TechLine

Forest Products Laboratory

Paying for Hazardous Fuel Treatments with Revenue from Removed Biomass

Fuel Treatment Evaluator (FTE) 3.0 is a web-based tool that allows users to simulate uneven-aged and even-aged silvicultural treatments on timberland in 12 western states. This tool simulates treatments to reduce forest fire hazard to specific levels and identifies the volume of biomass removed, harvesting costs, and estimated biomass value (revenue).

As an example, we use FTE 3.0 to estimate how many acres might be treated near three western communities (Pagosa Springs, Colorado; Hamilton, Montana; Colville, Washington) for which the value of biomass removed covers the treatment cost. Conclusions are on the last page.

FTE 3.0 uses data from 37,000 forest plots in 12 western states surveyed as part of the USDA Forest Service Forest Inventory and Analysis (FIA) program. A link to FTE 3.0 can be found at http://ncrs2.fs.fed.us/4801/fiadb/fire_tabler_us/rpa_fuel_reduction_treatment_opp.htm

Key features of FTE 3.0 are silvicultural treatment options and fire hazard screens and fire hazard reduction targets.

Silvicultural Treatment Options

Two types of treatments can be used to reduce fire hazard on each FIA plot that has high fire hazard:

- One treatment type takes some trees from all size classes and leaves an uneven-aged stand.
- The other treatment type takes trees starting with the smallest and progresses to larger trees, leaving an even-aged stand (thinned from below).

Fire Hazard Screens and Reduction Targets

A plot is identified as having high fire hazard if the

- crowning index is less than 25 mph or
- torching index is less than 25 mph and crowning index is less than 40 mph.

Each plot is assumed to have surface fuels characterized by the Forest Service fire model known as Fuel Model 9. Weather is assumed to be "Drought Summer" as defined by Rothermel.

Thinning is individually applied to each FIA plot, with the objective of increasing both the torching and crowning indexes to more than 25 mph or increasing the crowning index alone to greater than 40 mph. The objective is to either keep a crown fire from starting or prevent a crown fire from spreading if ignited.

Treatments used here in the community examples are limited to taking no more than 50% of initial basal area, which may not reach hazard reduction targets on some plots.

Estimating Treated Area and Biomass Removed

We simulate uneven-aged and even-aged silvicultural treatments on a high-fire-hazard timberland area that is within 75 miles of each community. For each type of treatment, the goal is to estimate the number of acres that can be treated and biomass obtained where the value of the biomass can cover the cost of treatment (see Treatments 2A and 3A in Skog et al. 2006).

First, we use FTE 3.0 simulation results to estimate

(1) fraction of biomass removed in the form of sawlogs (Figs. P1, H1, C1);

(2) acres that can be treated for a given cost, where the cost is $/od (ovendry) ton of wood at roadside (Figs. P2, H2, C2); and

(3) biomass to be removed (od tons) that can be treated for a given cost, where the cost is $/od ton of wood at road-side (Figs. P3, H3, C3).

These figures show acres and biomass obtained for a given cumulative average cost for biomass removed.

Next, we estimate the value that can be obtained for biomass at roadside ($/od ton) using the following assumptions:

- Biomass from treatments will be transported to the community for use.
- Delivered value for the main stem of trees 7 inches in dbh (diameter at breast height) will have sawlog value ($290/MBF) (MBF is thousand board feet).
- Delivered value of other trees and all tops and branches will have fuel chip value ($30/od ton).
- Average haul distance is 75 miles.
- Haul cost is $0.35/od ton-mile.

Roadside value
= Delivered value − Haul cost

Delivered value
= [($290/MBF) × (0.373 MBF/od tons)
× (fraction of biomass which is sawlogs)
+ ($30/odt)
× (1 − fraction of biomass which is sawlogs)]

Haul cost = 75 miles × $0.35/od ton-mile = $26.25

After computing roadside value, we can use Figures P2, H2, and C2 to determine how many acres can be treated and Figures P3, H3, and C3 to determine how much biomass can be removed for a given roadside value, where total value of biomass removed must cover total cost of all acres treated.

USDA

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Pagosa Springs, Colorado

Pagosa Springs is in southern Colorado near the San Juan and Rio Grande National Forests. Within 75 miles are 372,185 acres of timberland with high fire hazard (73% is federal land). If all acres are treated to reduce fire hazard, uneven-aged 2A and even-aged 3A treatments (Skog et al. 2006) would remove 4.19 (Fig. P1) and 1.67 million od tons, respectively.

Figures P2 and P3 show how many acres could be treated or biomass could be removed, respectively, by treatments 2A and 3A (Skog et al. 2006) for given average roadside costs per od ton.

To compute roadside value using our equation, we estimate the fraction of biomass removed that is sawlogs. We identify the sawlog percentage where cumulative average revenue at roadside per od ton equals cumulative average cost per od ton at roadside. The sawlog percentages are about 64% for treatment 2A and 65% for treatment 3A (Skog et al. 2006).

Using the estimated sawlog fraction in our roadside value equation, we compute average roadside values of $48 and $49 per od ton for treatments 2A and 3A (Skog et al. 2006), respectively.

We use these roadside values and Figures P2 and P3 to estimate acres treated and amounts removed. Results are shown in Table P1. Table P2 shows acres treated and biomass removed per year if treatments occur over 25 years.

Table P1. Acres treated and biomass removed where total biomass value covers total treatment costs, Pagosa Springs, Colorado

Treatment	Average value at roadside ($/od ton)	Area treated[1] (acres)	Biomass removed[1] (od tons)
Uneven-aged	$48	335,987 (+4/–5)	3,898,108 (+4/–5)
Even-aged	$49	194,531 (+3/–5)	1,001,516 (+25/–25)

[1]Also shown are the percentage increase (decrease) if roadside value of biomass is increased (decreased) by 10%.

Table P2. Acres treated and biomass removed per year if treatments are extended over 25 years, Pagosa Springs, Colorado

Treatment	Area treated (acre)	Sawlogs removed (MBF)	Other biomass removed (od ton)
Uneven-aged	13,439	37,223	56,133
Even-aged	3,206	9,713	14,021

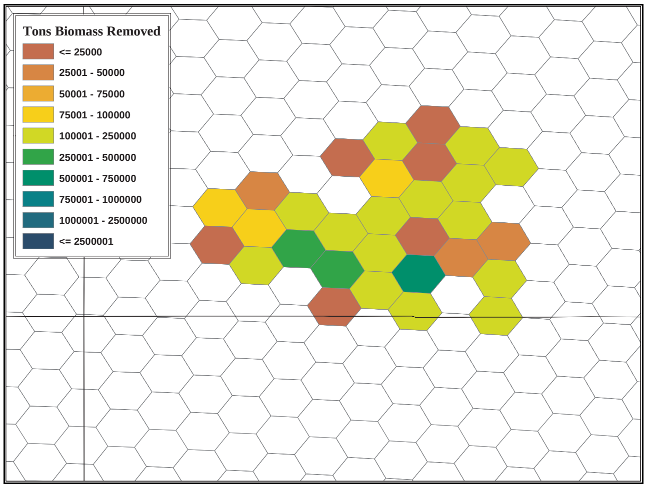

Figure P1—Biomass removed within 75 miles of Pagosa Springs, Colorado, by uneven-aged treatment for each 160,000-acre hexagon (od ton).

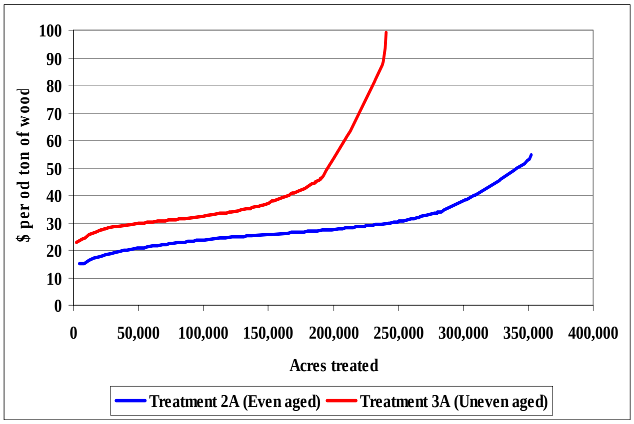

Figure P2—Acres treated for a given cumulative average cost per od ton delivered to roadside.

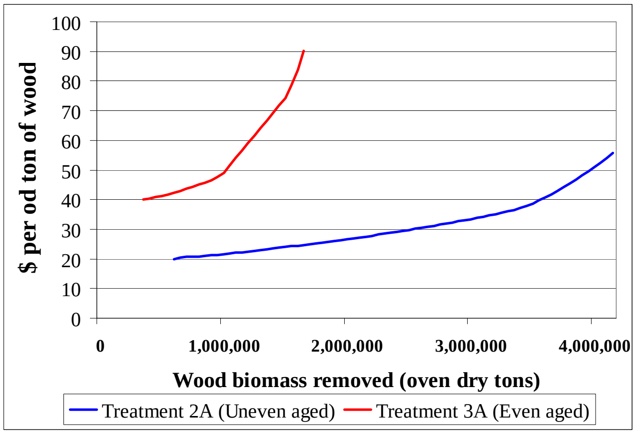

Figure P3—Biomass removed for a given cumulative average cost per od ton delivered to roadside.

Hamilton, Montana

Hamilton is in southwestern Montana, near several National Forests, including the Bitterroot and Lolo. Within 75 miles are 359,149 acres of timberland with high fire hazard (66% is federal land). If all acres are treated to reduce fire hazard, uneven-aged 2A and even-aged 3A treatments (Skog et al. 2006) would remove 7.2 (Fig. H1) and 3.2 million od tons, respectively.

Figures H2 and H3 show how many acres could be treated or biomass could be removed, respectively, by treatments 2A and 3A (Skog et al. 2006) for given average roadside costs per od ton.

To compute roadside value using our equation, we estimate the fraction of biomass removed that is sawlogs. We identify the sawlog percentage where cumulative average revenue at roadside per od ton equals cumulative average cost per od ton at roadside. The sawlog percentages are about 68% for treatment 2A and 40% for treatment 3A (Skog et al. 2006).

Using the estimated sawlog fraction in our roadside value equation, we compute average roadside values of $51 and $39 per od ton for treatments 2A and 3A (Skog et al. 2006), respectively.

We use these roadside values and Figures H2 and H3 to estimate acres treated and amounts removed. Results are shown in Table H1. Table H2 shows acres treated and biomass removed per year if treatments occur over 25 years.

Table H1. Acres treated and biomass removed where biomass value covers treatment costs, Hamilton, Montana

Treatment	Average value at roadside ($/od ton)	Area treated[1] (acre)	Biomass removed[1] (od ton)
Uneven-aged	$51	275,010 (+6/–7)	6,338,446 (+8/–12)
Even-aged	$39	42,469 (+32/–28)	1,472,786 (+12/–12)

[1]Also shown are the percentage increase (decrease) if roadside value of biomass is increased (decreased) by 10%.

Table H2. Acres treated and biomass removed per year if treatments are extended over 25 years, Hamilton, Montana

Treatment	Area treated (acre)	Sawlogs removed (MBF)	Other biomass removed (od ton)
Uneven-aged	11,000	64,307	81,132
Even-aged	1,699	8,790	35,347

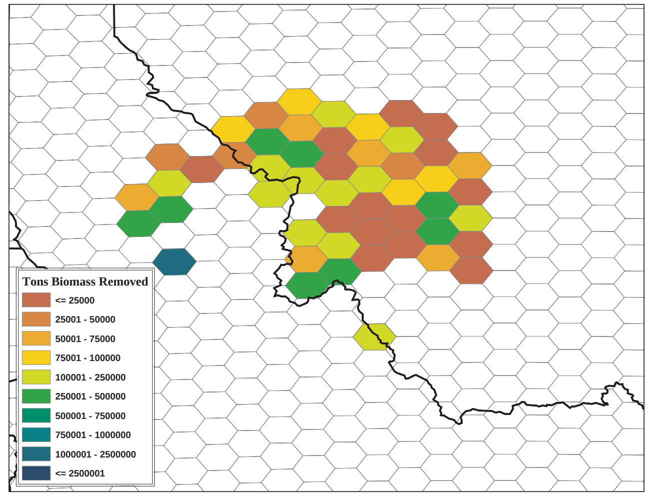

Figure H1—Biomass removed within 75 miles of Hamilton, Montana, by uneven-aged treatment for each 160,000-acre hexagon (od ton).

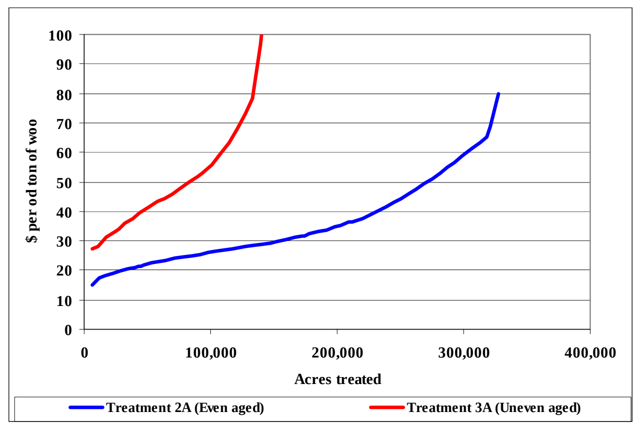

Figure H2—Acres treated for a given cumulative average cost per od ton delivered to roadside.

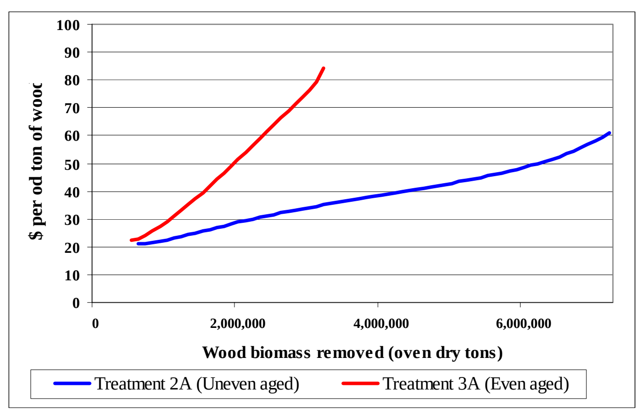

Figure H3—Biomass removed for a given cumulative average cost per od ton delivered to roadside.

Colville, Washington

Colville is in northwest Washington near the Colville, Kaniksu, and Okanogan National Forests. Within 75 miles are 1,741,571 acres of timberland with high fire hazard (50% is federal land). If all acres are treated to reduce fire hazard, uneven-aged 2A and even-aged 3A treatments (Skog et al. 2006) would remove 28.1 and 15.2 million od tons, respectively.

As for the previous examples, Figures C2 and C3 show how many acres could be treated or biomass could be removed for given average roadside costs per od ton.

Sawlog percentages used to estimate roadside values are about 68% for treatment 2A and 48% for treatment 3A. Estimated average roadside values are $50 and $38 per od ton for treatments 2A and 3A, respectively.

As for the previous examples, roadside values and Figures C2 and C3 are used to estimate acres treated and amounts removed, and results are shown in Tables C1 and C2.

Table C1. Acres treated and biomass removed where biomass value covers treatment costs, Colville, Washington

Treatment	Average value at roadside ($/od ton)	Area treated[1] (acre)	Biomass removed[1] (od ton)
Uneven-aged	$50	1,644,383 (+0/–2)	27,979,983 (+0/–3)
Even-aged	$38	506,544 (+15/–18)	11,000,761 (+12/–16)

[1]Also shown are the percentage increase (decrease) if roadside value of biomass is increased (decreased) by 10%.

Table C2. Acres treated and biomass removed per year if treatments are extended over 25 years, Colville, Washington

Treatment	Area treated (acre)	Sawlogs removed (MBF)	Other biomass removed (od ton)
Uneven-aged	65,775	283,874	358,144
Even-aged	20,262	78,783	228,816

Conclusions

Given our assumptions about values for biomass, our estimates suggest that business development and sale of biomass could pay for treatment of at least 5 times more acres near Colville, Washington than near Pagosa Springs, Colorado, or Hamilton, Montana.

If funds are limited to support development of businesses that use biomass, and the support needed to develop infrastructure per unit of biomass decreases with amount processed in an area, then given similar values for biomass in our three examples, each dollar spent to support infrastructure development near Colville will likely result in more acres treated than near Pagosa Springs or Hamilton.

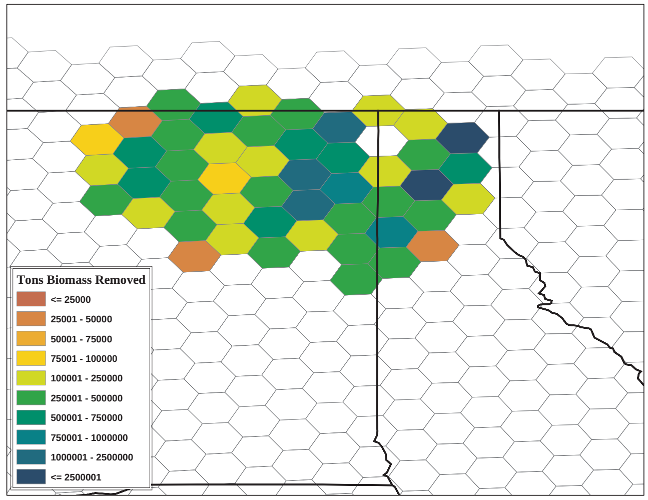

Figure C1—Biomass removed within 75 miles of Hamilton, Montana, by uneven-aged treatment for each 160,000-acre hexagon (od ton)

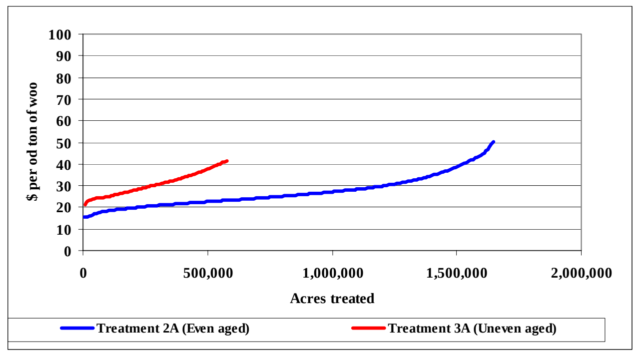

Figure C2—Acres treated for a given cumulative average cost per od ton delivered to roadside.

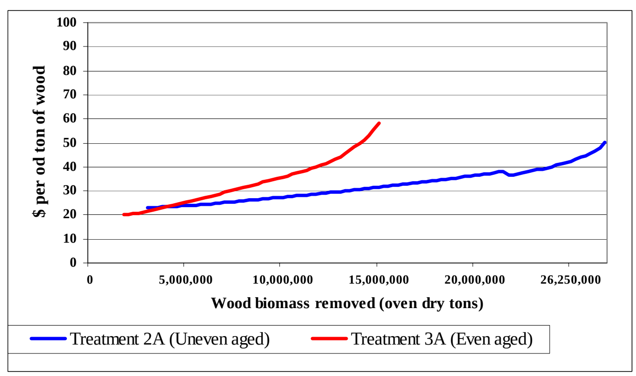

Figure C3—Biomass removed for a given cumulative average cost per od ton delivered to roadside.

Reference

Skog, K.E., et al. 2006. Evaluation of silvicultural treatments and biomass use for reducing fire hazard in western states. USDA Forest Service, Forest Products Laboratory, FPL RP-634. 29 p.