Assessing Spatial Distribution and Availability of Forest Biomass by Harvesting System in the Pacific Northwest, USA

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PROJECT COMPONENTS/ BACKGROUND

MOTIVATION

Forest residue collection costs can be a major barrier to sustainable utilization. Forest residues resulting from cable logging are generally concentrated at roadside, while residues from ground based operations (particularly shovel logging) are distributed over the harvest unit requiring additional cost to move them roadside. It is important to understand and adequately predict volume and spatial distributions of this resource for sustainable utilization.

HARVESTING SYSTEMS

GROUND-BASED SYSTEMS
- On level ground with slopes of 0 to 30 percent, ground based systems are used when the soil conditions are suitable.

CABLE-BASED SYSTEMS
- Typically, if the soil is too sensitive or the slope is greater than 30 percent cable systems are employed.

PROJECT GOAL

To develop a methodology and assessment for estimating the number of acres of forest area for state and private owners at various distances from existing roads by harvest method. Assessment completed for stands likely to be harvested over the next 20 years in a four state region aggregated by FIA plot locations.

LOGISTICS GROUP

METHDOLOGY OVERIVEW

INPUTS | TECHNIQUE

- FIA Plots
- DEM
- Road Network
- Ground Cover Change

- FIA Plot
- 1250Acre Sample
- 50Acre Subplots

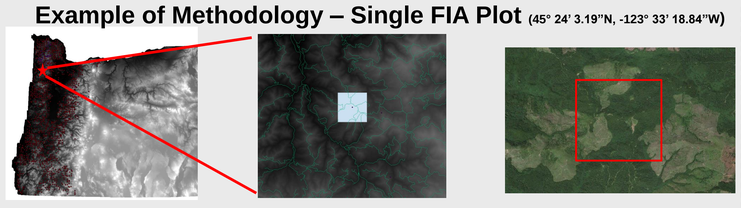
ArcGIS (ESRI) | python

LOGICAL FRAMEWORK

PRE-FILTERS EXCLUDE FEDERAL LANDS & THOSE REGEN-HARVESTED IN THE LAST 13 YRS	AVAILABLE
SPATIAL PROCESSING | DISCRITIZATION 1250AC FIA PLOTS, 50AC SUBPLOTS, LOGIC >30%= CABLE, CLASSIFCATION OF SUBPLOTS	30%
SPATIAL PROCESSING | RECLASSIFICATION OF LAND TYPE REGENERATION/ RECLASSIFICATION OF SUBPLOTS AS CABLE OR GROUND = RAW DATA FOR ANALYSIS	50%
ROAD DATA PROCESSING GROUND => ROADS => 300' BUFFER & AREA CALCULATIONS | CABLE => LAND AREA	300' 150'
DATA ANALYSIS COMPOSITE OF INDIVIDUAL SUB-PLOT DATA	Per FIA Plot

SINGLE PLOT EXAMPLE | CONCEPT CONFIRMATION

Example of Methodology – Single FIA Plot (45° 24' 3.19"N, -123° 33' 18.84"W)



SLOPE ⇒ RECLASSIFICATION ⇒ 300' ROAD OFFSET

FIA Plot location, point envelope, Google Earth aerial imagery, slope manipulation, reclassification and discretization, road system 300' offset buffer overlay.

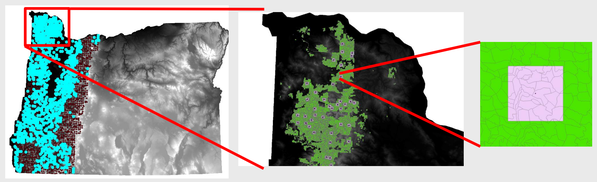
Land Cover Change & Qualitative Comparison of Harvesting Systems

Comparison of ODF Harvesting Systems with Model Projections. Google Earth Overlay, Global Forest Change Layer, ODF Harvest Unit Separation, ODF Harvest Unit (Dark Green is 70% ground-based, Light Green is less than 40% ground-based, all others are cable-based).

	ODF	Model	Difference
Ground-Based Systems (G)	8.08%	16.00%	7.92%
Cable-Based Systems (C)	91.92%	84.00%	

CLOSE APPROXIMATION | CONSERVATIVE

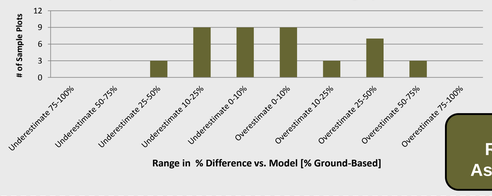
MODEL VALIDATION : ODF HARVEST UNITS



39 FIA Plots Compared | 48,750 Acre Area

	ODF	MODEL	DIFFERENCE
Ground-Based Systems	25.42%	31.28%	5.86%
Cable-Based Systems	69.31%	68.72%	-0.59%
Helicopter	5.27%		

Comparison of ODF and Model Harvesting Systems



GOAL: Regional Assessment

COLLECTION COST : SPATIAL REFINEMENT

Collection Cost Components (Of Available)			
Ground-Based			Cable-Based
150'	300'	Other	ALL
5.2%	5.2%	2.4%	87.2%
$10	$17	$22	$3

*AVERAGE COLLECTION COST = $4.55/BDT

*Cost does NOT include mobilization, comminution and transportation costs

NOTE:
- Concurrent NARA Work: Volume Estimates, Cost Refinement

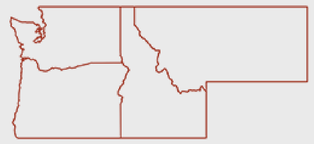
OUTPUT/ DELIVERABLES

The output from this analysis is being used to inform the cost models for the NARA biomass supply model. Over 6000 FIA plots (nearly 8 million acres) were analyzed.

REGIONAL SUMMARY

		OF AVAILABLE AREA				
REGION	# PLOTS	AVAIL	*G1 -150'	G2- 300'	G3 -REST	C
OR	1973	87.24%	11.14%	11.14%	43.88%	33.83%
WA	2093	87.61%	12.16%	12.16%	47.76%	27.92%
ID	675	89.83%	9.02%	9.02%	43.29%	38.67%
MT	1419	92.27%	2.86%	2.86%	66.29%	28.00%

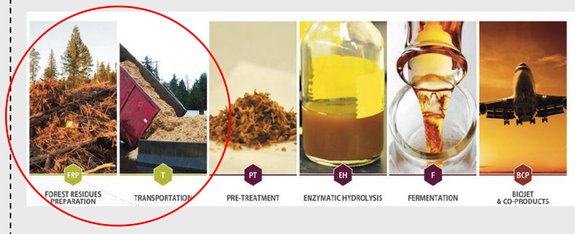
WHERE
G1= GROUND-BASED SYSTEMS % LAND AREA 0-150' ROAD OFFSET
G2= GROUND-BASED SYSTEMS % LAND AREA 150-300' ROAD OFFSET
G3= GROUND-BASED SYSTEMS % LAND AREA > 300' + OFFSET
C= CABLE-BASED SYSTEMS % LAND AREA
AVAIL = % LAND AREA THAT HAS NOT BEEN RECENTLY HARVESTED
*Assumed to be ⅓ of the calculated 300' buffer area



BROAD CONTEXT

- Input into current research related to Biomass Supply Chain, Logistics and Economic modeling

- Further refine residual collection models to be used to improve cost and volume estimates



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NARA
Northwest Advanced Renewables Alliance

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