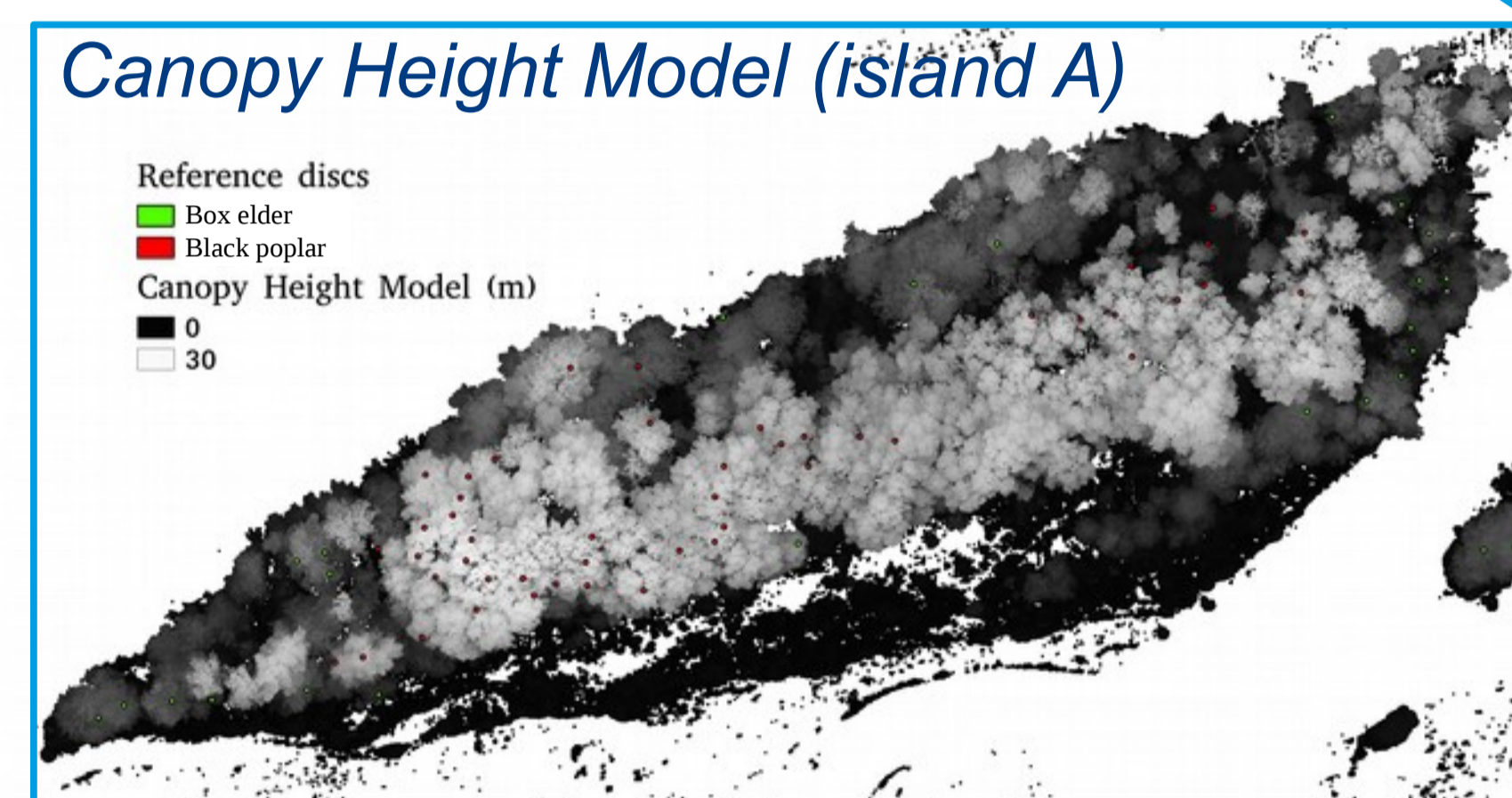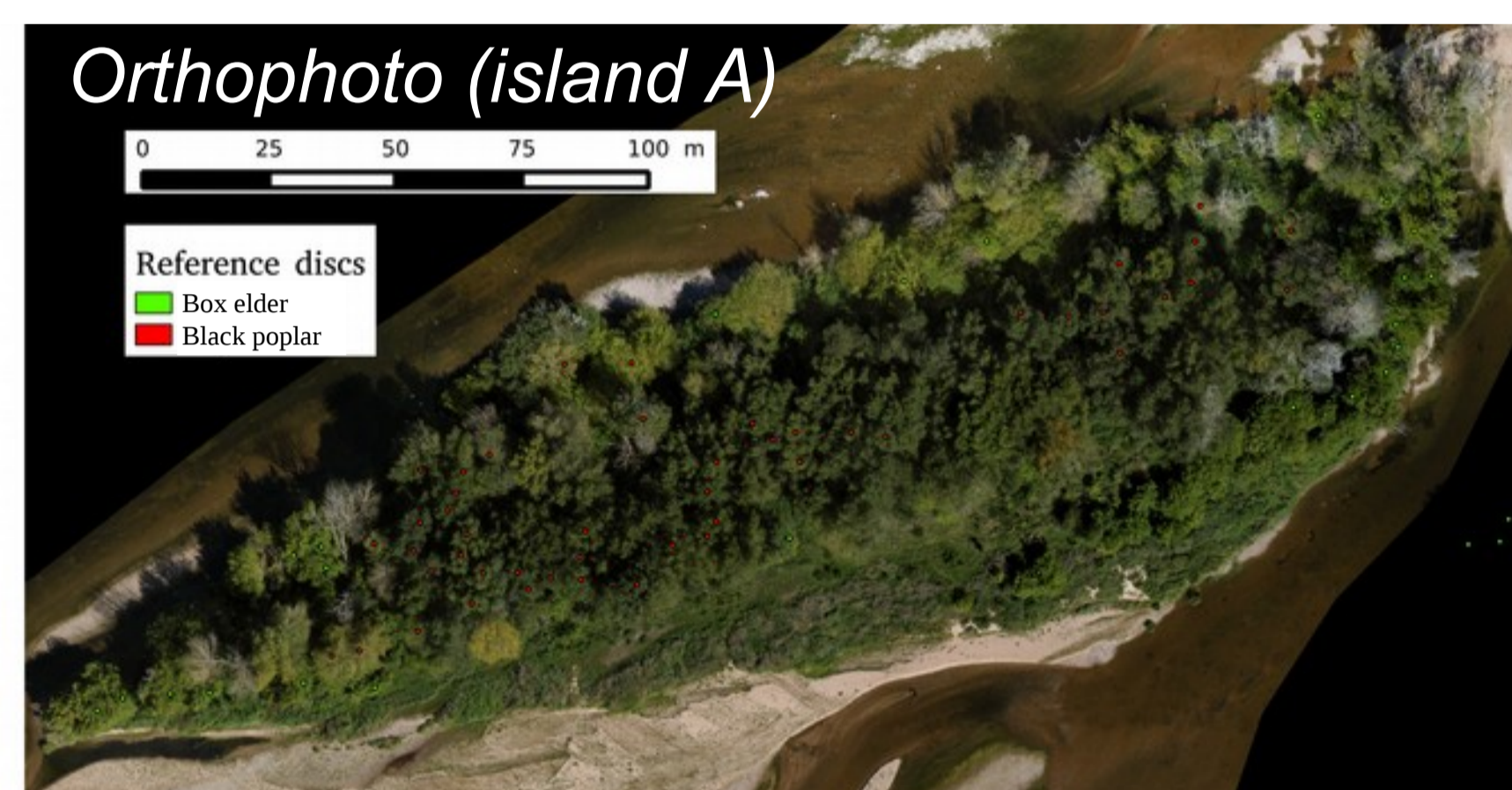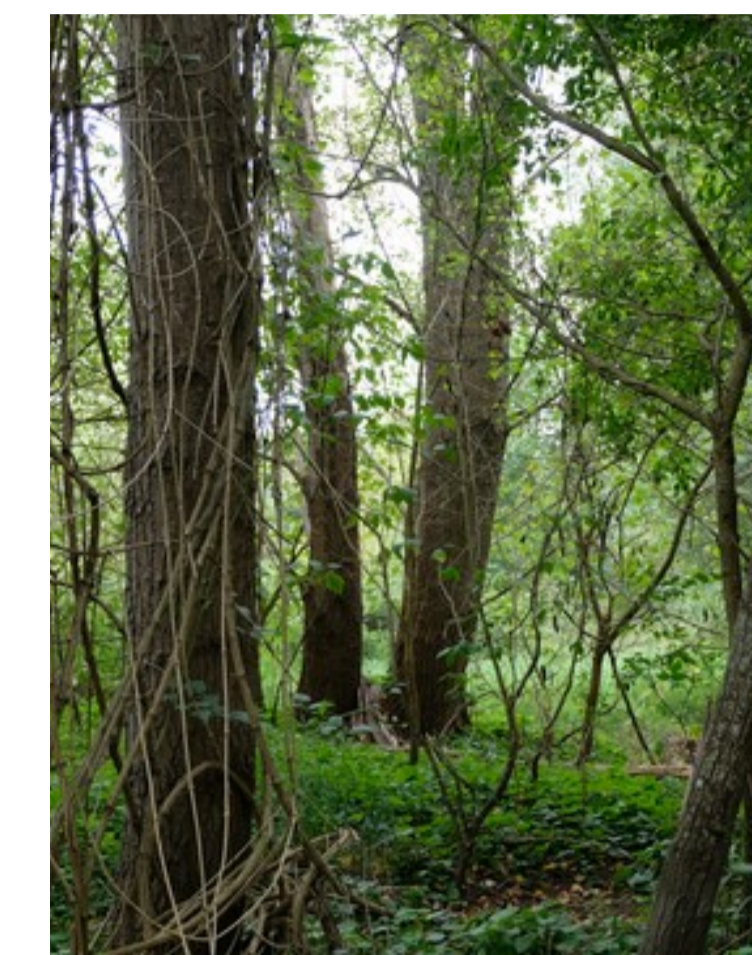# Detection of an Introduced Tree Species in Protected River Islands with UAV Remote Sensing

Jean-Matthieu Monnet[1], Hilaire Martin[2], Richard Chevalier[2] & Marc Villar[3]
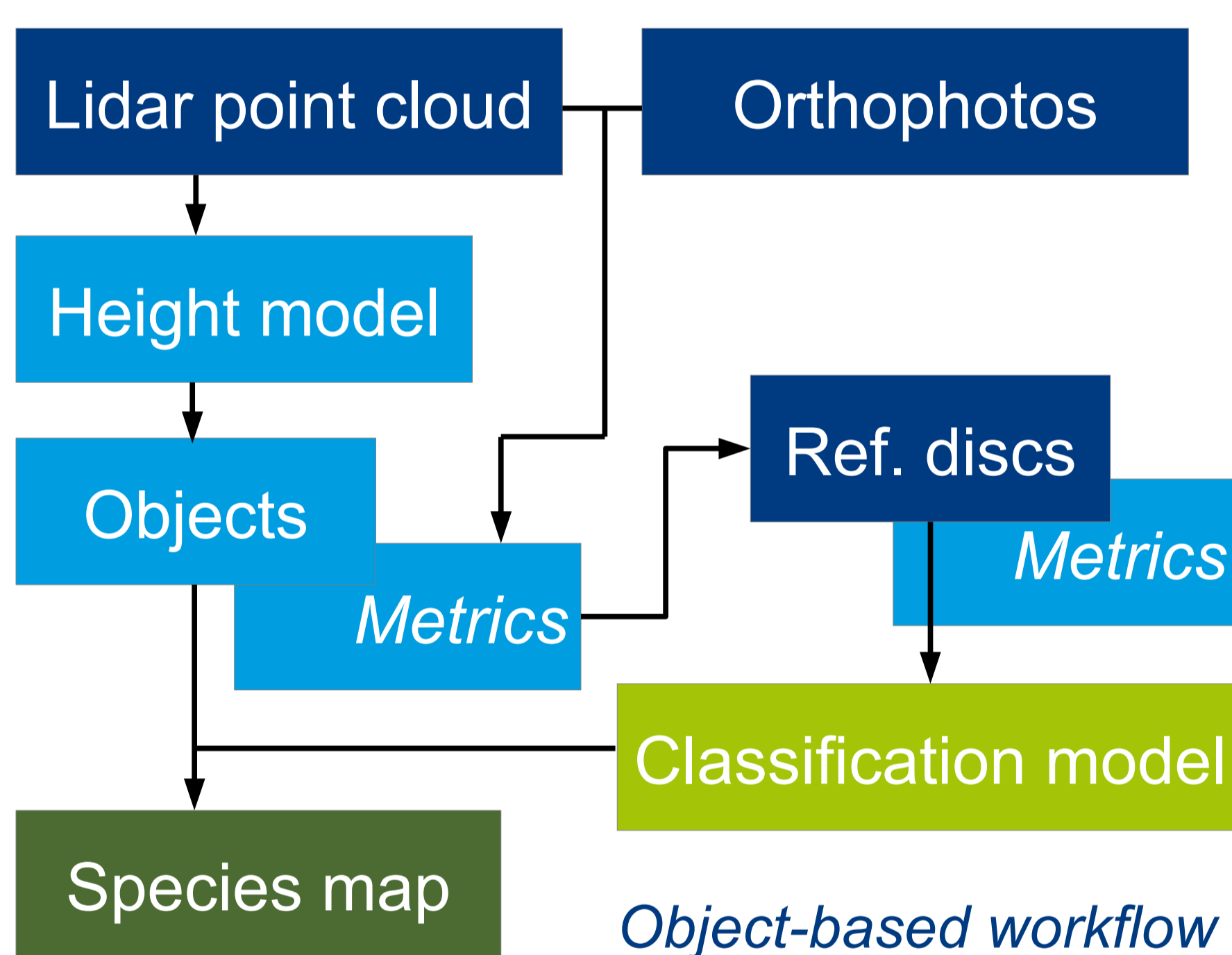
Study area

- Island mosaic of Mareau-aux-Prés on the Loire river (France)
  - Four islands dominated by black poplar (*Populus nigra*)
  - Beaver presence favors an introduced species: box elder (*Acer negundo*)
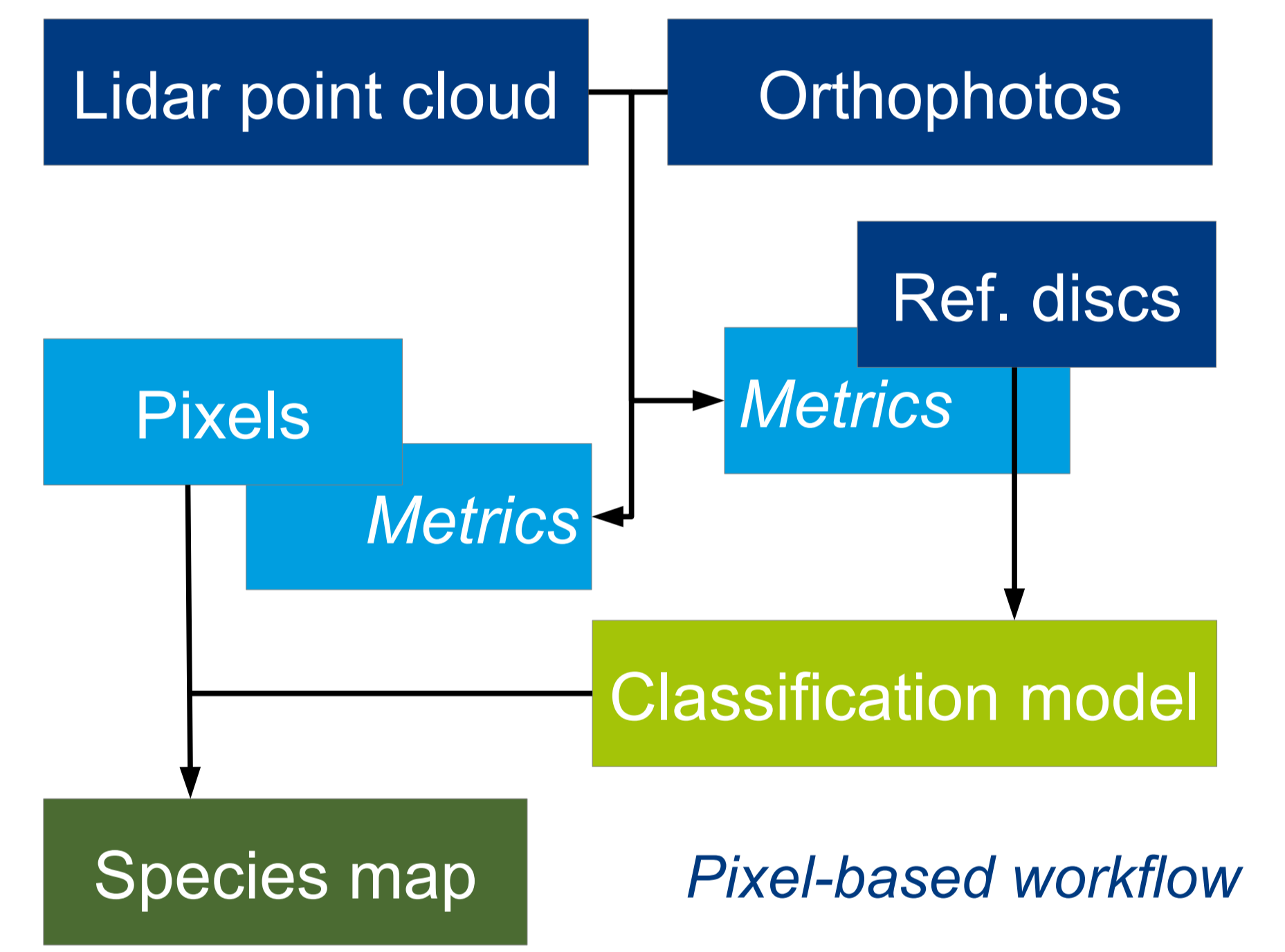

Orthophoto (island A)

Reference discs
Box elder
Black poplar
0   25   50   75   100 m

Canopy Height Model (island A)

Reference discs
Box elder
Black poplar
Canopy Height Model (m)
0
30

Material

- Lidar data acquired with a YellowScan surveyor (mean density 193 points/m^2)
- Orthophotos: RGB+NIR, 2 cm resolution resampled at 10 cm
- 300 discs of 1 m diameter are sampled and manually classified as poplar or elder

Methods

Lidar point cloud — Orthophotos
Height model
Objects
Metrics
Ref. discs
Metrics
Classification model
Species map

Object-based workflow

- Object segmentation is performed by applying a watershed algorithm to the canopy height model (0.5 m)
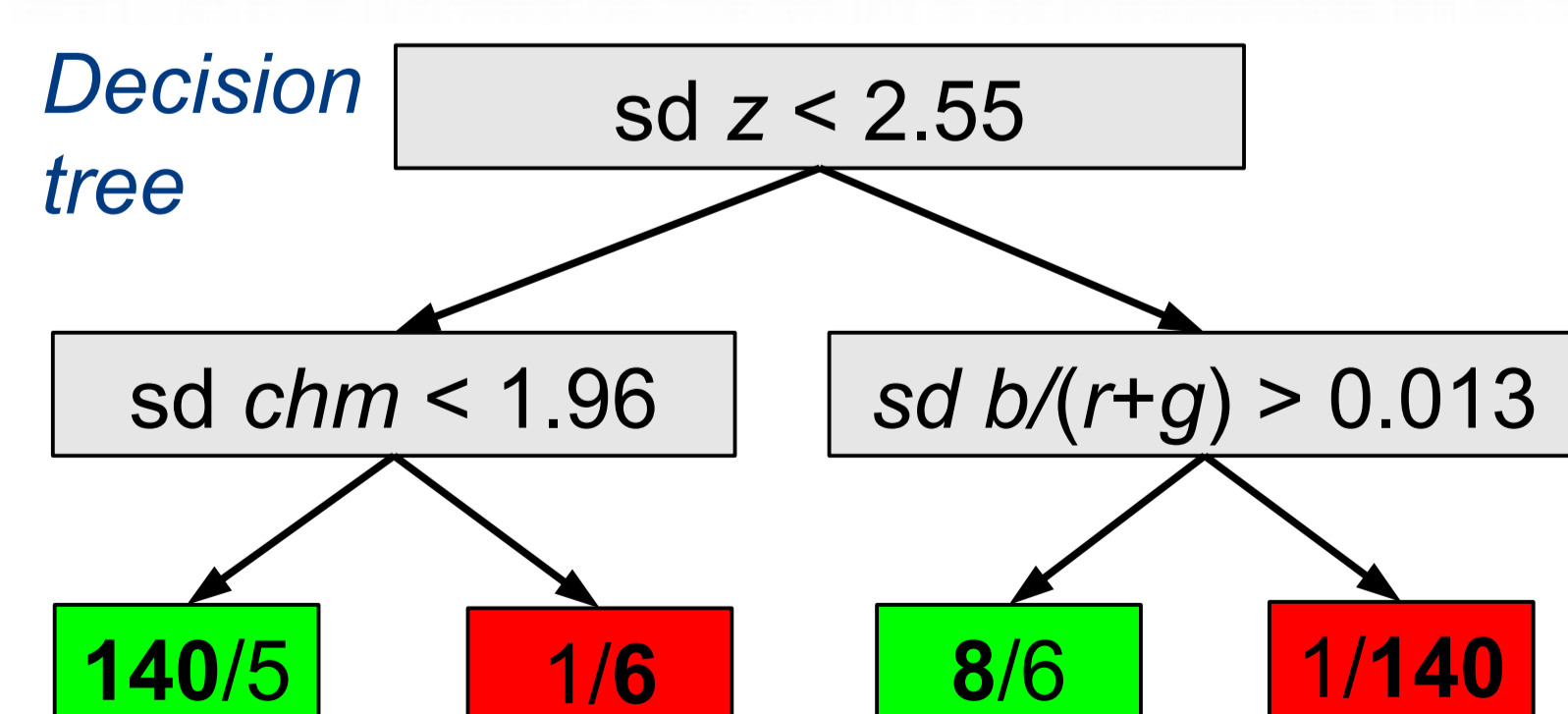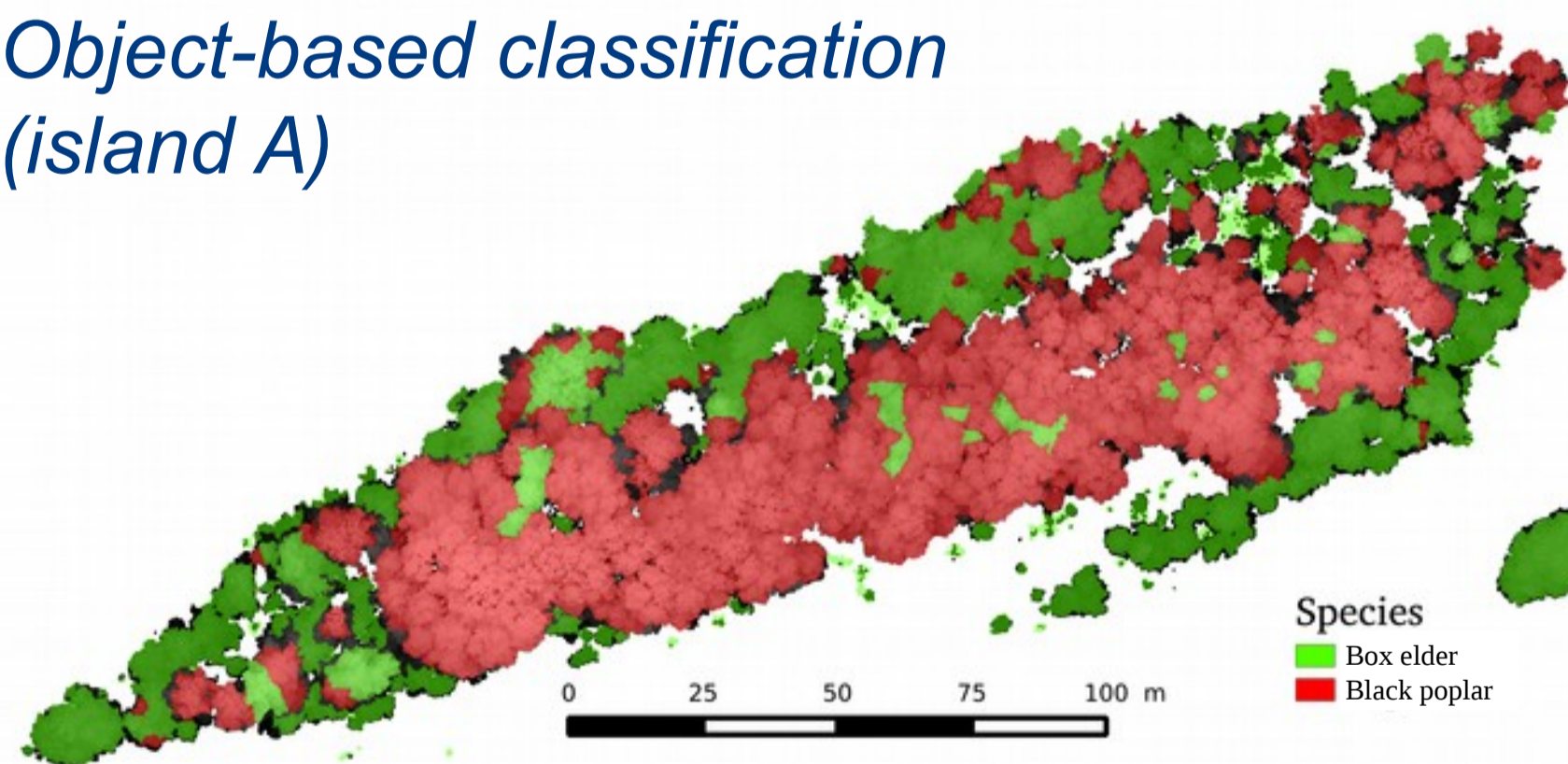
- Two classification workflows are compared: pixel- and object-based
- Derived metrics are computed in each object/pixel:
  - mean and standard deviation of band ratios: r/(g+b), g/(r+b), b/(r+g), ndvi, grvi, nir/r
  - standard deviation of Lidar heights (point cloud and canopy height model)
- Tested classifiers are linear discriminant analysis (LDA), support vector machines (SVM) and partition trees

Lidar point cloud — Orthophotos
Pixels
Metrics
Ref. discs
Metrics
Classification model
Species map

Pixel-based workflow

- Metrics are computed for pixels at 1 m resolution

Results

Object-based classification (island A)

25 50 75 100 m

Species
Box elder
Black poplar

Decision tree

sd z < 2.55
sd *chm* < 1.96
sd b/(r+g) > 0.013
140/5   1/**6**   **8**/6   1/**140**
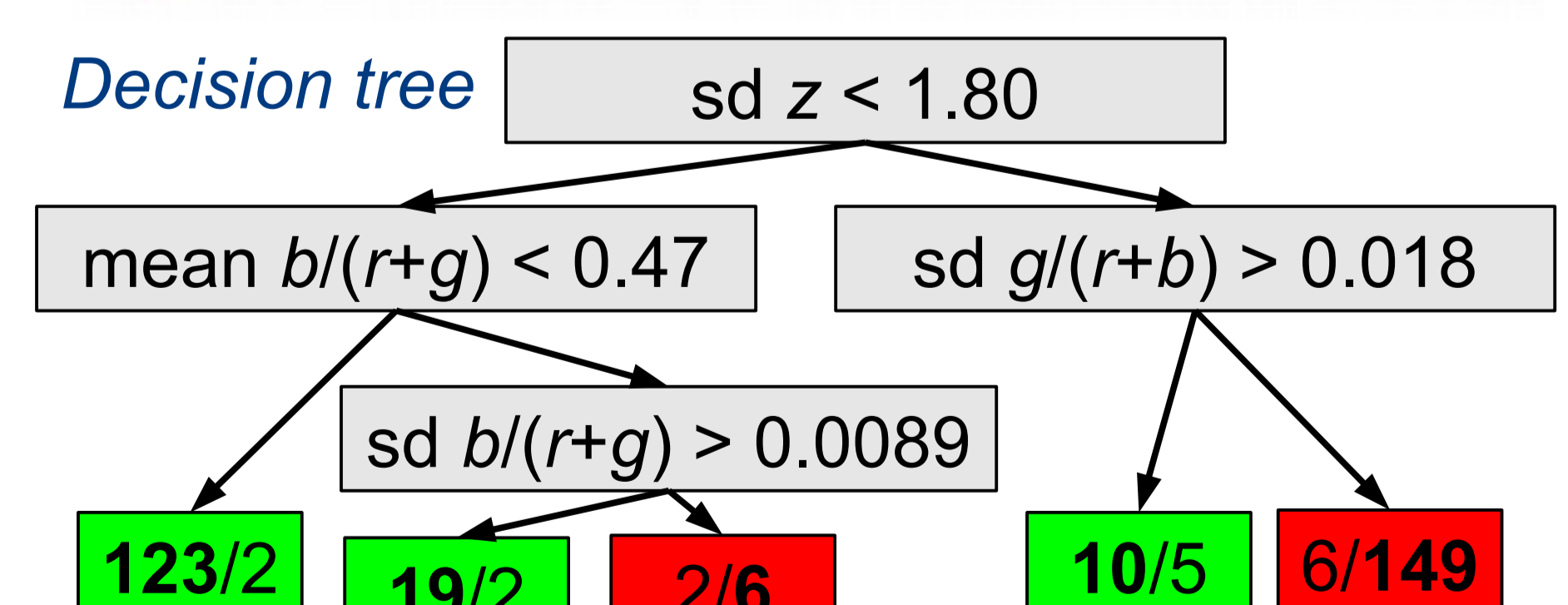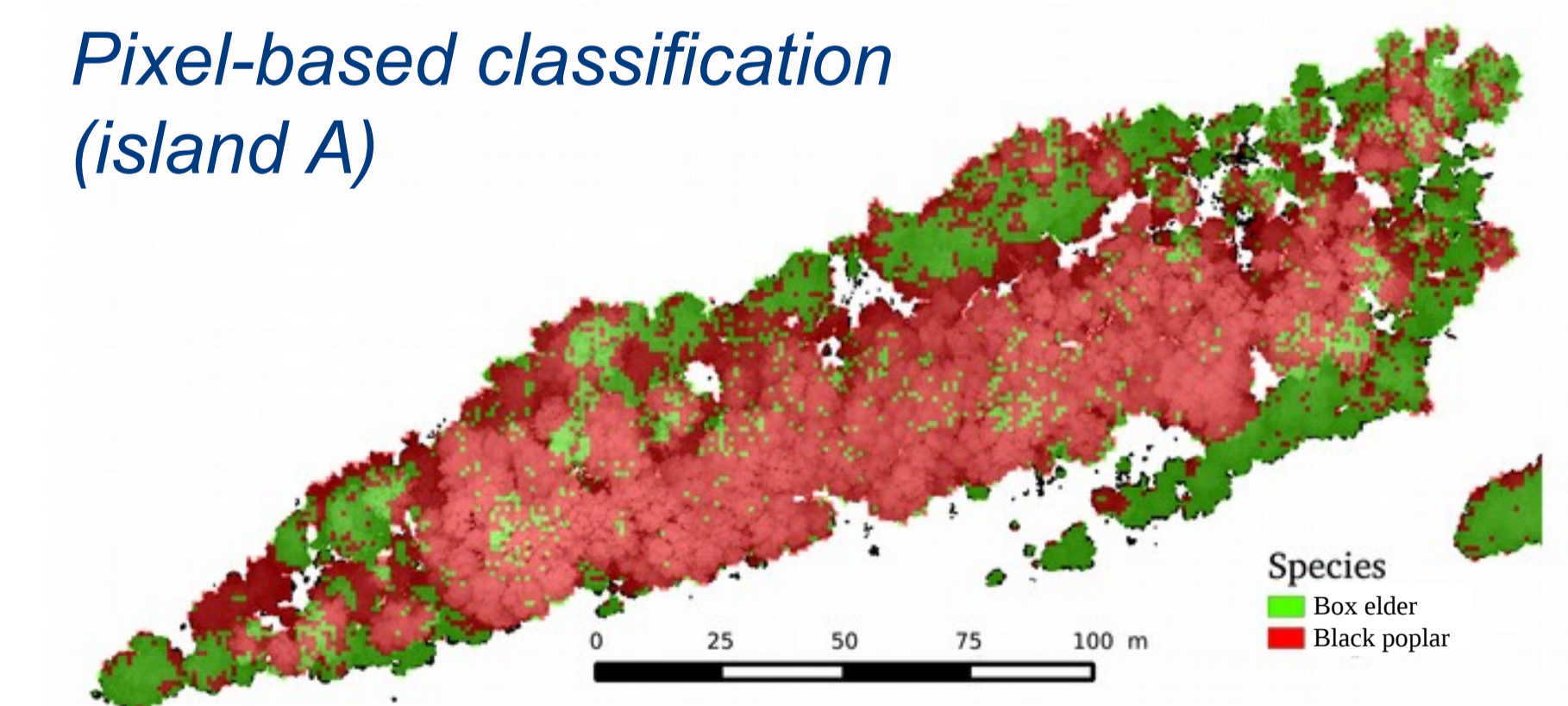
- Classification accuracy is similar in both workflows. LDA and SVM perform better than partition tree classifier.
- Noise in pixel-based maps could be reduced by regularization, with specific case of shadows.

Classification accuracy (%) for workflows and classifiers

Workflow	AFD	SVM	Partition tree
Object	96.2	95.7	92.1
Pixel	96.2	94.7	91.0

Pixel-based classification (island A)

25 50 75 100 m

Species
Box elder
Black poplar

Decision tree

sd z < 1.80
mean b/(r+g) < 0.47
sd g/(r+b) > 0.018
sd b/(r+g) > 0.0089
123/2   **19**/2   2/**6**   **10**/5   6/**149**

Radiometric and geometric metrics derived from UAV remote sensing were efficient in classifying two tree species in a riparian environment. Further research has yet to investigate how to make the most of UAV high resolution data, e.g. for tree mortality or regeneration monitoring.