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

Presenter: Michael Berry, MF Candidate, Oregon State University

Advisor: Dr. John Sessions, Professor, Oregon State University

Western Forestry Graduate Research Symposium
April 28th, 2014 | Room 107 Richardson Hall
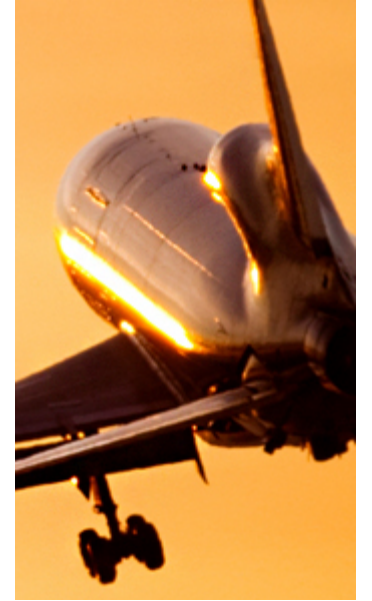
NARA
Northwest Advanced Renewables Alliance

USDA

NIFA

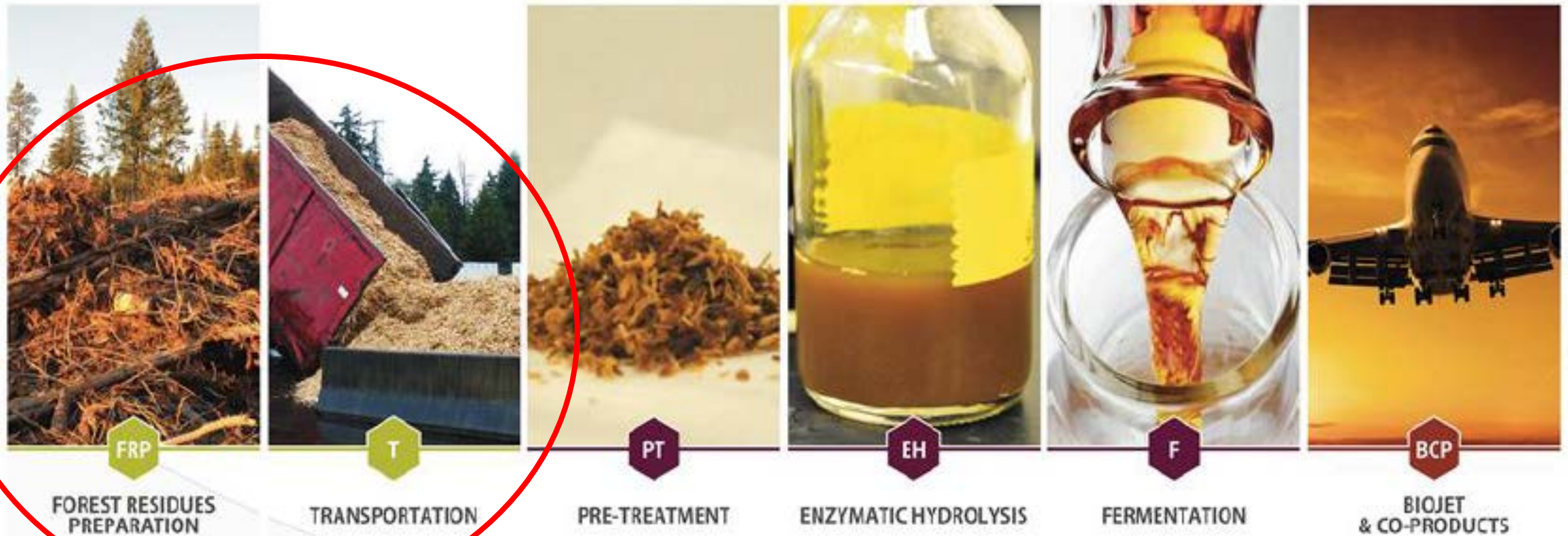# INTRODUCTION | NARA MISSION

▫ **MISSION**

"To provide stakeholders, interested in creating a forest residuals to bio-jet industry, with <u>regional solutions that are economically viable</u>, socially acceptable, and meet the high environmental standards of the Pacific Northwest"

▫ **GOALS:**

Education | Conversation | Feedstocks | Sustainability | Outreach

RESEARCH SCOPE | NARA SUPPLY CHAIN

FRP — FOREST RESIDUES PREPARATION

T — TRANSPORTATION

PT — PRE-TREATMENT

EH — ENZYMATIC HYDROLYSIS

F — FERMENTATION

BCP — BIOJET & CO-PRODUCTS

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MOTIVATION

□ **RESIDUAL COLLECTION COSTS = MAJOR BARRIER TO SUSTAINABLE UTILIZATION**
- $25-30/BDT to roadside if not piled as part of site preparation
- $20-22/BDT to roadside if already piled as part of site preparation
- **$5-10 /BDT to roadside if already piled and within 150 feet of road**

□ **RESIDUAL SPATIAL DISTRIBUTION**
- **Cable-Based Systems : Roadside**
- **Ground-Based Systems : Distributed**

**30 % Of Costs
+/- ~20%**

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PROBLEM IDENTIFICATION | CONTEXT

▫ **ESTIMATING FOREST HARVEST RESIDUE ACCESSIBILITY**

- The output from this analysis will be **used to inform the cost models** for the NARA biomass supply model.

▫ **CURRENT METHODS**

- **SINGLE POINT | UNKNOWN**

=> IMPROVE MODEL INPUTS

RESEARCH QUESTION

▫ **DEVELOP A METHODOLOGY AND ASSESSMENT FOR ESTIMATING RESIDUAL ACCESSIBLITY**

- Number of Acres of forested area for state and private owners at various distances from existing roads?

- Area Likely Available for Near-Term Harvest?
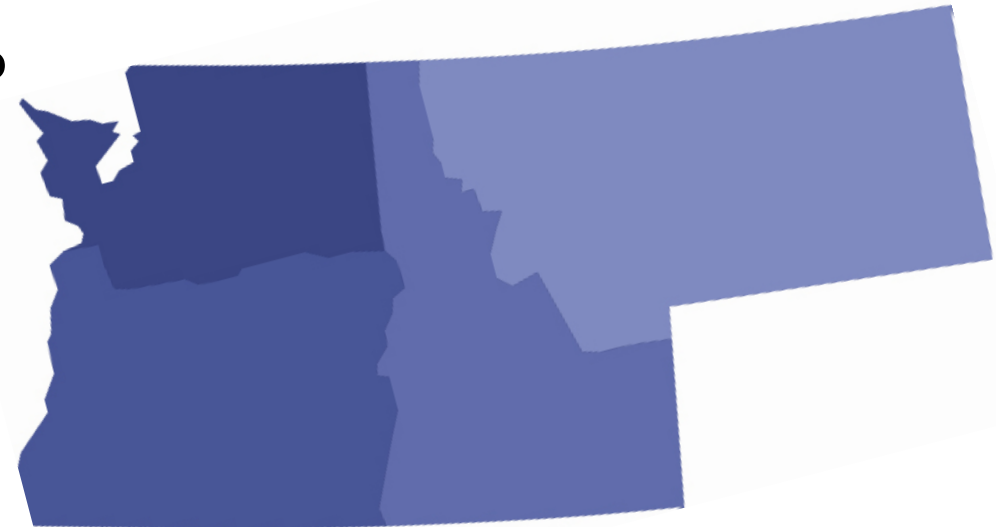
OVERVIEW OF METHDOLOGY

▫ **INPUT DATA**
- FIA Plots |Regional Road Network
- DEM | Ground Cover Change

▫ **LOGICAL FRAMEWORK**
- Estimated Harvesting Method
- Estimated Residual Location Characteristics

▫ **TOOLS FOR ANALYSIS**
- ArcGIS | Python Programming
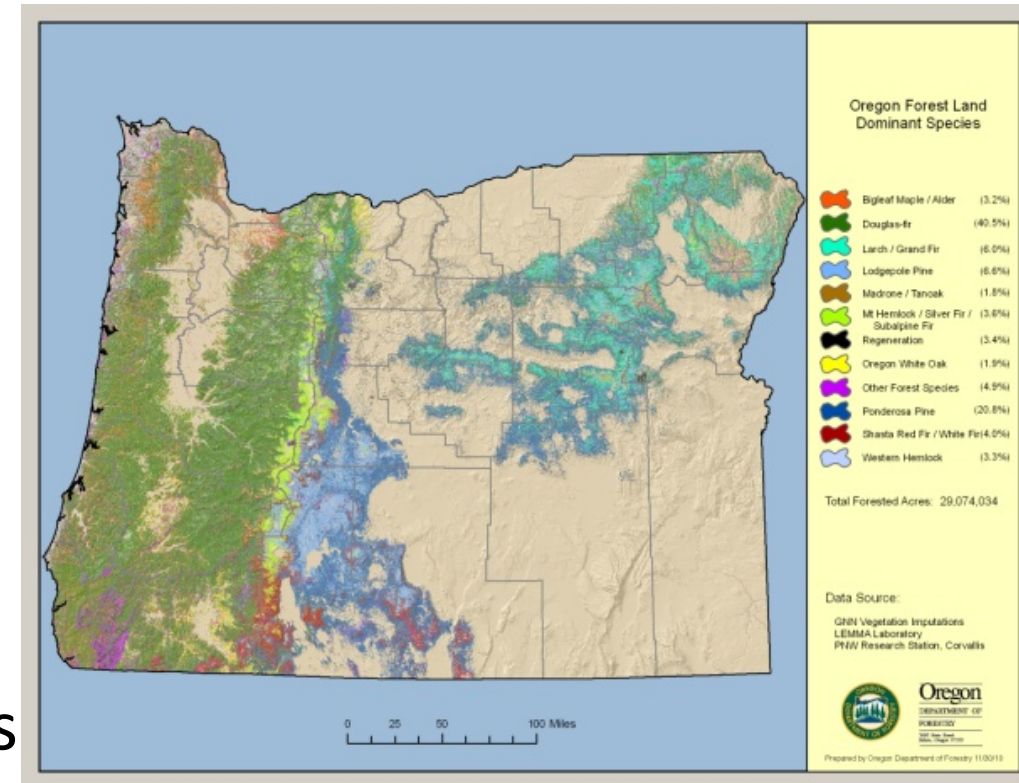
LOGICAL FRAMEWORK

PRE-FILTERS: EXCLUDE FEDERAL LANDS & THOSE LOGGED IN LAST 15YRS	**AVAILABLE**
PHASE #1: SPATIAL PROCESSING/ IDENTIFICATION 6000AC FIA PLOTS, 50AC SUBPLOTS, LOGIC >30%= CABLE, CLASSIFCATION OF SUBPLOTS	**30%**
PHASE #2: RECLASSIFICATION OF LAND TYPE REGENERATION/ RECLASSIFICATION OF SUBPLOTS AS CABLE OR GROUND = RAW DATA FOR ANALYSIS	**50%**
PHASE #3: DATA PROCESSING GROUND => ROADS => 300' & 150' BUFFER & AREA CALCULATIONS CABLE => LAND AREA	**300'** **150'**
PHASE #4: DATA ANALYSIS COMPOSITE OF INDIVIDUAL SUB-PLOT DATA	**Per FIA Plot**

LOGIC : PRE-FILTER

- □ **INPUT**
  - Oregon Raw Data
  - FIA Plot Locations
- □ **PROCESSING**
  - Individualize/ Selection By Attribute
- □ **OUTPUT**
  - Selected FIA Plot Locations & DataFile
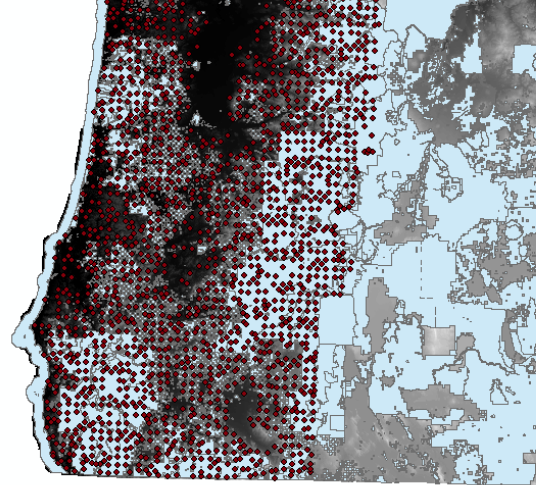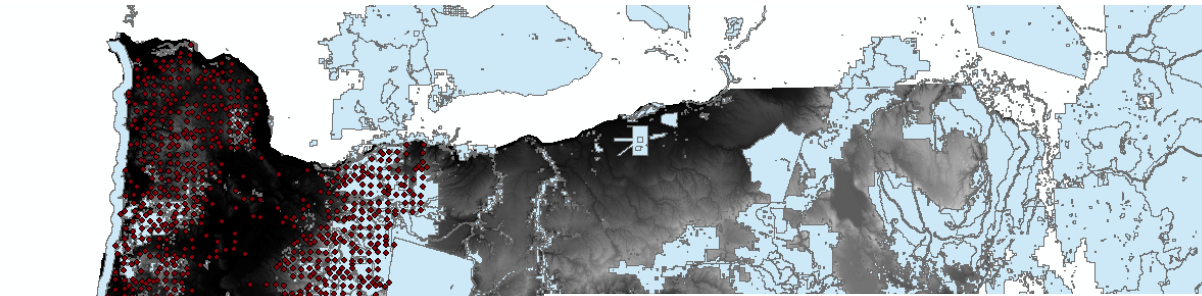
State & Private Land
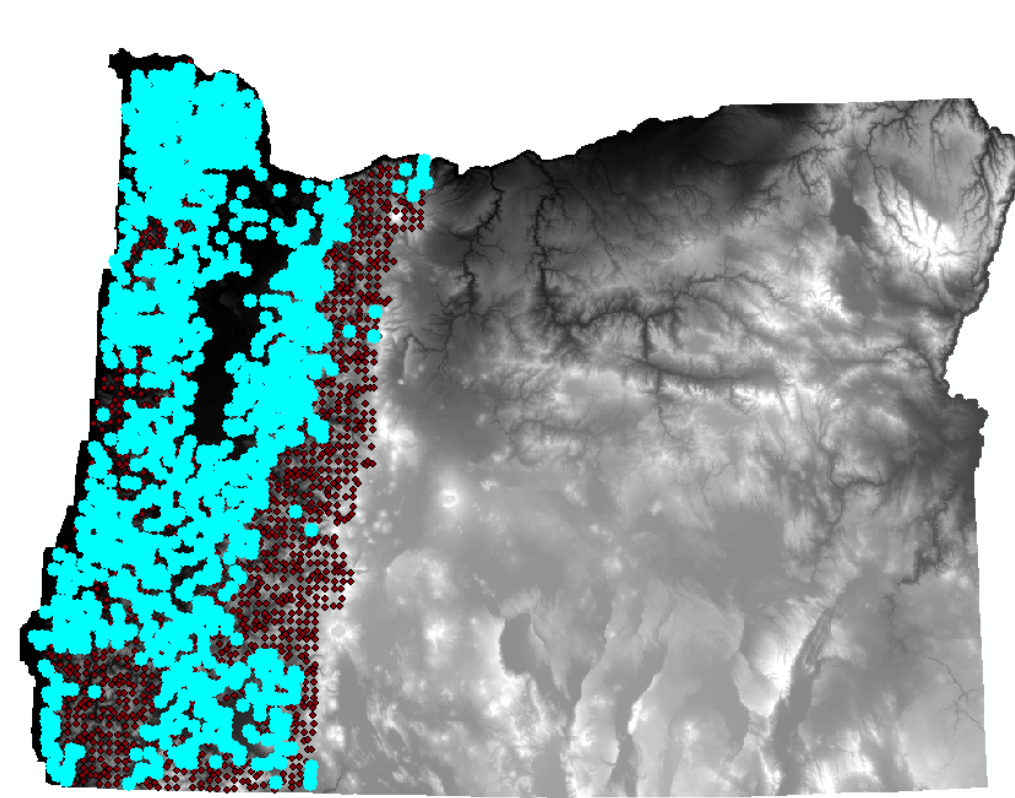
LOGIC : PHASE #1 & 2 : SPATIAL PROCESSING

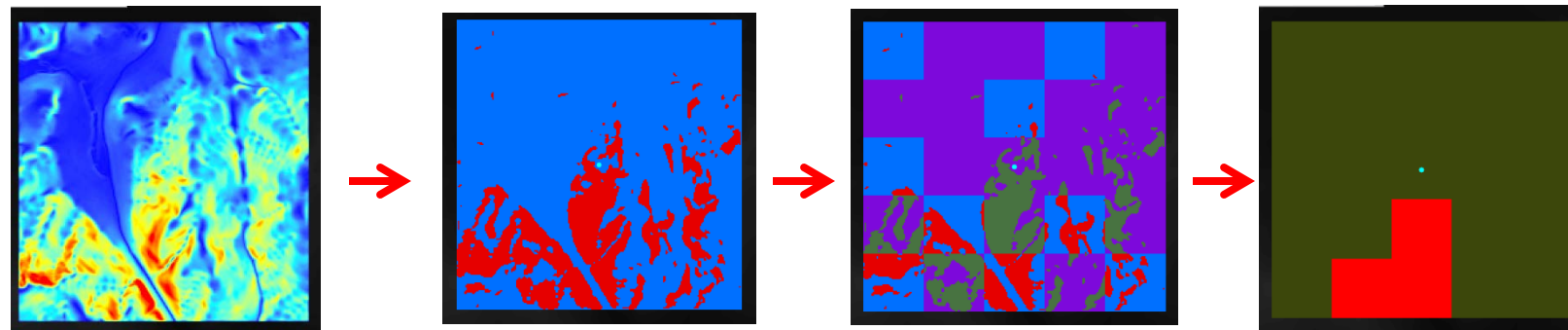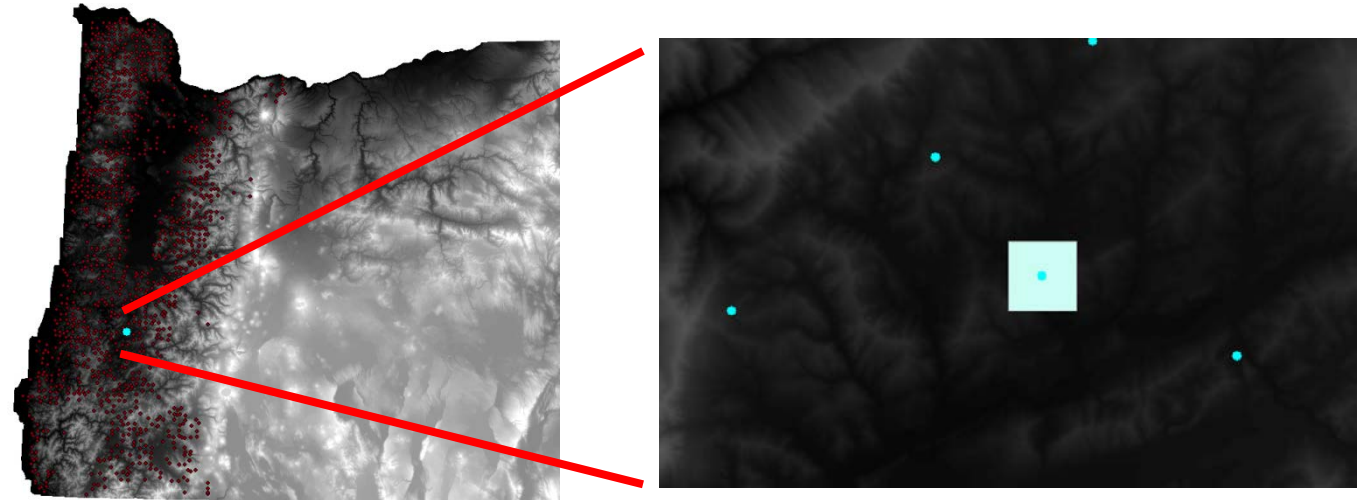- **INPUT**
  - Individual FIA Plot
  - DEM
- **PROCESSING**
  - Buffer, Envelope, Mask, Slope, Reclass, Split
- **OUTPUT**
  - Split/ Reclassified Raster
    - Slope (30%)
    - Ground/ Cable

Automated Processing: 1000s of FIA Plots & 10,000s of Subplots

1250AC Area Plots |50AC Subplots

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LOGIC : PHASE #3: ROAD DATA PROCESSING

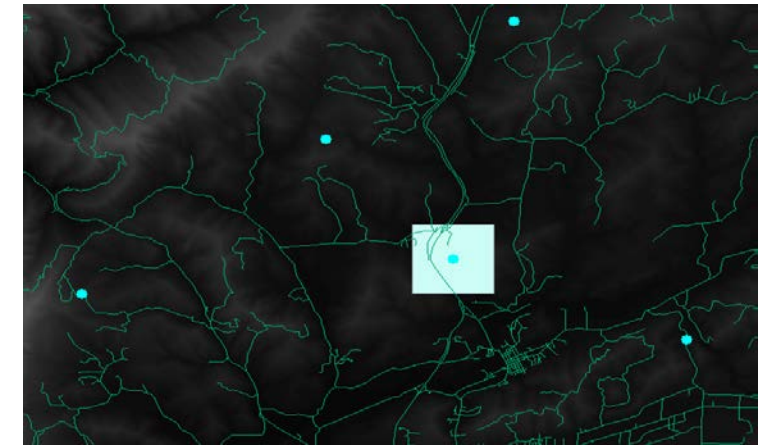- □ **INPUT**
  - Reclass FIA Subplots
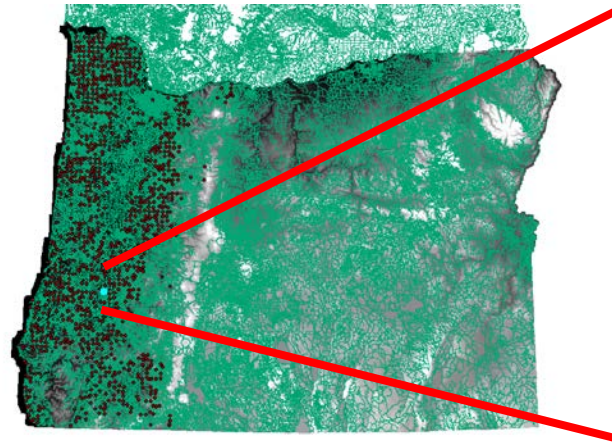 - Road Data Layer
- □ **PROCESSING**
  - Road Mask, Dissolve, Intersection
- □ **OUTPUT**
  - Ground-Based Road Offset Distance
    - 150'
    - 300'

Automated Processing: 1000s of FIA Plots & 10,000s of Subplots

1250AC Area Plots |50AC Subplots
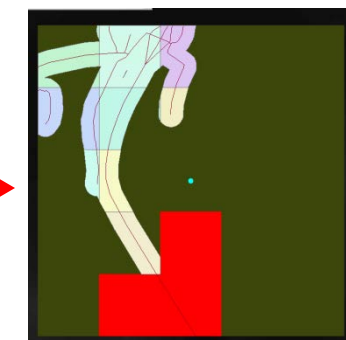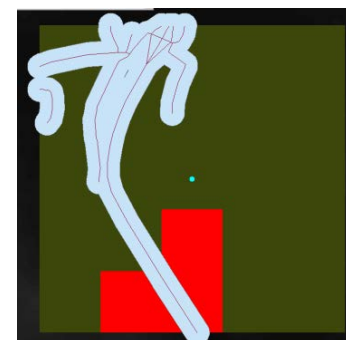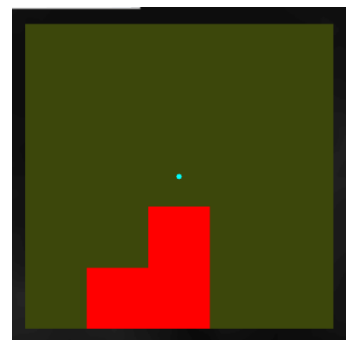
Offset Road Calculations
237/1250AC

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LOGIC : PHASE #4: LAND COVER CHANGE

- □ **INPUT**
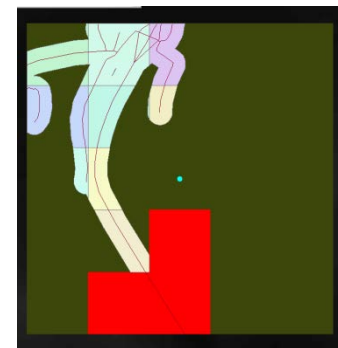 - FIA Subplot Data
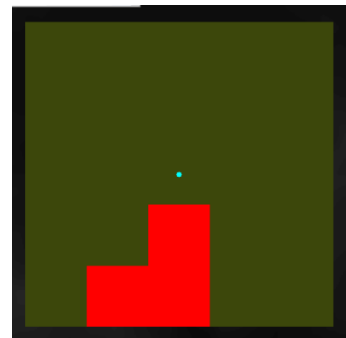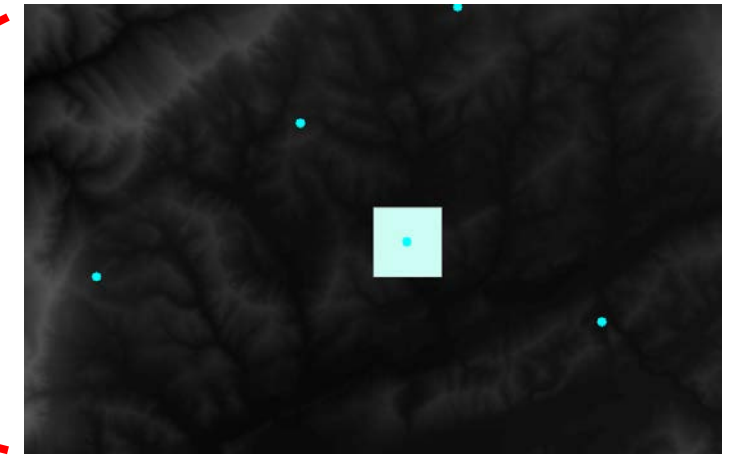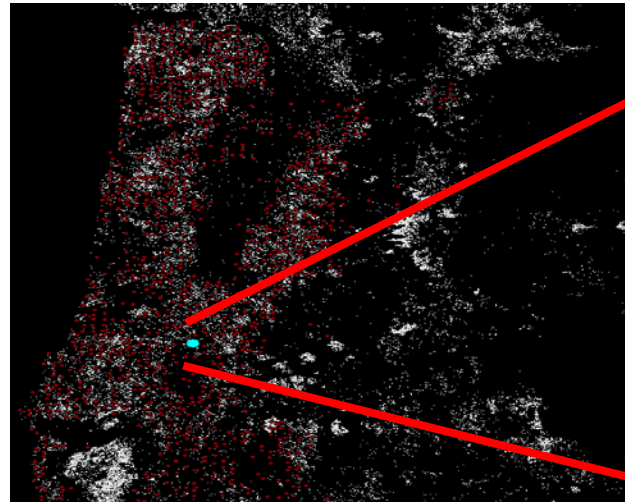 - Land Cover Change
- □ **PROCESSING**
  - Split to Subplot
- □ **OUTPUT**
  - Area Available/ Loss
    - Ground
    - Cable

Automated Processing: 1000s of FIA Plots & 10,000s of Subplots
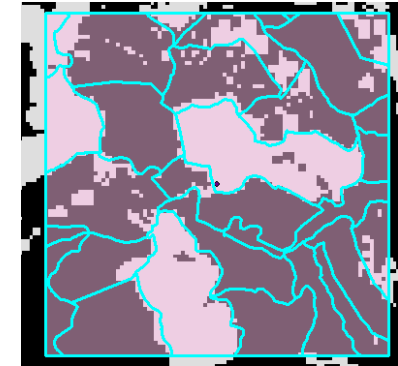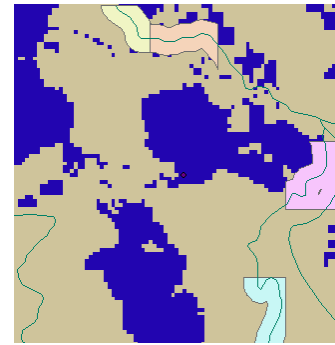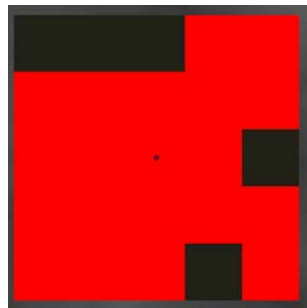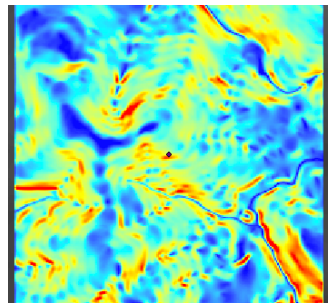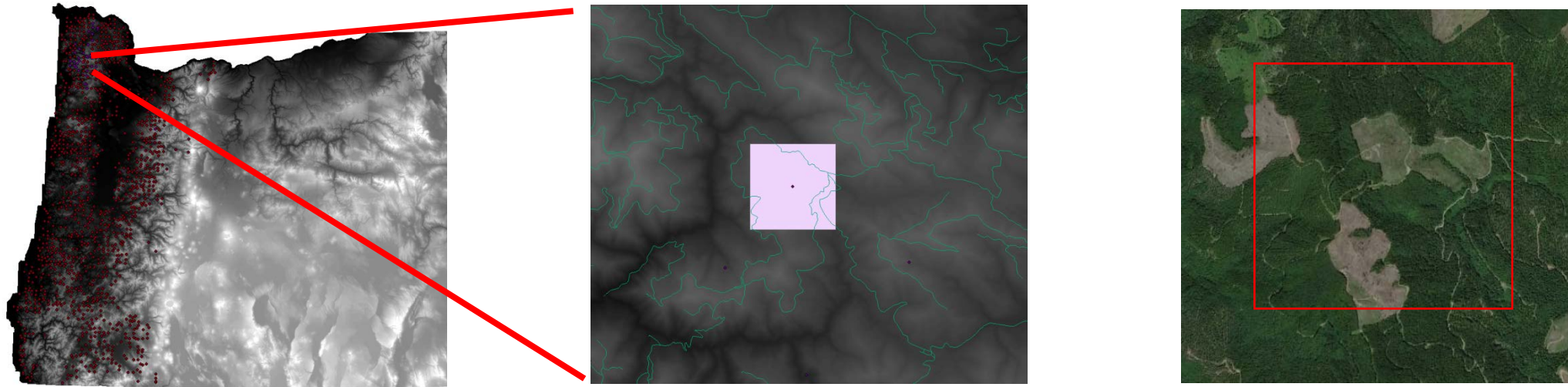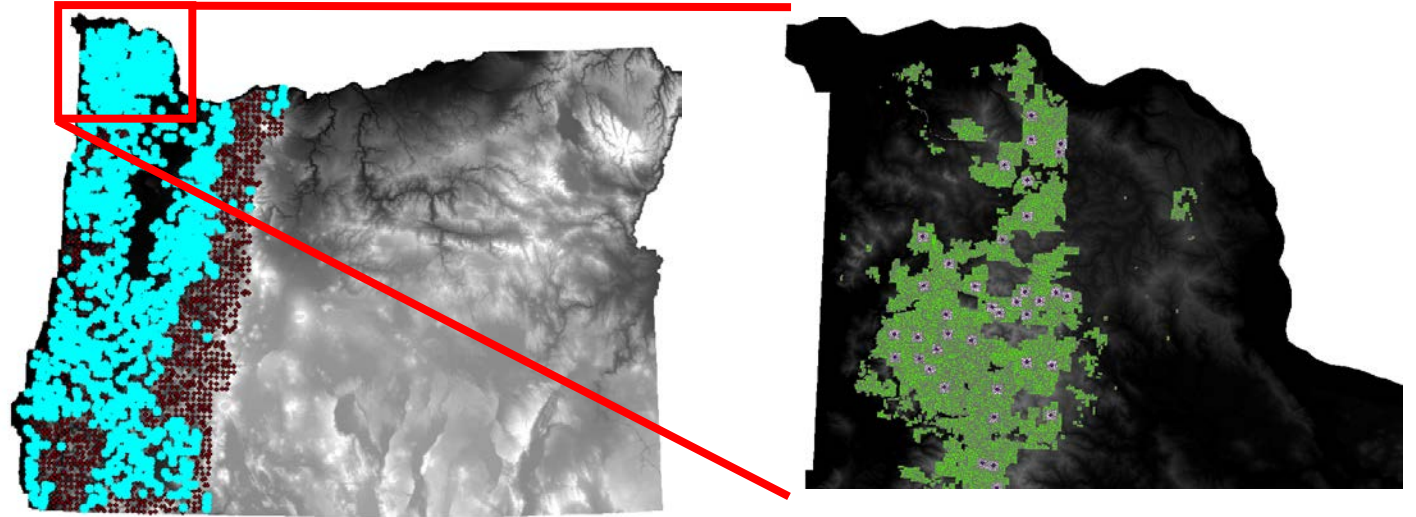
1250AC Area Plots |50AC Subplots
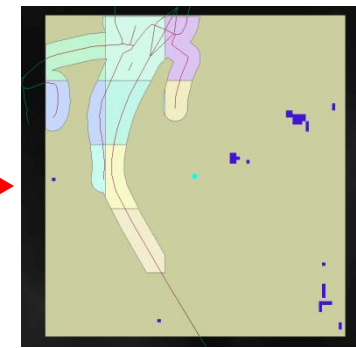
Land Area Available

EXAMPLE 2: LAND COVER CHANGE

1250AC Area Plots |50AC Subplots

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PRELIMINARY VALIDATION VS. ODF DATA

- **ODF Regional Data**
- **44 FIA Plots Analyzed**
- **55,000 Acre Area**

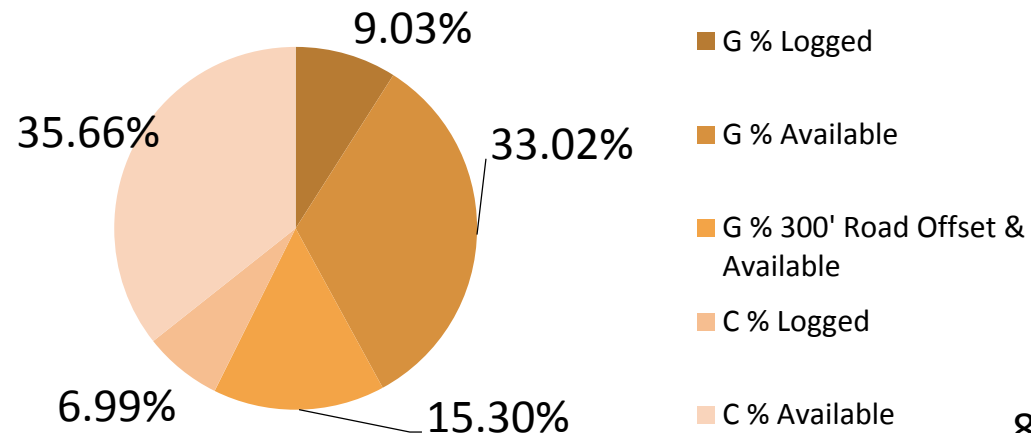|	ODF	MODEL	DIFFERENCE
Ground-Based Systems	26.53%	32.09%	+5.56%
Cable-Based Systems	70.13%	67.91%	- 2.22%
Helicopter	3.33%		

PRELIMINARY RESULTS: WESTERN OREGON COMPOSITE

□ **1,394 FIA PLOTS ANALYSIZED | 35,650 SUBPLOTS**
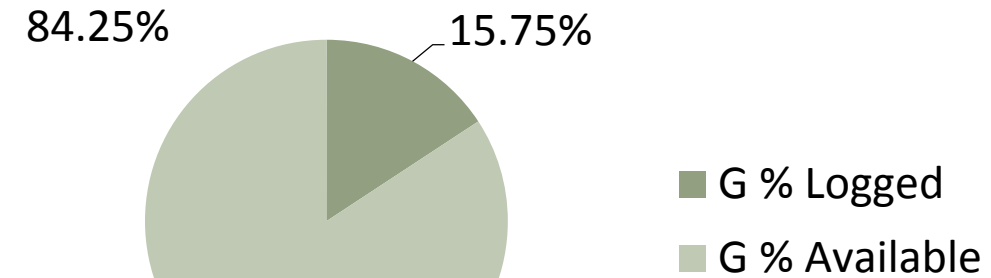
- % Ground Based (G): 57%
- % Cable Based (C) : 43%

GROUND-BASED

84.25%   15.75%

- G % Logged
- G % Available

RELATIVE LAND AREA PROPORTIONS

9.03%

35.66%

33.02%

6.99%

15.30%

- G % Logged
- G % Available
- G % 300' Road Offset & Available
- C % Logged
- C % Available

CABLE-BASED

16.38%

- C % Logged
- C % Available

83.62%
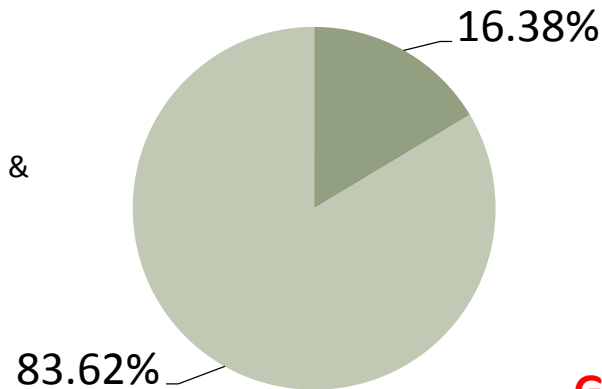
300' Road Offset: 31.67%

NOTE: ACTUAL INFORMATION IS GENERATED ON A PER FIA PLOT BASIS

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NEXT STEPS.....

▫ **WASHINGTON, IDAHO, MONTANA**

▫ Develop Output Protocol For NARA Biomass Supply Model
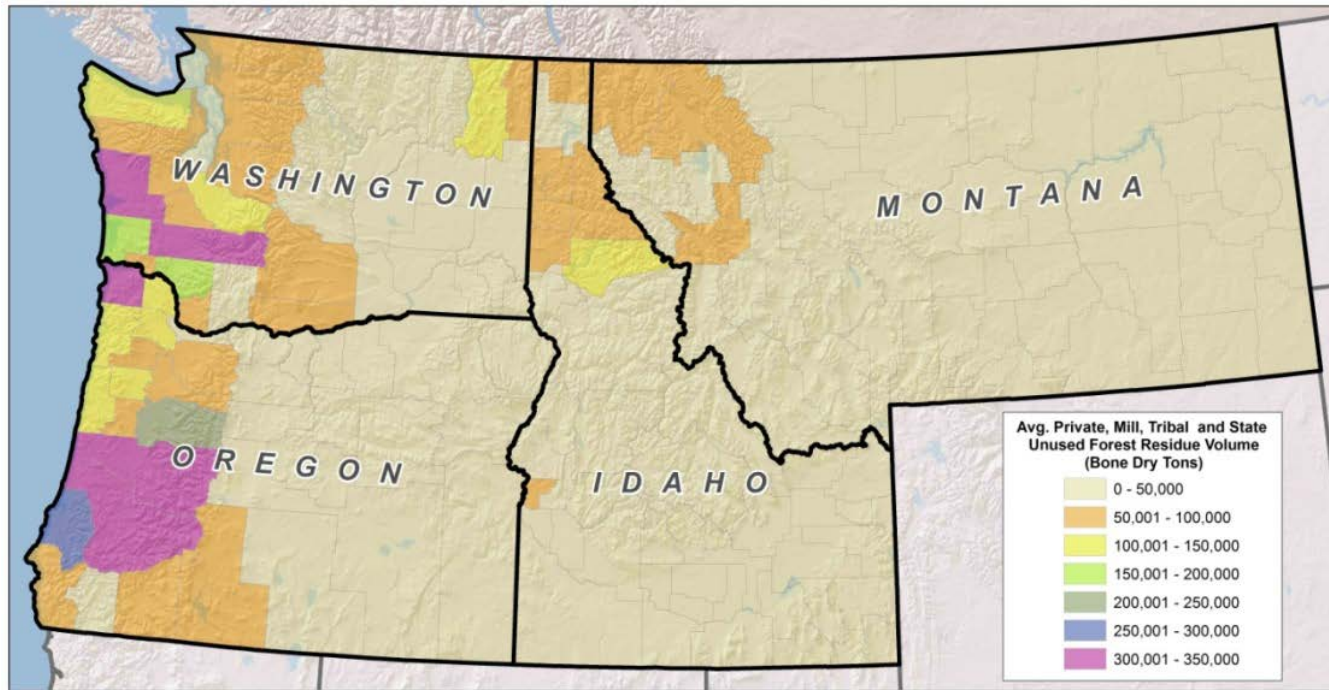
SUMMARY | CONCLUSIONS

▫ **CONCEPT/ METHDOLOGY DEVELOPMENT**
- 2014-2015

▫ **PROJECT TIMELINE**
- Oregon/ Washington Data (June 2015)

▫ **PRELIMINARY VALIDATION**
- Closely Resembles Existing ODF Harvest Characteristics / Sample Area

▫ **MODEL GENERATION DELIVERABLE**
- Spatially Discrete Model Generation Per FIA Point Location
- Provides Spatial Input for Biomass Supply Costing

QUESTIONS?

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