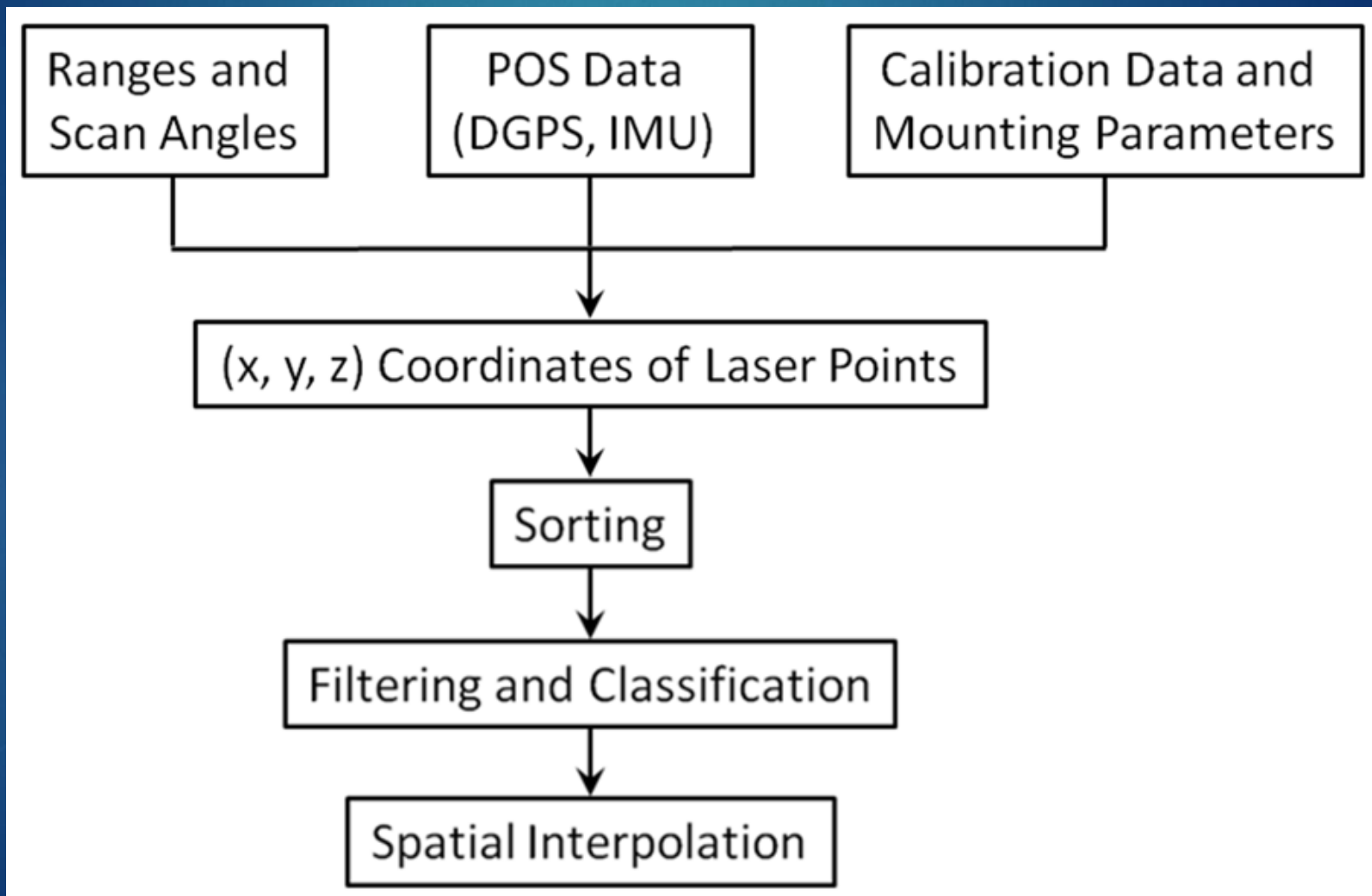




Vegetation Mapping and Measurement Using LiDAR (2)

- 
- 4.1 Introduction
 - 4.2 Canopy Surface Height Modeling and Mapping
 - 4.3 LiDAR Metrics for Vegetation Analysis
 - 4.4 Individual Tree Isolation and Mapping
 - 4.5 Area-based Modeling and Mapping
 - 4.6 Modeling, Mapping, and Estimating Biomass

LiDAR Data Processing (Review)





Diqing china



Deqen

迪庆藏族自治州

Yunnan

China



Cloudy · 44°F
6:21 AM



Directions



SAVE



NEARBY



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Google, ORION-ME, SK telecom, ZENRIN, United States, Terms, Send feedback









Article

Estimating Individual Tree Height and Diameter at Breast Height (DBH) from Terrestrial Laser Scanning (TLS) Data at Plot Level

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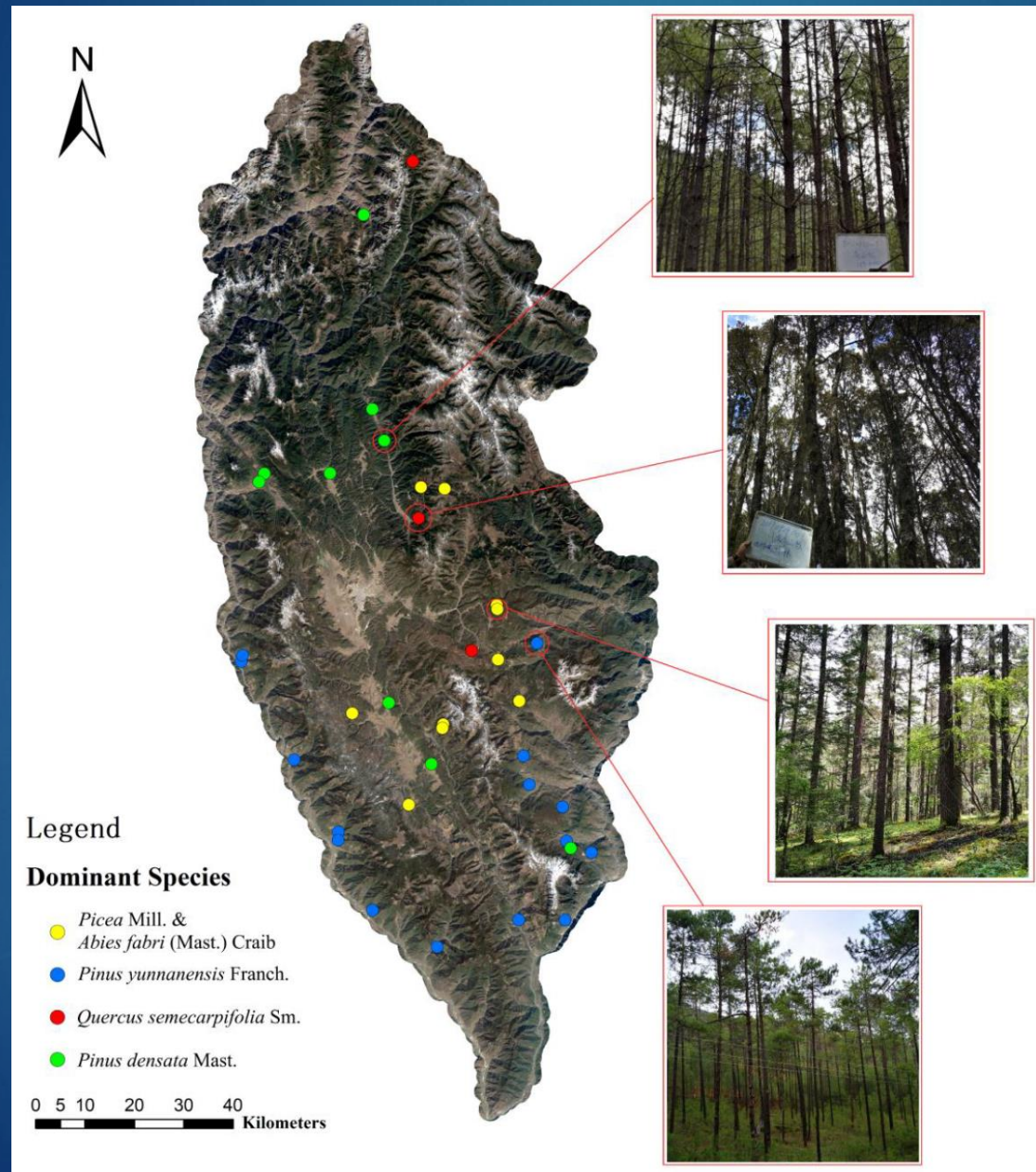
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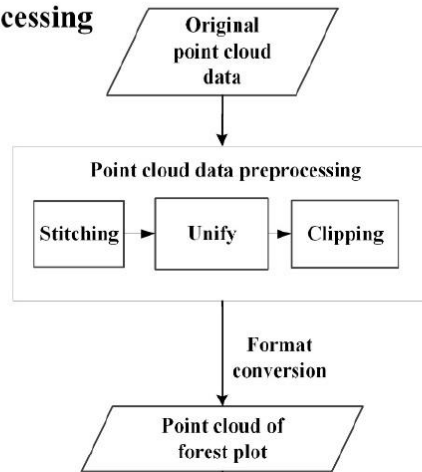
check for
updates

Sample plots in Shangri-La, Yunnan, China

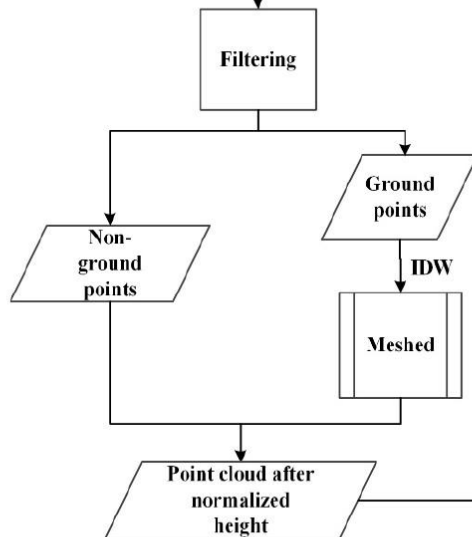


Methodology Flowchart

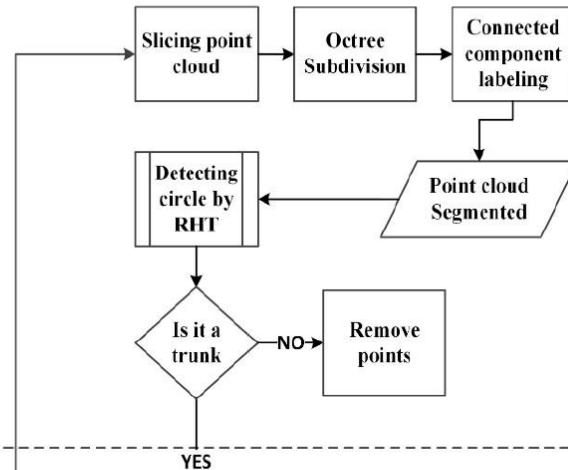
(a) Preprocessing



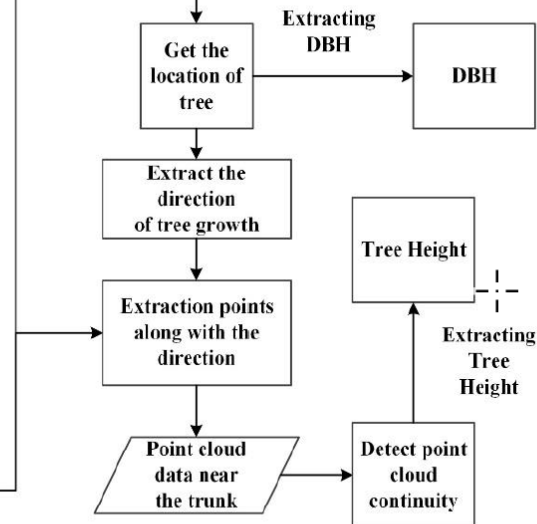
(b) Normalization height



(c) Segmentation and trunk recognition



(d) Extraction of DBH and Tree height



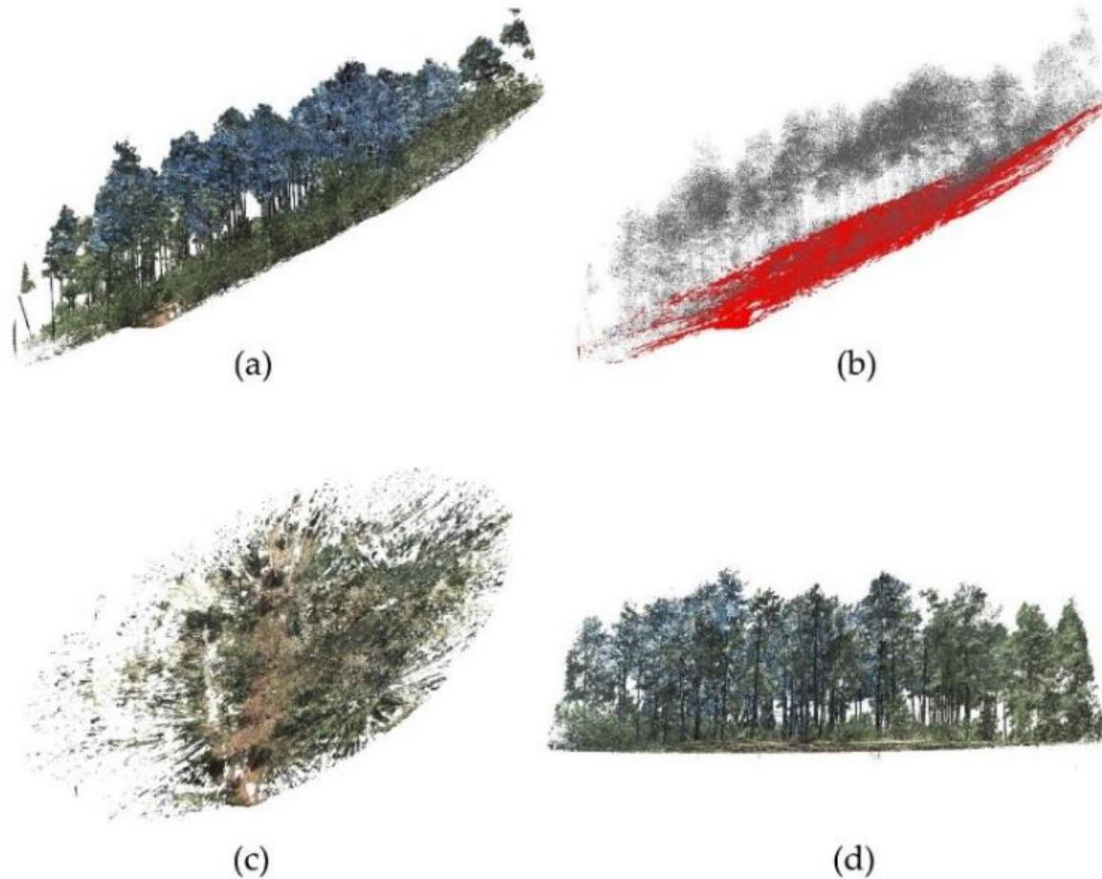


Figure 4. Normalization of point cloud height. (a) Original point cloud data acquired using TLS; (b) Filtering results with ground points in red and non-ground points in gray; (c) Ground points with RGB color; (d) Points with normalized height.

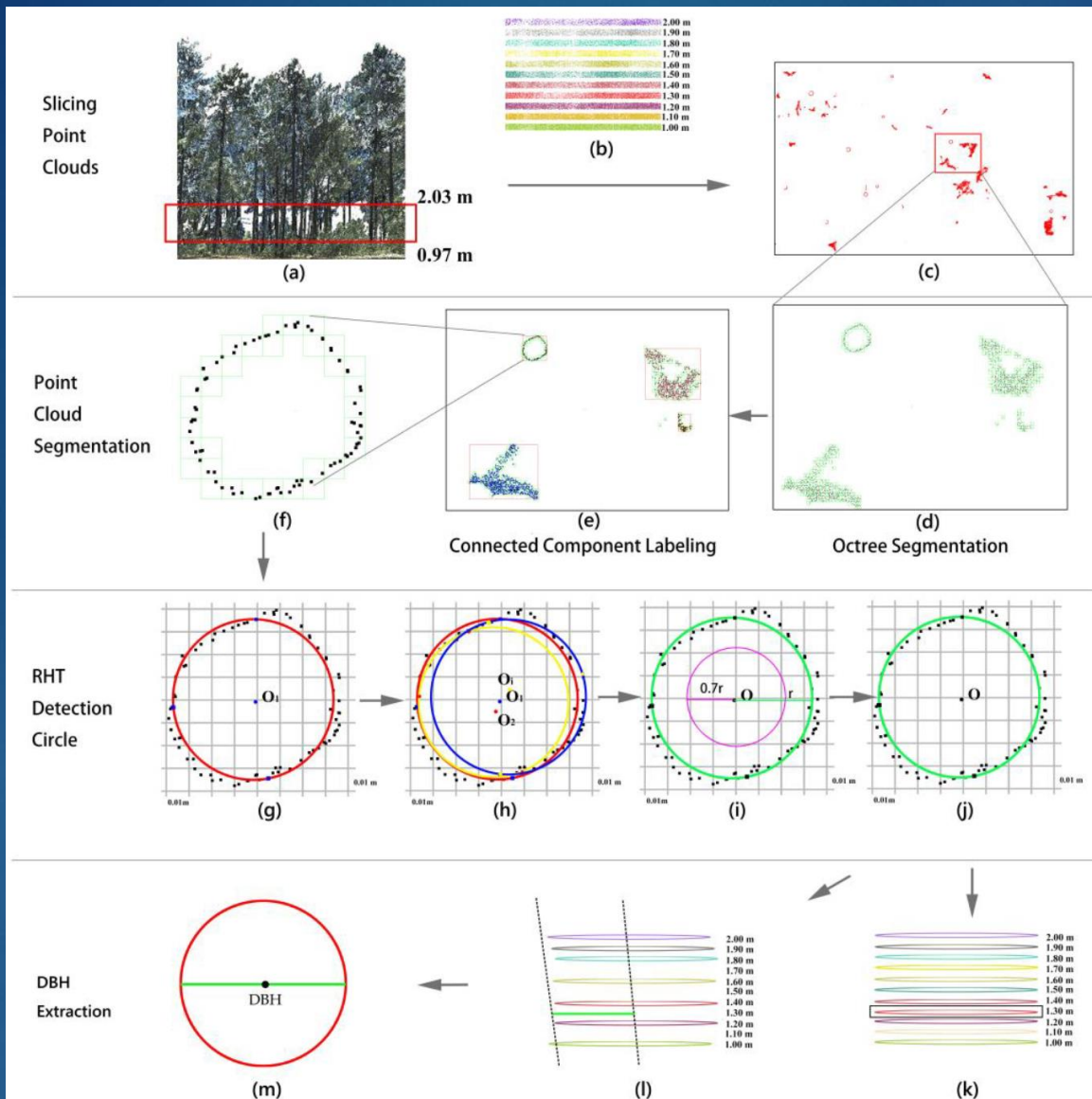
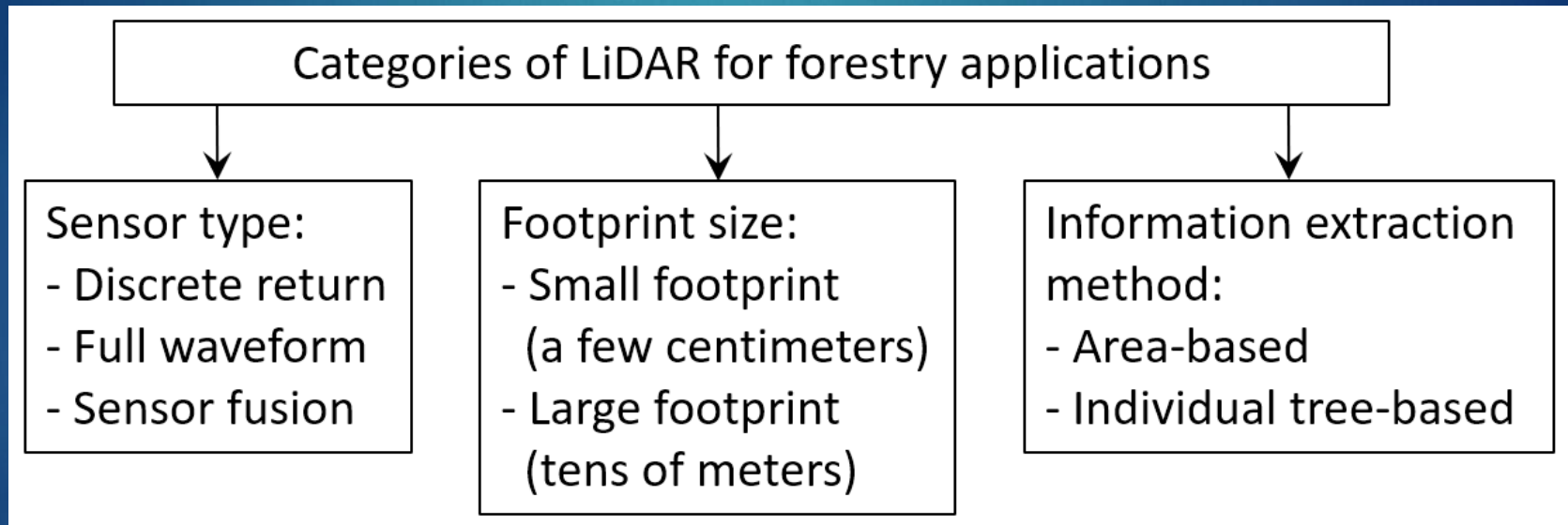


Figure 6. The detailed process of extracting DBH using random Hough transform. After extracting and slicing point cloud data from normalized data, each layer of point cloud is processed separately. Methods of octree segmentation and connected component labeling are used to segment each layer's points. Finally, RHT method is used to extract the trunk and obtain the DBH.

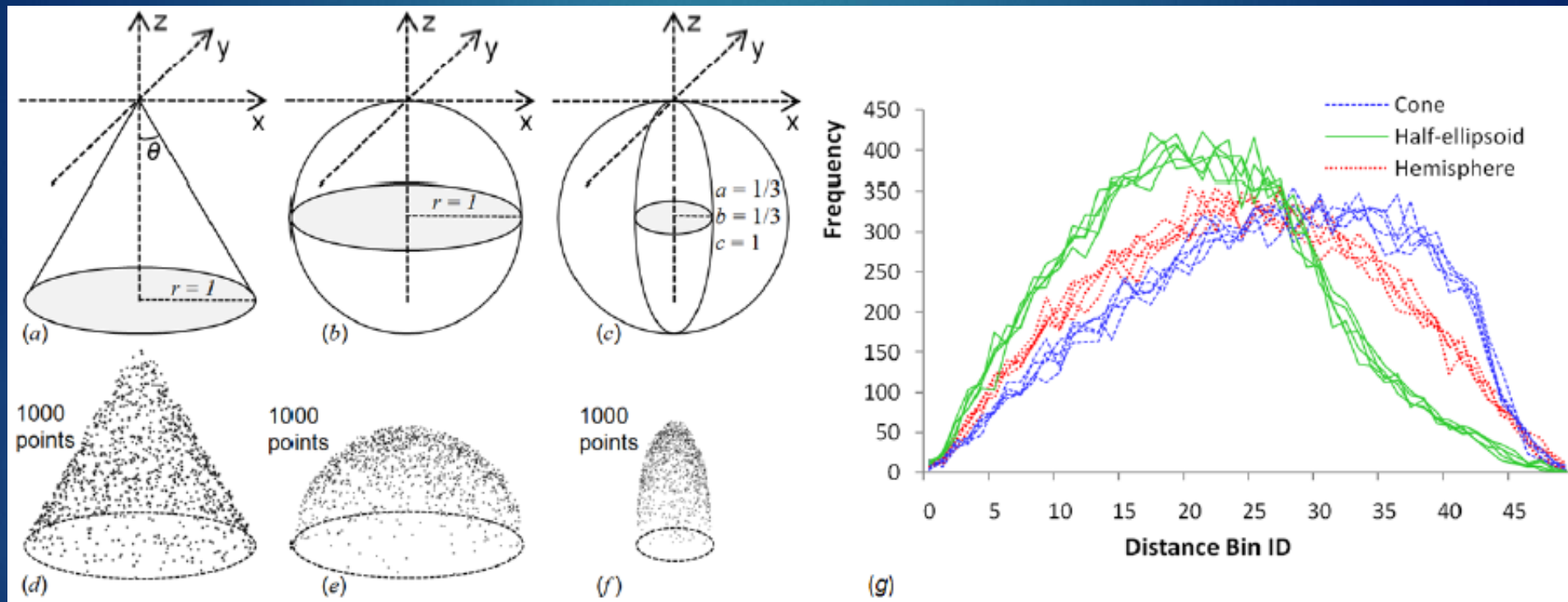


Figure 9. Morphological characteristics of dominant forest tree species in Shangri-La. (a) *Pinus yunnanensis*; (b) *Pinus densata*; (c) *Picea & Abies fabri*; (d) *Quercus semecarpifolia*.

Categories of LiDAR for Forestry Applications

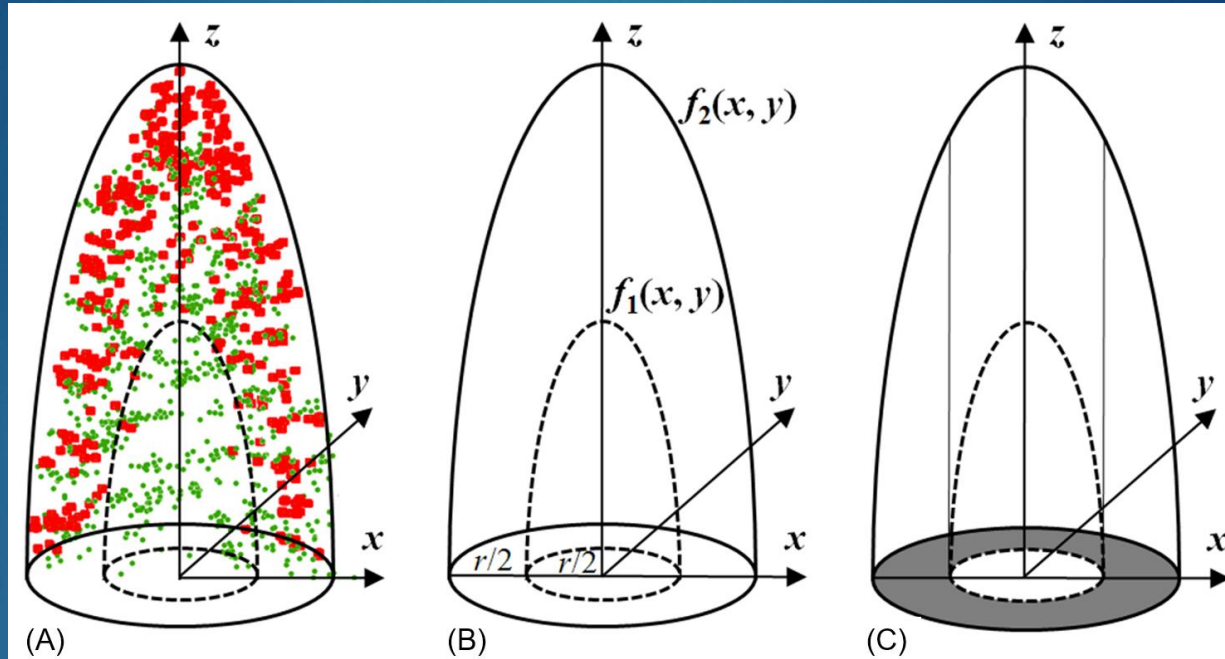


How does a machine recognize different 3D shapes?



(Dong 2010a)

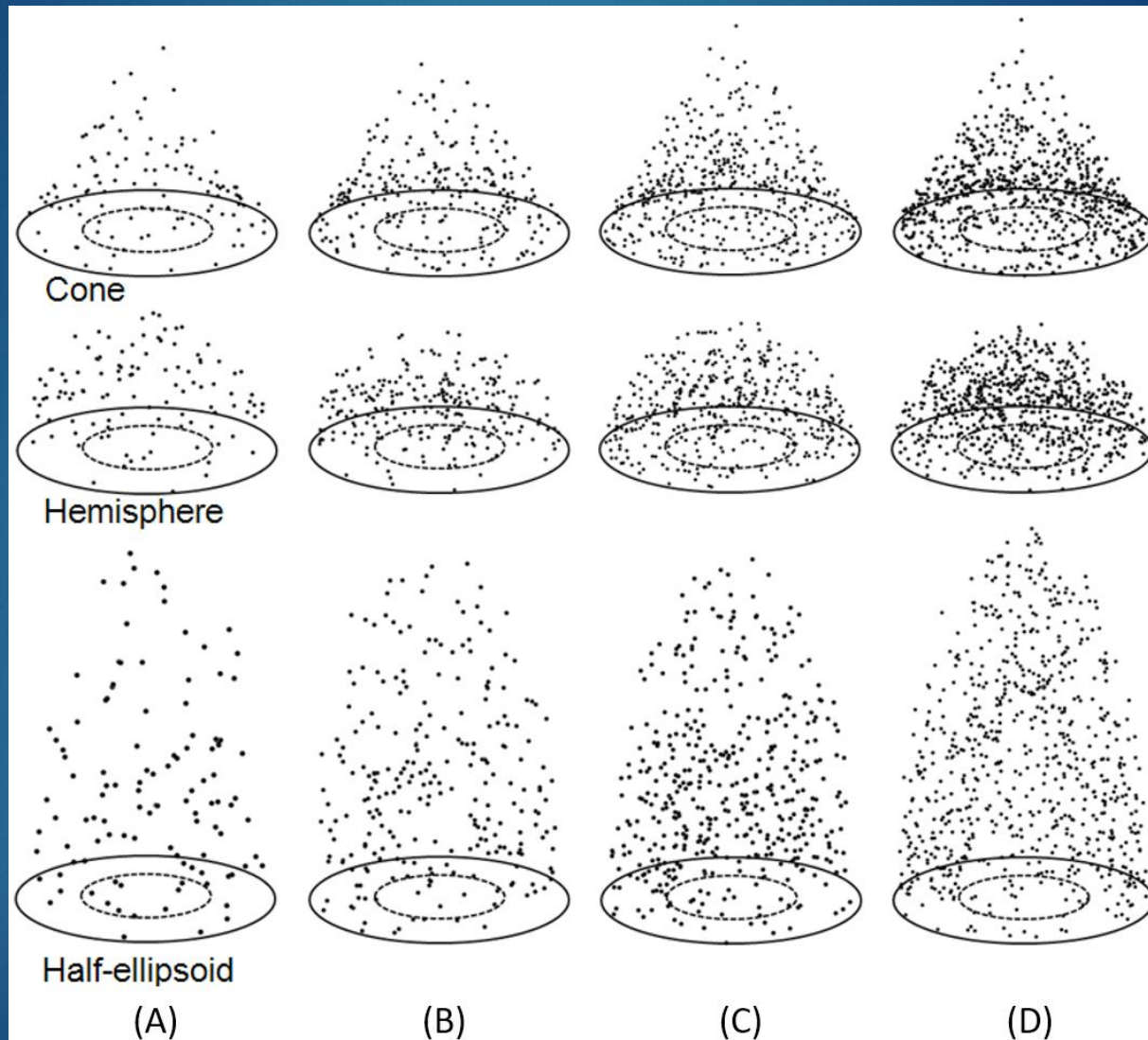
Simulation of tree crown LiDAR point clouds (Dong 2010b)



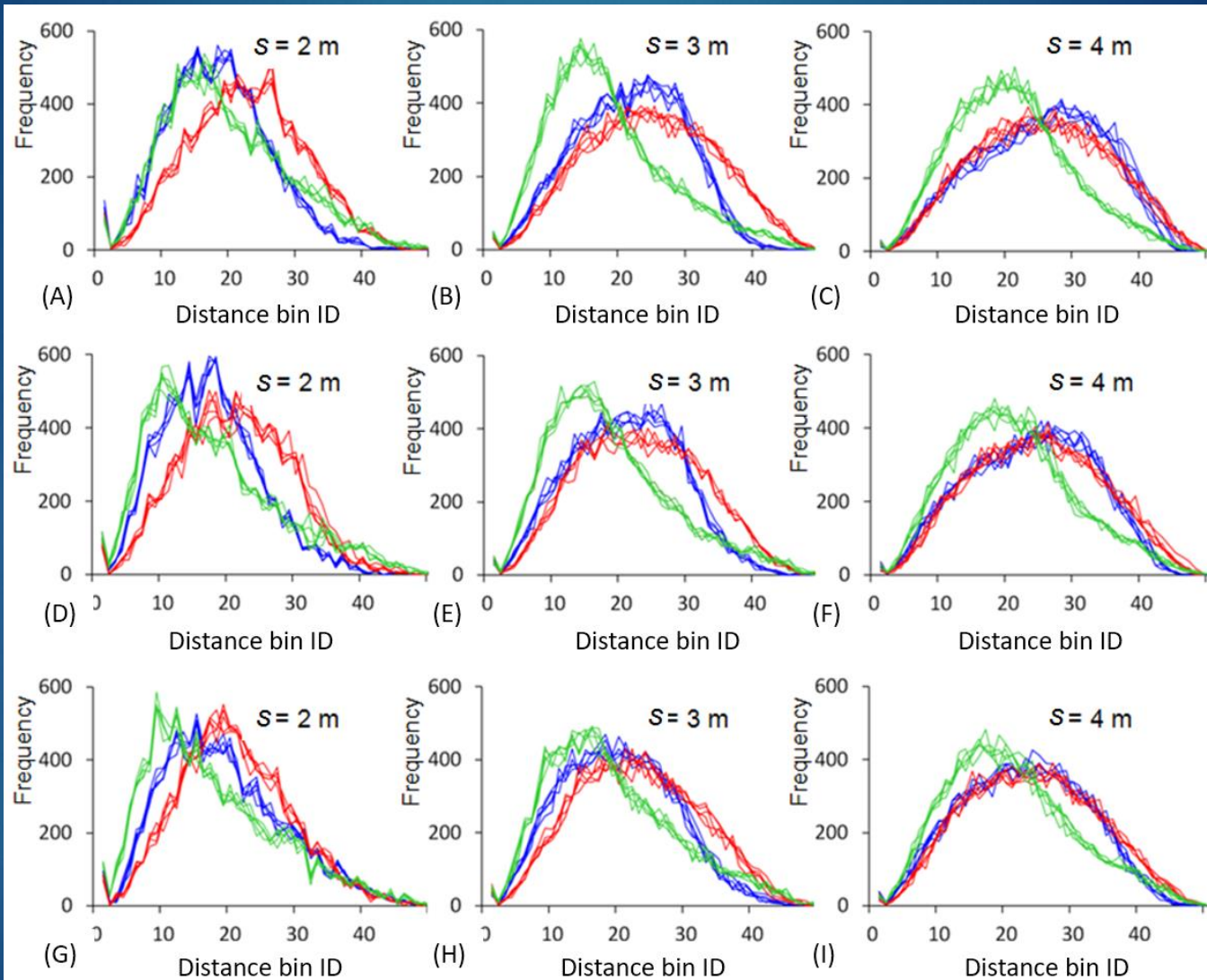
$$z(x, y) = f_2(x, y)t \quad \left(\left(\frac{r}{2} \right)^2 \leq x^2 + y^2 \leq r^2 \right) \quad (1)$$

$$z(x, y) = f_1(x, y) + (f_2(x, y) - f_1(x, y))t \quad \left(x^2 + y^2 < \left(\frac{r}{2} \right)^2 \right) \quad (2)$$

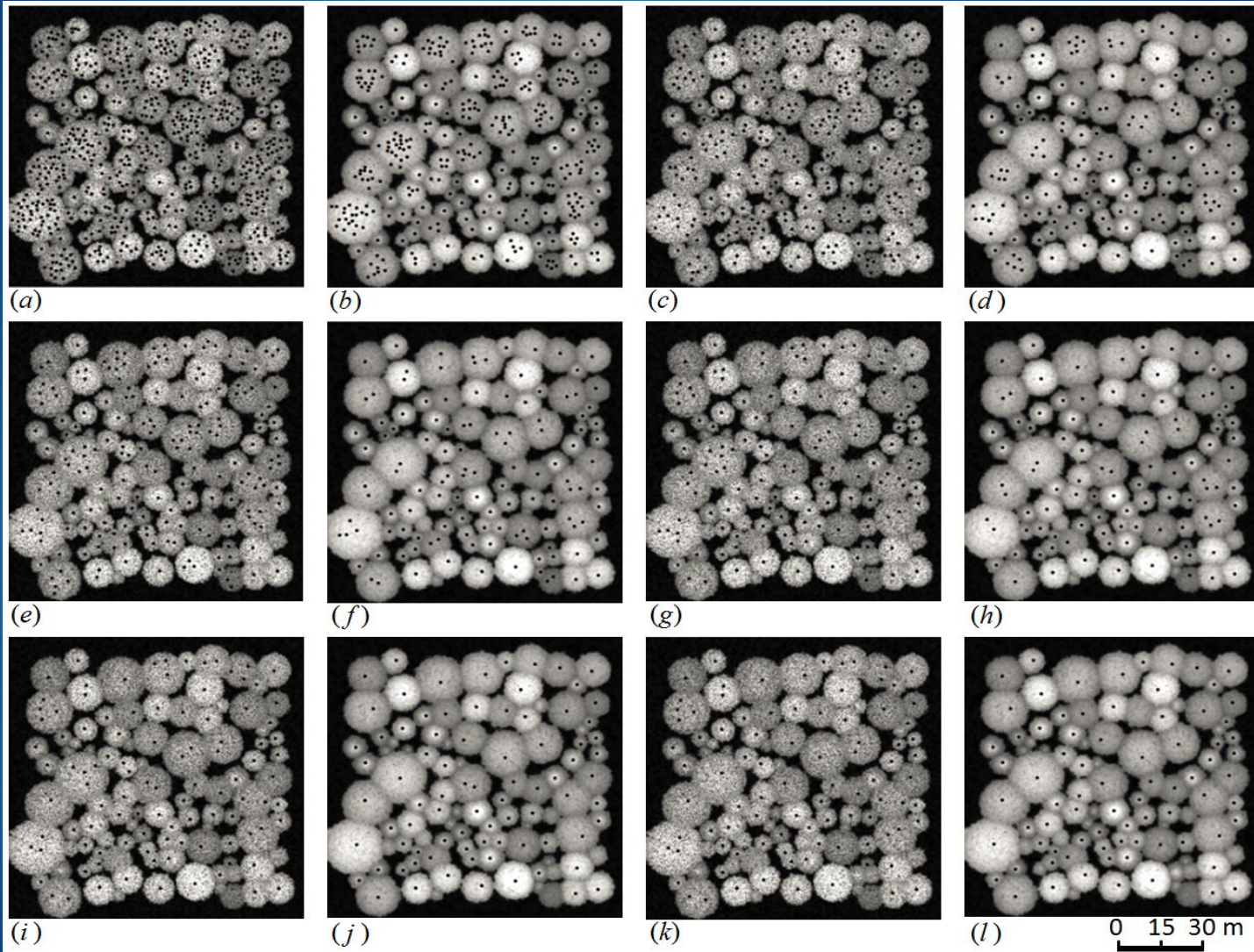
Simulated Tree Crowns



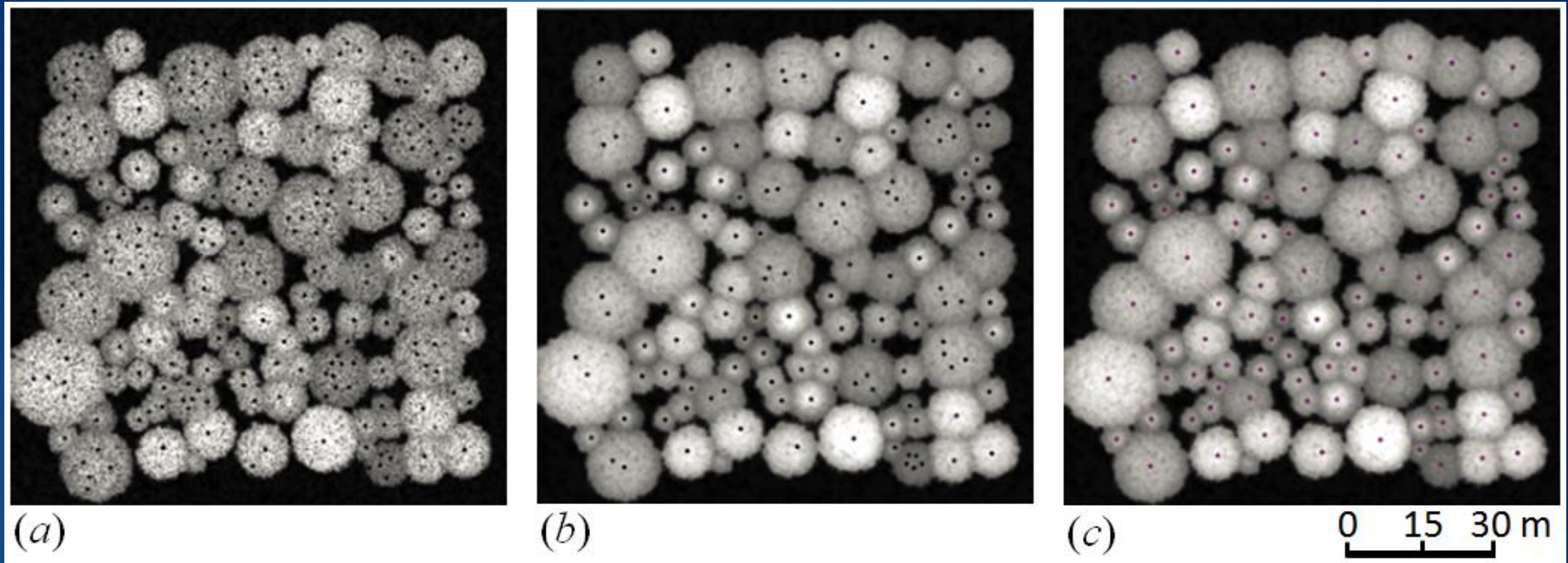
3D Signatures of Tree Crowns



Automated treetop detection using 100 simulated tree crowns

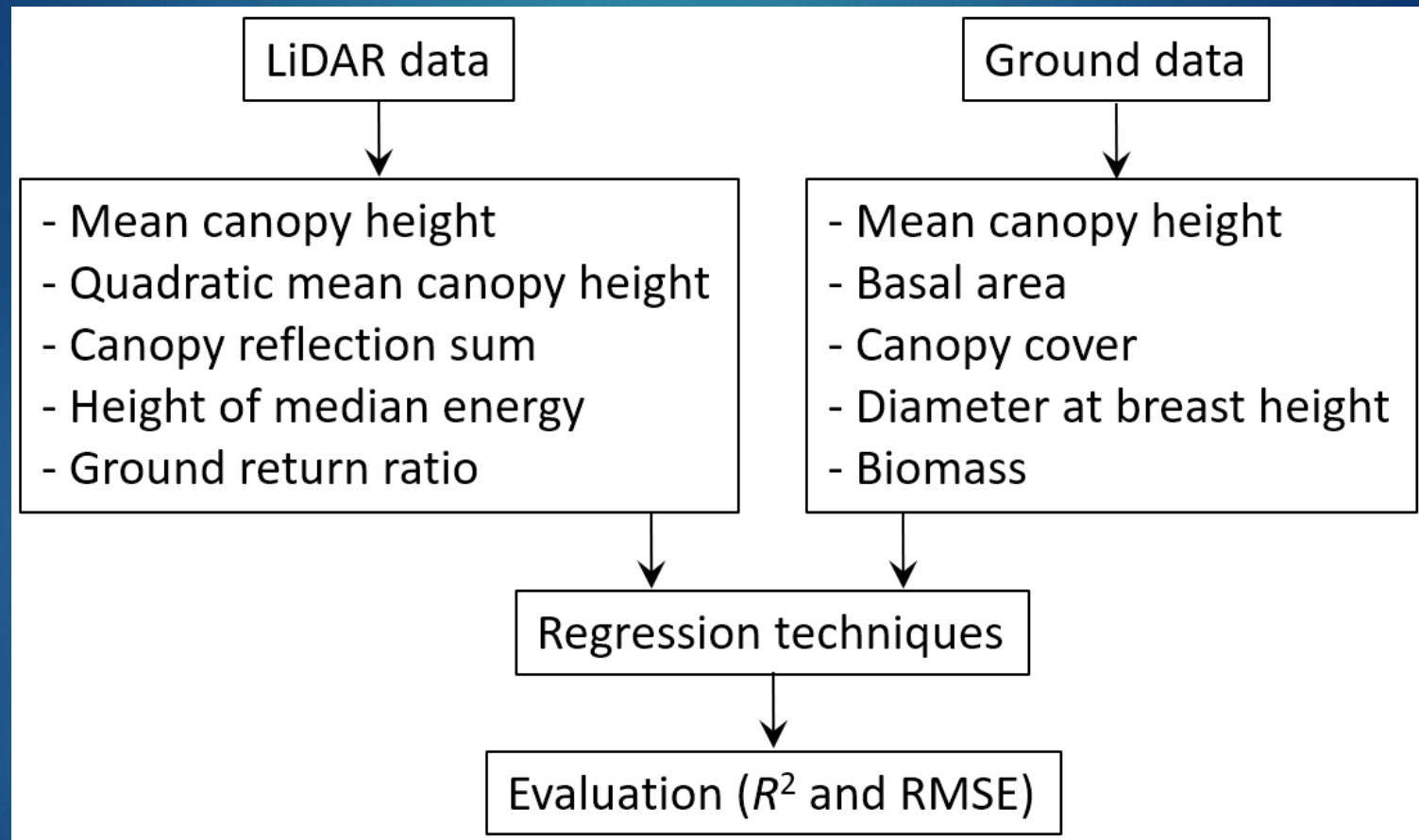


Automated treetop detection using 100 simulated tree crowns

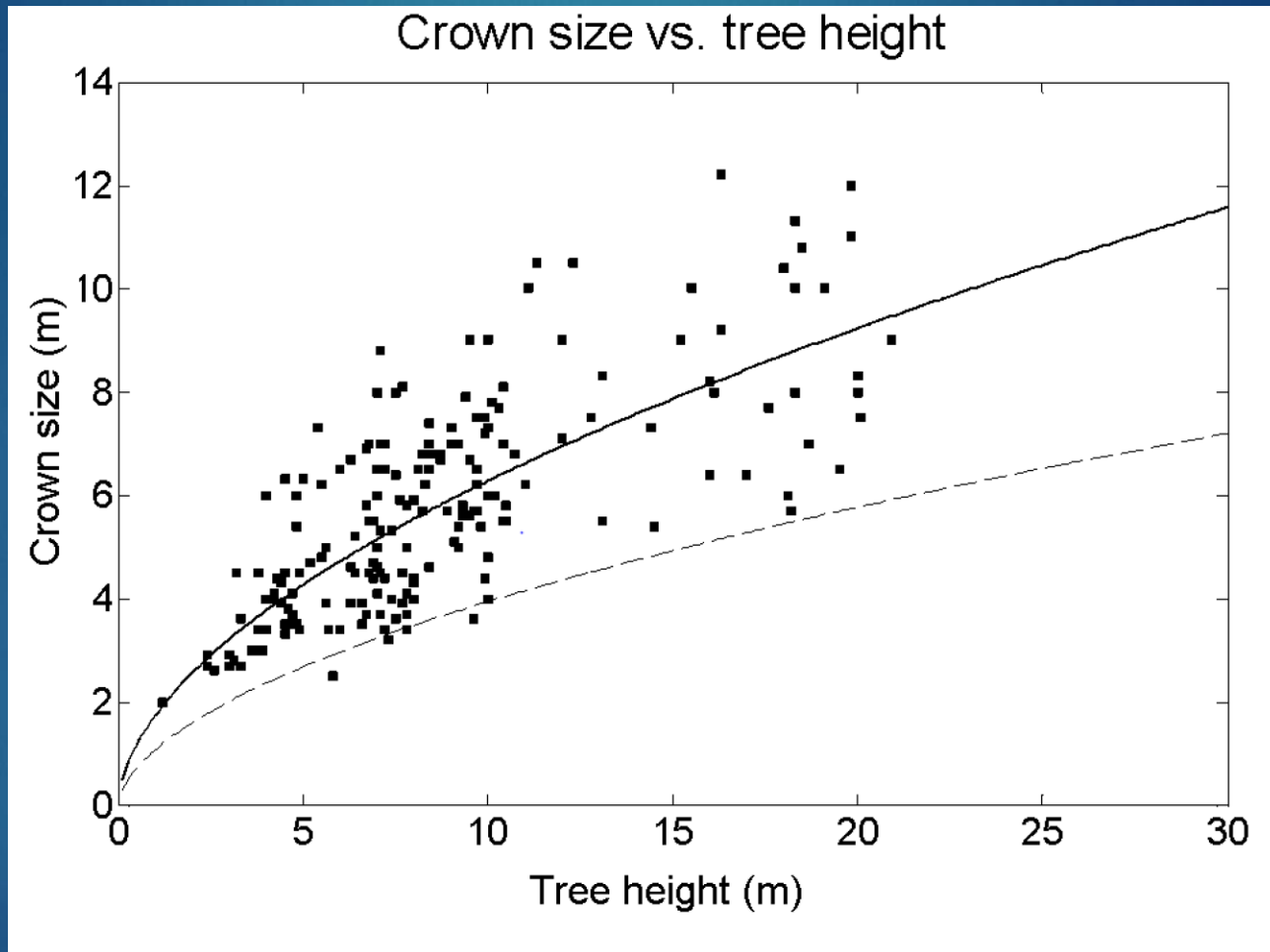


Treetops (black points) detected using variable window method and new method. (a) Results obtained from IDW raster using variable windows, (b) results obtained from SAS raster using variable windows, and (c) results obtained from SAS raster using new method.

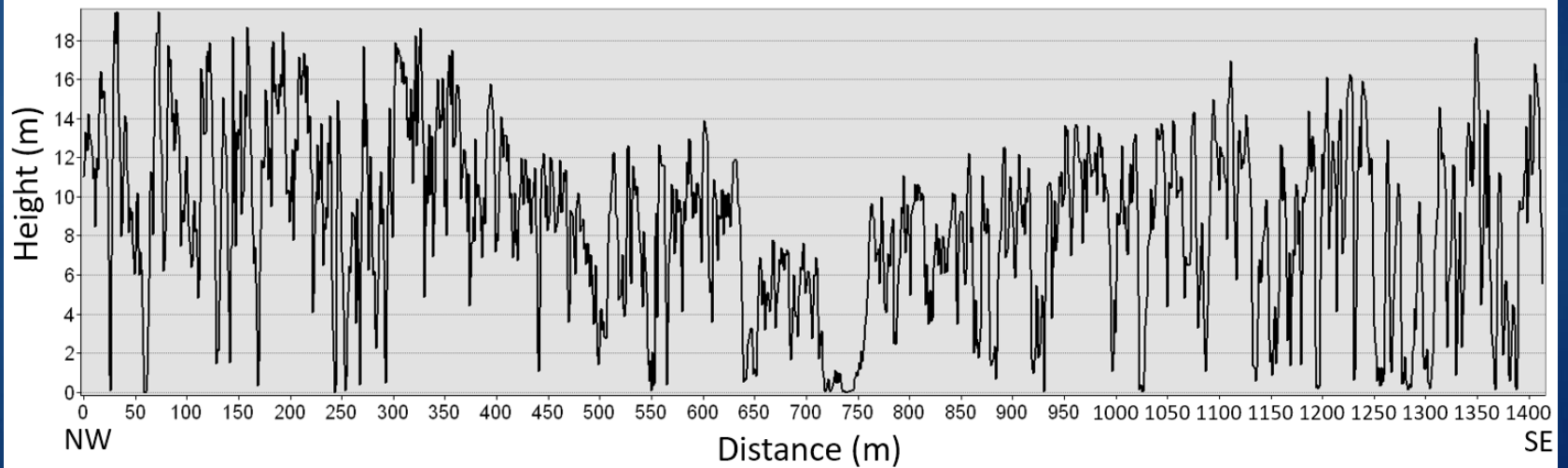
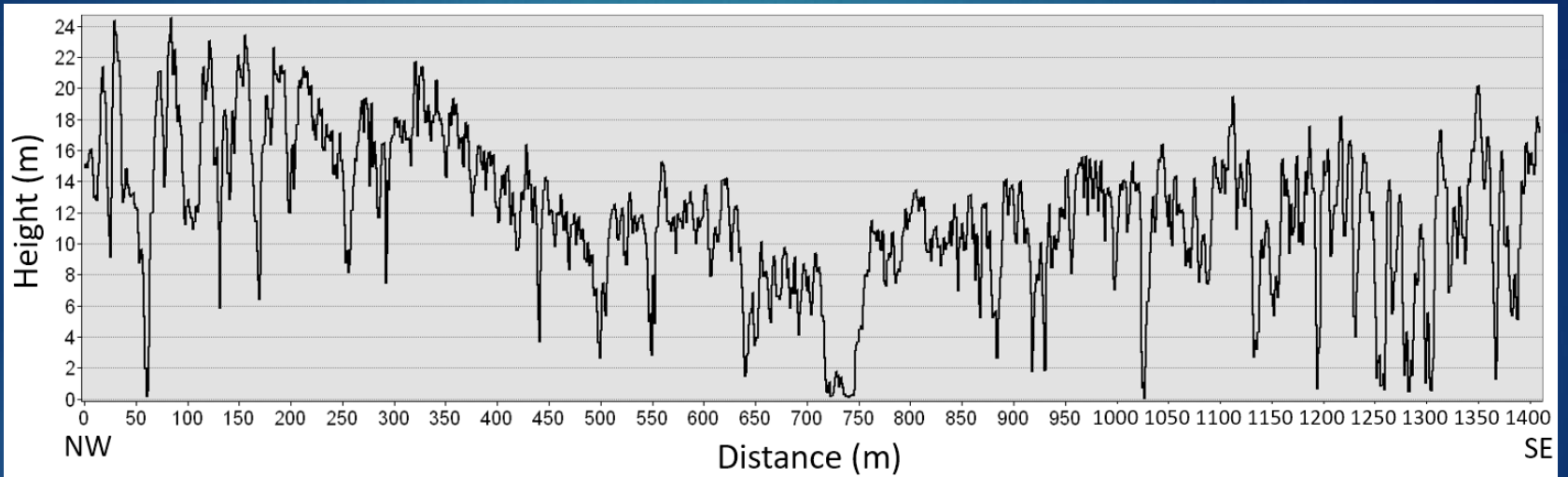
Area-based Information Extraction



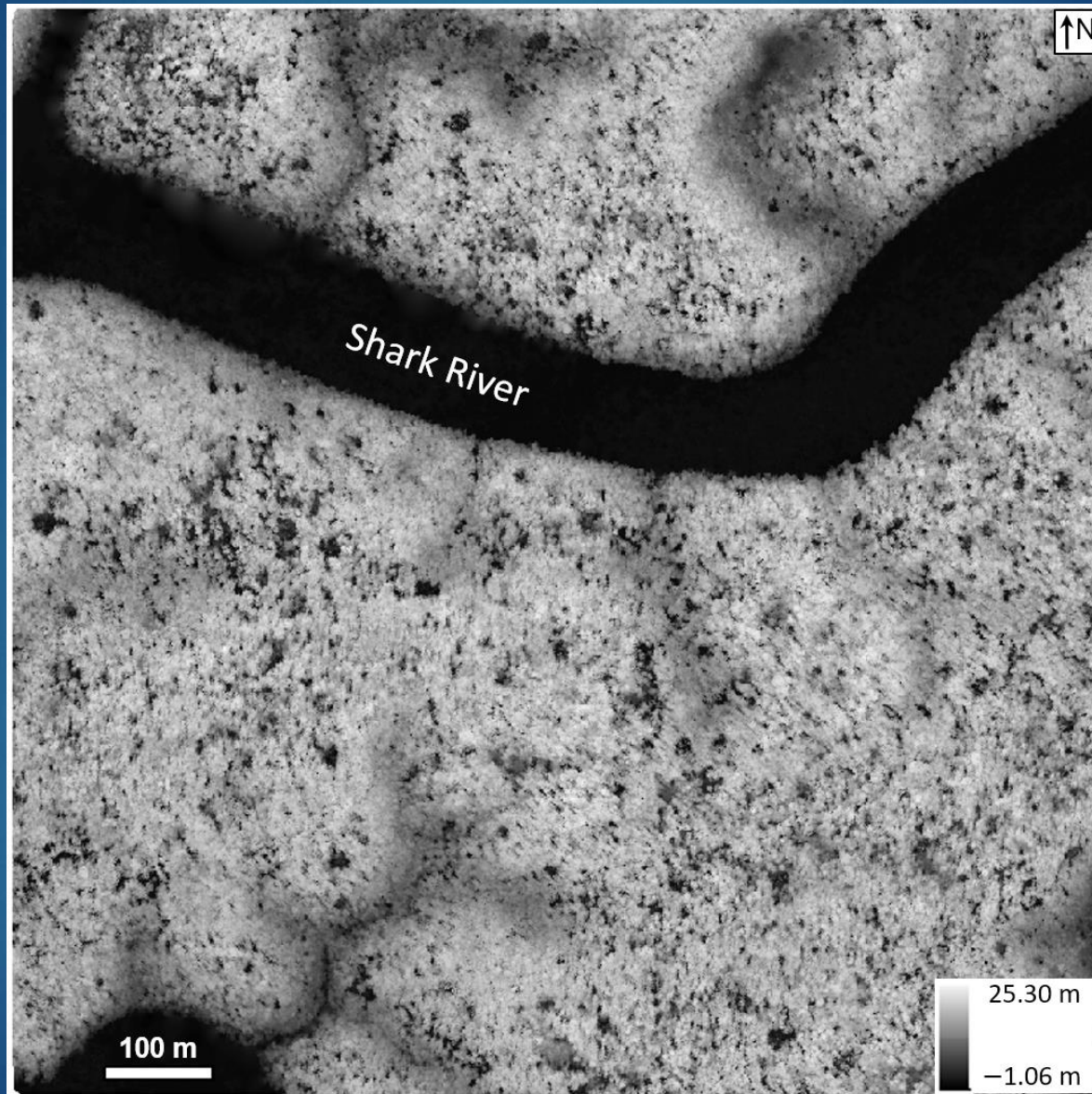
Crown size vs. Tree height



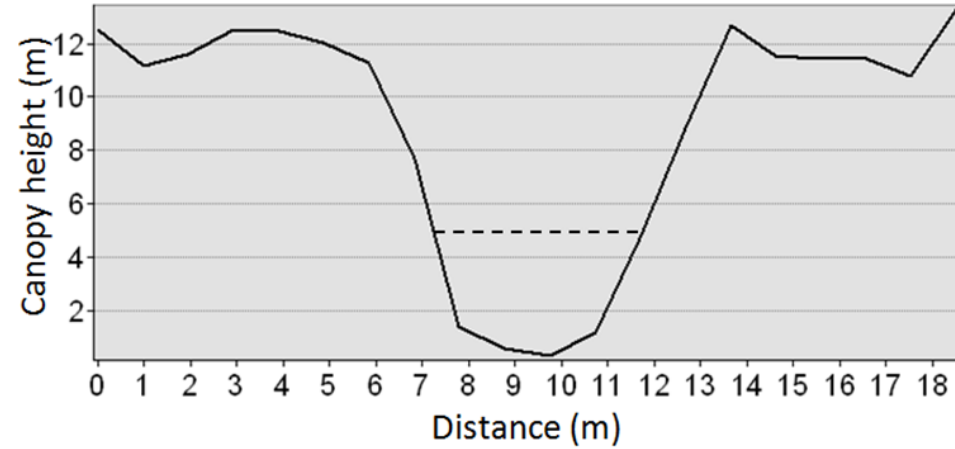
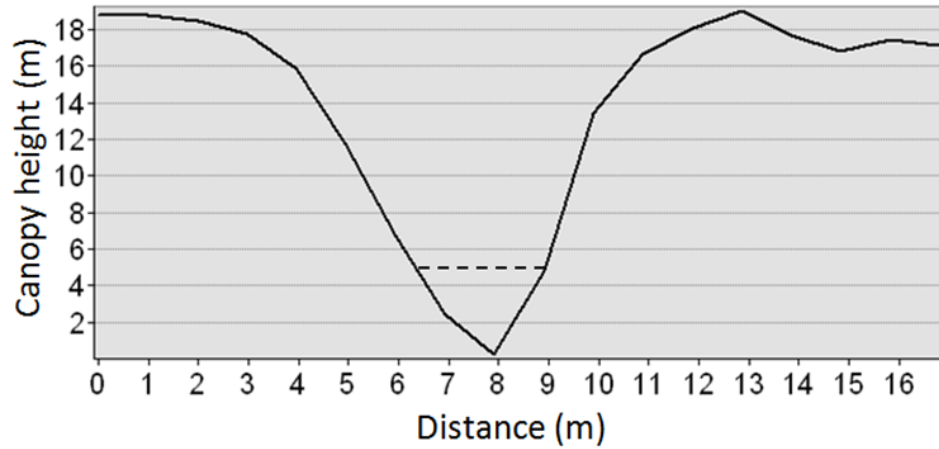
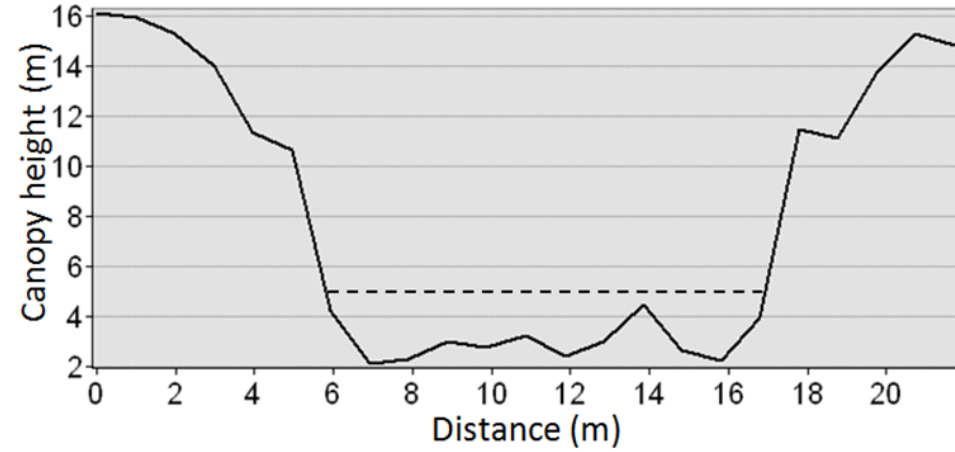
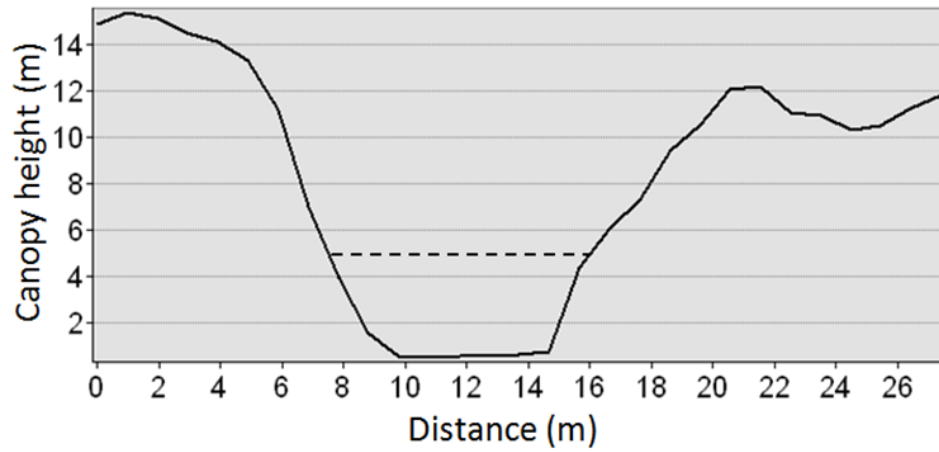
Leaf-on vs. leaf-off



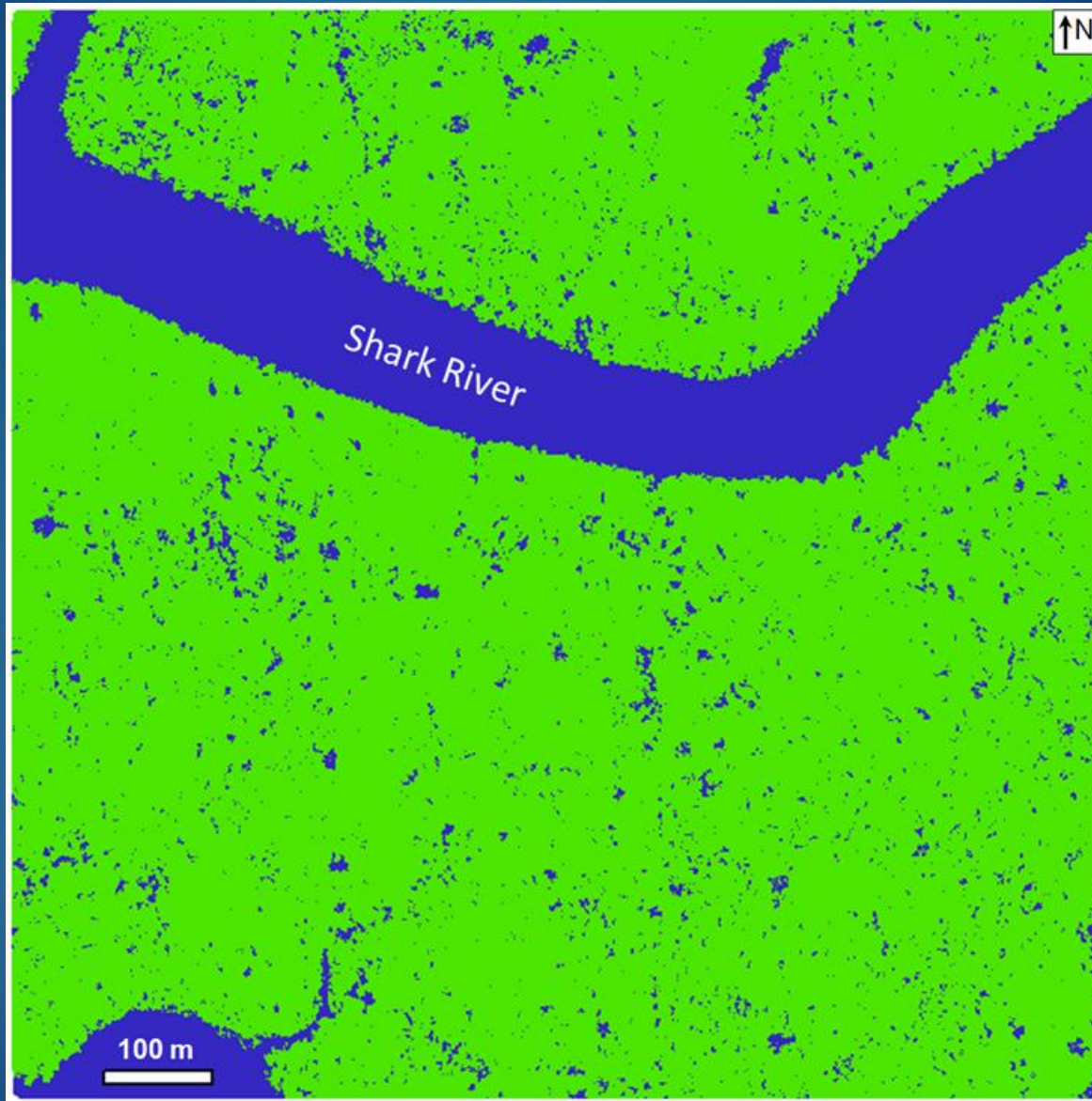
Canopy Height Model



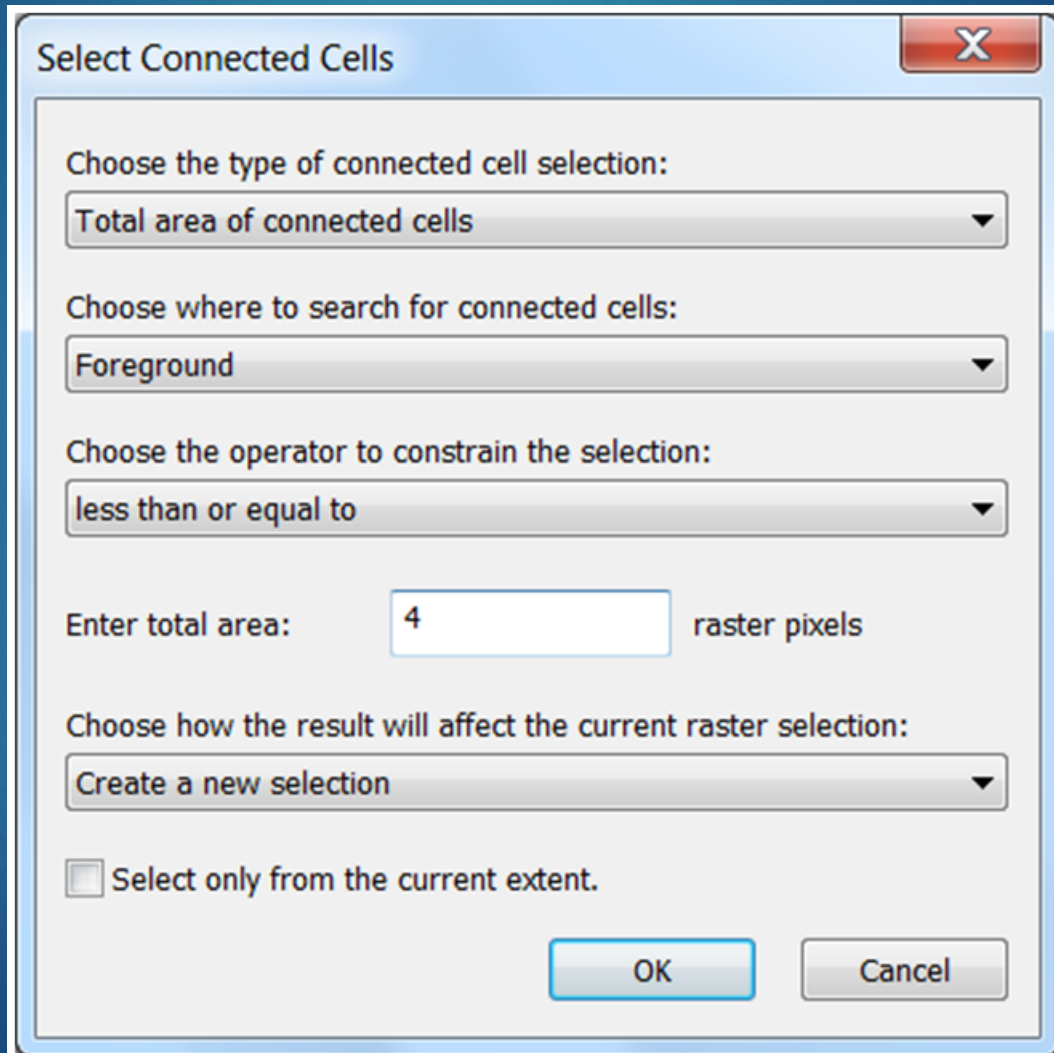
Threshold for Gaps



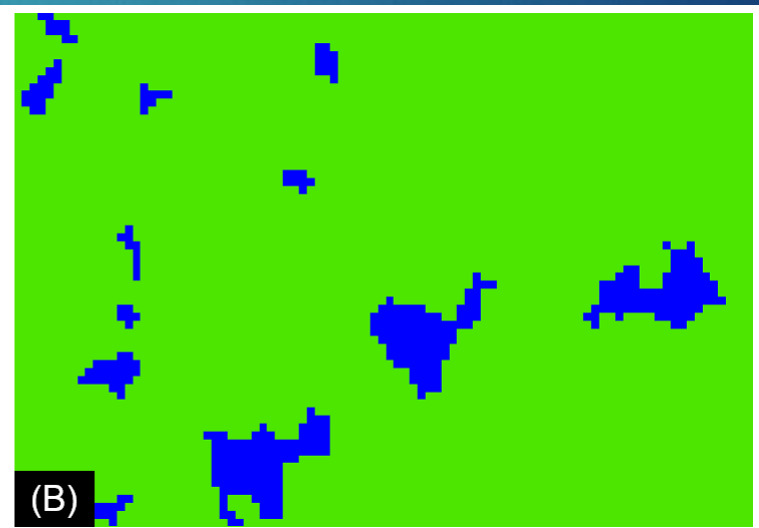
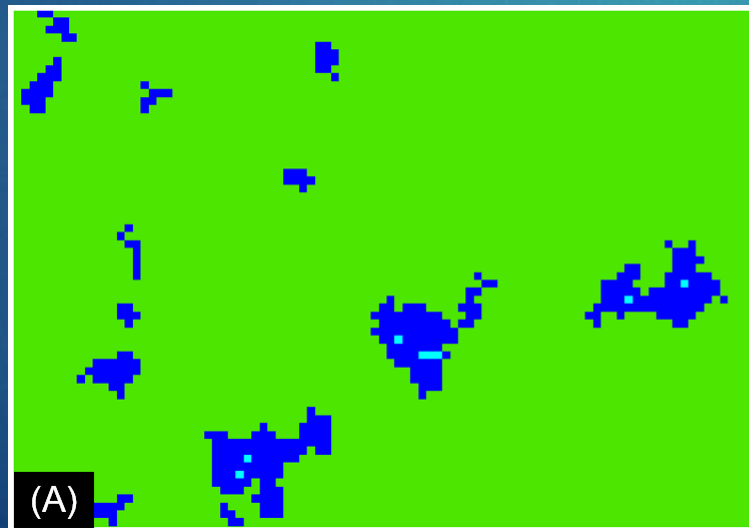
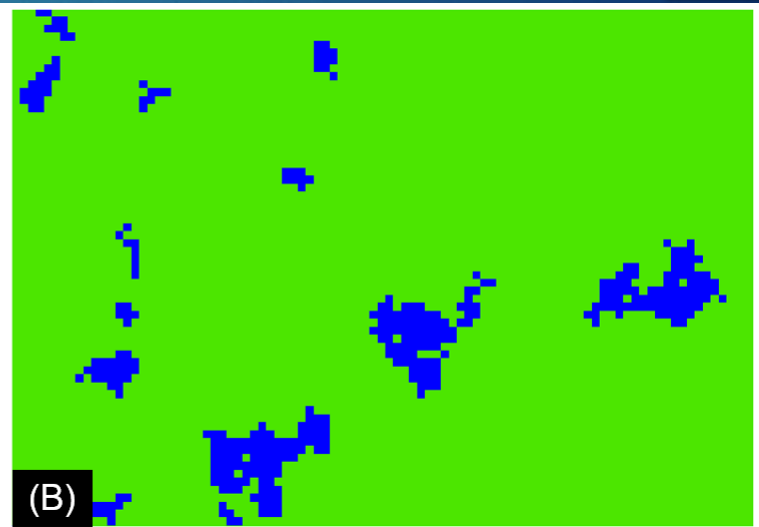
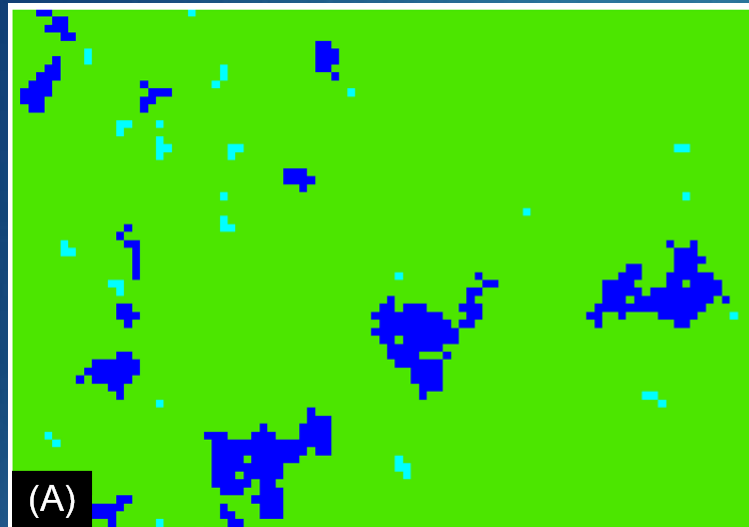
Extracting Gaps



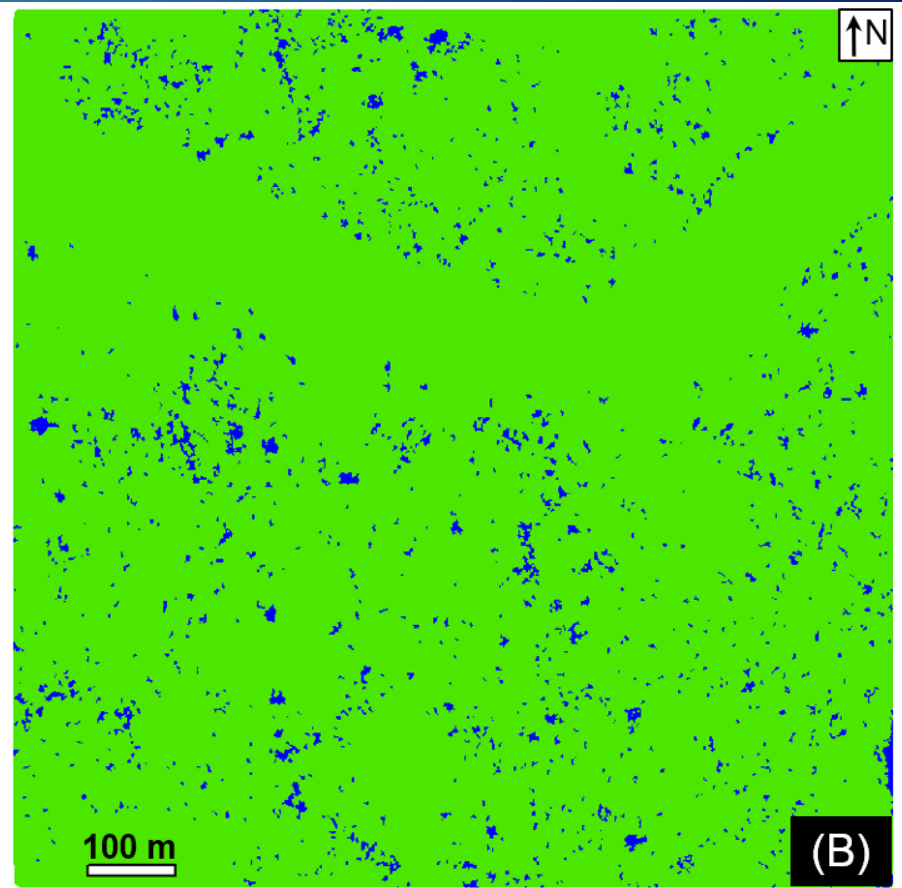
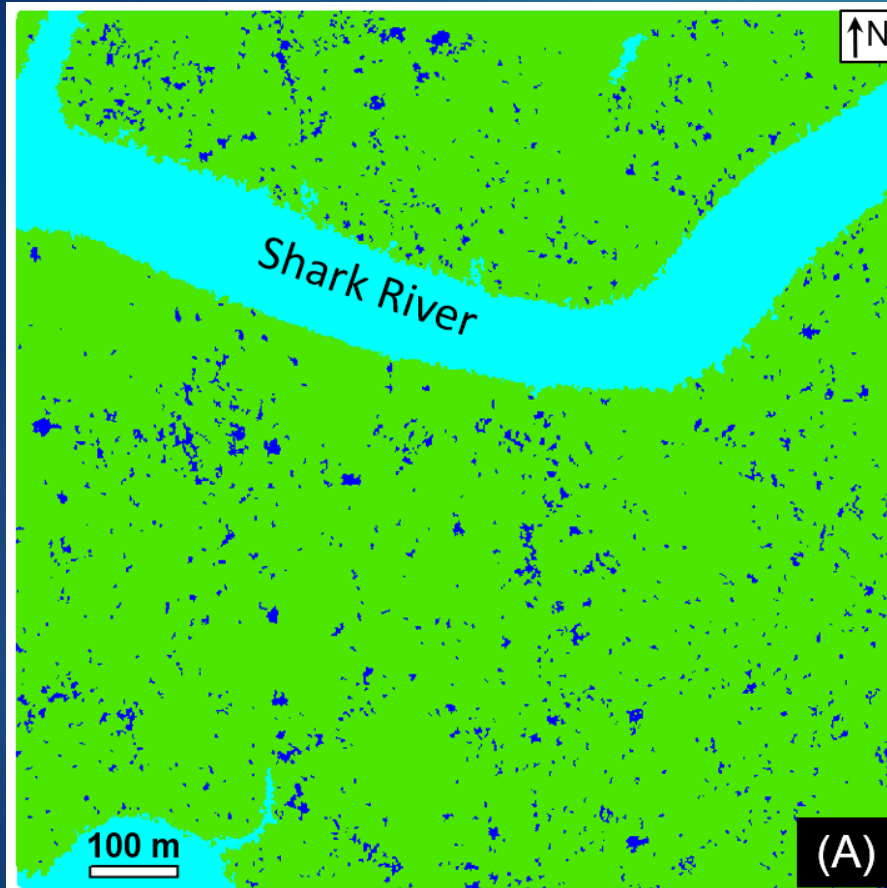
ArcScan



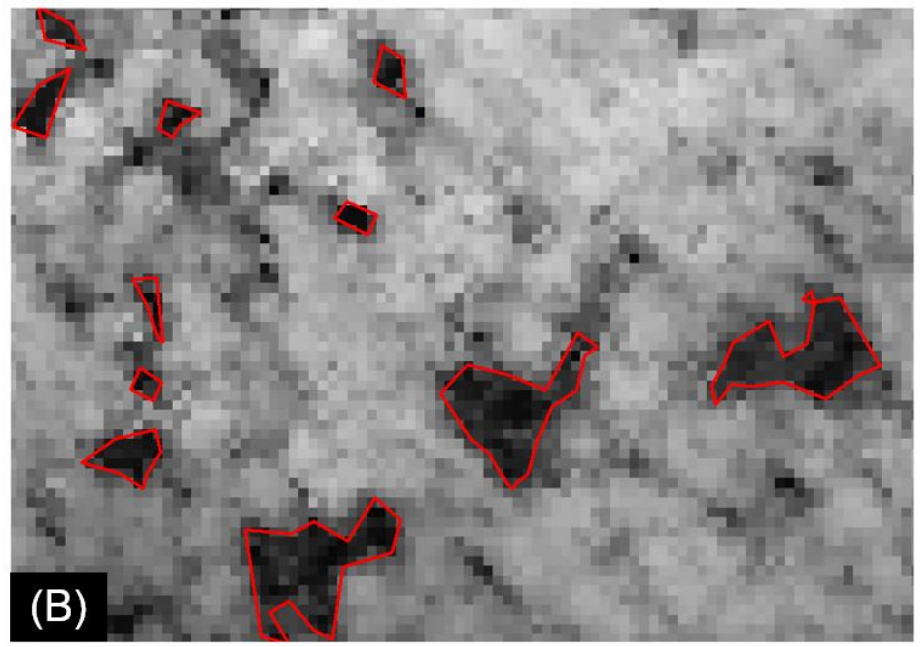
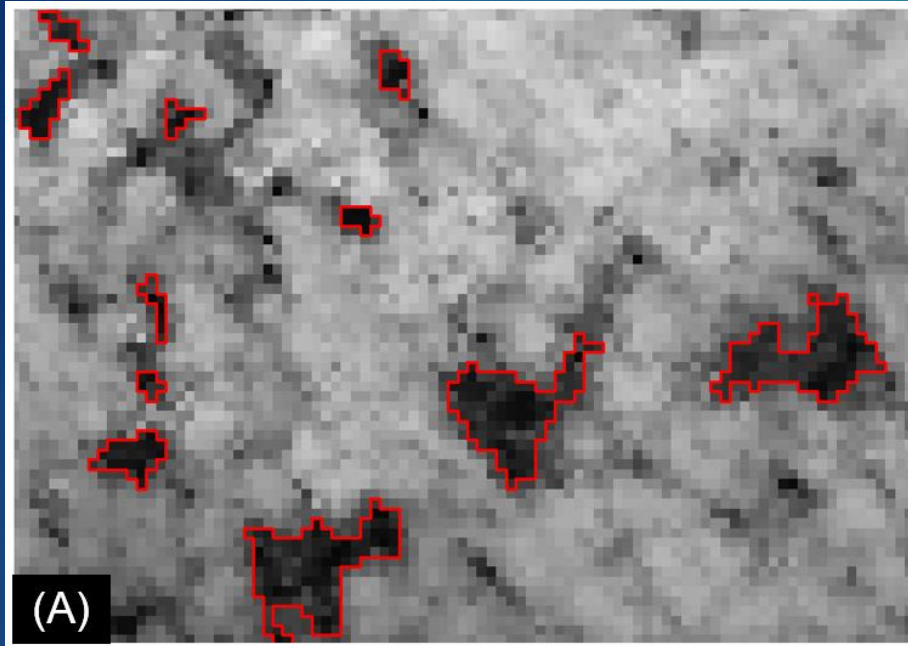
ArcScan



ArcScan



Raster to Polygon



If you are still looking for a course project, you may try this one ...

1. Download “Denton2011.las” from <http://geography.unt.edu/~pdong/LiDAR/Chapter5/Project5.1/>
2. Develop a method to map individual trees or tree groups (taller than 2 m) in the dataset, and save the tree locations and tree heights in a shapefile or geodatabase.
3. Do some accuracy assessment (true or false) through field investigation.
4. Write a project report.

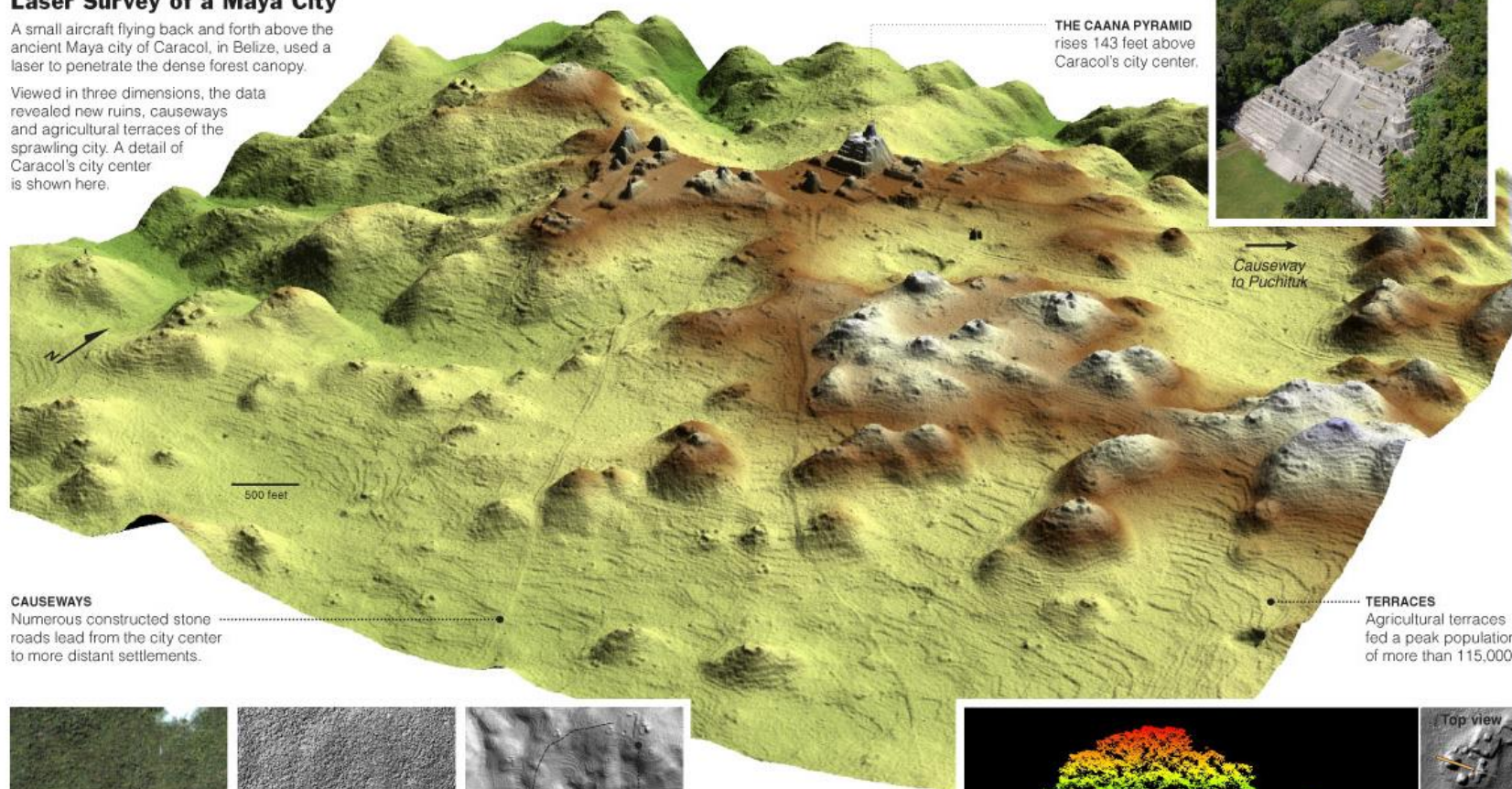
The New York Times

May 11, 2010

Laser Survey of a Maya City

A small aircraft flying back and forth above the ancient Maya city of Caracol, in Belize, used a laser to penetrate the dense forest canopy.

Viewed in three dimensions, the data revealed new ruins, causeways and agricultural terraces of the sprawling city. A detail of Caracol's city center is shown here.



Causeway to Puchituk

CAUSEWAYS

Numerous constructed stone roads lead from the city center to more distant settlements.

TERRACES

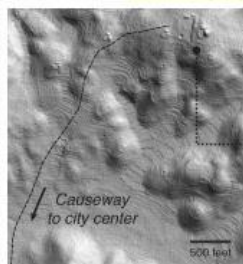
Agricultural terraces fed a peak population of more than 115,000.



SATELLITE IMAGERY from the Ikonos satellite is unable to penetrate heavy foliage.

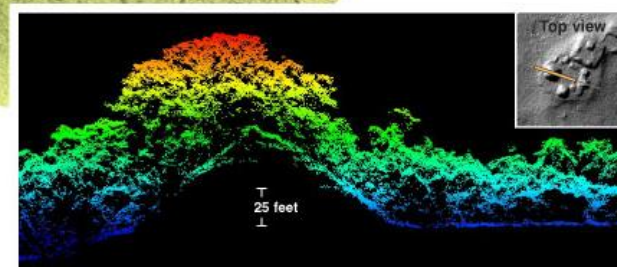


LIDAR Using a laser instrument called lidar, for light detection and ranging, to scan the upper canopy shows little detail (left). But some of the laser pulses penetrate the foliage and reflect off of the ground, revealing ruins and extensive terracing (right).



PUCHITUK

Once surrounded by hundreds of open terraces, the hilltop settlement of Puchituk is now obscured by the forest.



PEERING THROUGH THE FOREST A lidar scan along a straight track (orange line, inset) shows reflections off of the ground and different layers of foliage, revealing the cross-section of a pyramid-shaped structure. In this image the measured points are colored according to height, and are accurate to about six inches.

Source: Arlen F. Chase, Diane Z. Chase and John F. Weishampel, University of Central Florida

THE NEW YORK TIMES IMAGES COURTESY OF CARACOL ARCHAEOLOGICAL PROJECT

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