CFRU & LiDAR
Technology Wrap Up

Brian Roth, CFRU Acting Director
NERCOFE 2017 Workshop
Orono, Maine – March 14th, 2017

Cooperative Forestry Research Unit

Since 1975: Partnership between Maine's forest landowners, managers and the University of Maine to solve most important problems facing managers of Maine's commercial forestlands

35 CFRU Member Organizations

LANDOWNER / MANAGER:

- **Irving Woodlands, LLC**
- **Wagner Forest Management**
- **BBC Land, LLC**
- **Weyerhaeuser**
- **Prentiss and Carlisle Company, Inc.**
- **Seven Islands Land Company**
- **Clayton Lake Woodlands Holding, LLC**
- **Maine Bureau of Parks & Public Lands**
- **Katahdin Forest Management, LLC**
- **The Tall Timber Trust**
- **The Nature Conservancy**
- **Snowshoe Timberlands, LLC**
- **Baskahegan Corporation**
- **Sylvan Timberlands, LLC**
- **Sandy Gray Forest, LLC**
- **North Woods Maine, LLC**
- **Appalachian Mountain Club**
- **Simorg North Forest LLC**
- **Frontier Forest, LLC**

- **Downeast Lakes Landtrust**
- **Baxter State Park, SFMA**
- **Robbins Lumber Company**
- **Timbervest, LLC**
- **St. John Timber, LLC**
- **EMC Holdings, LLC**
- **Mosquito, LLC**
- **New England Forestry Foundation**
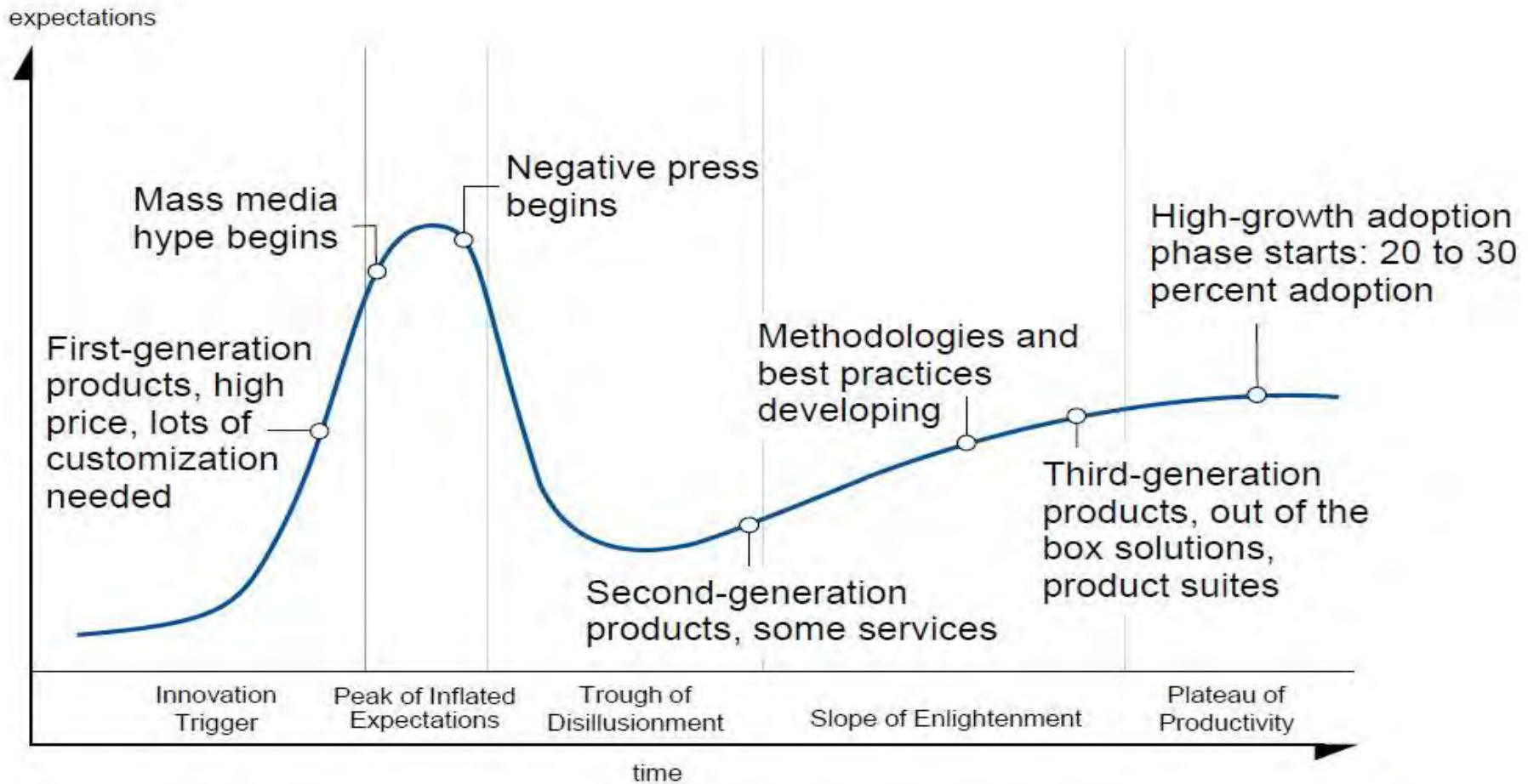
WOOD PROCESSOR:

- **SAPPI Fine Paper**

CORPORATE and INDIVIDUAL:

- **ReEnergy Holdings, LLC**
- **James W. Sewall Co.**
- **Huber Engineered Woods, LLC**
- **Forest Society of Maine**
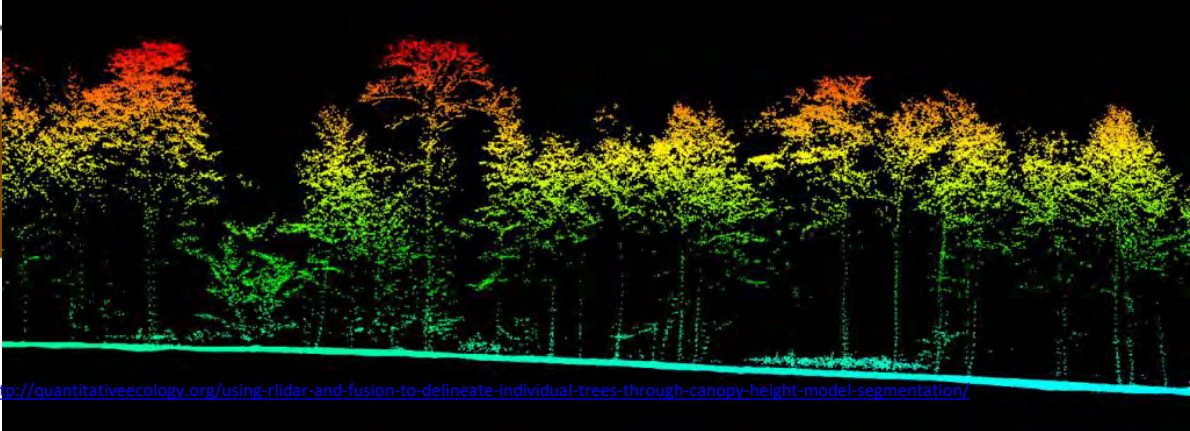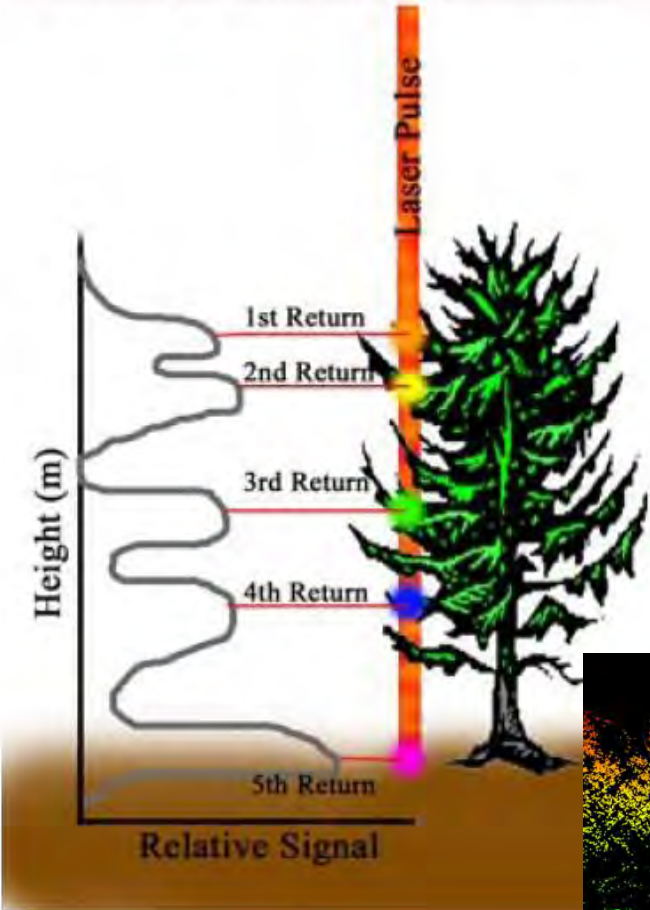- **LandVest**
- **Field Timberlands**
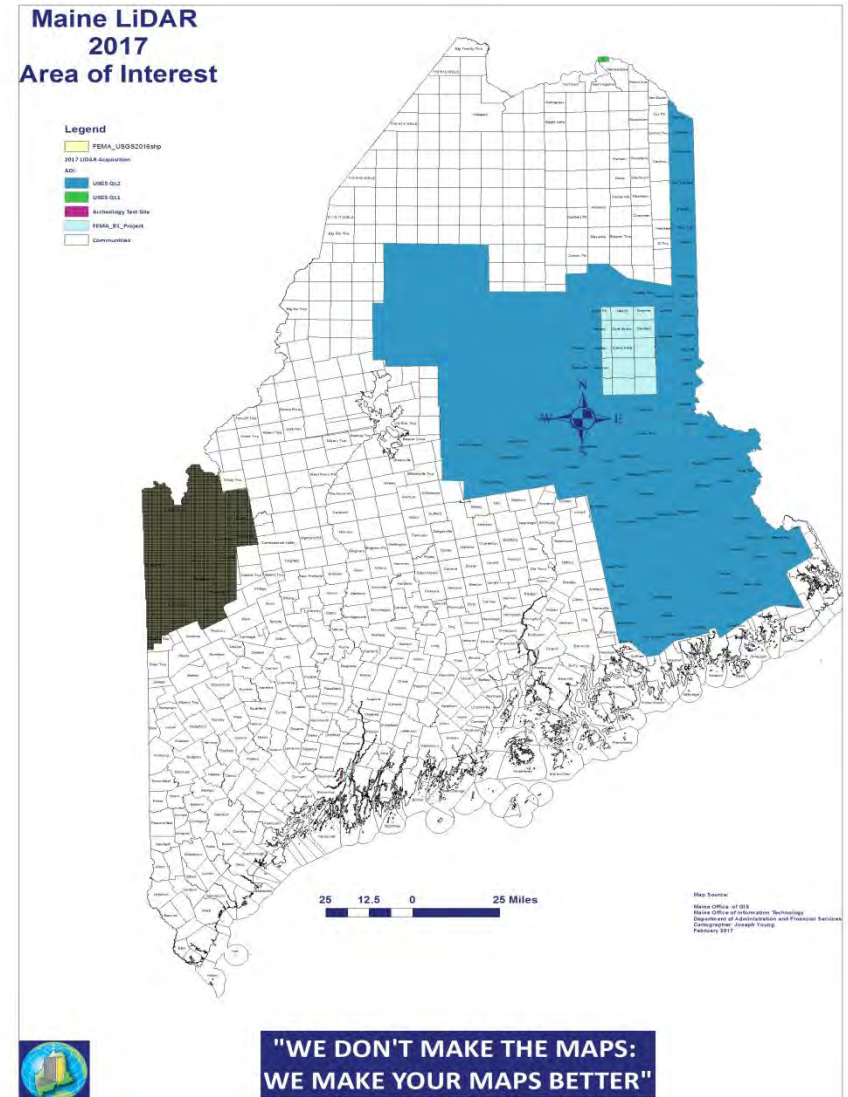- **Acadia Forestry, LLC**

The Hype Cycle of Innovation

expectations
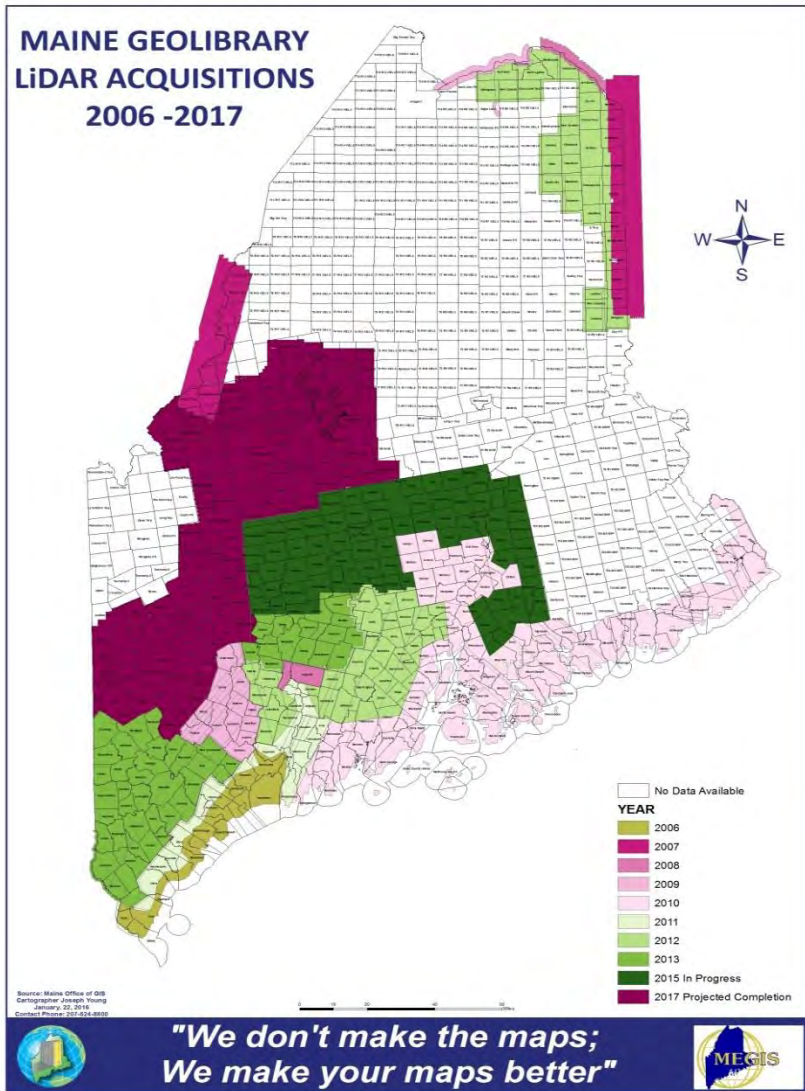
Mass media
hype begins

Negative press
begins

High-growth adoption
phase starts: 20 to 30
percent adoption

First-generation
products, high
price, lots of
customization
needed

Methodologies and
best practices
developing

Third-generation
products, out of the
box solutions,
product suites

Second-generation
products, some services

| Innovation Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Gartner.

LiDAR Overview

Multiple Return Explanation

Laser Pulse

Height (m)

1st Return
2nd Return
3rd Return
4th Return
5th Return

Relative Signal

https://www.e-education.psu.edu/geog481/l8_p3.html

http://www.dnr.wa.gov

http://quantitativeecology.org/using-rlidar-and-fusion-to-delineate-individual-trees-through-canopy-height-model-segmentation/
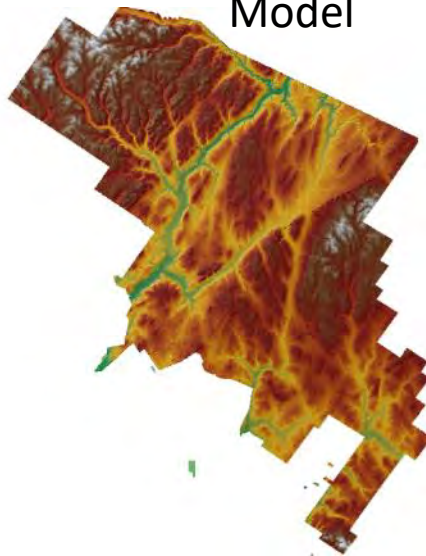
Statewide LiDAR Acquisition
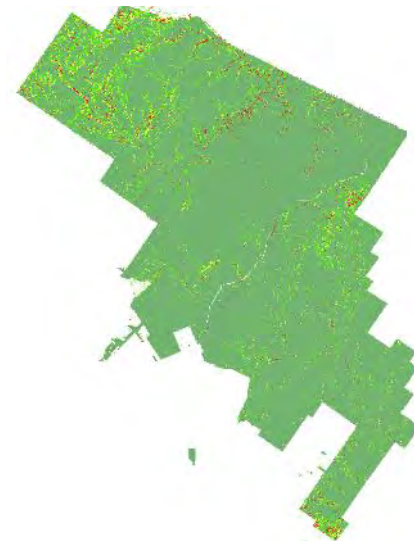
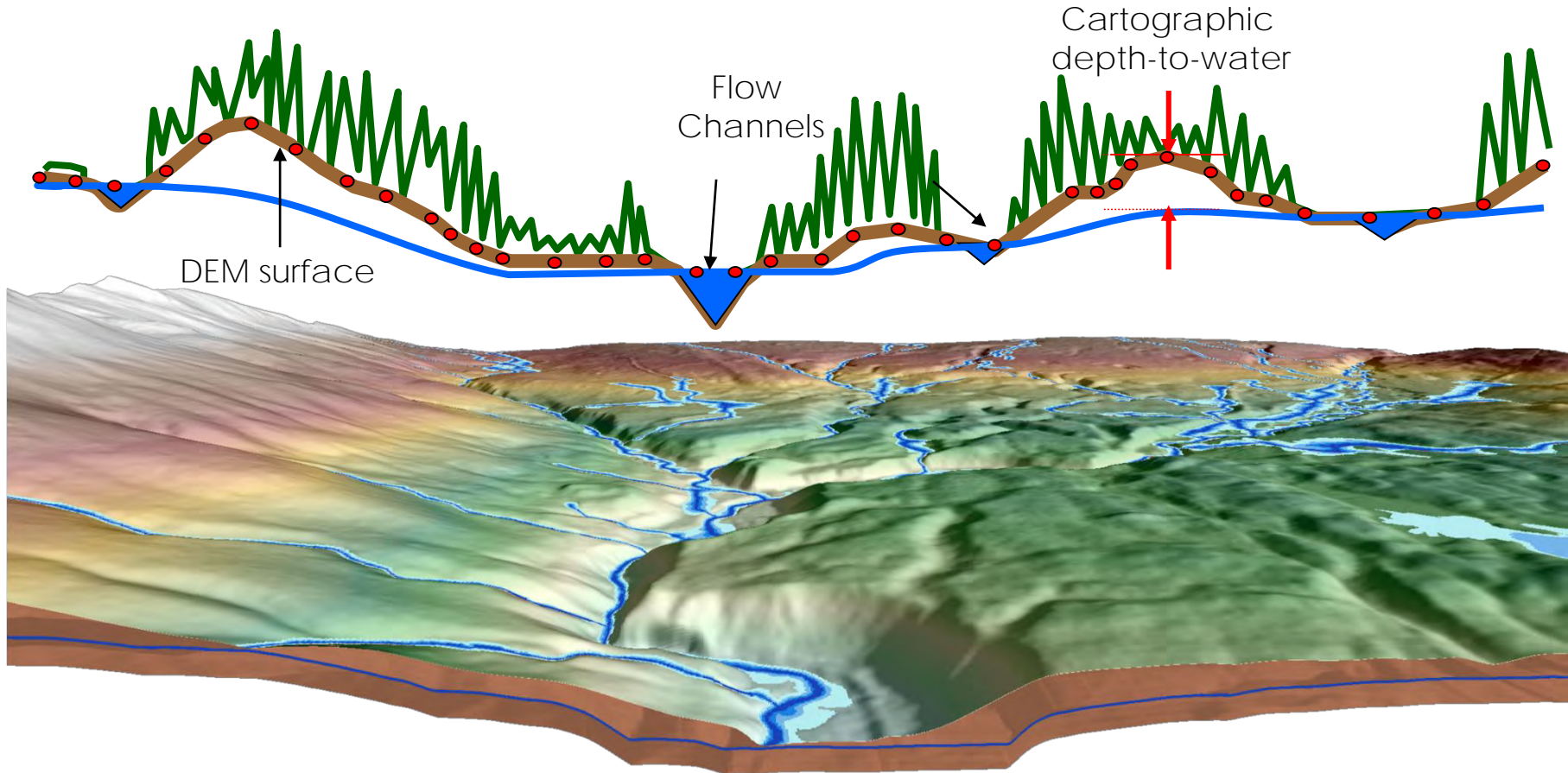# BOILER PLATE LiDAR BI-PRODUCTS

Hill Shade Model

Digital Elevation Model

Canopy Height Model

Slope Model

Wet Areas Mapping with LiDAR

Cartographic depth-to-water

Flow Channels

DEM surface

1. Prepare DEM Surface
2. Predict locations of potential stream channels
3. Use the Wet Areas algorithms to predict potential cartographic wetness across the landscape.
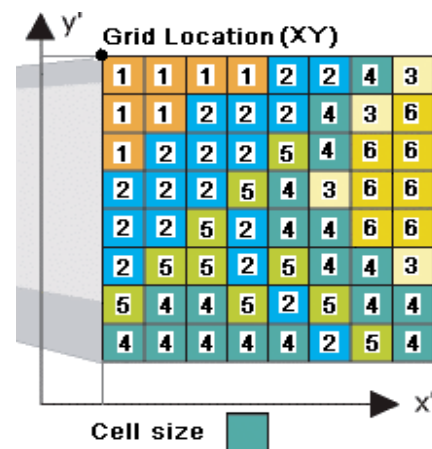
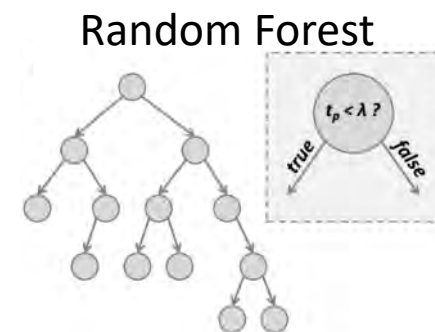UNB Forest Watershed Research Centre

Disruptive Technology

TRADITIONAL FOREST INVENTORY

MODELED-PRODUCT • Enhanced Forest Inventory

- Stem Density>10cm (trees\ha)
- Gross Merchantable Volume (m³\ha)
- Piece size (m³\tree)
- Live crown Ratio (%)
- Top Tree height (m)
- Average Tree height (m)
- Basal area(m²\ha)
- Basal area > 10 cm (m²\ha)
- Mean DBH (cm)
- Diameter Distribution (trees\ha)
- Density all (stems\ha)

Random Forest

$t_p < \lambda$?

true false

Grid Location (XY)

1	1	1	1	2	2	4	3
1	1	2	2	2	4	3	6
1	2	2	2	5	4	6	6
2	2	2	5	4	3	6	6
2	2	5	2	4	4	6	6
2	5	5	2	5	4	4	3
5	4	4	5	2	5	4	4
4	4	4	4	4	2	5	4

Cell size

Deer Wintering Habitat
Allagash, Maine
Habitat Type

- Primary
- Secondary

Canopy Height

High : 50 m

Low : 0

Kilometers

0   0.75   1.5   3   4.5   6
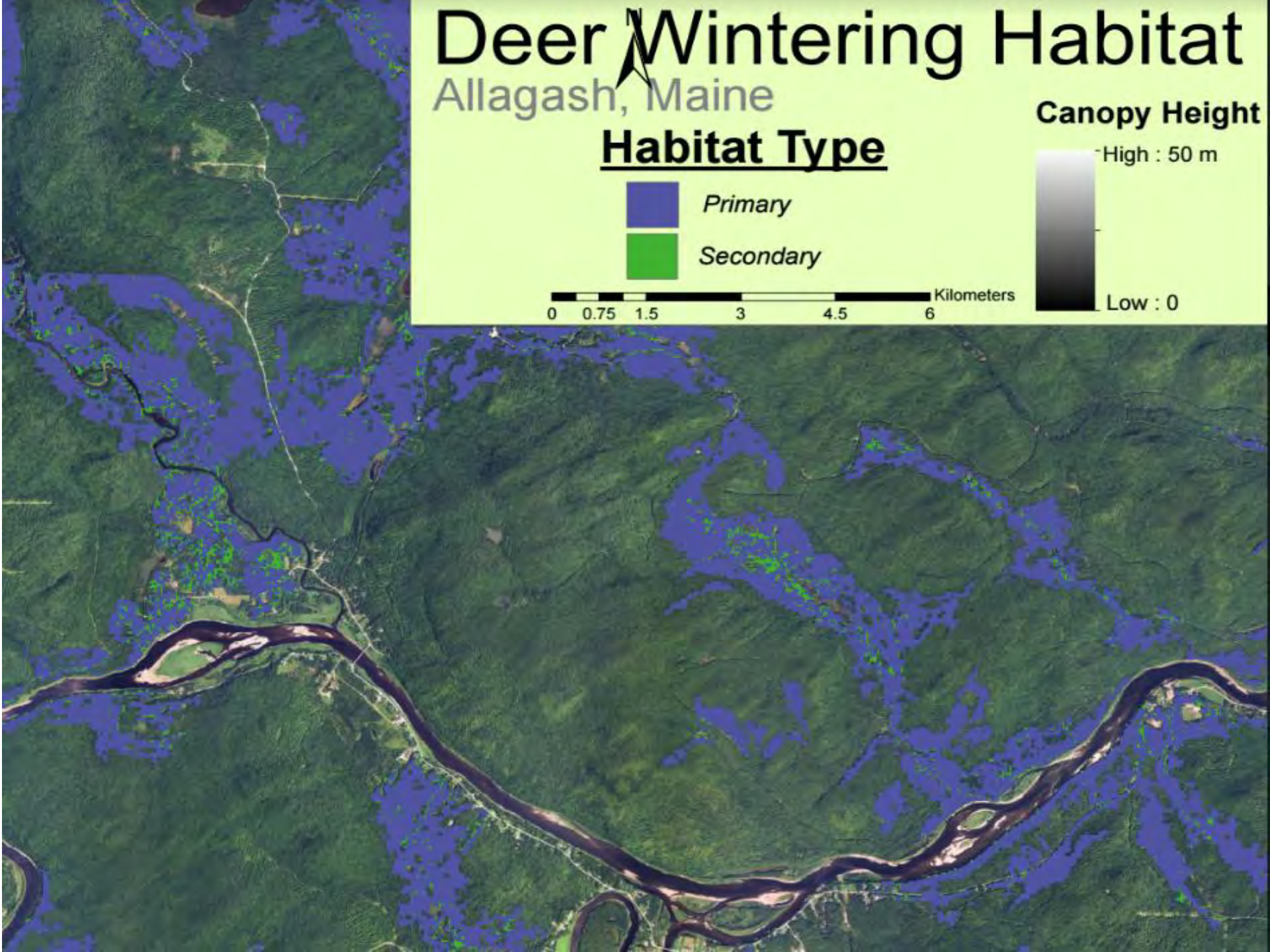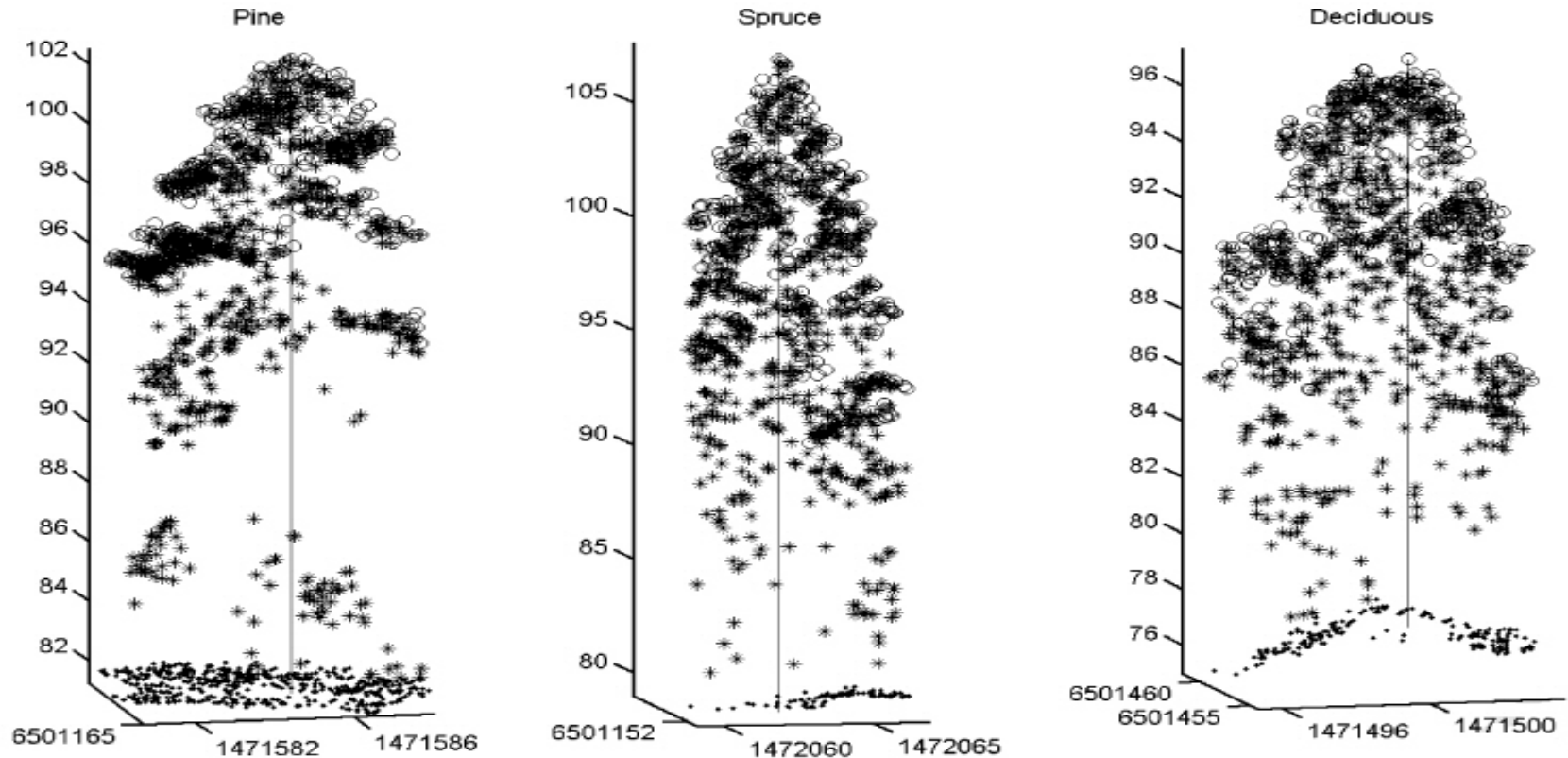
Species Identification

Individual species predictions probably limited to overstory
- Difficult to assign species to LIDAR diameter distribution for uneven or mixed stands
- Therefore, difficult to quantify volume by species and log products with LIDAR alone
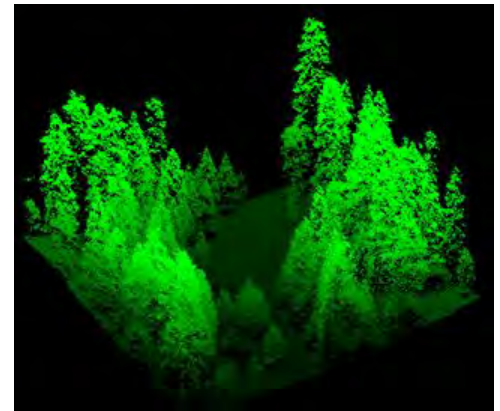
Future LiDAR Applications

- Self Driving Vacuums to Harvesters?
- Wood product/tree inventory on the fly?
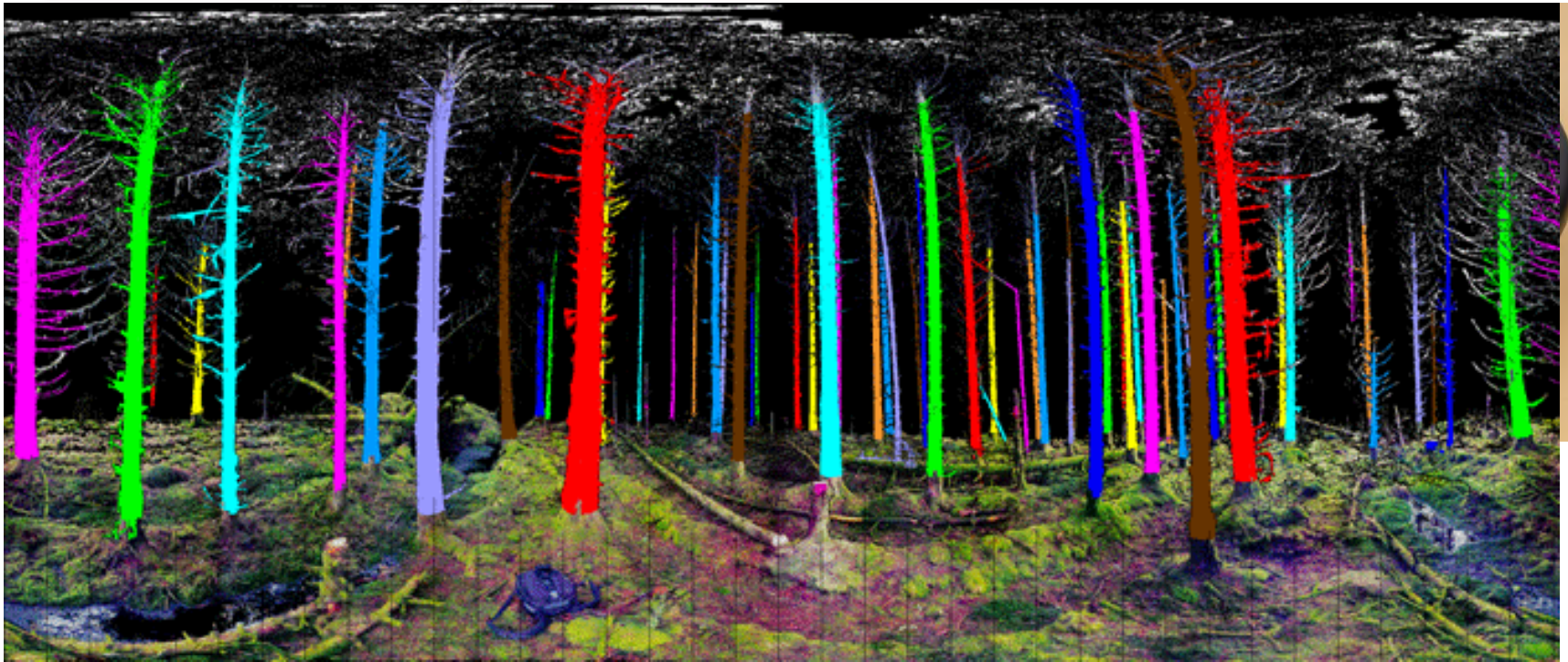
LiDAR Can Help You:
work better, faster, smarter, and cheaper

- road location planning, construction and maintenance

- determination and delineation of unmapped streams

- Prioritization of harvest & commercial thinning treatments

- inventory determination and growth and yield forecasts

- forecasts of harvest volumes and product yields

- identification of critical habitat

Questions?