Perspectives on LiDAR Assisted Inventory

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Perspectives on LiDAR Assisted Forest Inventory

What will we try to cover?

➢ What’s LiDAR

➢ What’s a Forest Inventory
  ➢ Where have we been
  ➢ Where are we now

➢ Evolution?

OR

➢ Revolution?
What’s LiDAR?

LiDAR – Light Detection And Ranging

Basics:
• Active remote sensing technology based on laser pulses
• A laser pulse is emitted and the reflection recorded
• Returns from each pulse are recorded

Types:
• Pulse based Discrete (What most call “LiDAR’)
• Phase based Full waveform (Developing)
• Photon counting

Modes or Platforms:
Space (SLS)  Plane (ALS)  Drone (ULS)  Terrestrial (MLS)
Forest Inventory: Where have we been?

1953 Field Inventory

- It's spatial
- Provides:
  - Volume
  - Species
  - Topography
  - Timber Value
  - Roads
  - Operating Constraints
Modern Inventory Characteristics

- Digital GIS
- Stand based
- Inventory based on plot sampling
- Field data collected 10 – 20 years
- Some manual interpretation (boundaries)
- Some averaged information (slope, elevation, inventory)
What is LiDAR providing that’s new?

http://arcg.is/1S9jDD

- Extremely high spatial sample density / resolution
- Individual tree level data
- Vertical structure (forest) detail
- Details on other forest level characteristics
Starting point: What’s your time frame?

Mature Stand Condition

- LiDAR is collected at a single point in time.
- That point in time will represent a single size/structure only.
- Repeated collections will represent a different point in time for any point in space.
- Sub-stand information may be practical using LiDAR data.
Revolution: Sub-Stand Features

- Stand polygons have been the basis of inventory and forest inventory systems for decades (or longer)
- Most systems rely on the average metrics provided by current sampling systems.

Sub-Stand Level Details

Preserving Spatial Details

- No minimum mapping unit
- Data managed at the raster / sub-raster level
- Data averaged to ANY polygon as desired
- Important characteristics are no longer ignored
Revolution: Sample vs Census

Sample

Census

30 – 40 m

< 10 m

Average to the Polygon

Much more precise estimates for totals and averages.

Potential For:
- Individual trees
- Tree Height
- Crown Width
- Leaf Area
- Crown Volume
- DBH

| NetAcres  | 0   |
| StandAge  | 72  |
| CruiseYear| 2016|
| Species   | WH  |
| TPAc      | 111 |
| pTPAc     | 0   |
| mTPAc     | 111 |
| MQMD      | 21.7|
| mHT       | 117 |
| RD        | 61  |
| SDI       | 384 |
| BAAc      | 285 |
| mBAAc     | 285 |
| MBFAc     | 44.1|
| TotalMBF  | 0   |
| BFpc      | 133 |
| GrowthMBFAc| 0.73|
Revolution: High precision feature tracking

Features can be tracked and change measured over time
What are the limits on precision?

1. The practical limit on precision it will shrink over time.
2. Currently cell level estimates for forest metrics are common
   - TPA
   - QMD
   - Height
3. Individual tree imputation is coming… sooner than you think!
   That means every* tree in your forest.. But what’s a tree?

* Every - Dominant / Co-Dominant trees will be the initial focus
Data / Product Examples

• There are almost no limits on the available products
• LiDAR base products include:

  ✓ DEM   (Digital Elevation Model)
  ✓ DSM   (Digital Surface Model)
  ✓ CHM   (Canopy Height Model)

• Forest Inventory products (Cell based)
  ✓ TPA
  ✓ Tree Crown Cover
  ✓ Veg Cover
  ✓ Height
  ✓ QMD
  ✓ Volume

• Site Productivity? The preverbal unicorn!

  http://arcg.is/1uC445  Canopy Height Model
The Future? It depends on your vision

What if you don’t want to change? You Won’t!
Is anybody going to make you change? Probably not
Where’s the value? It depends
Isn’t it expensive? Maybe
Do I have to do all this in one day? No
• Develop a vision for your information system
• Begin to understand the use of enhanced data
• Start by augmenting your existing system
• Move toward a higher precision system at your pace

Best Suggestion: Start… No one will do it for you!
What did we cover:

- LiDAR isn’t LiDAR, there are differences
- Before you collect have a plan for how you want to use it
- Assume you will use it for inventory / vegetation assessment
- The main difference in LiDAR platforms is sample density
- Every platform is not suited for every level of collection
- LiDAR measures distance, intensity, and even more
- The data is measured at the point level but interpreted at higher and higher levels, such as the tree, the stand and the forest.

QUESTIONS?