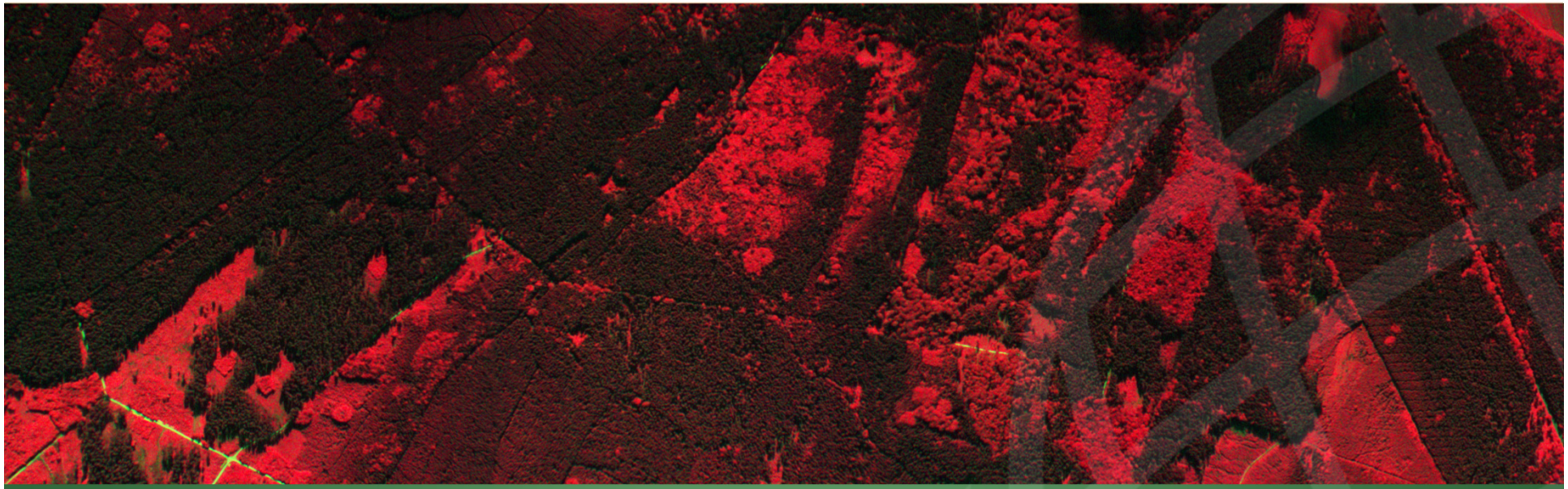


Seeing the Wood from the Trees

Driving Efficiency

www.precisiondecisions.co.uk +44(0)1347 844132

Introduction

- Precision Forestry
- Global Positioning Systems - GNSS
- Accuracy of Global Navigation Systems
- Alternative to Satellite positioning
- Mapping Systems
- Telematics Opportunities
- RTK base stations

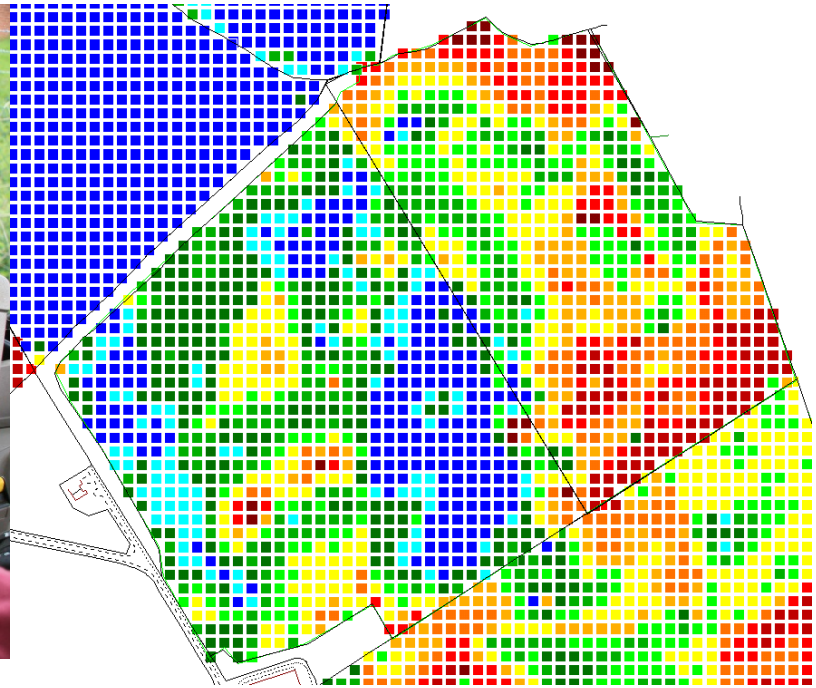
Why Precision Forestry

- It Increase efficiency and productivity
- It Generates new information
- It provides comprehensive view of the resources
- It includes disciplines of remote sensing, modelling, optimisation, robotics, geometrics etc.

Increasing UK Forestry Assets

- At the start of the last century the forest area of Britain was less than five per cent of the land area as a result of centuries of conversion to agriculture, overgrazing, unsustainable exploitation and other factors. Since 1919 there has been a sustained expansion of forest cover in many areas of the country. As a result, at the beginning of the twenty-first century, forests cover nearly 12 per cent of Britain, with the figure in parts of Scotland nearing 25 per cent. In other words, areas of the country have moved from being 'forest poor' to becoming 'forest rich'.

Precision Agriculture



Forestry

- Increase Efficiency
- Improve Profitability
- Reduce Waste – Up to 20% of losses are at Harvest
- Marketable produce from area
- Stability of land form
- Environmental stewardship

Precision Forestry

- Using geospatial information to assist forest management and planning
- Site-specific operational planning
- Performance monitoring of equipment
- As-treated records
  - Planting
  - Application Records
- Harvest records
- Transportation logistics

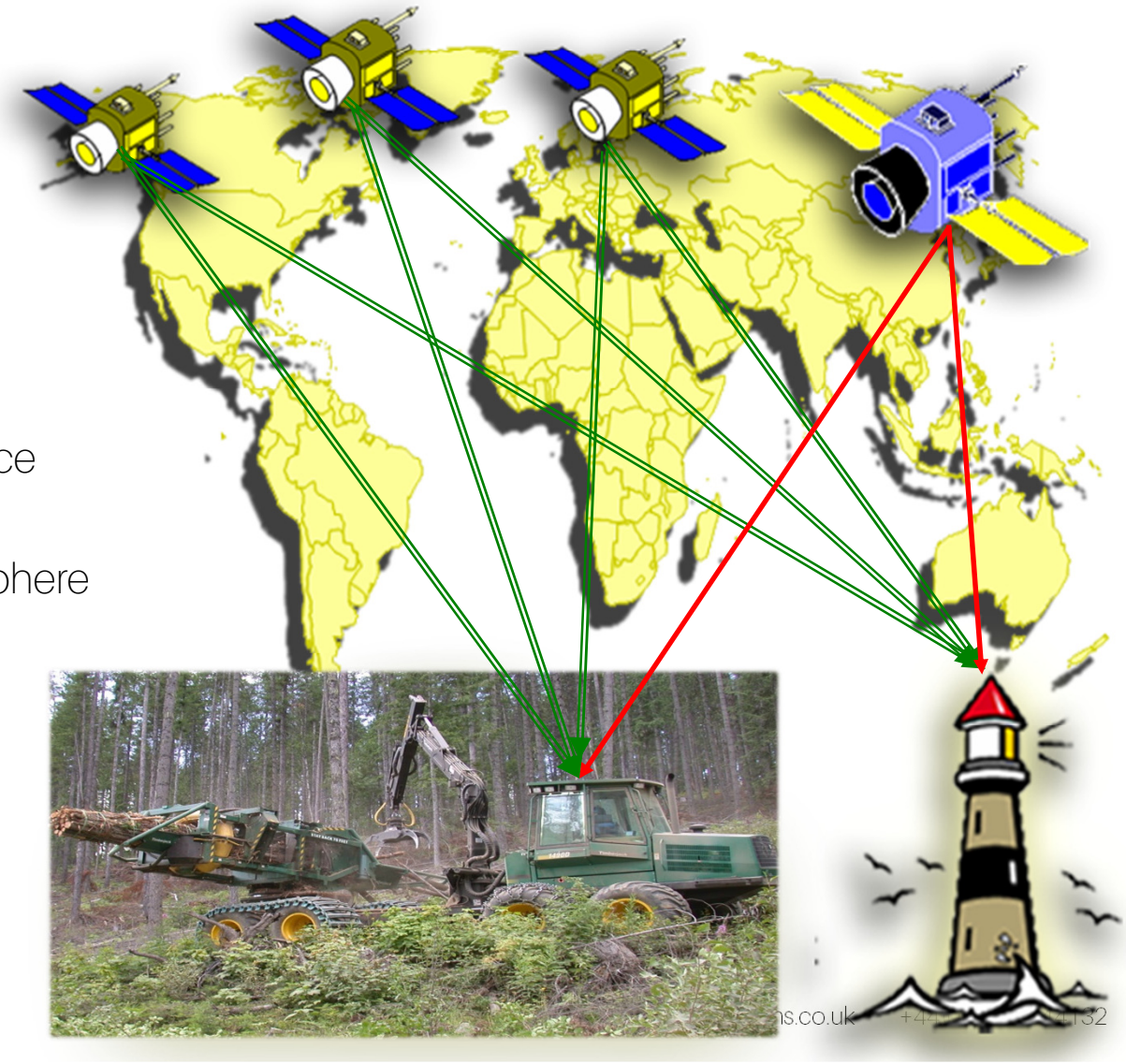
Challenges for precision forestry

- In contrast to precision agriculture applications, forestry landscapes have dense canopy cover and typically mountainous terrain
- This limits the use of technologies such as GPS or airborne remote sensing technologies
  - With GPS, scheduling data collection during "leaf-off" periods or times of strong satellite geometry can improve reception
  - With GPS, scheduling data collection during "leaf-off" periods or times of strong satellite geometry can improve reception

How GPS works

Triangulate
4 satellites + 1 checking
L1: Low power free
L2: Encrypted high power

Measure time of radio signals
Time x speed of light = distance
BUT
Speed of light varies in atmosphere
HENCE
The need for DGPS
Base Station
Geostationary satellite
Correction signal



Background to GPS/DGPS

GNSS

(Global Navigation Satellite System)

24 Satellite Constellation

GPS
GLONASS
Galileo
} G3 technology

17 Satellite Constellation

GPS

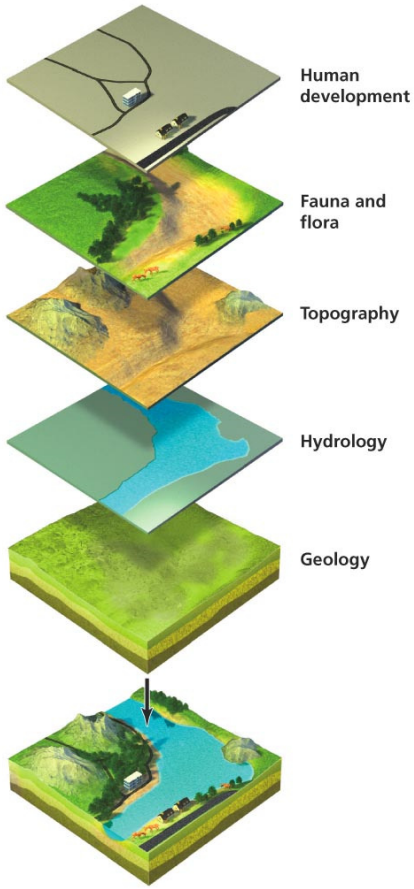
Mainly used in World currently

Planned 30 Satellite Constellation

Evolving Technology's

Mapping Assets

- Software and hardware advances
- New types of data collection techniques and devices
- New types of applications of technology
- GIS is gradually becoming a technology that is being used in most segments of society, not just natural resources



Accurate data collection

GRS-1 + PG-A1
w/ RH-1 Radio
for GGD

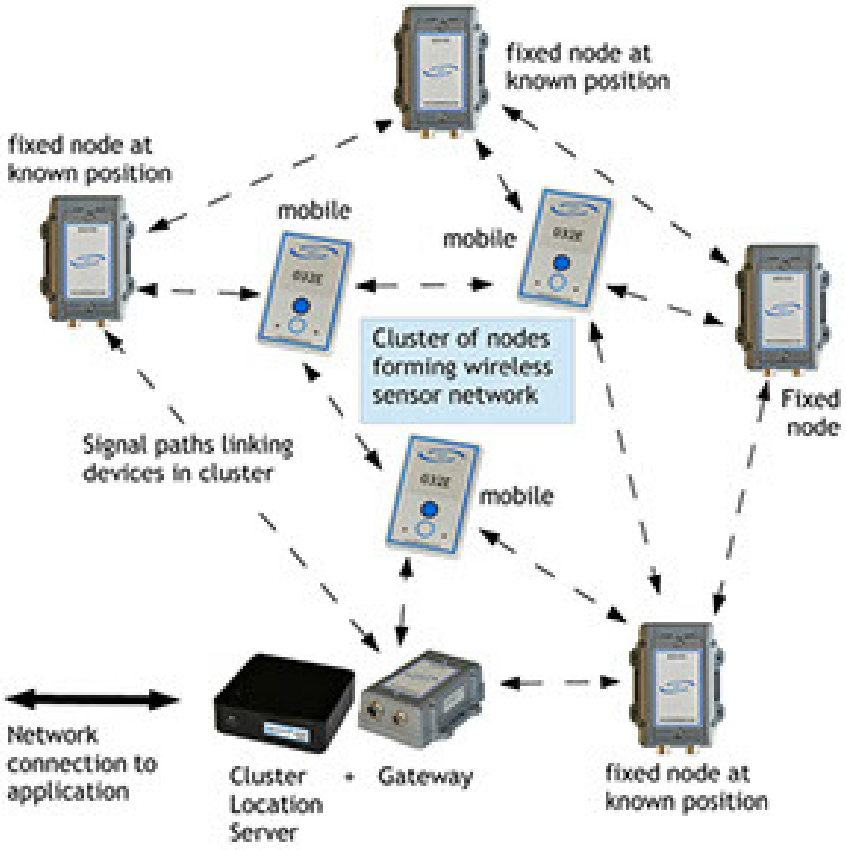
GRS-1 + PG-A1
w/ NTRIP
corrections for
GGD

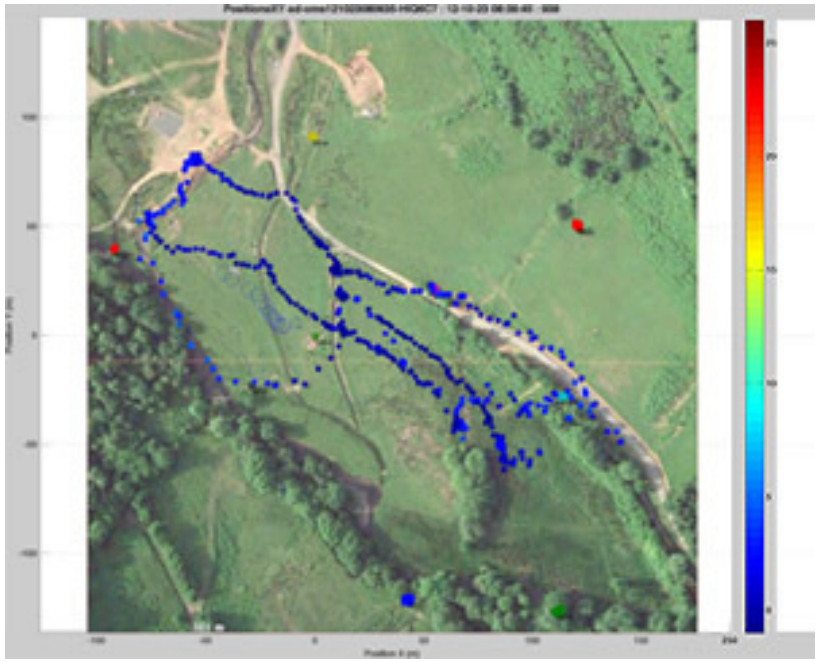
GRS-1
w/ NTRIP
corrections GG

GRS-1
w/external
Beacon receiver

GRS-1
w/ EGNOS

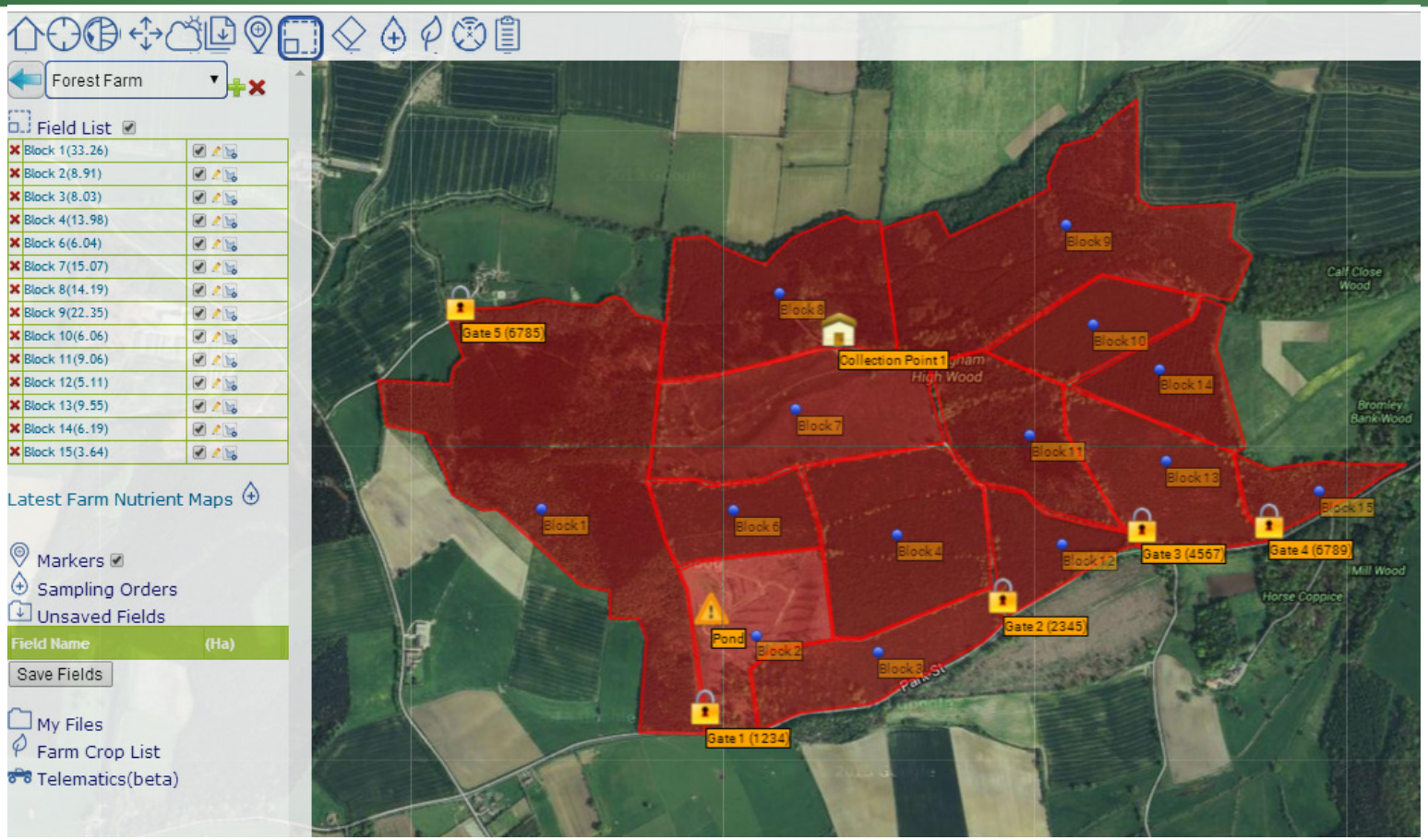
None GNSS based tracking





MiFarm Mapping Portal

Online mapping delivered Interactively



Precision Decisions

MiFarm APP

Interactive In Forest Mapping

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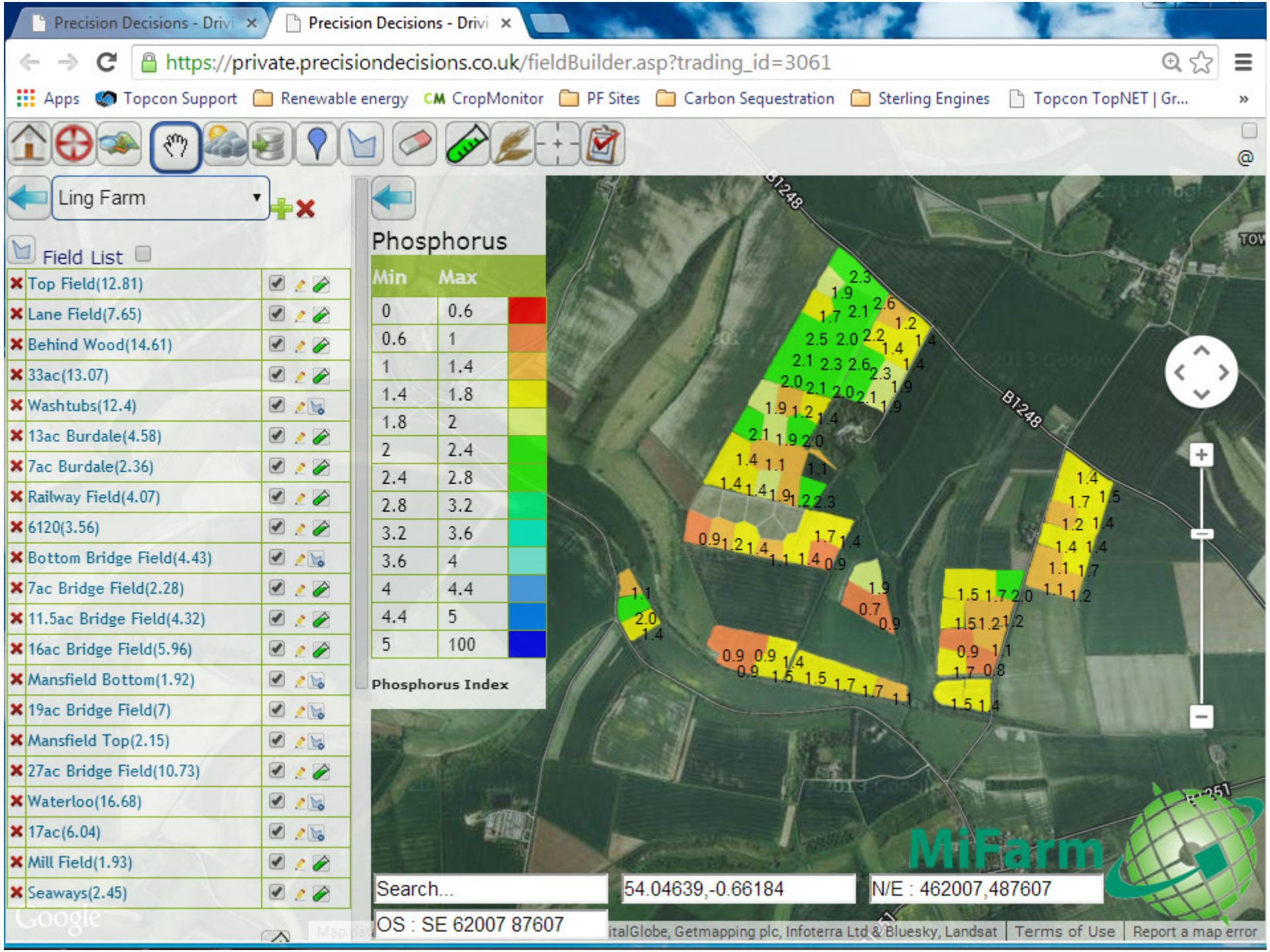

Precision Decisions - Drivi
Precision Decisions - Drivi
https://private.precisiondecisions.co.uk/fieldBuilder.asp?trading_id=3061
Apps
Topcon Support
Renewable energy
CropMonitor
PF Sites
Carbon Sequestration
Sterling Engines
Topcon TopNET | Gr...
Ling Farm
Field List
Top Field(12.81)
Lane Field(7.65)
Behind Wood(14.61)
33ac(13.07)
Washtubs(12.4)
13ac Burdale(4.58)
7ac Burdale(2.36)
Railway Field(4.07)
6120(3.56)
Bottom Bridge Field(4.43)
7ac Bridge Field(2.28)
11.5ac Bridge Field(4.32)
16ac Bridge Field(5.96)
Mansfield Bottom(1.92)
19ac Bridge Field(7)
Mansfield Top(2.15)
27ac Bridge Field(10.73)
Waterloo(16.68)
17ac(6.04)
Mill Field(1.93)
Seaways(2.45)
Phosphorus
Min Max
0 0.6
0.6 1
1 1.4
1.4 1.8
1.8 2
2 2.4
2.4 2.8
2.8 3.2
3.2 3.6
3.6 4
4 4.4
4.4 5
5 100
Phosphorus Index
B1248
B1248
Search...
54.04639,-0.66184
N/E : 462007,487607
OS : SE 62007 87607
MiFarm
Terms of Use
Report a map error

Precision forestry applications

- Using electronic distance measuring tools to capture precise spatial positions of forest landscape features
- Capturing precise and timely satellite imagery to assist in monitoring threats to forest health (fire, disease, floods)
- Developing precise, fine-scale DEMs to identify steep forested areas that may be susceptible to landslide activity

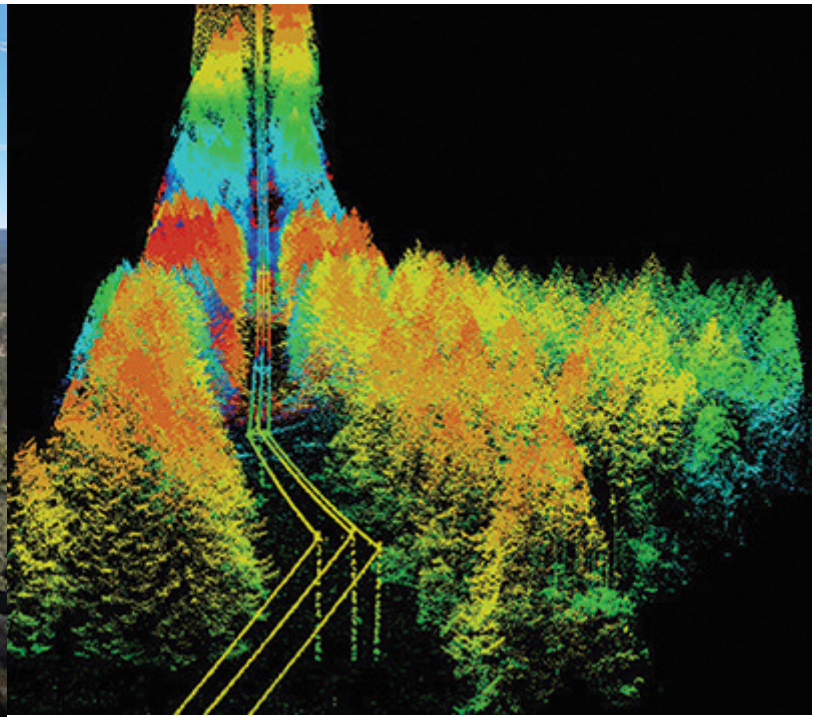
Accurate measurement and reporting

TOPCON

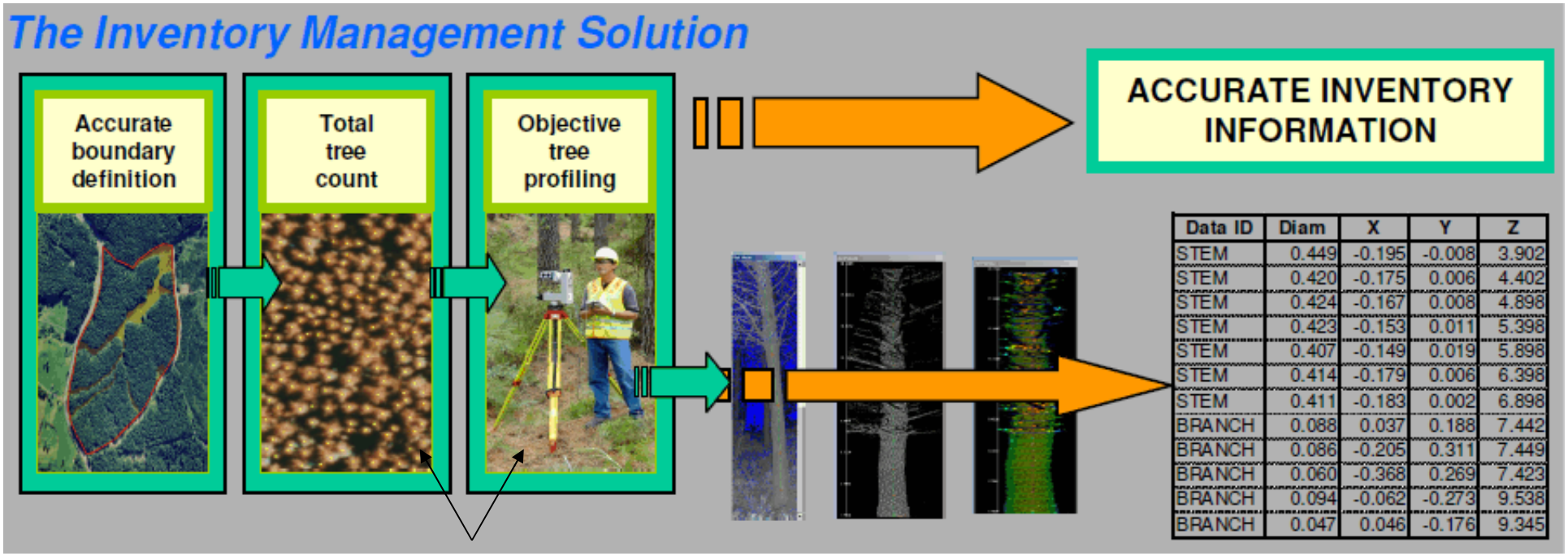
Info " (1)"

Name: (1)
Length: 473 m
Remark:
Date: 2011-07-05
UTC: 18:33:15
S/N: 596-05006
Project: TP360B

New Mapping tools



Ground-based mapping with 3-D laser scanning (New Zealand and Ireland)



Data ID	Diam	X	Y	Z
STEM	0.449	-0.195	-0.008	3.902
STEM	0.420	-0.175	0.006	4.402
STEM	0.424	-0.167	0.008	4.898
STEM	0.423	-0.153	0.011	5.398
STEM	0.407	-0.149	0.019	5.898
STEM	0.414	-0.179	0.006	6.398
STEM	0.411	-0.183	0.002	6.898
BRANCH	0.088	0.037	0.188	7.442
BRANCH	0.086	-0.205	0.311	7.449
BRANCH	0.060	-0.368	0.269	7.423
BRANCH	0.094	-0.062	-0.273	9.538
BRANCH	0.047	0.046	-0.176	9.345

The link between these two operations is not widely divulged

Precision Decisions

Ground-based mapping with 3-D laser scanning

FARO® Laser Scanner Focus^{3D}

Intuitive touchscreen display

Control all scanner functions with a touch interface for unparalleled ease of use and control

Stand-alone solution

Ultraportable design allows for operation without external devices

Small and compact

With a size of only 9.5 x 8 x 4 in. and a weight of just 11lbs., the Focus^{3D} is the smallest 3D scanner ever built

Integrated color camera

Photorealistic 3D color scans due to an integrated color camera featuring an automatic 70 megapixels parallax-free color overlay

High-performance battery

Integrated lithium-ion battery provides up to five hours of battery life and can be charged during operation

Data management

All data is stored on a SD card enabling easy and secure transfer to a PC. Using SCENE WebShare images can be shared on the internet

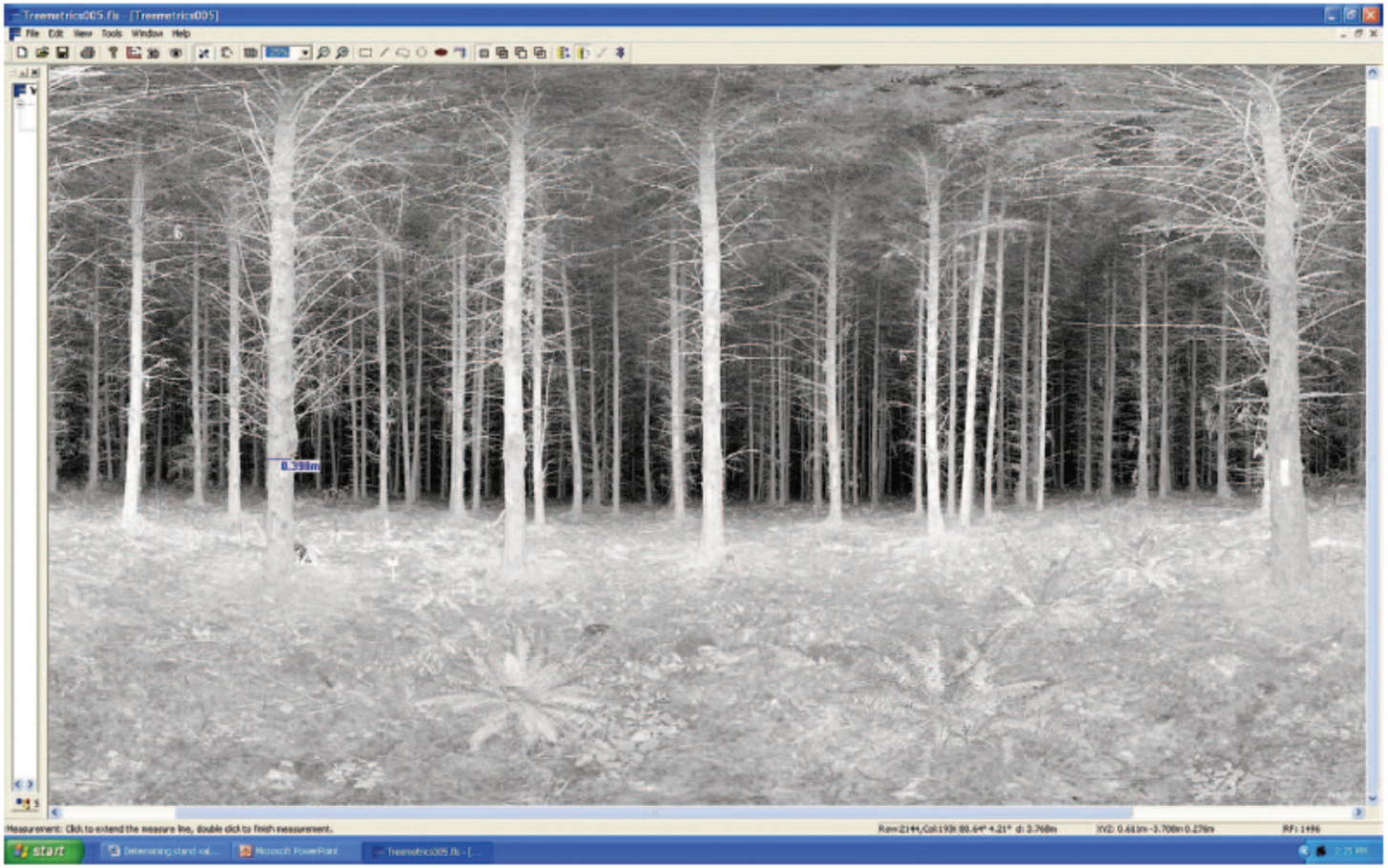
FARO Focus^{3D}: Small, light, user-friendly

The Focus^{3D} is a high-speed 3D scanner for detailed measurement and documentation. The Focus^{3D} uses laser technology to produce incredibly detailed three-dimensional images of complex environments and geometries in only a few minutes. The Focus^{3D} has a touch operated screen to control scanning functions and parameters. The resulting image is an assembly of millions of 3D measurement points in color which provides an exact digital reproduction of existing conditions.

Benefits

- **Complete 3D documentation**: Suitable for documentation of large environments, quality control of components and reverse engineering
- **Precise & fast:** Its millimeter-accuracy and its 976,000 measurement points/sec mean precise and efficient measurement

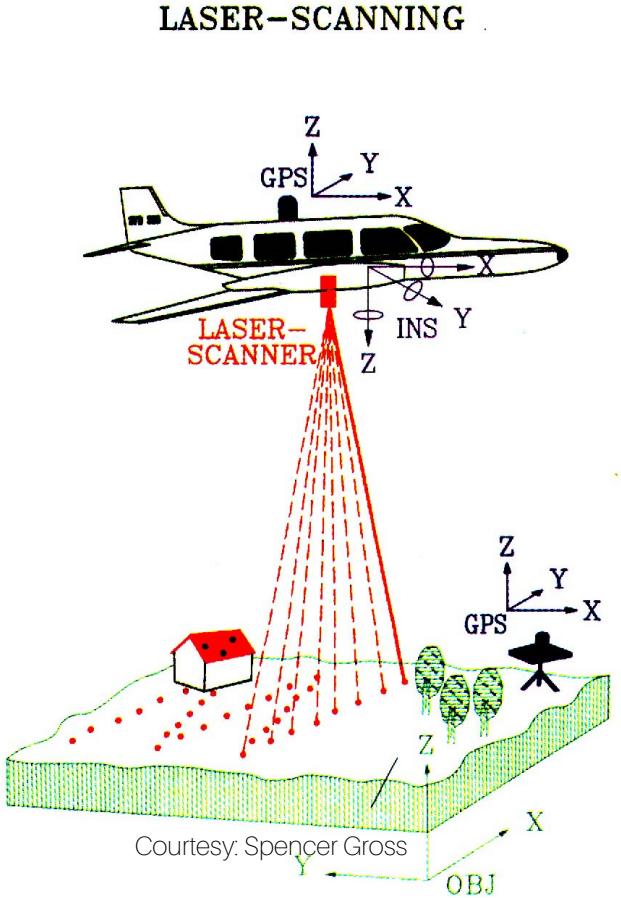
Murphy (2008) reports that hidden trees and false positive trees equal ≈ 12% from a single point



Scanners cost $40,000 and can complete a 360° sweep in 80 sec.

LIDAR (Light Detection And Ranging)

- Active airborne sensor emits several thousand infrared laser pulses per second
- Operates on principle that if *location* and *orientation* of laser scanner is known, we can calculate a range measurement for each recorded echo from a laser pulse
- Components of system include INS (inertial navigation system), airborne differential GPS, and laser scanner
- Range measurements are post-processed and delivered as XYZ coordinates

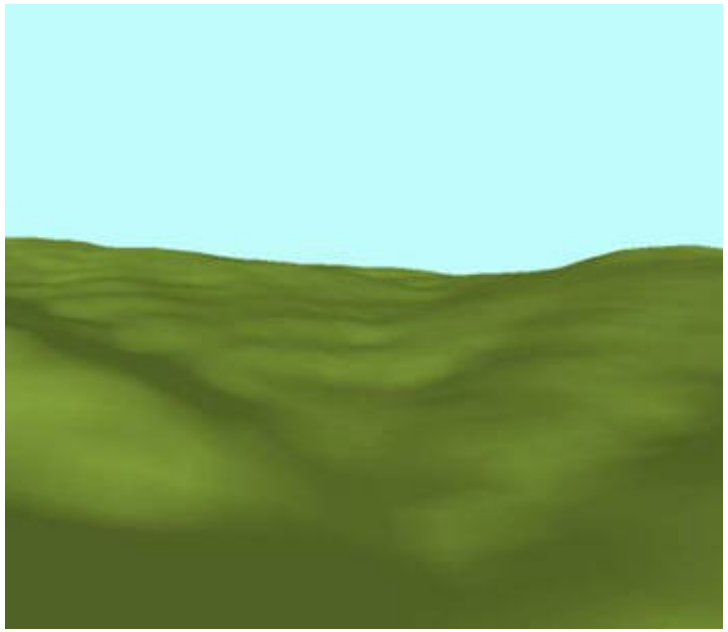


Courtesy: Spencer Gross

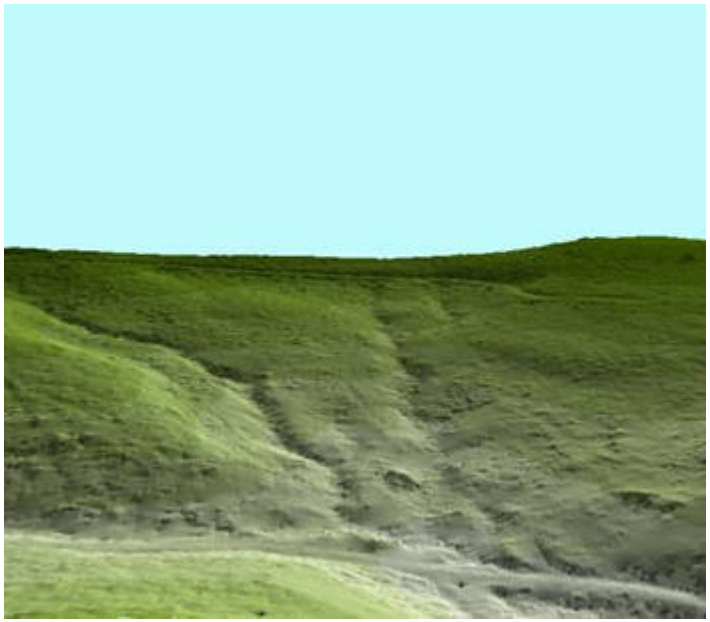
LIDAR for topographic mapping

- Laser pulses can penetrate forest canopy through gaps
- Some laser pulses reach forest floor, other returns reflect from canopy and sub-canopy vegetation
- Allows for detailed modeling of terrain surface

USGS DTM

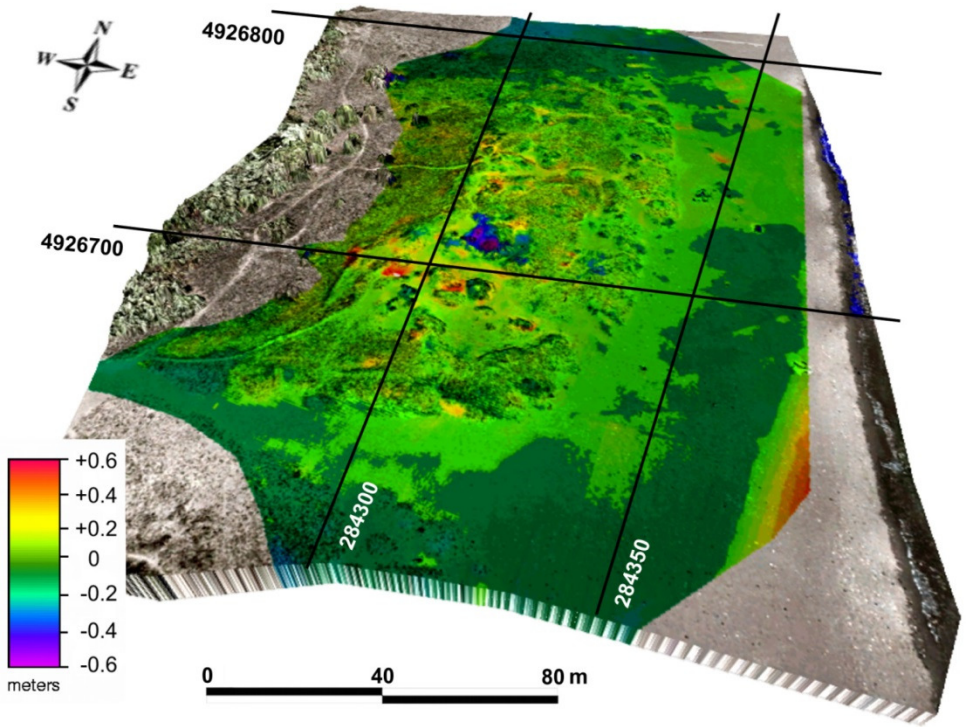


LIDAR DTM



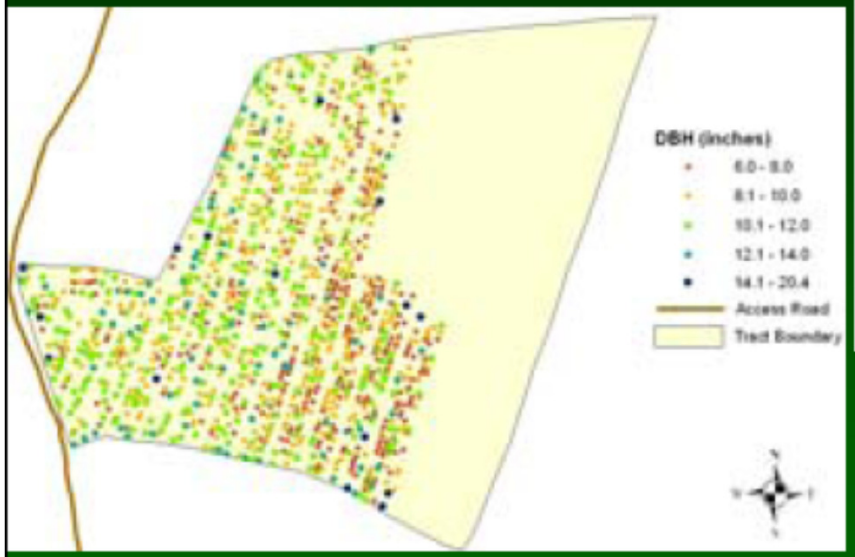
UAV (Drone) Digital Mapping

- Don't discount the UAV
- Reduced costs
- Faster data collection – 50 times faster than conventional
- Improved safety – survey hazardous areas more accurately and safer
- Increase accuracy of data
- High Resolution images – improved decision making



Value map based on sensor measurements mounted on a tree feller

Merchantable Timber Assessment



Variable	
AVG DBH	9.4 inches
Range of DBH	6.0 - 20.4 inches
AVG Height	58.2 ft
Basal Area	146 ft²/ac
Stand Density	291 trees/ac

Additional data:

- Harvest rate
- Machine audit
- Electronic file of harvest

Options

- Fire Prevention and monitoring
- Biomass estimation
- Control of invasive species
- Avoid loos of open space
- Monitor unmanaged regeneration

Precision Decisions

Commercial GPS-based mapping of site preparation

Precision Decisions

Forest structure analysis using remotely sensed data

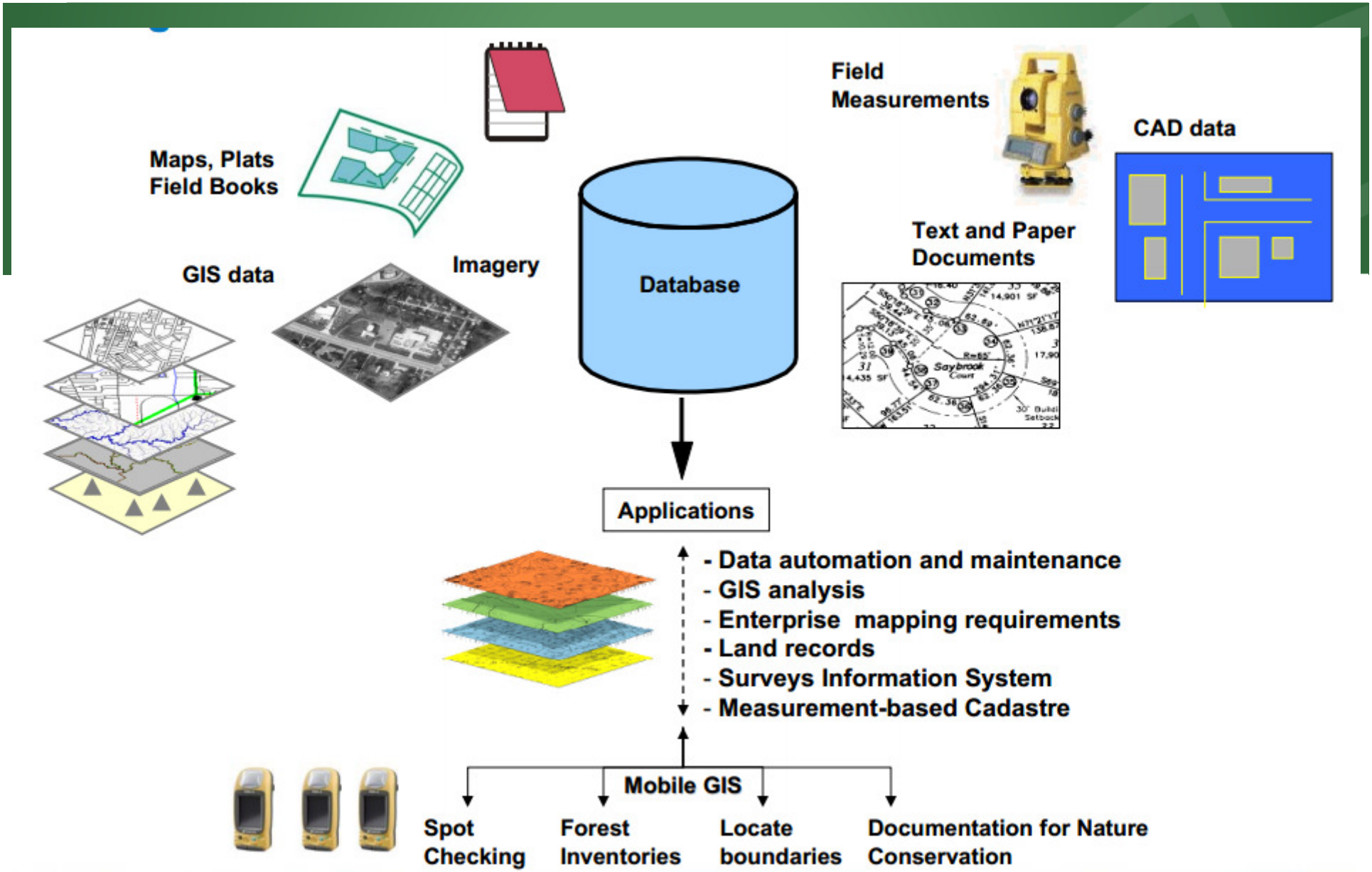
Three-dimensional forest structure information is required to support a variety of resource management activities

- Timber inventory and management
- Habitat monitoring
- Watershed management
- Fire behavior modeling
- Forest operations

Telematics

Automated Inventory traceability

Transport and Conversion



Questions?

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