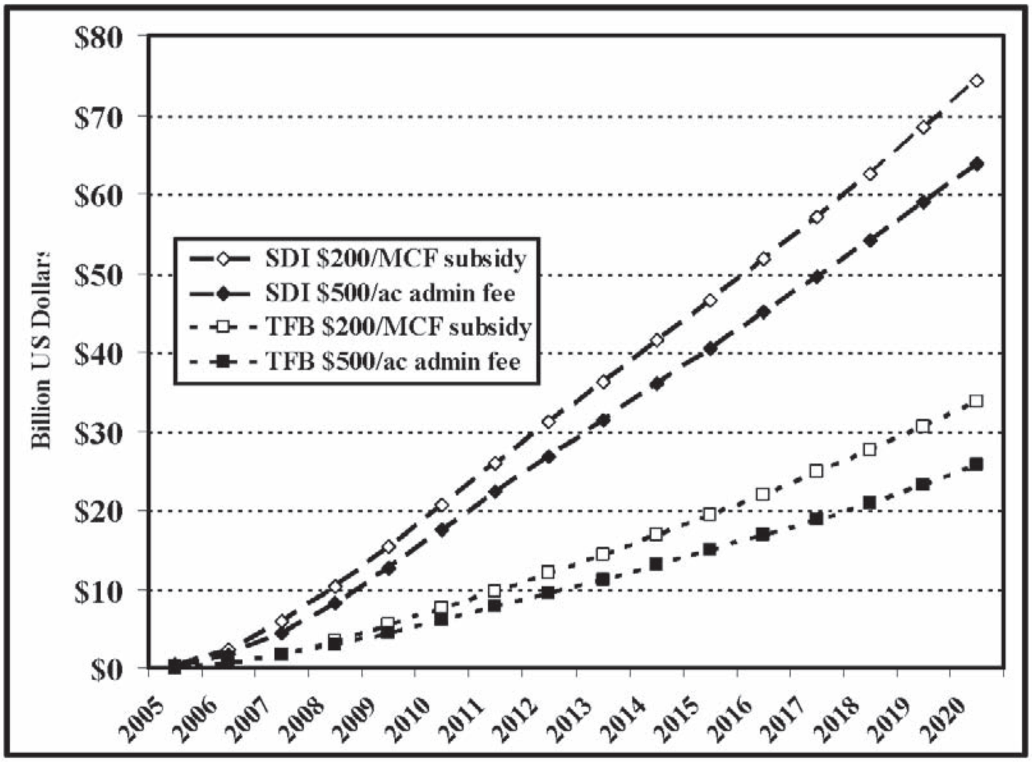

Figure 8—Cumulative change in consumer surplus as compared to a no-treatment scenario. SDI, Stand Density Index; MCF, per thousand cubic feet; TFB, Thinning From Below; ac, acre.

the subsidy making little difference. Conversely, the SDI scenarios show an increasing net welfare and, in fact, the unsubsidized program shows the largest increase in net welfare, $5.7 billion after 16 years (figure 9). This can be seen mainly as a result of the fact that the SDI treatment makes much more high value large timber available than the TFB. This large timber has lower harvest costs, higher product yields, higher output capacity, and lower manufacturing costs (all per volume), and only a model like the FTM-Westthat models these economic complexities of tree and log size class can observe such economic effects. Note that these figures for changes in net welfare do not include a quantification of the effects from reduced fire hazard; they represent only market welfare impacts. The social welfare benefits from reduction in fire hazard are difficult to assess. However, Lippke and others (2006), in their analysis, make a conservative estimate from $1,186/acre to $1,982/acre, increasing with initial fire risk.

Conclusions

We can draw several important conclusions from these results. First, markets would use a substantial volume of wood from fuel treatment programs, even if administrative fees are levied. Second, subsidies for wood from forest treatments seem unnecessary in the coastal region but are crucial to achieve forest treatment goals in the interior region. Third, expanded fuel treatments can have substantial positive impacts on forest product consumer surplus yet negative impacts on revenue to conventional timber sources. Finally, the SDI

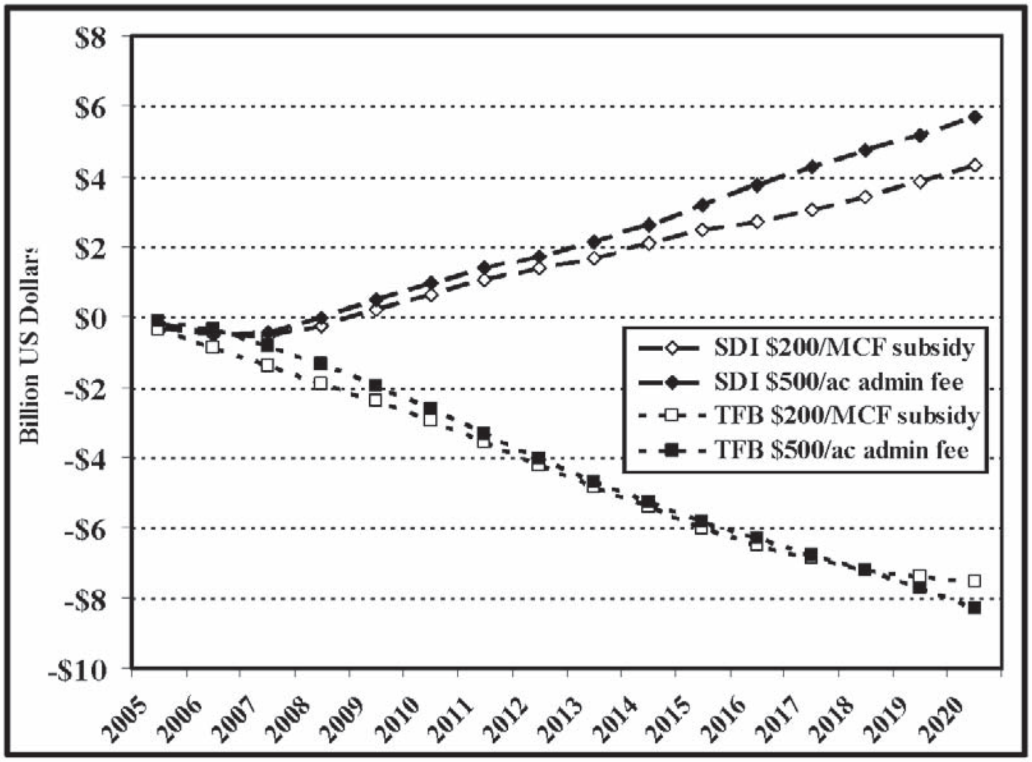

Figure 9—Cumulative change in net economic welfare as compared to a no-treatment scenario. SDI, Stand Density Index; MCF, per thousand cubic feet; TFB, Thinning From Below; ac, acre.

thinning regime can result in potential gains in forest product consumer surplus that more than offset losses in timber producer surplus, resulting in positive net market welfare, while the TFB regime can produce the opposite result (negative net market welfare).

In addition, since the SDI scenarios result in more acres treated and more wood per acre removed, logically they would also result in greater reductions in forest fuels and related fire hazard, producing consequently unambiguously higher net welfare than the TFB scenarios, taking into account both the market welfare and fuel reduction impacts. Other factors should also be considered in judging net welfare, including changes in suppression costs, environmental impacts, wildfire damages, and other less tangible costs and benefits of reduced fire hazard that are addressed, for example, by Lippke and others (2006). All these factors are important when considering policy toward use of thinning treatments that include biomass utilization. In this study, we have focused primarily on the market welfare and fuel reduction impacts.

Acknowledgments

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