

THE VIEW FROM KEW

UAV's (aka drones) in pursuit of
plant conservation and science.
Real world experiences

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 [@KewGIS](https://twitter.com/KewGIS)

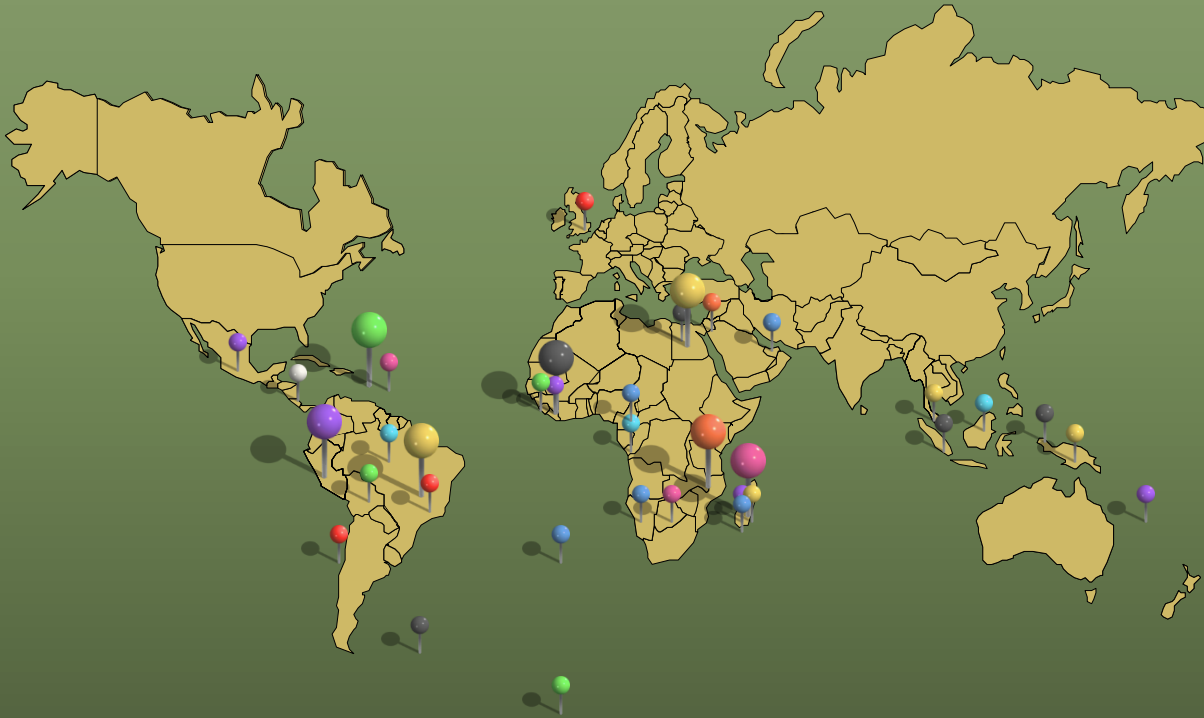
<http://www.kew.org/gis/>





THE VIEW FROM KEW

- ▣ ~ 300 Scientists
- ▣ Across 2 sites, 3 labs and 8 Science Departments



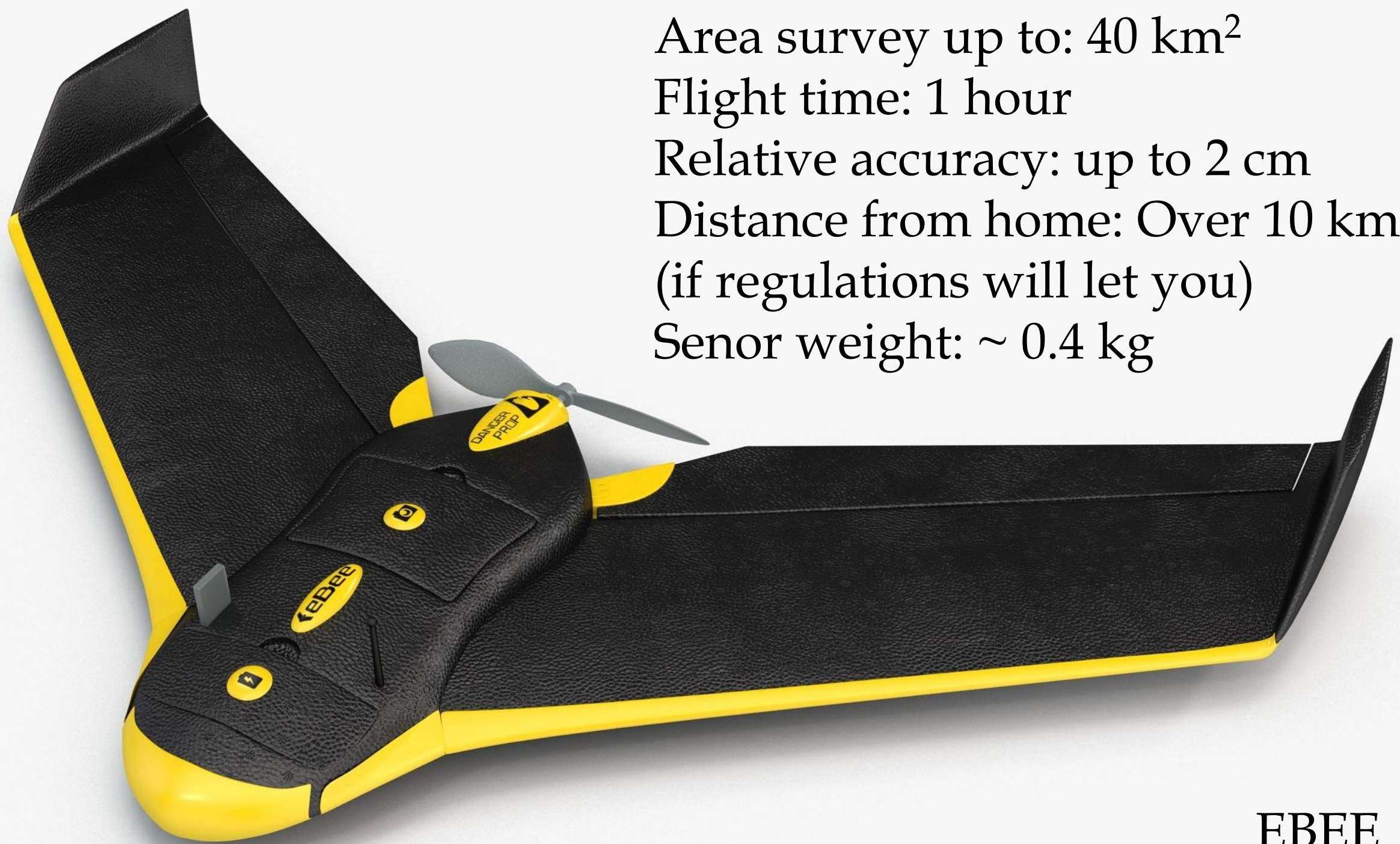
What will be Covered

- ▣ Why
- ▣ Equipment
- ▣ Where
- ▣ Issues
- ▣ Two example projects



Why are we using UAV's

- ▣ **Coverage and speed**
 - We can cover 10km² in 30 minutes.
 - NB In simple dry forest it can take about 4 hours to survey every tree 0.1% of this
 - Within reason we can put the UAV up when we like (i.e. after rains, or seasonally or different times of the day)
- ▣ **Accessibly**
 - We can get at areas which are inaccessibly or at least very hard to get to on the ground
 - NB It can take 1 hour just to walk/hack 250m through dry vegetation in the Cayman island
- ▣ **Cost savings**
 - Much cheaper than Aerial surveys
 - \$33 per km² for archived satellite imagery
- ▣ **Flexibility**
 - We can fly to our needs (i.e. height overlap)
 - We can tweak for our own sensors or plug in manufacturers
- ▣ **Below cloud** (sometimes!)
- ▣ **3D Data**



Area survey up to: 40 km²

Flight time: 1 hour

Relative accuracy: up to 2 cm

Distance from home: Over 10 km
(if regulations will let you)

Senor weight: ~ 0.4 kg

EBEE

Phantom pro 4



Area survey up to: $< 0.8 \text{ km}^2$
Flight time: ~ 20 minutes
Relative accuracy: up to $\sim 1 \text{ cm}$
Distance from home: $\sim 0.5 \text{ km}$
Sensor weight: $\sim 0.2 \text{ kg}$

DJI Matrice 600pro



Area survey up to: $< 0.8 \text{ km}^2$

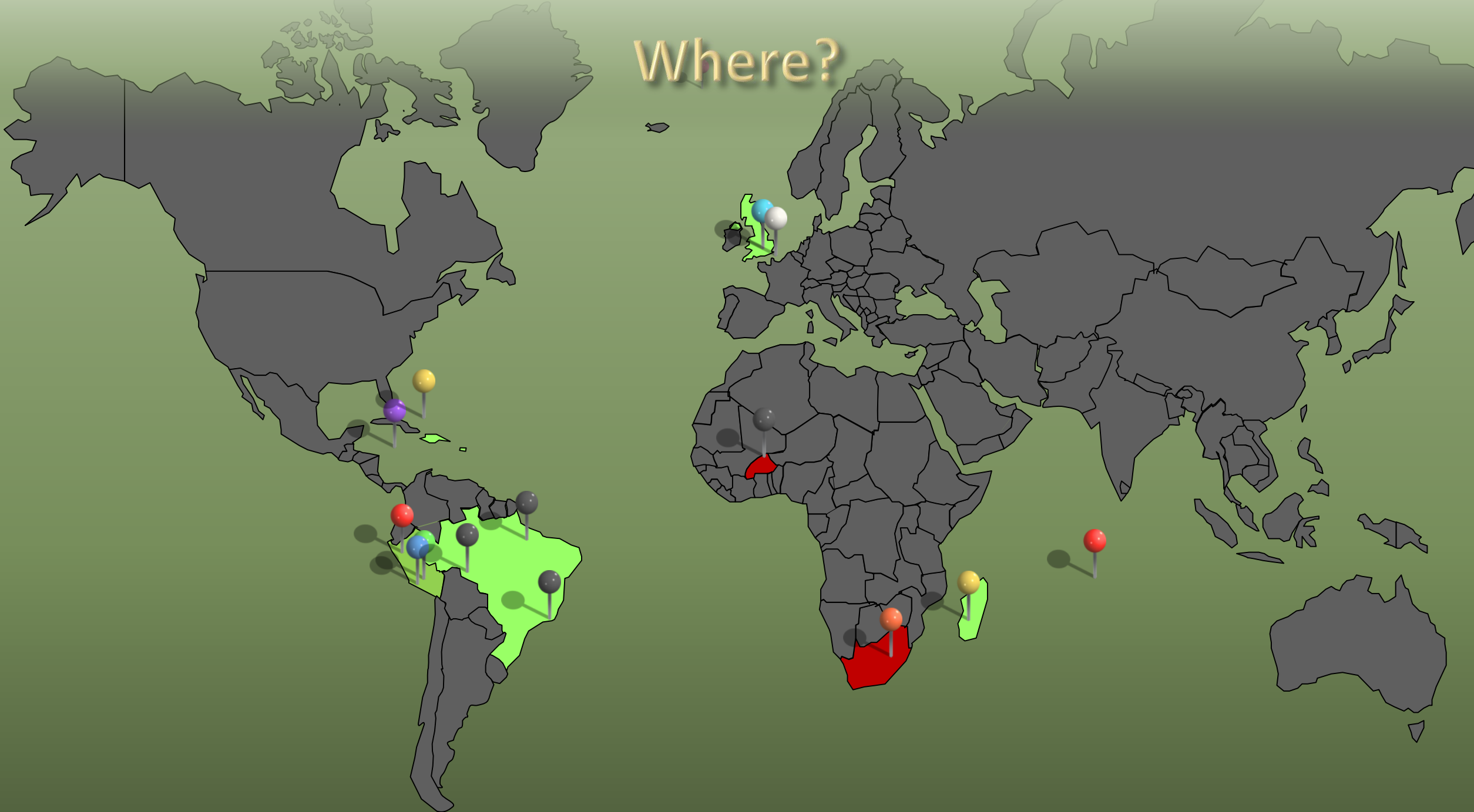
Flight time: $\sim 20\text{-}30$ minutes

Accuracy: up to $> 3 \text{ cm}$

Distance from home: $\sim 0.5 \text{ km}$

Senor weight: $< 6 \text{ kg}$

Where?



Regulations and Issues by Country

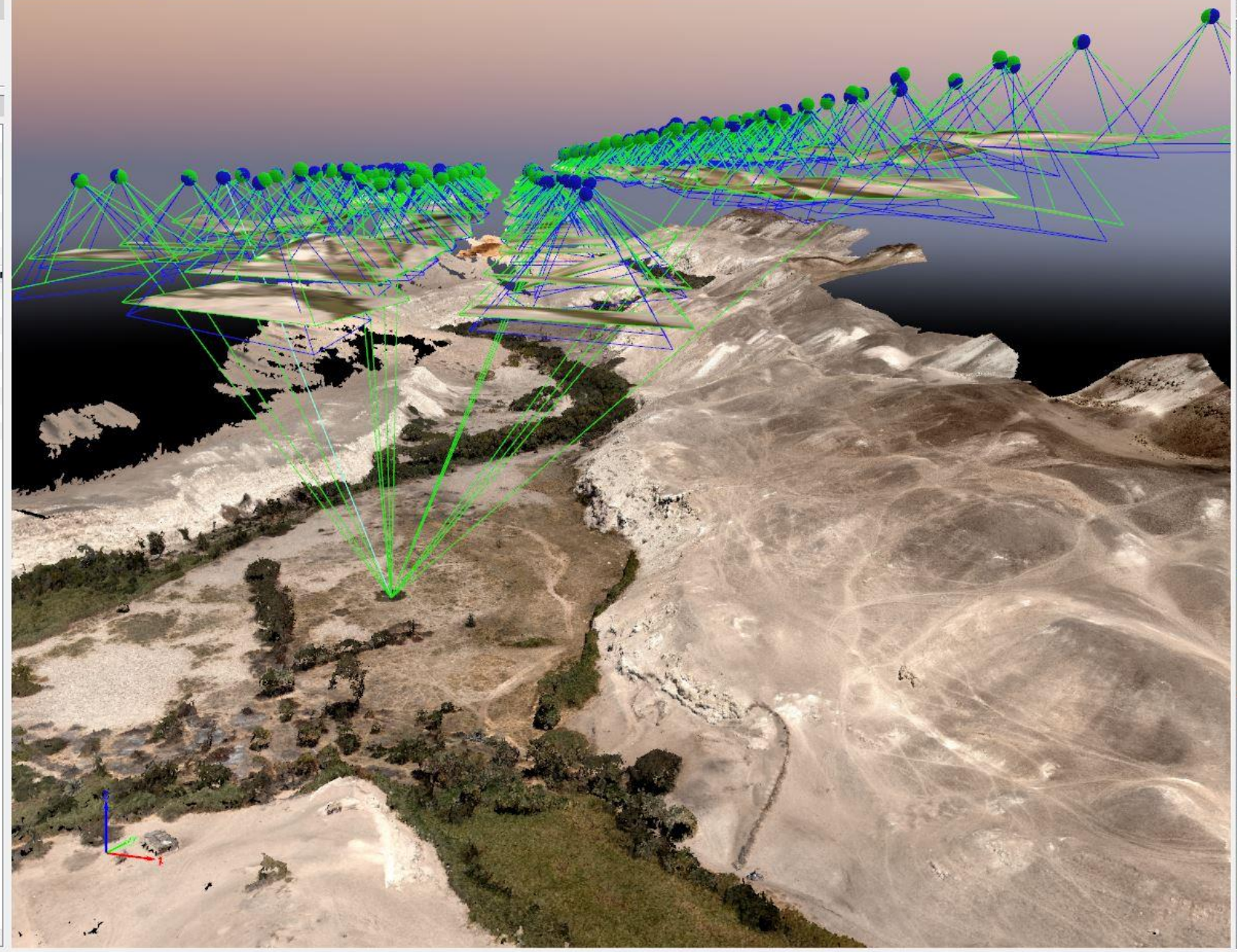
Country/Issue	Permissions	Customs	Regulations	Obstacles/Issues
UK Wakehurst place (testing and research only)	Land owner and within regulations	n/a	500/120 Within sight only	Grass houses, public access
UK - Kew	Within Heathrow flight path. CCA approval needed	n/a	-	Grass houses, public access
Peru	None needed, but Land owners permission given	20% of value and permission to import (\$2000 deposit and 4 days to get paperwork)	None	Birds of prey, Magnetite , down drafts
Cayman Island	CAA, permission give, owners permission given	Letter from partners	Given, but not 500/120 has come in	Landing , weather conditions, Birds of prey
Burkina Faso	Insurance refused	-	-	-
Turks and Caicos Islands	CAA	Declaration	None, but now 500/120 Within sight only	Landing, weather conditions
South Africa	CAA Refusal	-	-	-
Brazil	Register Drone online	Declaration and check in and out of country	500/120 Within sight only	Heat
Chagos archipelago	BIOTA, UK and USA millary	Impounded in Bahrain, recovered on connecting flight	500/120 Within sight only	Birds and landing
Madagascar	None needed, but Land owners permission given	None	None, at time, now licenced	Landing, altimeter issues

Peru

Create

Layers

- Cameras
- Rays
- Tie Points
 - GCPs / MTPs
 - Automatic
- Point Clouds
 - Densified Point Cloud
 - Display Properties
 - flight199_backup_2.1.43.gr
- Point Groups
 - Unclassified
 - Deleted
 - Ground
 - Road Surface
 - High Vegetation
 - Building
 - Human Made Object
- Triangle Meshes
- Objects



Properties

Selection

Densified Point

Number of Images Visible In: 15

Computed Position [m]: 479184.19, 8358955.69, 317.39

Help

Images

Image Size Zoom Level

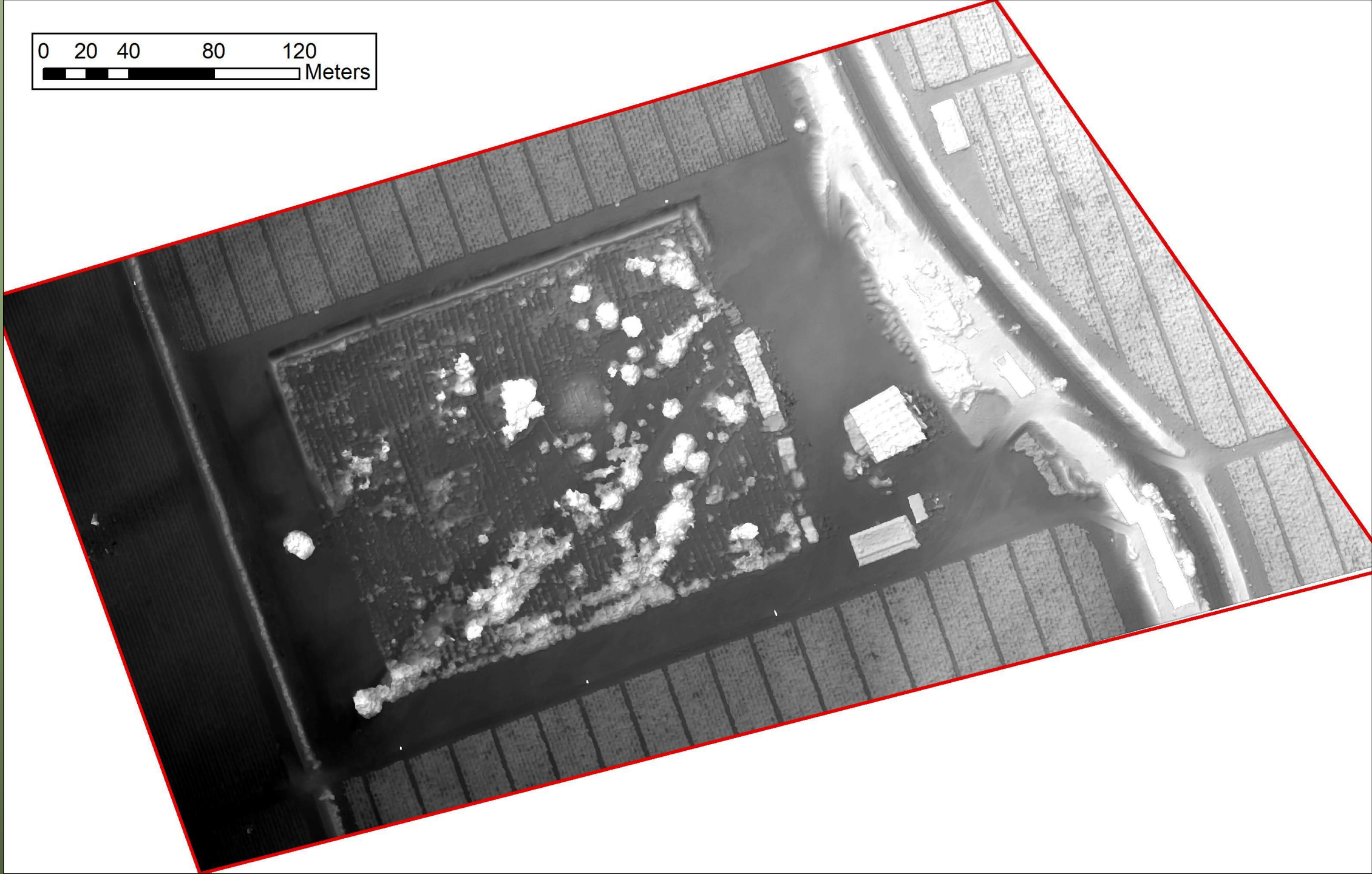
The image grid consists of 15 thumbnails arranged in a 5x3 grid. Each thumbnail shows a small section of an aerial photograph with a green 'X' mark indicating a tie point. The thumbnails are labeled with image IDs and 'RGB 12'.

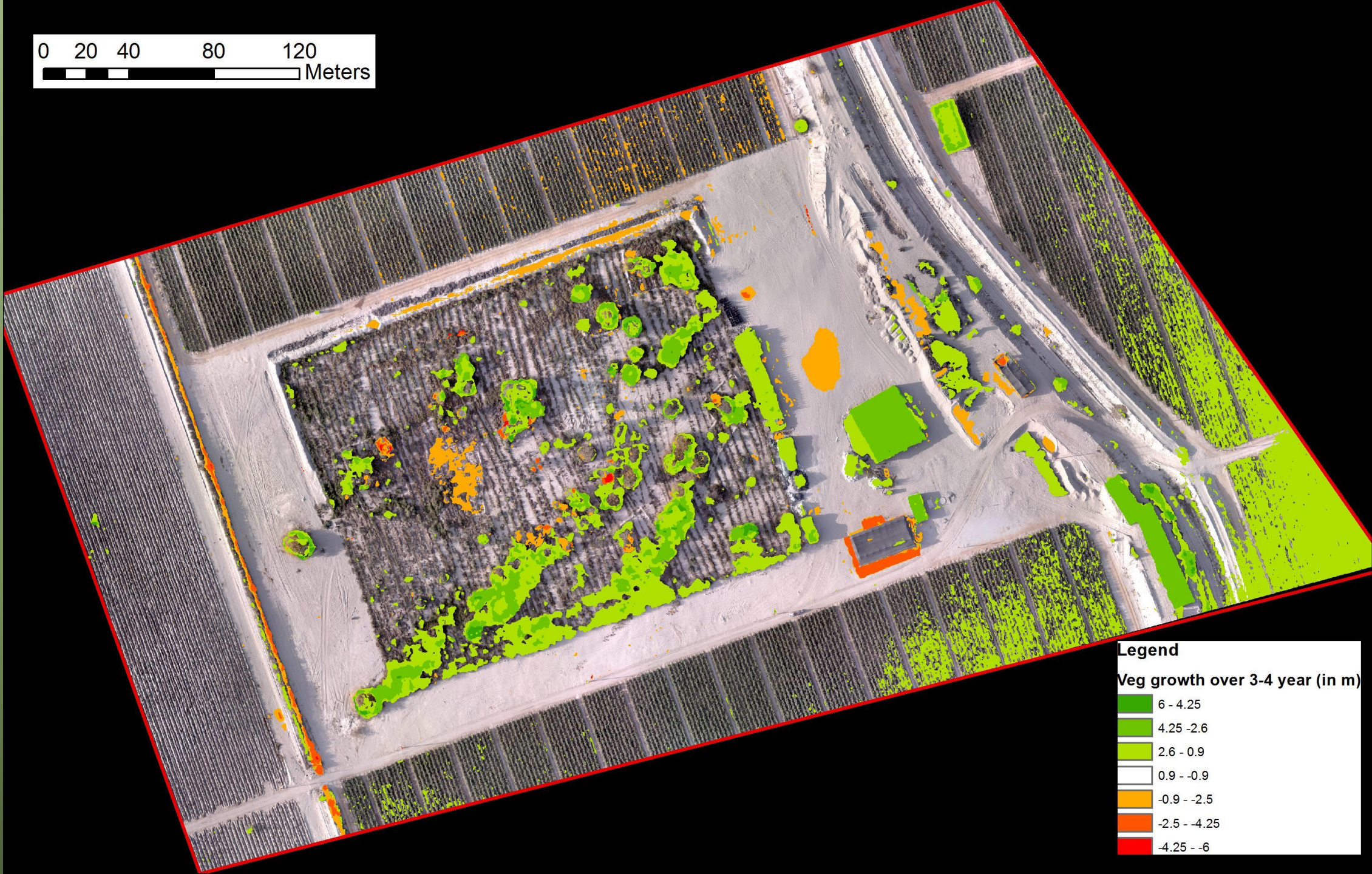
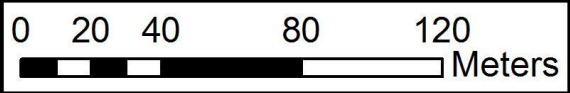
IMG 1897 RGB 12	IMG 1896 RGB 12	IMG 1898 RGB 12
IMG 1935 RGB 12	IMG 1889 RGB 12	IMG 1888 RGB 12
IMG 1934 RGB 12	IMG 1936 RGB 12	IMG 1895 RGB 12
IMG 1887 RGB 12	IMG 1937 RGB 12	IMG 1821 RGB 12
IMG 1820 RGB 12	IMG 1819 RGB 12	IMG 1812 RGB 12

0 20 40 80 120
Meters

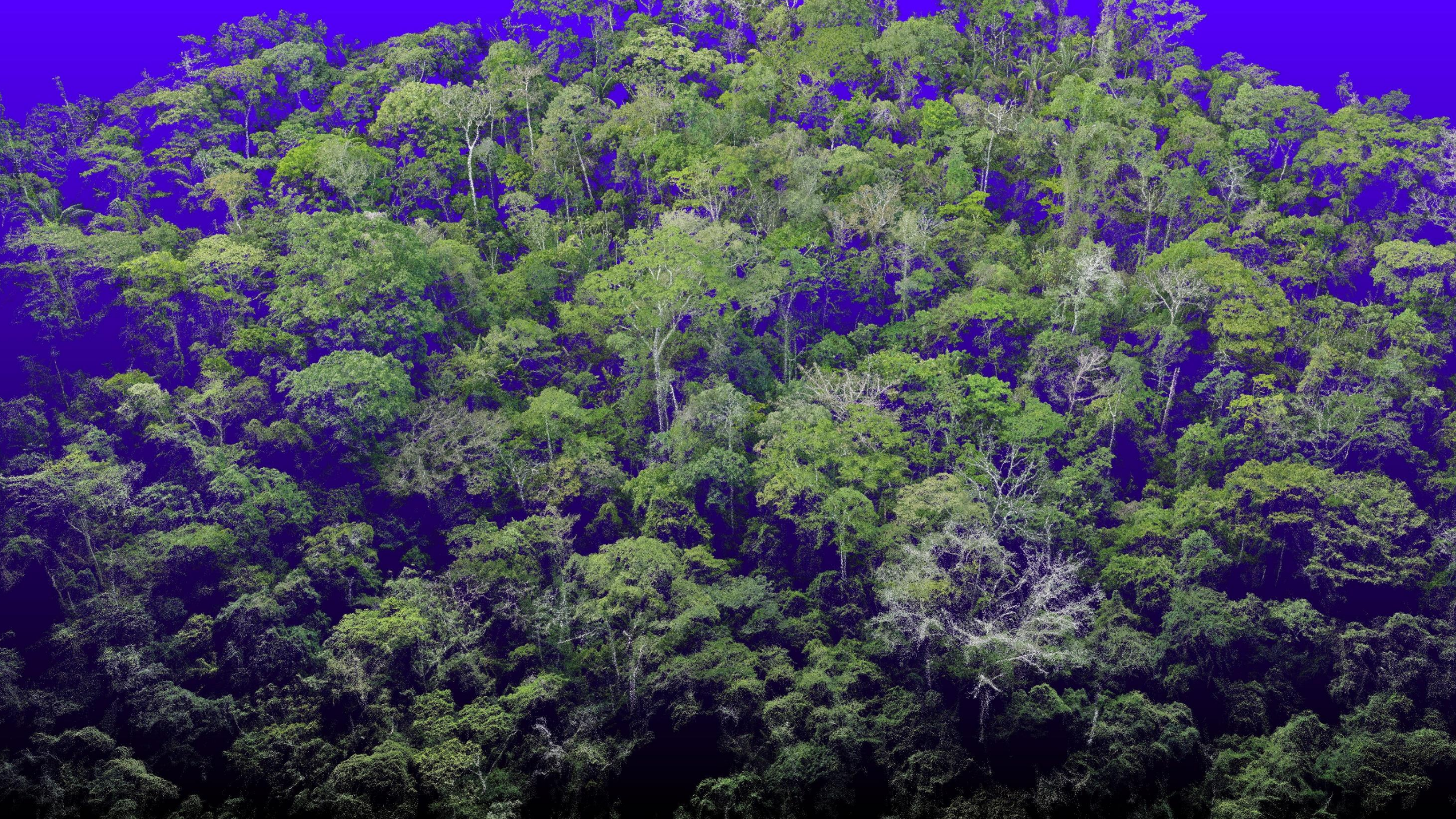


0 20 40 80 120
Meters





Brazil



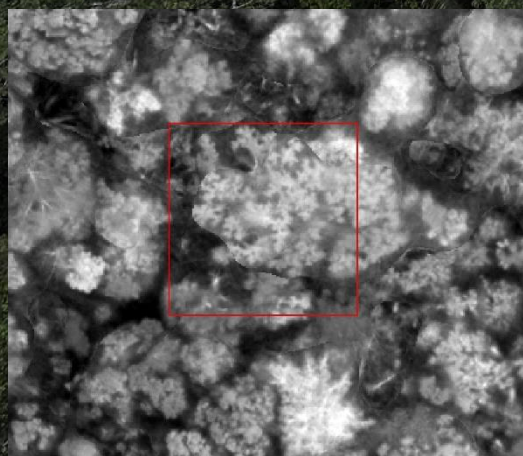




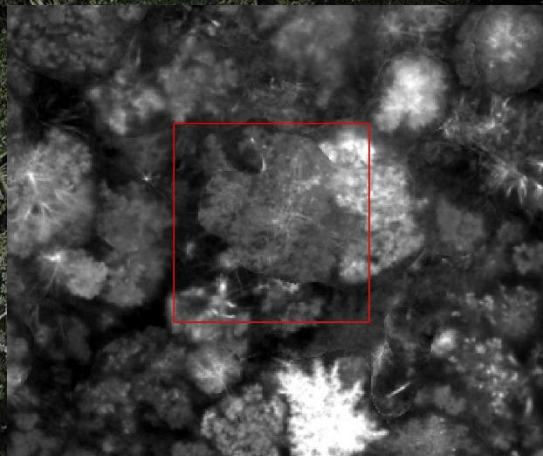
Colour image



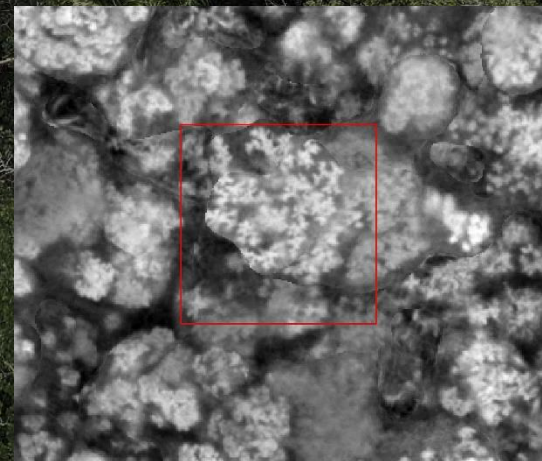
Elevation (DSM)



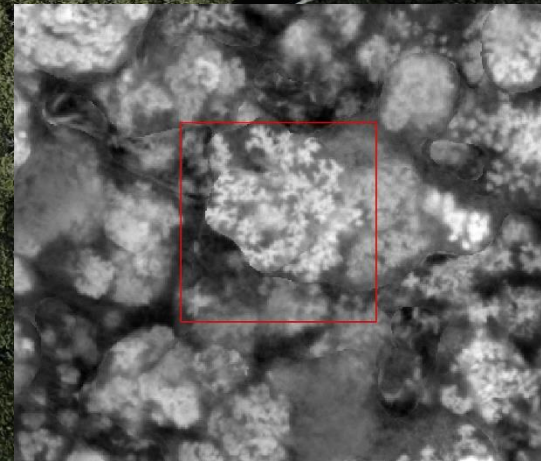
Green



Red



Red Edge



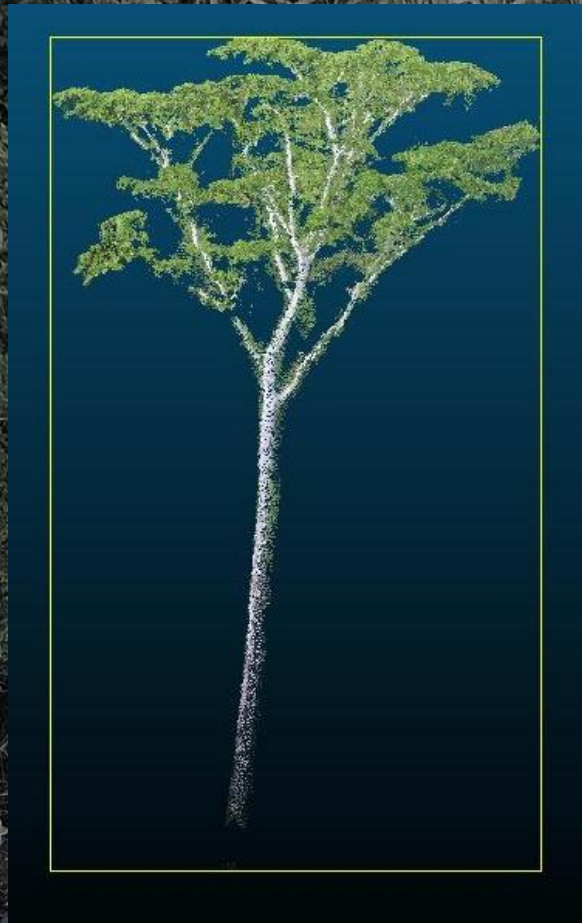
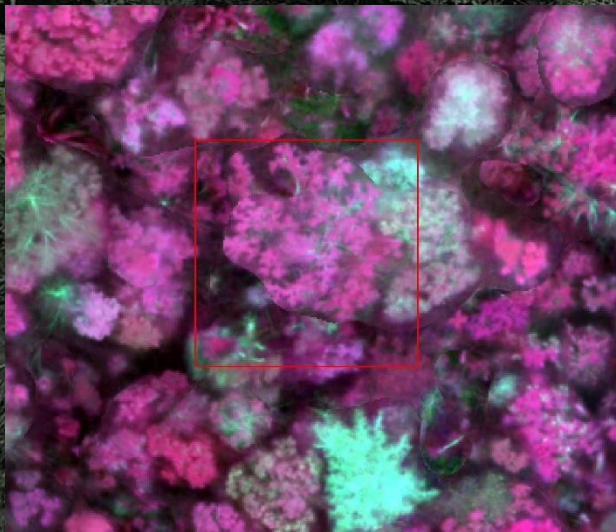
Near Infrared





Colour image

Red, red-edge & NIR image



- Location
- Height
- DBH
- Crown area
- Crown volume
- Volume
- Biomass -> Carbon
- Leaf density
- Shape
- Branch: length, angle
- Health
- Chemistry



Kew

Royal Botanic Gardens

