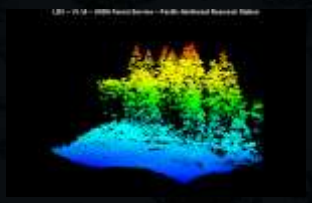
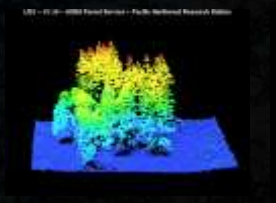
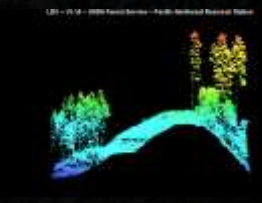
Delineating Mature Forests and Habitat Models Using LiDAR Data

Joel Thompson

Andrew Ennis



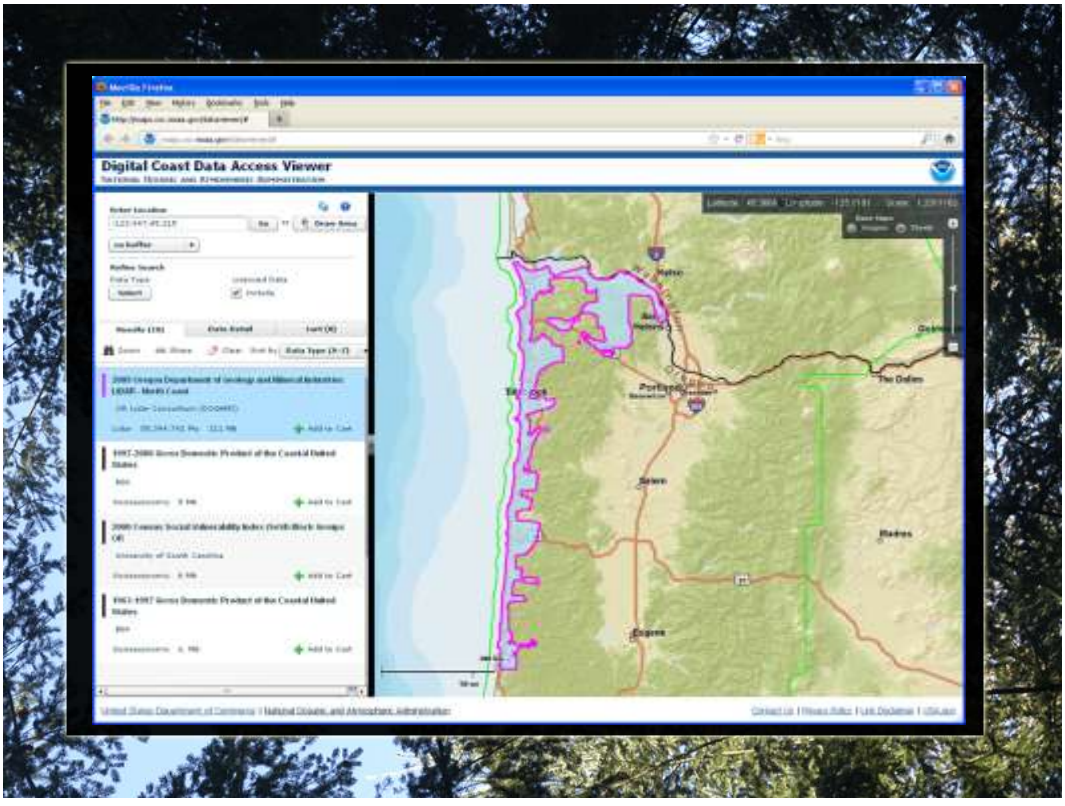


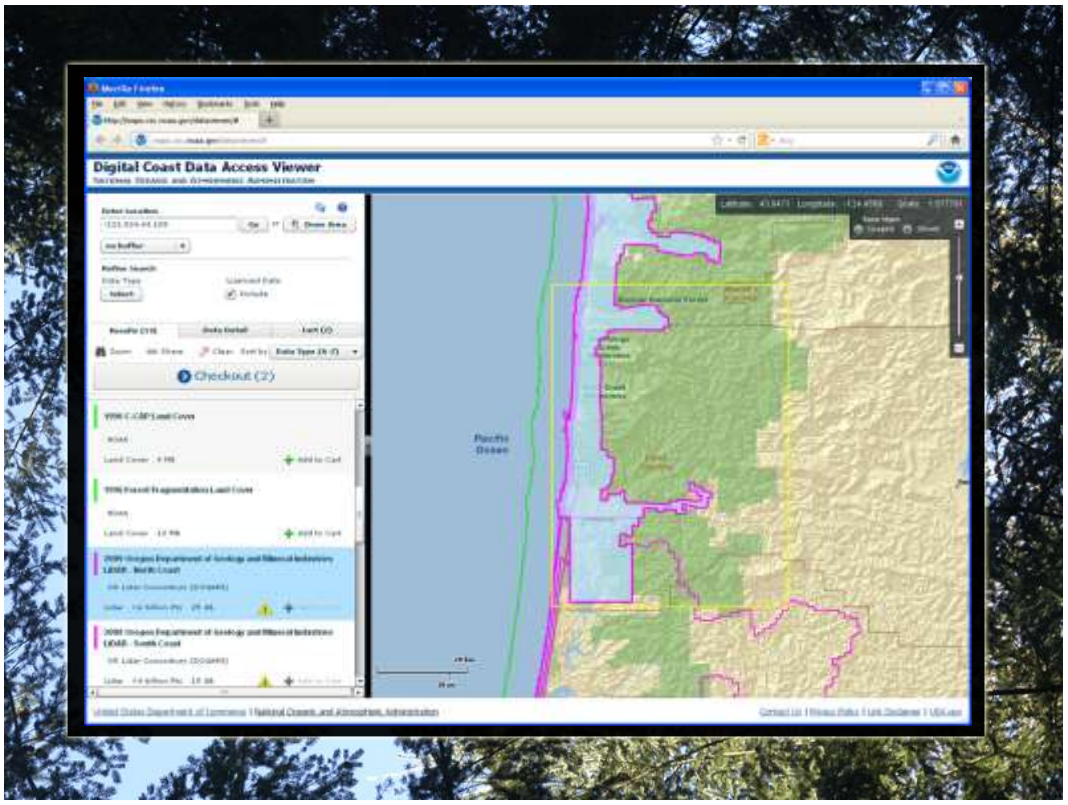


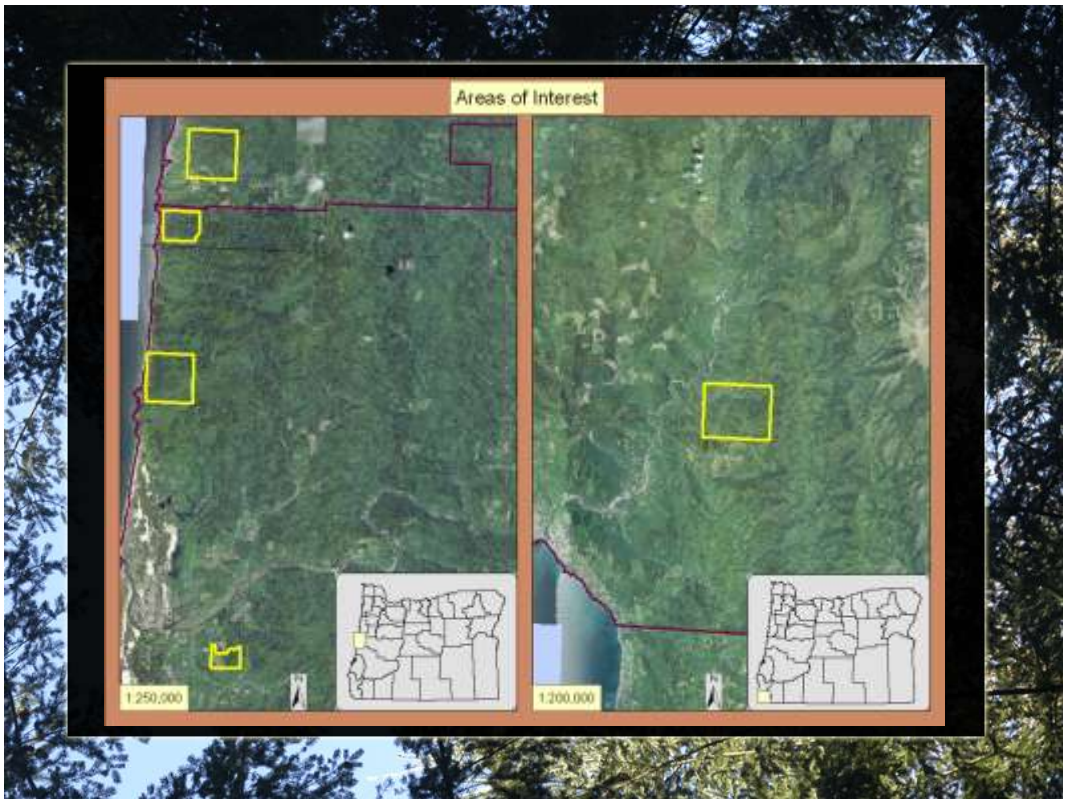
Software Used

- Fusion LiDAR Toolkit
  - Processing LiDAR data to create Rasters
  - Visualization
- ArcGIS
  - Raster Calculations
  - Maps

LiDAR Data Source

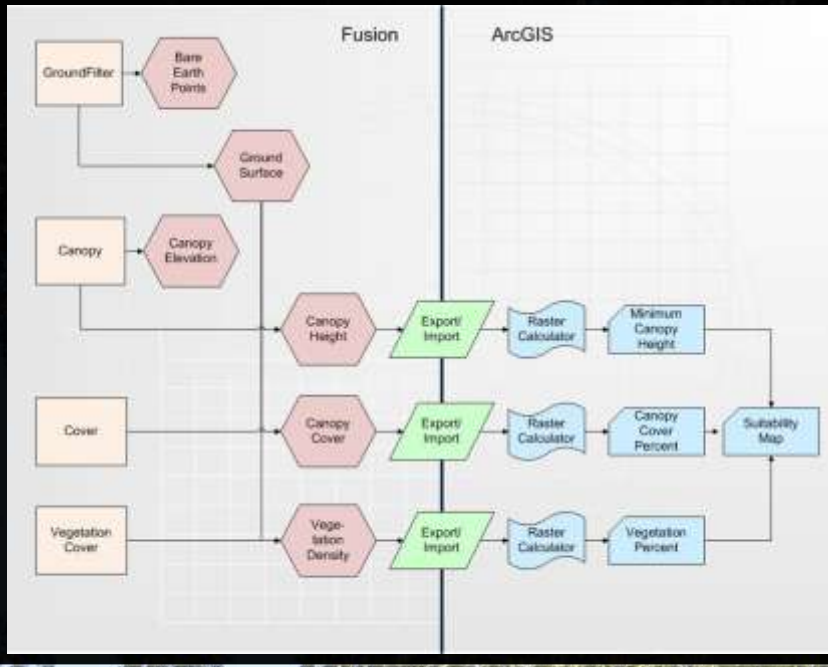



Digital Coast Data Access Viewer
Checkout (2)
Pacific Ocean


Areas of Interest
1:250,000
1:200,000

Fusion Tools

- GroundFilter
  - Bare earth points
  - DEM
- CanopyModel
  - Canopy height
  - Canopy Elevation
- Cover
  - Canopy cover
  - Vegetation density

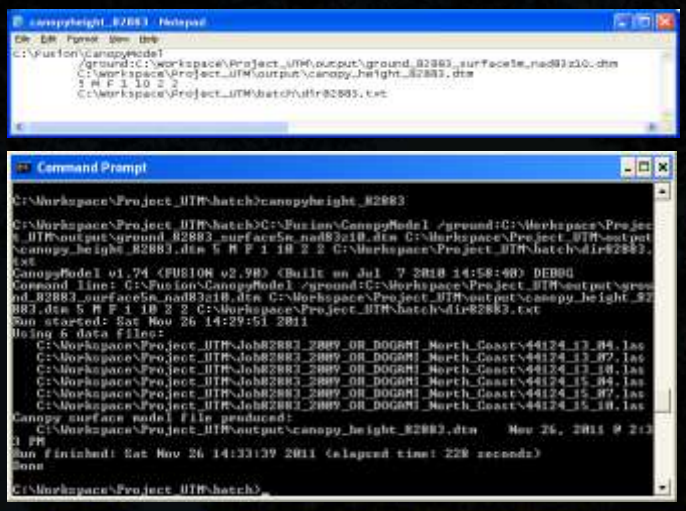


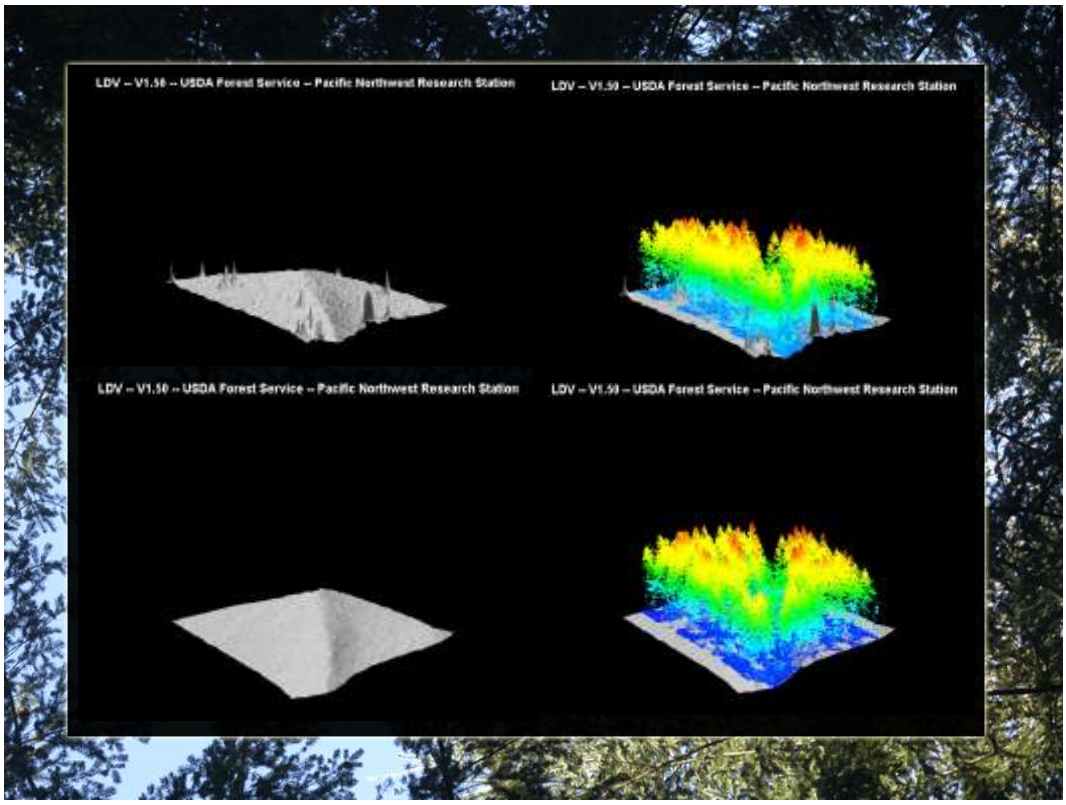
Fusion Command Line

- Tools are run by typing commands at the command prompt or by running a batch file
- Each tool has its own set of inputs, outputs, and parameters
- Example: calculating canopy height
  - CanopyModel Tool
  - Input DEM
  - Output Surface Model
  - Parameters
  - Input LAS File(s)

Fusion Command Line

- Calculating Canopy Height Using a Batch File




LDV – V1.50 – USDA Forest Service – Pacific Northwest Research Station
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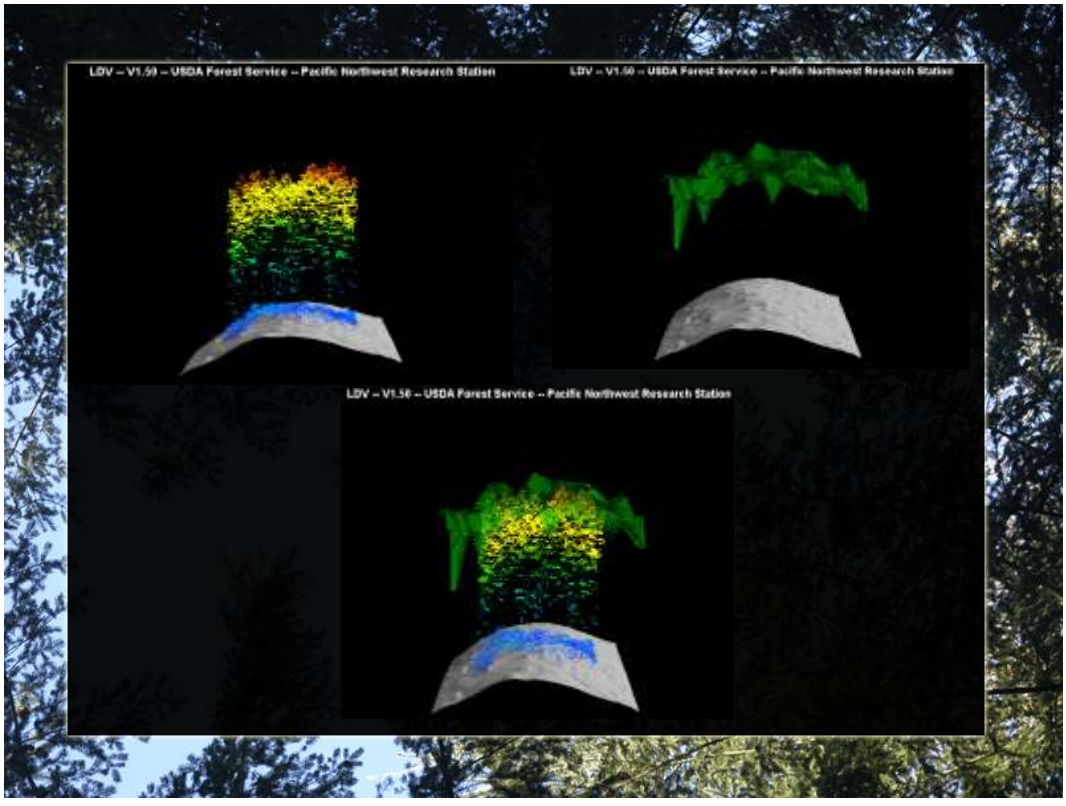
LDV – V1.50 – USDA Forest Service – Pacific Northwest Research Station
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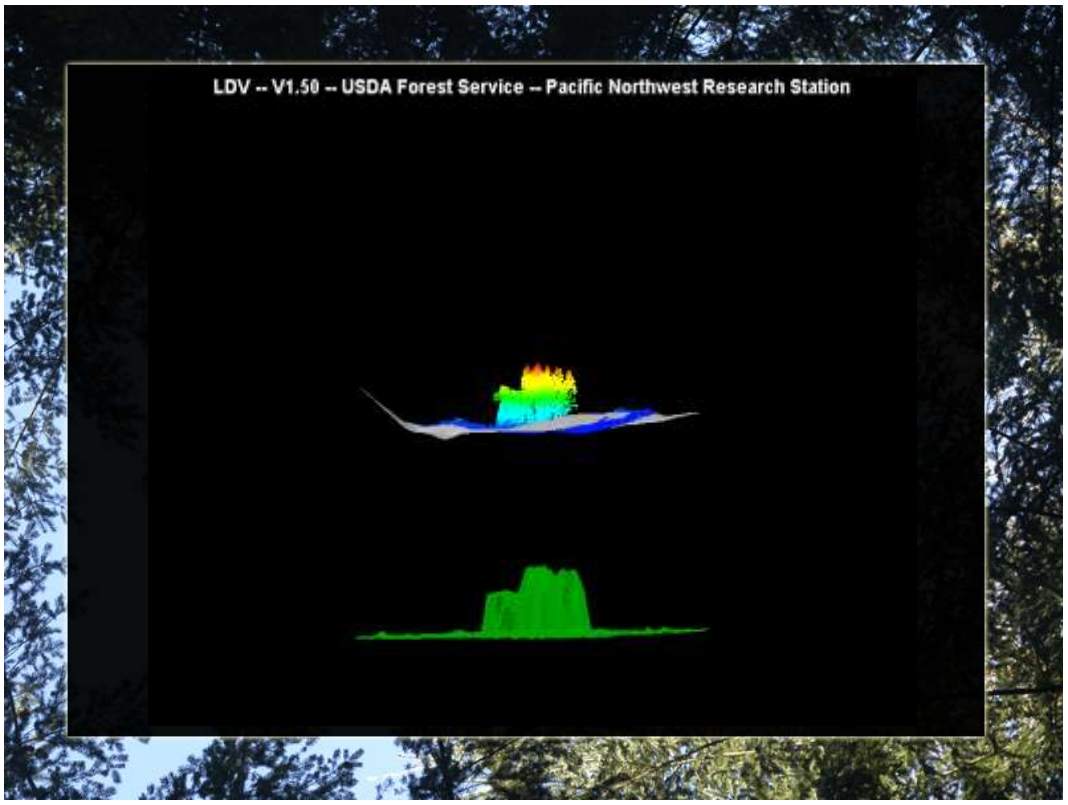
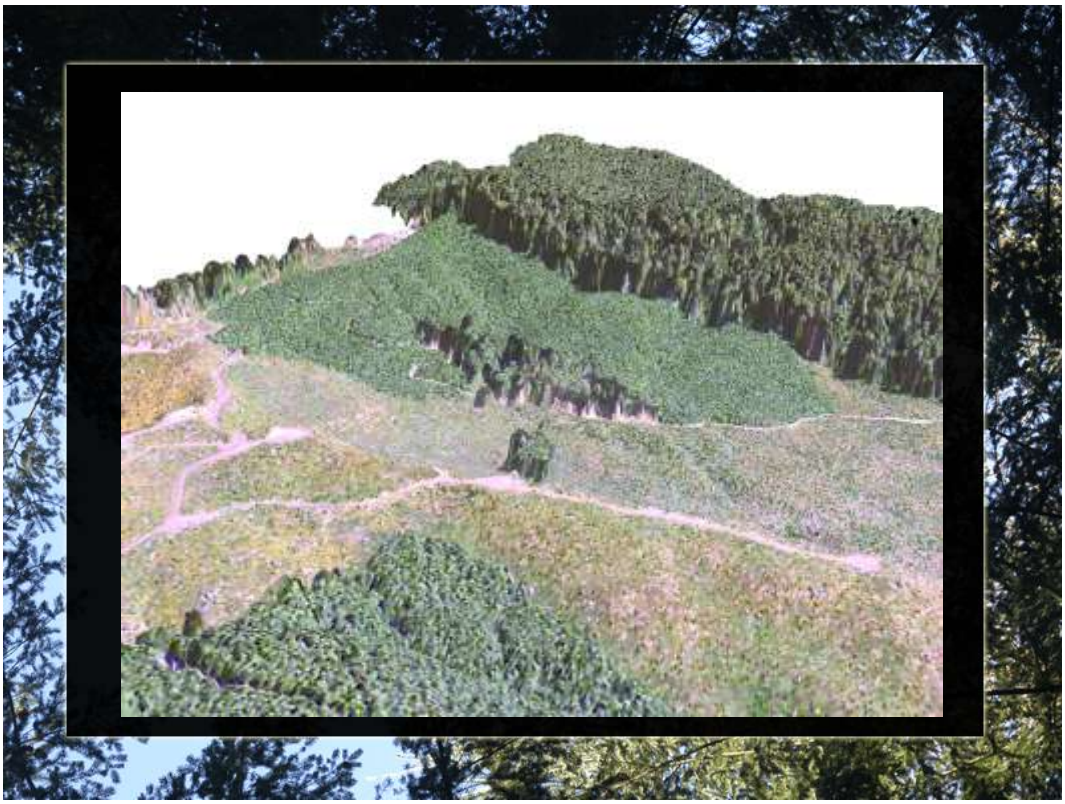


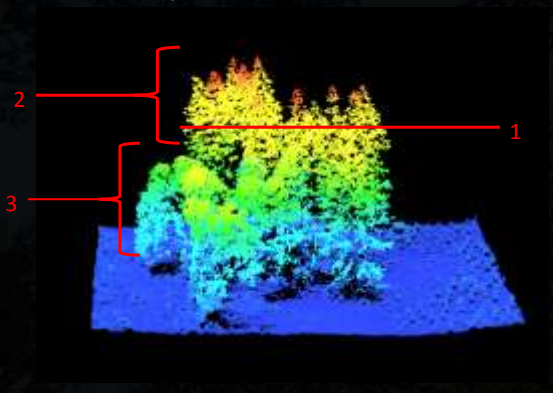
Fusion Output

- DEM
- Canopy Height
  - Canopy height
  - Canopy elevation
- Canopy Cover Above:
  - 20 feet
  - 30 feet
  - 40 feet
  - 50 feet
  - 75 feet
- Vegetation Density Between:
  - 6 and 30 feet
  - 6 and 50 feet
  - 30 and 50 feet
  - 30 and 75 feet
  - 30 and 100 feet

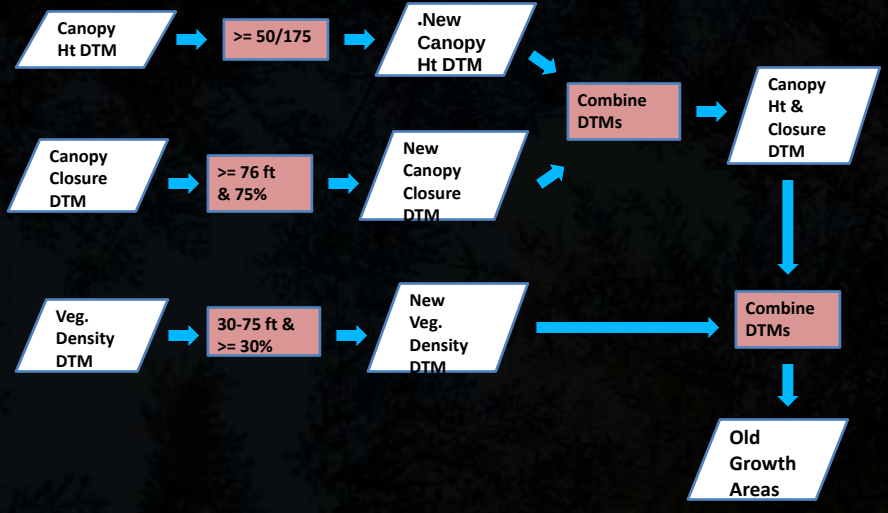


Mature Forest: Assumptions

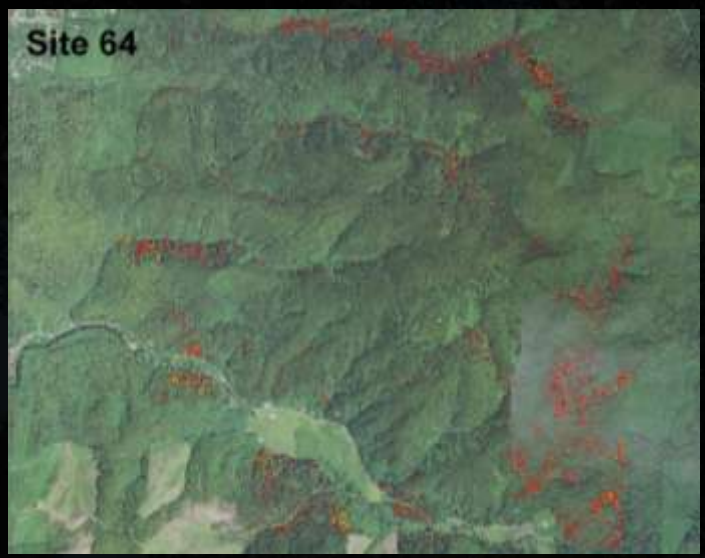
1. Tall Trees ➔ Minimum tree height: >= 150ft and >=175ft
2. Canopy ➔ Minimum Canopy Closure (Density): 75%
3. Multi-Layered ➔ Vegetation Density within a specific height range:
   - 30-75 ft with >= 30% density



Methodology



Results: Site 64



Mature Forests1:
Ht. > 175 ft.
5.56 acres

Mature Forests2:
Ht. > 150 ft
44.50 acres

N

1

Kilometers

Results: Site 75

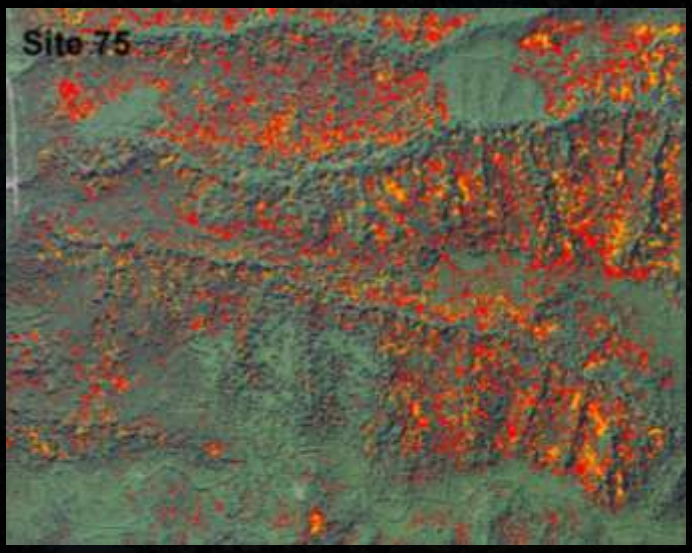
Mature Forests1:
Ht. > 175 ft.
66.75 acres

Mature Forests2:
Ht. > 150 ft
210.50 acres

N

1

Kilometers



Results: Site 63

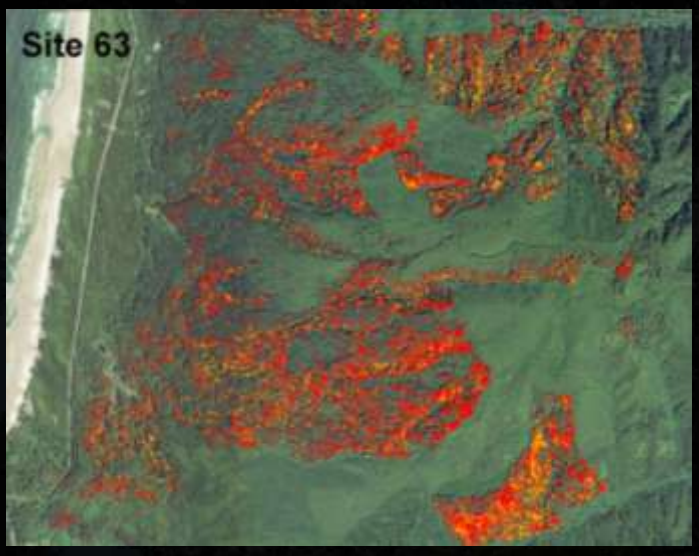
Mature Forests1:
Ht. > 175 ft.
86.80 acres

Mature Forests2:
Ht. > 150 ft
307.31 acres

N

1

Kilometers



Results: Site 39

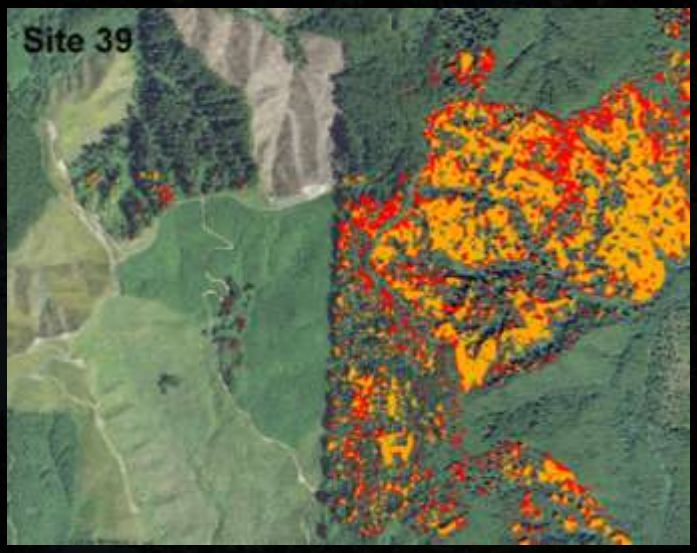
Mature Forests1:
Ht. > 175 ft.
75.34 acres

Mature Forests2:
Ht. > 150 ft
113.14 acres

N

1

Kilometers



Results: Site 77

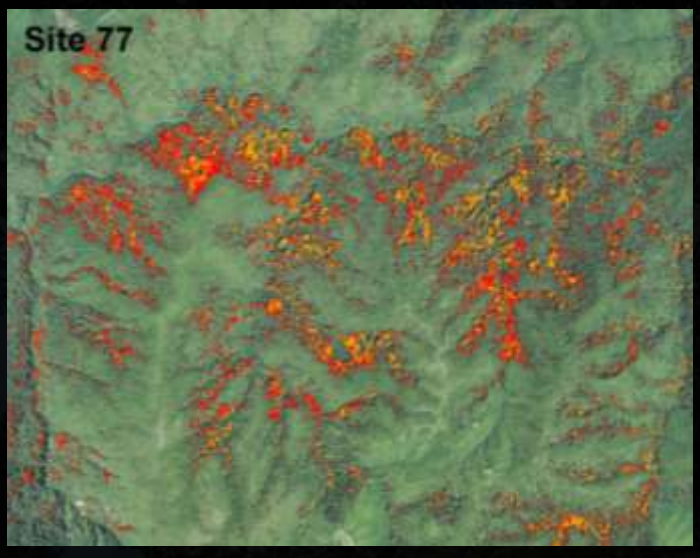
Mature Forests1:
Ht. > 175 ft.
92.01 acres

Mature Forests2:
Ht. > 150 ft
249.60 acres

N

1

Kilometers



Conclusions

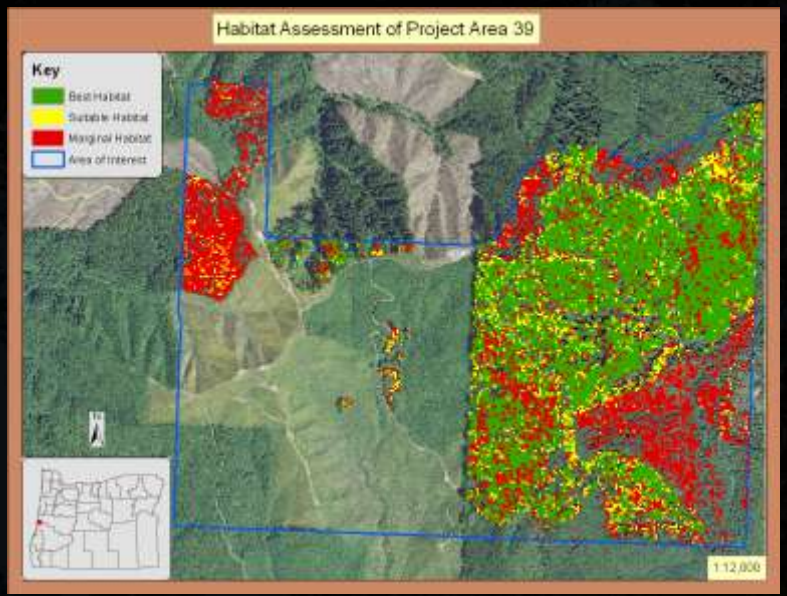
- A viable method
  - More refined parameters
  - Comparison with areas of known Old Growth
- Compare with data on Private and State land
- Industry and USFS data
- Ground truthing
- Larger study areas

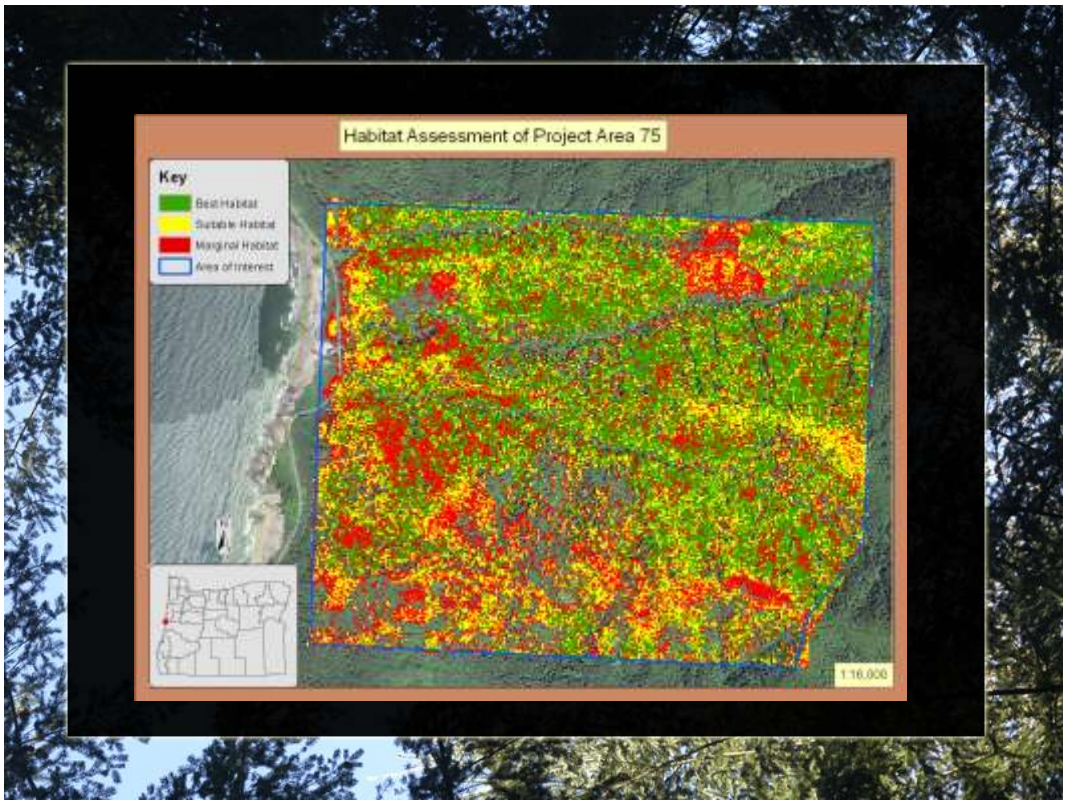
Marbled Murrelet Habitat

- Endangered seabird found within 50 miles of the Oregon coast
- Habitat
  - Mature forests
  - Nests in large diameter trees high in the canopy on large limbs or platforms
    - Trees ≥ 20 inches in diameter
    - Limbs ≥ 30 feet above the ground and ≥ 6 inches in diameter

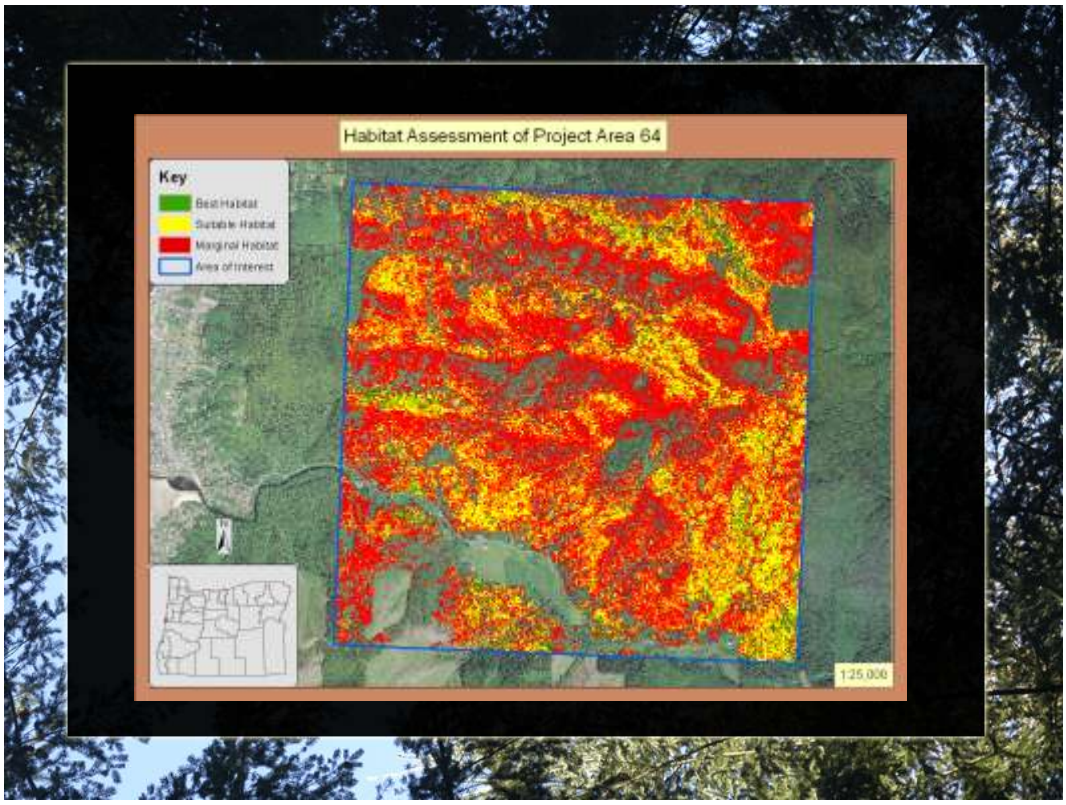
Parameters Used

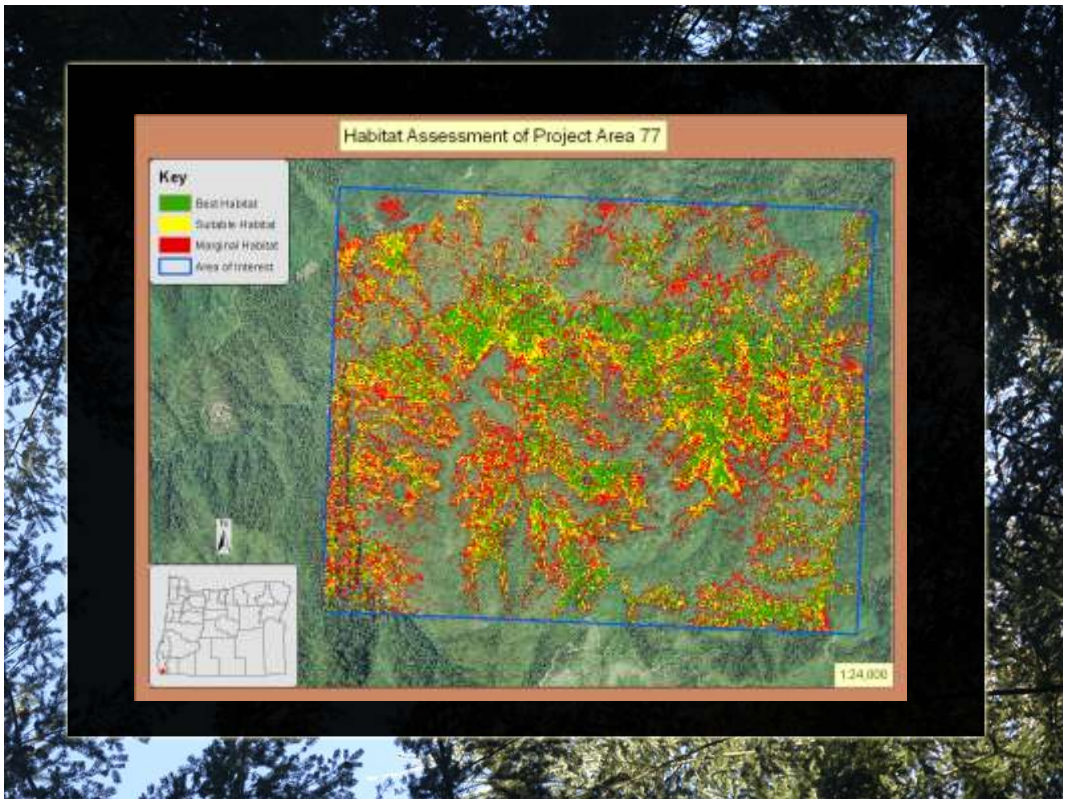
- Best Habitat
  - Canopy is more than 150 feet tall
  - Greater than 50% canopy cover over 50 feet
  - Greater than 30% vegetation cover between 30 and 100 feet
- Suitable Habitat
  - Canopy is more than 125 feet tall
  - Greater than 50% canopy cover over 50 feet
  - Greater than 30% vegetation cover between 30 and 100 feet
- Marginal Habitat
  - Canopy is more than 100 feet tall
  - Greater than 50% canopy cover over 50 feet



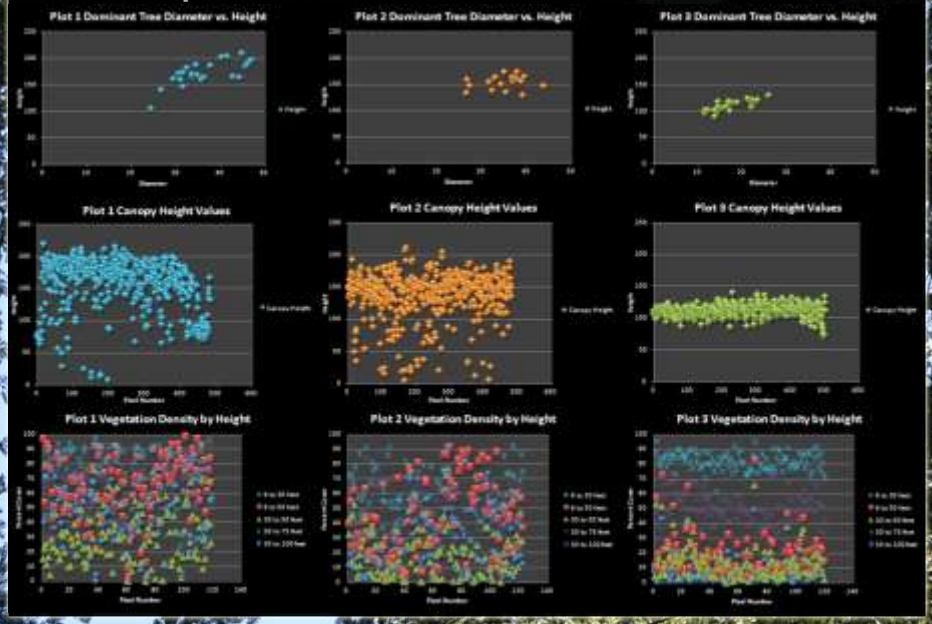

Habitat Assessment of Project Area 75
Key
Best Habitat
Suitable Habitat
Marginal Habitat
Area of Interest
1:16,000


Habitat Assessment of Project Area 63
Key
Best Habitat
Suitable Habitat
Marginal Habitat
Area of Interest
1:25,000

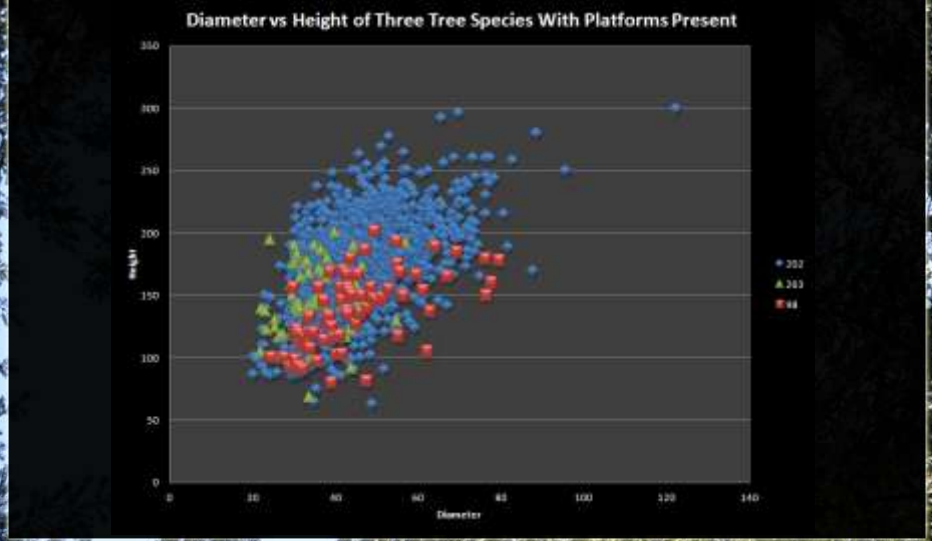

Habitat Assessment of Project Area 64
Key
Best Habitat
Suitable Habitat
Marginal Habitat
Area of Interest
125,000


Habitat Assessment of Project Area 77
Key
Best Habitat
Suitable Habitat
Marginal Habitat
Area of Interest
124,000

Comparison of Three FIA Field Plots



Selection of Oregon FIA Plots Where Platforms Were Recorded



Conclusions for Murrelet Habitat

- Further analysis and parameter refinement is required
- Extracted canopy heights closely match measured heights
- The model and plot extracts suggest that there are relationships
- The next steps would be applying the model to larger data sets using Fusion's Tile Processing

References

- United States Forest Service, Remote Sensing Application Center. 2010
- Fusion Tutorial Exercises 1-11.
- http://www.fs.fed.us/eng/rsac/fusion/
- McGaughey, R. J. 2010. FUSION/LDV: Software for LIDAR Data Analysis and Visualization. USDA Forest Service, Pacific Northwest Research Station.
- NOAA website
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