Carbon Values of Doug Fir in JDSF

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Doug Fir harvest and inventory numbers include other (minor) firs

JDSF = Jackson Demonstration State Forest

Parameters and Calculations

Fraction of biomass in harvested trees converted to wood products (1)	0.16
Fraction of harvested tree in bole delivered to mill (1)	0.6
Doug Fir wood density (lbs/cu ft) (2)	28.08
Harvest bd ft Unit (bd ft)	1000
Cu ft per 1000 bd ft (3)	163
Net to gross fraction: fraction of harvested timber delivered to mill (gross harvest minus less breakage and defects = net to mills) (4)	0.850
Biomass in boles of trees yielding 1000 bd ft of delivered timber (tons): equals Wood Density x cu ft per 1000 bd ft/(net to gross fraction*2000) (tons/1000 board feet)	2.69
Standard estimate of fraction of timber that is carbon (5)	0.5
Jones and O'Hara JDSF carbon adjustment factor (5)	1.26
Adjusted fraction of timber that is carbon - used in the following	0.63
Carbon in tree boles (tons/1000 bd ft): equals biomass x carbon fraction	1.69
Carbon in entire tree (tons/1000 bd ft) = carbon in boles/fraction of tree in boles	2.82
Ratio of C02 to C	3.67
C02 in entire tree = carbon in entire tree x ratio of C02 to C (tons/1000 bd ft)	10.37
C02 in entire harvested tree emitted to the atmosphere in short term (tons/1000 bd ft) = carbon in entire tree x (1 - Fraction of biomass in harvested tree converted to wood products) (tons/1000 bd ft)	8.71
Average 2015-2020 timber sales of conifers in JDSF (net) converted to gross bd ft by accounting for breakage and culls (thousands of bd feet - gross) (6)	16,190
Fraction of JDSF conifers that are firs (3)	0.38
Annual average harvest of Doug Fir in JDSF (thousands of bd ft - gross)	6,152
C02 in Doug Firs in annual average harvest (tons)	63,776
C02 emitted from annual JDSF Doug Fir harvest (allowing for carbon sequestered in timber products) (tons)	53,572
C02 emitted per mile for average car (lbs/mi) (7)	0.891
Miles driven by average cars to equal C02 emissions from JDSF Doug Fir harvest.	120,290,943
California cap and trade permit cost per ton of C02 emitted (8)	$31
Cost to California of C02 emissions from annual JDSF Doug Fir harvest ($)	$1,660,719
JDSF Doug Fir price ($/1000 net bd ft)	$40

JDSF revenue from average annual Doug Fir sales at sale price of $40/1000 net bd ft	$209,170
JDSF average annual operating expenses (9)	$3,921,191
JDSF average annual operating expenses allocated to Doug Fir	$1,490,053
Net operating loss from Doug Fir harvests	-$1,280,883
Net annual cost to state of Doug Fir sales = Doug Fir CO2 cost +Doug Fir operating costs - sale revenue	**$2,941,602**

Notes and Sources

(1) Based on 84% of carbon in harvested trees going into atmosphere. John Battles, *California Forest and Rangeland Greenhouse Gas Inventory Development FINAL REPORT* , December 30, 2013; Minor revision Jan 30, 2014. No allowance for decay over time.

(2) FIA biomass.equations.ca.or.wa.pdf, 09-19-2014

(3) JDSF 2017 FRI Summary

(4) John Griffen, JDSF, private communication

(5) Jones, D and O'Hara, K *Carbon density in managed coast redwood stands: implications for forest carbon estimation,* Forestry, Vol. 85, No. 1, 06/12/2011 Advance Access Date

(6) Source: JDSF Annual Reports 2015-20. Average sales to mill (net) equalled 13.8 m bf per year; adjusted for breakage and defects (15% of gross) = 16.2 m bf (gross) per year

(7) https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#driving

(8) California Air Resources Board, November 2021 auction for future emissions, converted from metric tons to US tons. Reported by David Baker, "California Carbon Sets Record Price in Cap-and-Trade Auction," Bloomberg, November 21, 2021.

(9) Source: JDSF Annual Reports 2015-20

(10) Expenses allocated to Redwood and firs proportional to their fraction of inventory; 62% redwood; 38% firs

(11) $51/tonne value from Interagency Working Group on Social Cost of Greenhouse Gases, “Technical support document: Social cost of carbon, methane, and nitrous oxide, interim estimates under executive order 13990” (US government, February 2021). $51/tonne = $46/US ton