

Tongass Young Growth mapping: An Applied example of Using LIDAR Technology in Forestry:

Forestry LIDAR Overview

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2. First Order Products
3. Second Order Products
4. Derived and Modeled Products
 - Forest Inventory Parameters
5. What LIDAR does well and poorly
6. Using LIDAR for Tongass YG management
 - LIDAR assisted timber typing
 - Using LIDAR to speed up net down mapping

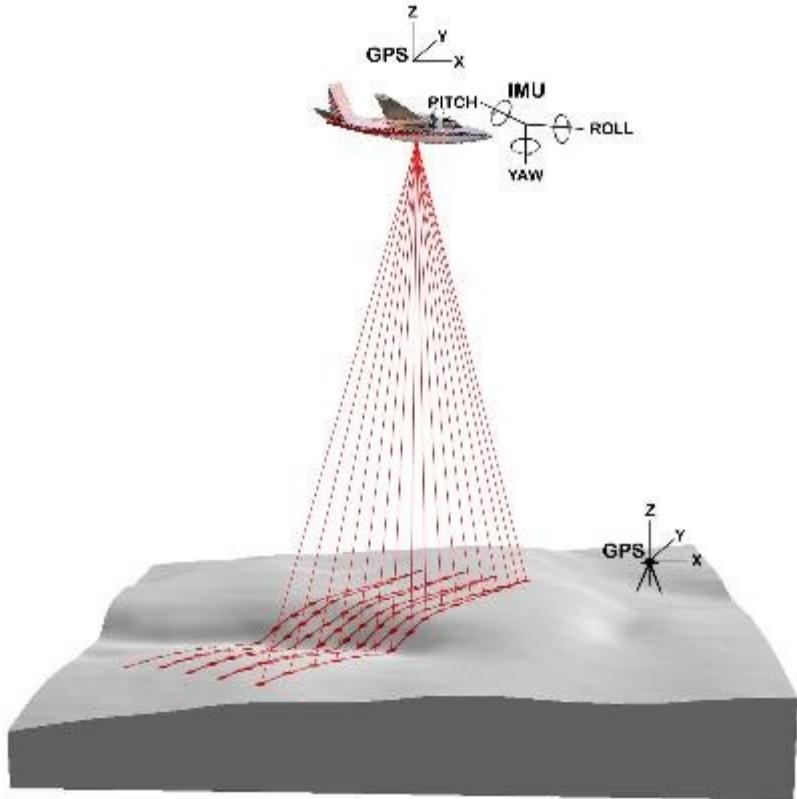


Image from PNW research Station Vegetation Monitoring and Remote Sensing Team
http://forsys.cfr.washington.edu/jfsp06/lidar_technology.htm

What is LIDAR?

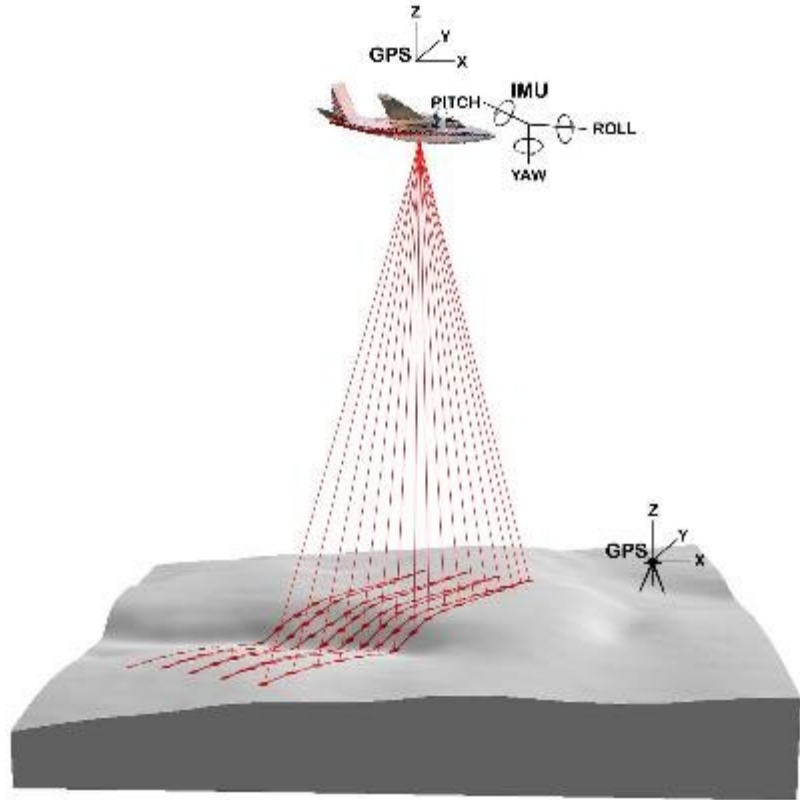


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- LIDAR: Light Detection and Ranging
- An array of lasers are bounced off a surface and the distance is measured.
- Can be airborne or ground-based.
- It is very important to know the sensor position and so it is very closely integrated with GPS (Global Position System) technology.
- Typically deployed with fixed wing aircraft for forestry applications.
- Remains fairly expensive to collect in Alaska due to high aviation related costs.

LIDAR Products

First Order (Direct) Products

Often provided by the vendor who flew the LIDAR

- The “Point Cloud”
- A Classified Point Cloud
- Digital Elevation Model
- Hill shade model
- High Density Contour Lines



Key Concepts:

- First order products are very large data files
- Require high power GIS systems
- Are often broken up into small pieces (tiles) because of file sizes
- Provide too much detail for many forestry applications

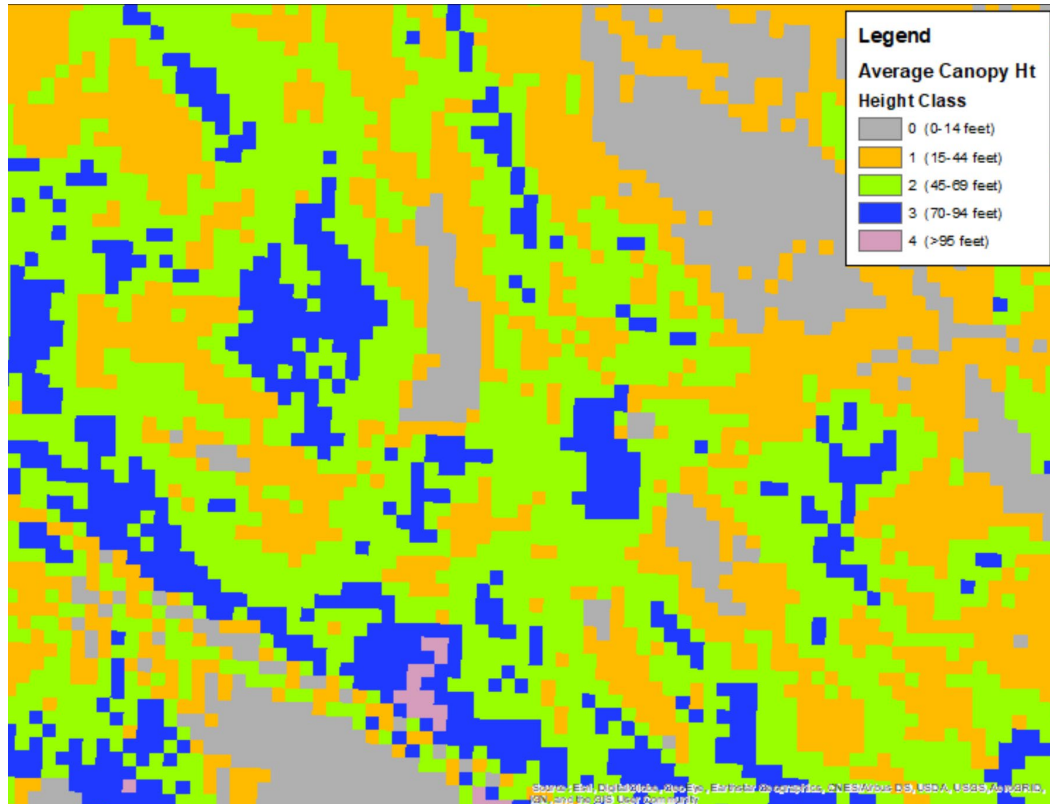
LIDAR Products

Second Order Products

Useful things generated from the raw data

Examples include:

- Tree Canopy Heights
- Canopy Coverage



Key Concepts:

- Second order products are single metrics or simplified metrics
- Much smaller file sizes
- Whole basins can be mapped
- More accessible and easier to use
- Typically generated by third party software (for example FUSION)

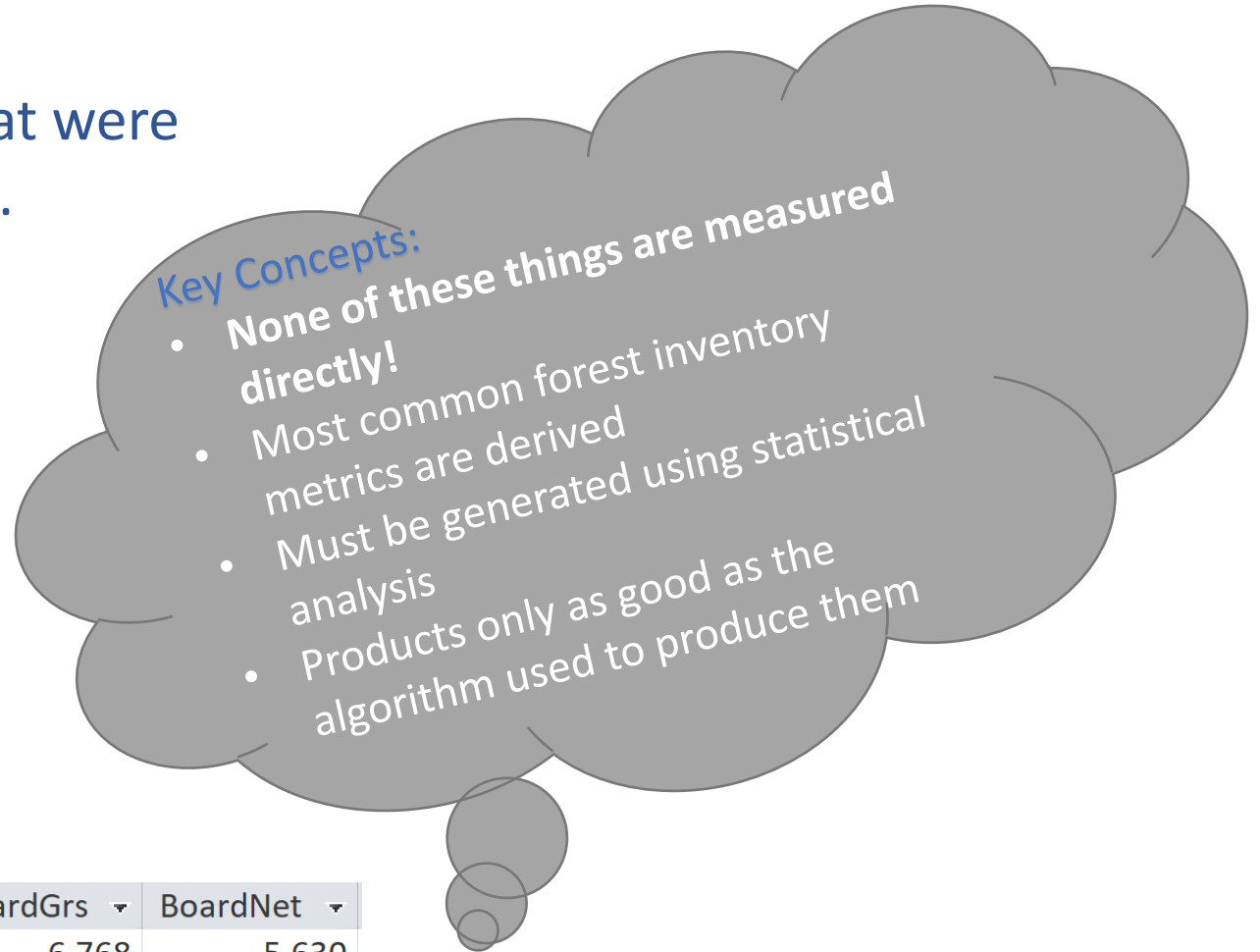
LIDAR Products

Derived Products

Statistical Correlations between things that were measured and things we are interested in.

Examples include:

- Basal Area
- Timber volume
- Trees per acre
- Tree diameter
- Tree Species



Trees ▾	QDBH ▾	BASAL ▾	TOP_HT ▾	CubicGrs ▾	CubicNet ▾	BoardGrs ▾	BoardNet ▾
1208.25	5.1	170.8	73.2	2,009	1,675	6,768	5,630
1163.61	5.3	178.5	74.7	2,215	1,839	7,418	6,118

Common Forestry Metrics

Things LIDAR Does Very Well:	LIDAR Does Reasonable Well:	LIDAR Struggles with:
<p><u>Tree Height:</u> LIDAR can directly measure the height of every single tree!!</p>	<p><u>Total Gross Volume</u> Total biomass or total volume can be fairly accurate.</p>	<p><u>Tree Species</u> Much work is being dedicated to improving this. Requires “training plots”.</p>
<p><u>Canopy Coverage:</u> Percent coverage of tree canopies can be interpreted from the raw data.</p>	<p><u>Basal Area and Tree Diameter:</u> There is a strong relationship to individual tree canopies</p>	<p><u>Defect and Log Level Detail</u> Wood quality is even more difficult than species to quantify. Requires “training plots”.</p>

LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths



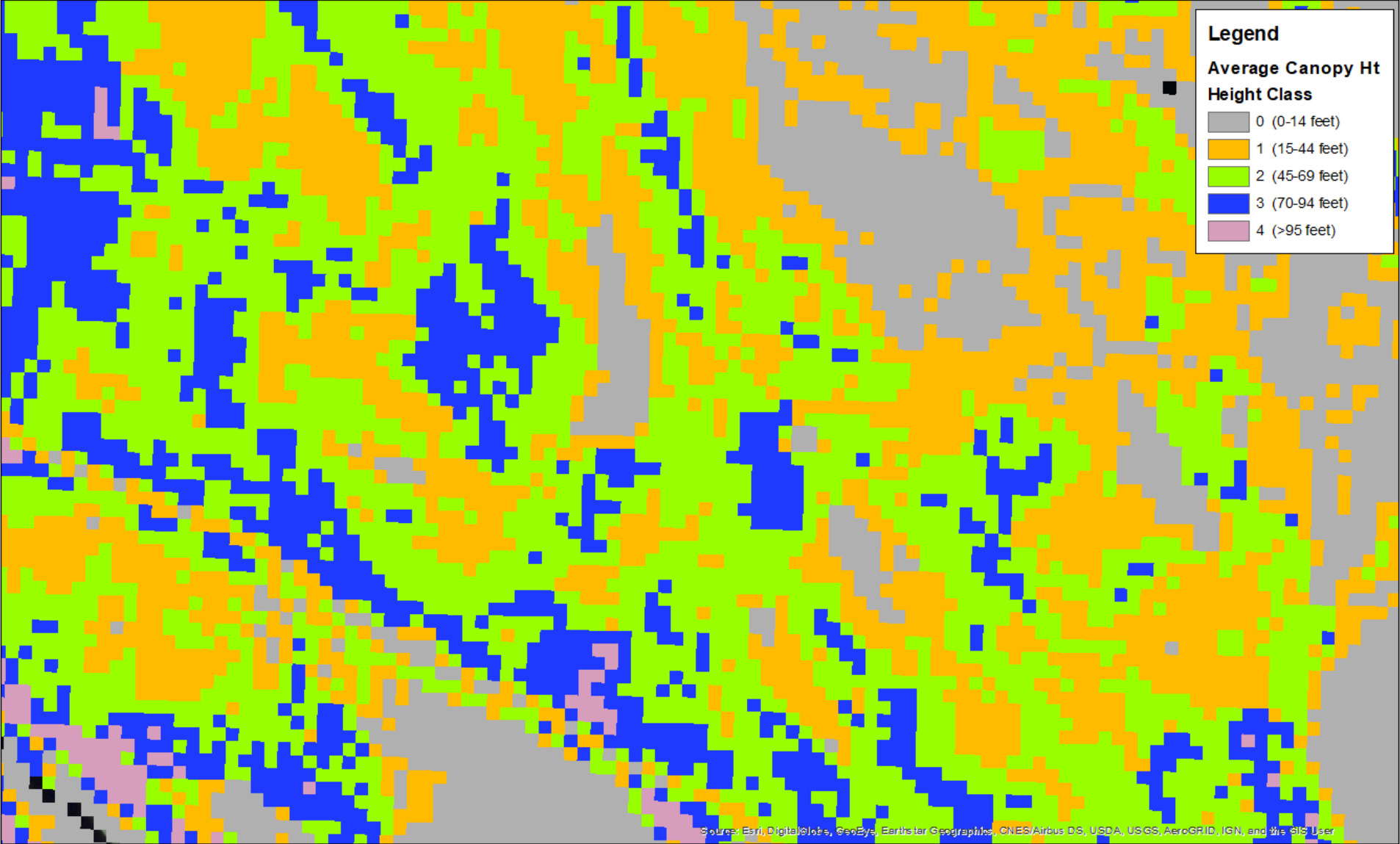
- Tongass Young Growth near Thorne Bay, AK
- Recent Satellite imagery showing new harvests, several age classes of YG and areas of Old Growth

LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths



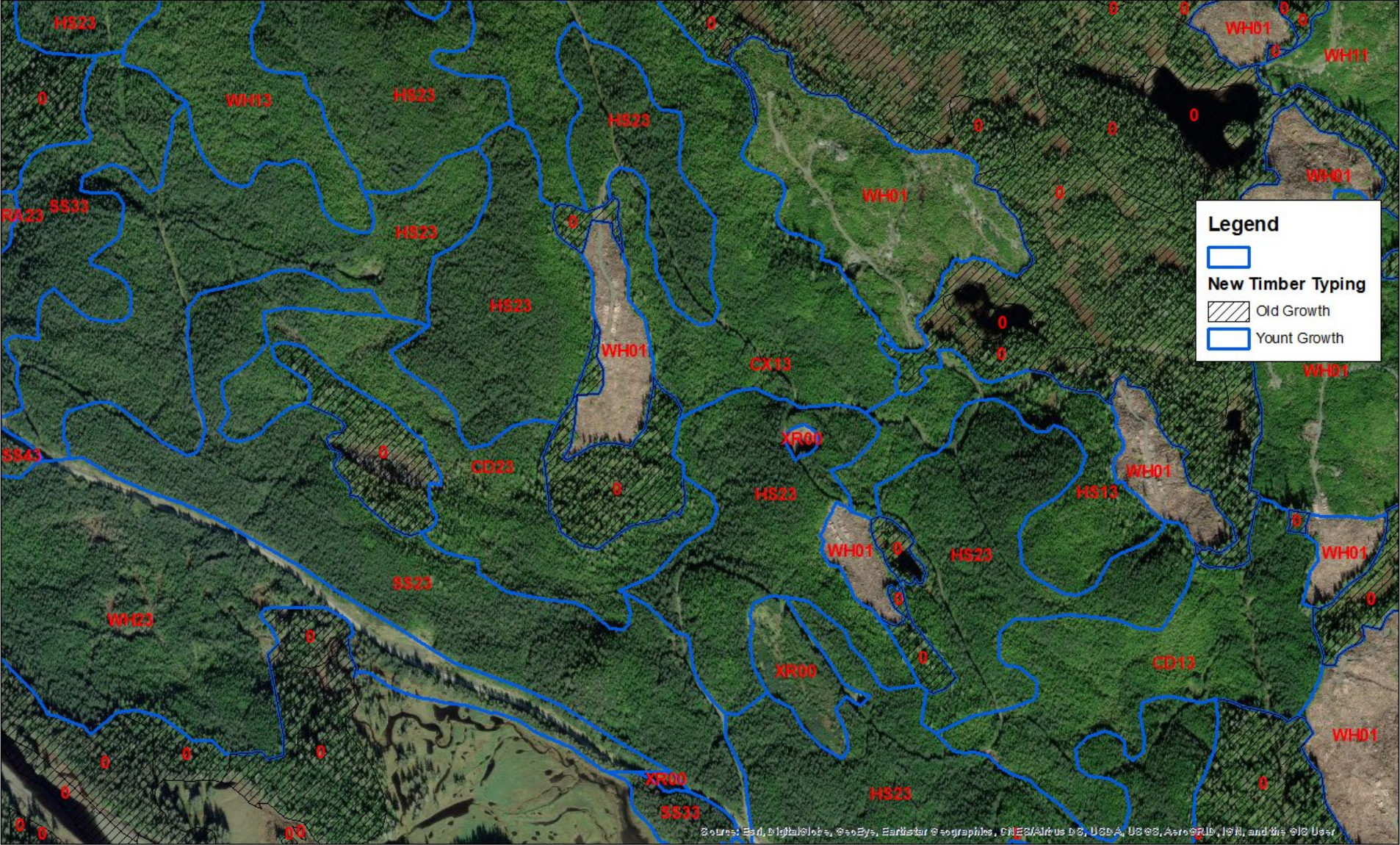
- Legacy Linework is a mix of old harvest unit mapping other forest management and treatment information

LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths



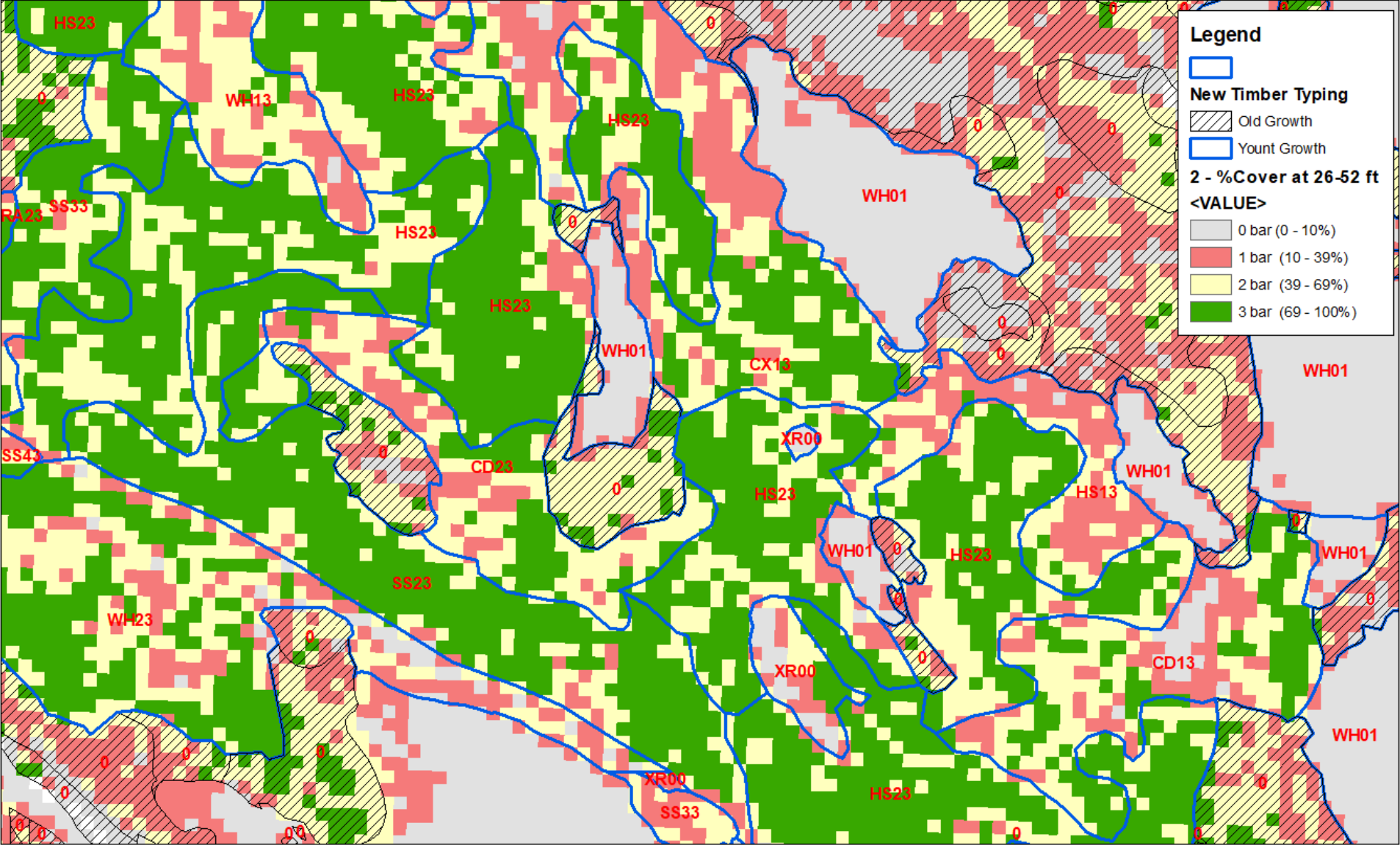
- This a LIDAR derived map of Average tree height
- From the FUSION software package

LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths



- By toggling back and forth between LIDAR and recent imagery, an excellent representation of the forest condition can be built.

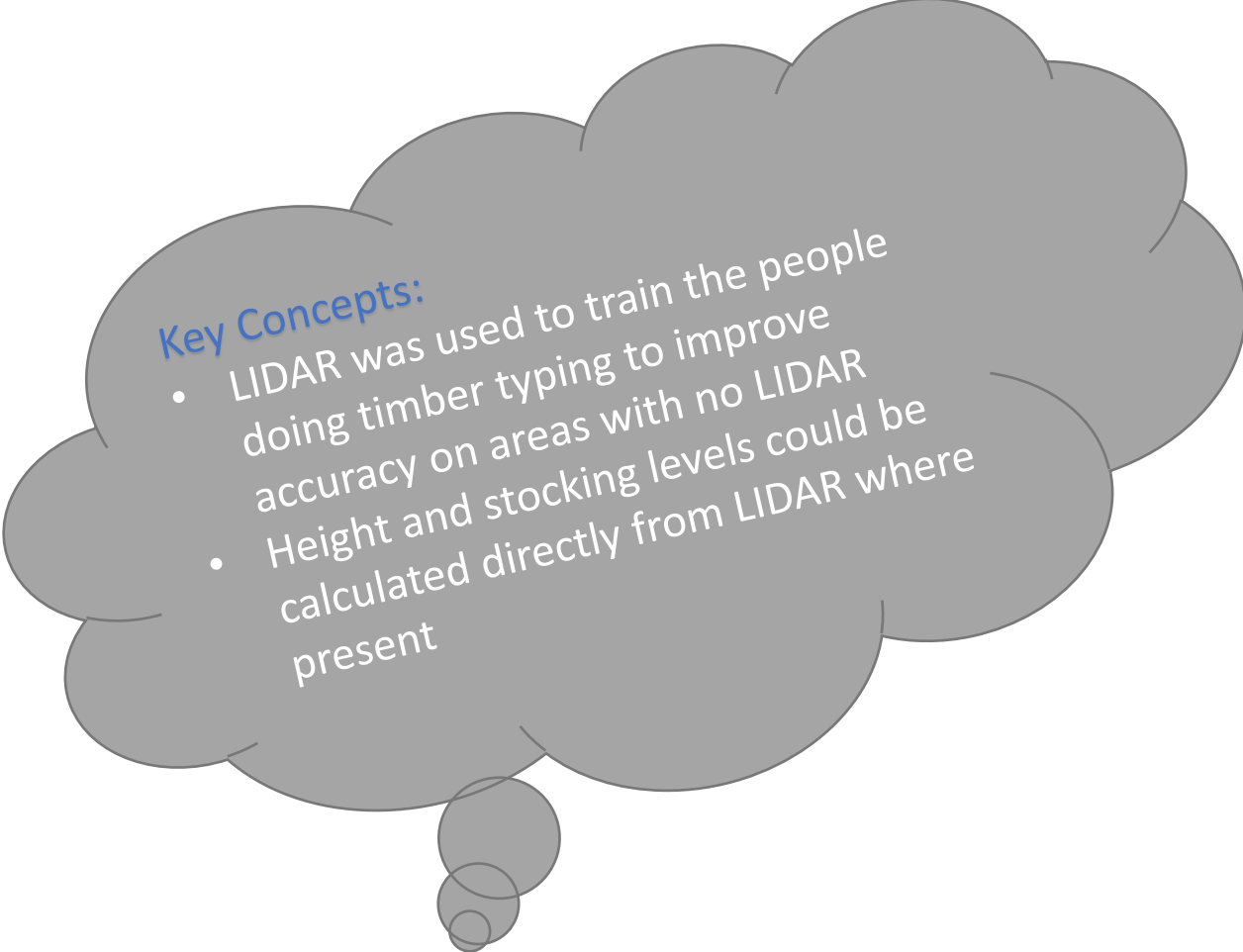
LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths



- LIDAR also does an excellent job helping to pull out detail on tree stocking.
- Note how the recent clear cuts show up with no stocking.

LIDAR used in the Tongass Young Growth Inventory: Playing to the strengths

- 40% of the Tongass Young Growth has LIDAR data
- Terra Verde made “manual” timber type calls for every stand
- After training on LIDAR areas, we made type calls from imagery



We compared manual calls to computer calculated calls directly from the LIDAR. The two lined up very closely.

Manual Height call vs LIDAR calculated Ht on 995 stands that differed by one class

Height class	1	2	3	4	
Min Ht for class (ft)	14	44	69	94	
Avg height of stands labeled one class too high	12.4	36.0	62.7	89.0	These should be greater than the “min Ht for class” row
Avg height of stands labeled one class too low	17.0	47.7	77.6	98.3	These should be less than the “min Ht for class” row