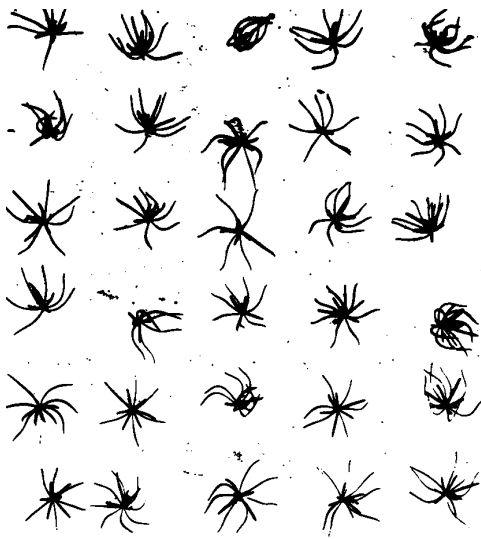
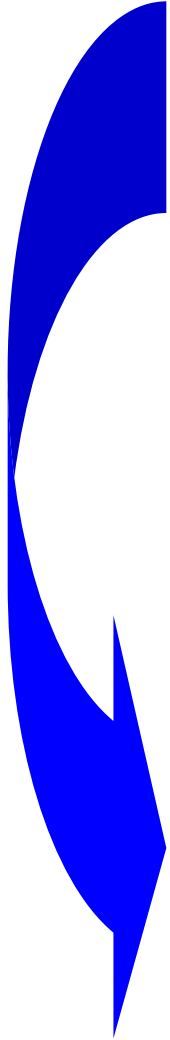




Phenotypical selections of planting material through new technological approaches

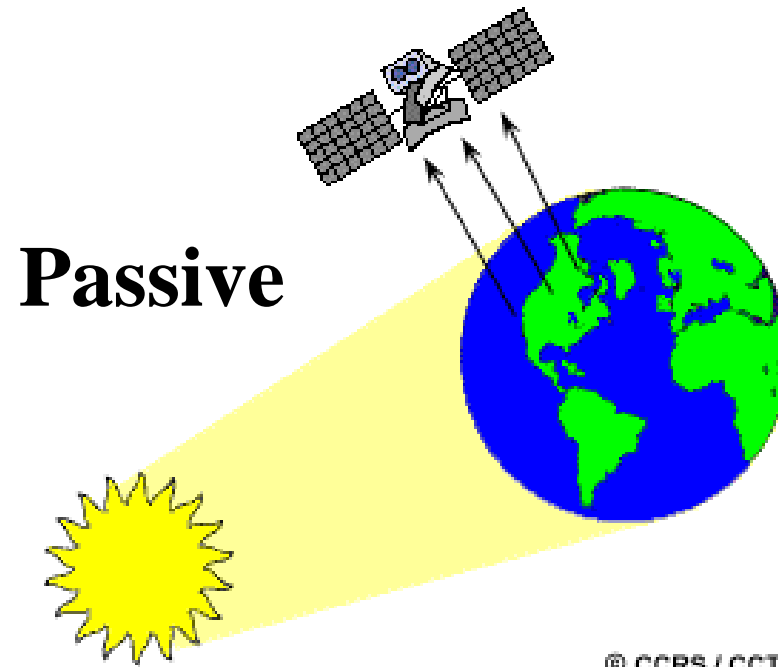


ENVIRONMENTAL SCIENCE

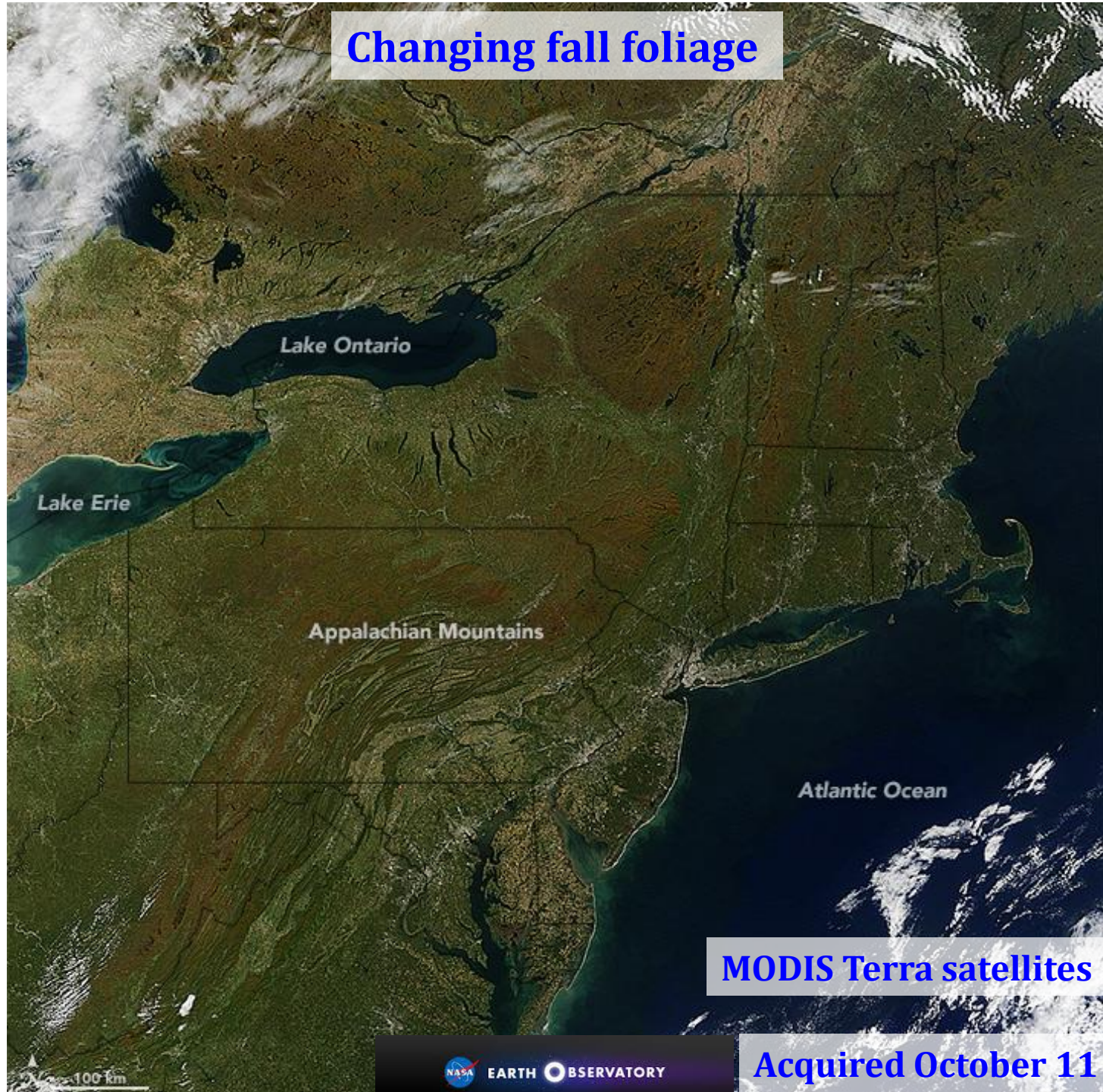


Single tree level

passive sensor



Changing fall foliage



Lake Ontario

Lake Erie

Appalachian Mountains

Atlantic Ocean

MODIS Terra satellites

Acquired October 11

Changing fall foliage

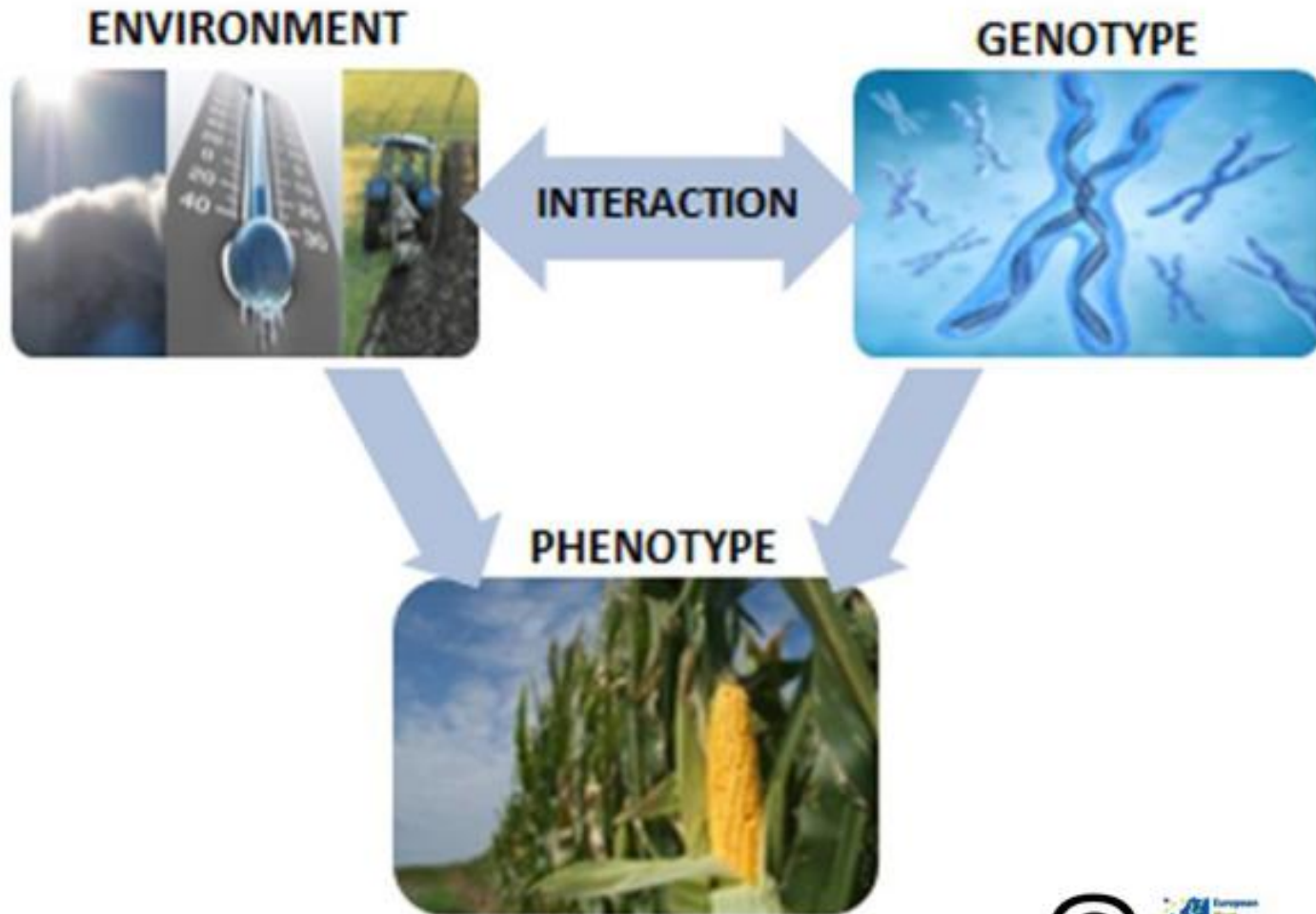
Sunlight and temperature are the primary factors responsible for the shift from green to shades of brown and orange.



MODIS Aqua satellite

Acquired September 9

Plant Phenotype



Phenotype: different environment (sport) + different genotype (body)

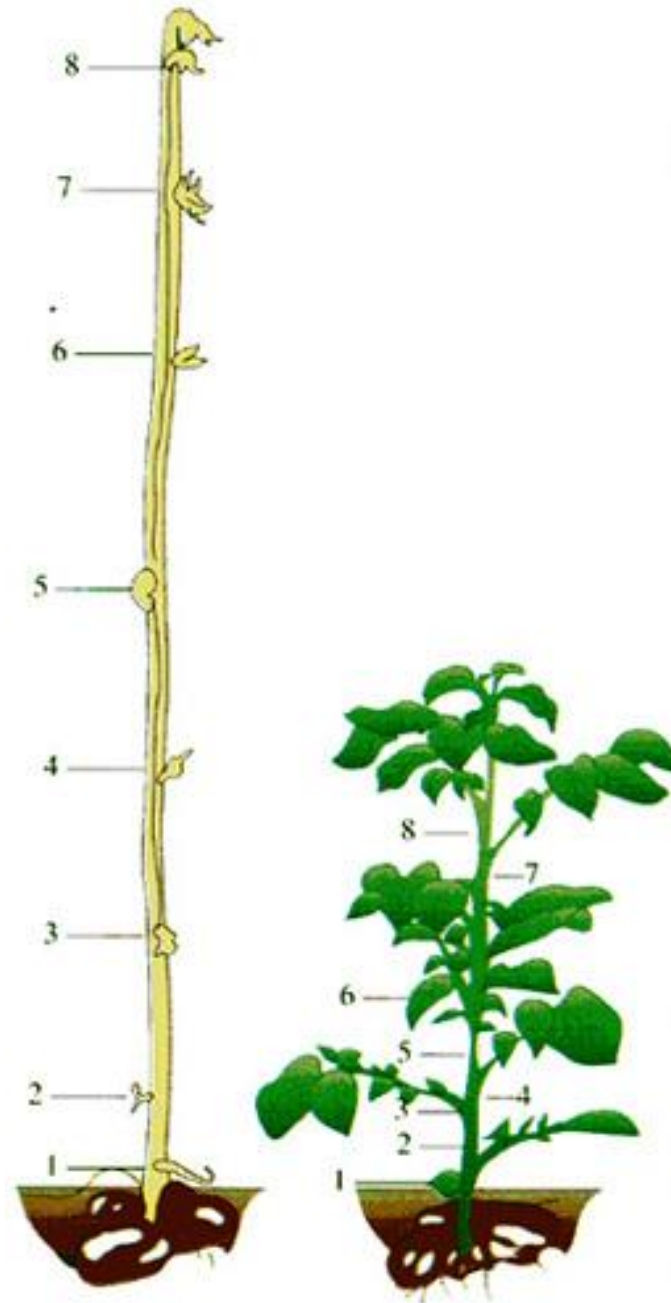


Walt Wigo Volleyball 6'2", 155 lbs.	Gary Hall Swimming (Freestyle) 6'5", 185 lbs.	Dan O'Brien Doomer 6'2", 185 lbs.	Terrence Trammell Hurdles (110m) 6'2", 175 lbs.	Ron Warren, Jr. Horse Racing 5'4", 115 lbs.	Emanuel Yarbrough Sumo 6'8", 700 lbs.	Tony Gonzalez Football 6'4", 248 lbs.	Adam Nelson Shot Put 6'0", 255 lbs.	Carlos Delgado Baseball 6'3", 225 lbs.	Bob Kennedy Long Distance Running 6'0", 146 lbs.	Brandon Stay Wrestling 5'8", 167 lbs.	Joseph Chebet Marathon 5'4.5", 114 lbs.	Alonzo Mourning Basketball 6'10", 261 lbs.	Adam Setiff Discus 6'4", 270 lbs.
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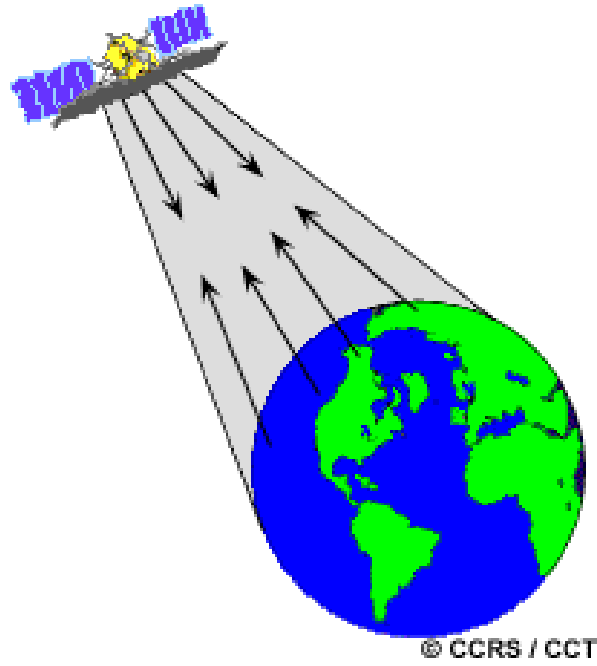


Danielle Scott Volleyball 6'2", 185 lbs.	Dara Torres Swimming 6'0", 150 lbs.	Kathy Collins Boxing 5'5", 137 lbs.	Olga Karmansky Rhythmic Gymnastics 5'1", 85 lbs.	Connie Price-Smith Shot Put 6'3", 210 lbs.	Shannon Miller Gymnastics 5'0", 97 lbs.	Stacy Dragila Pole Vault 5'7.5", 140 lbs.	Staciana Stitts Swimming 5'10", 140 lbs.	Cathy Sassin Adventure Racing 5'6", 138 lbs.	Dawn Ellerbe Hammer Throw 6'2", 240 lbs.	DeLisha Milton Basketball 6'1", 172 lbs.	Kim Chizevsky Bodybuilding 5'8.5", 135 lbs.	Annika Sorenstam Golf 5'5", 120 lbs.	Tara Nott Weightlifting 5'11", 105 lbs.	Te... Long D... 4'
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Phenotype: different environment (light) + same plant species



active sensor



Active

LIDAR technology

Uses a laser to transmit a light pulse



Receiver with detectors that measures the reflected light

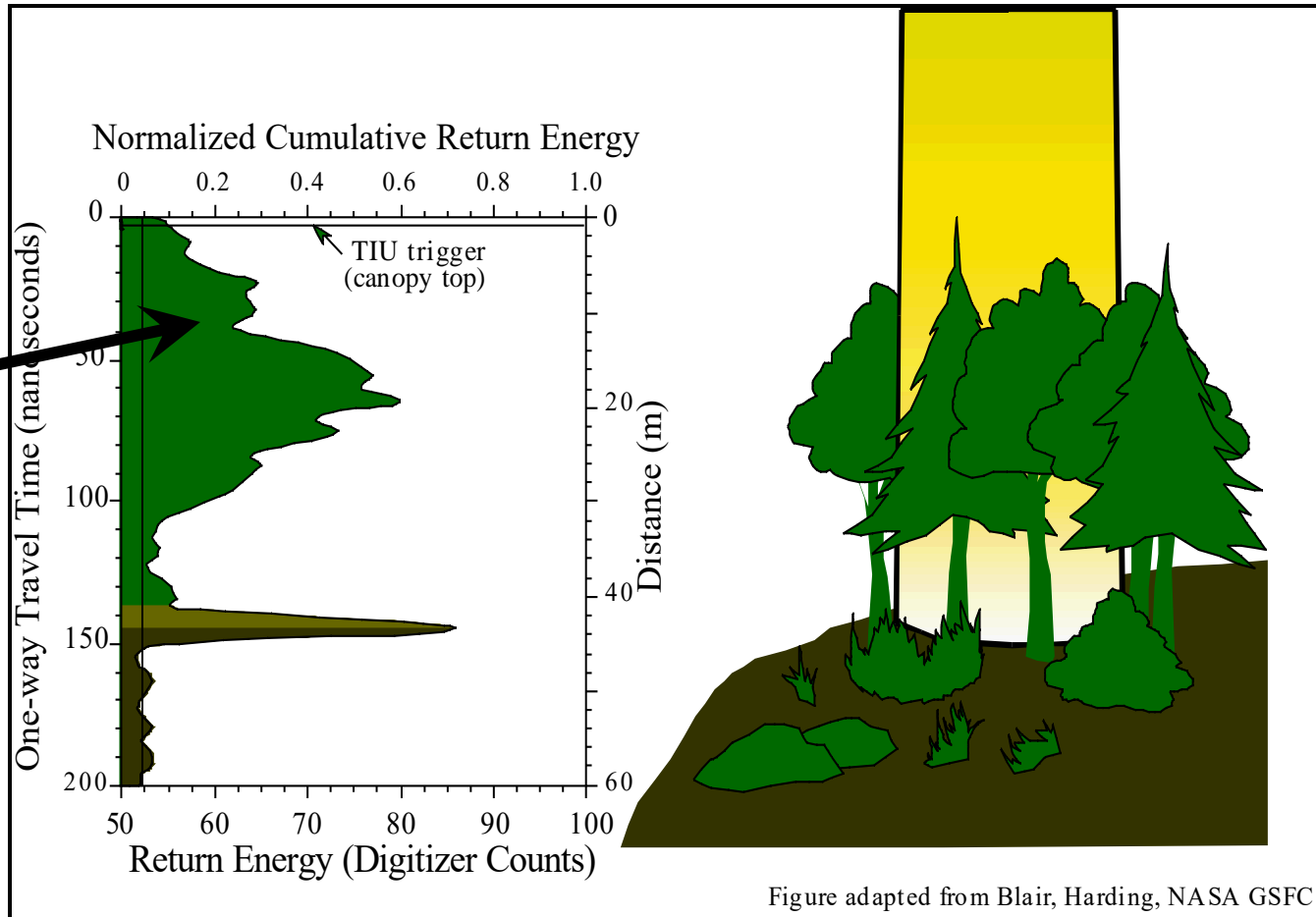
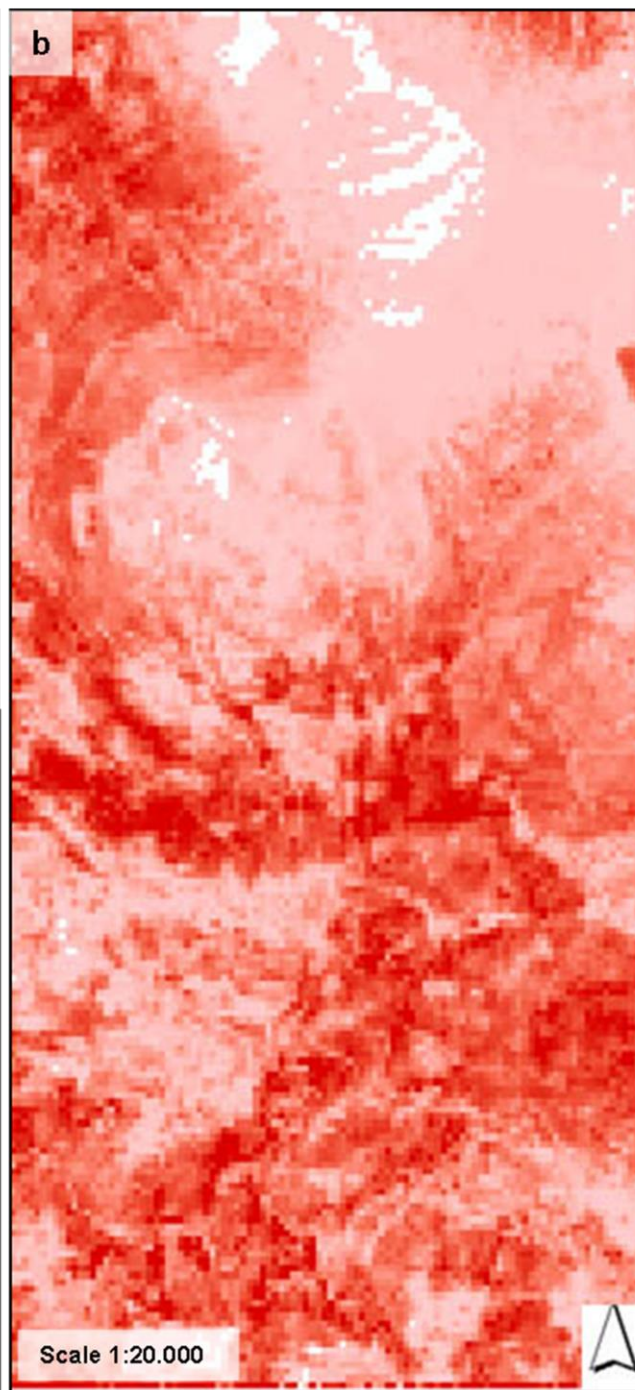
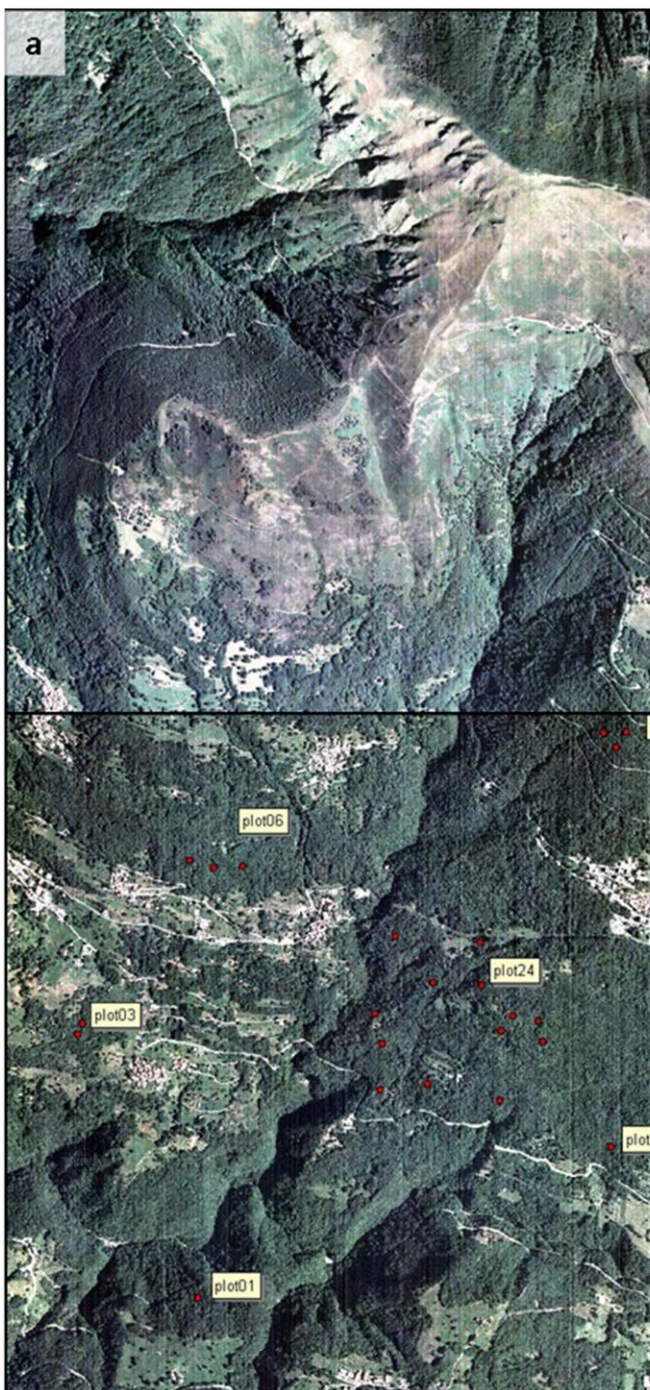


Figure adapted from Blair, Harding, NASA GSFC





Val Sassina (LC)

Regione Lombardia Lidar Data

Montagnoli et al. Forest Ecosystems
DOI 10.1186/s40663-015-0035-6

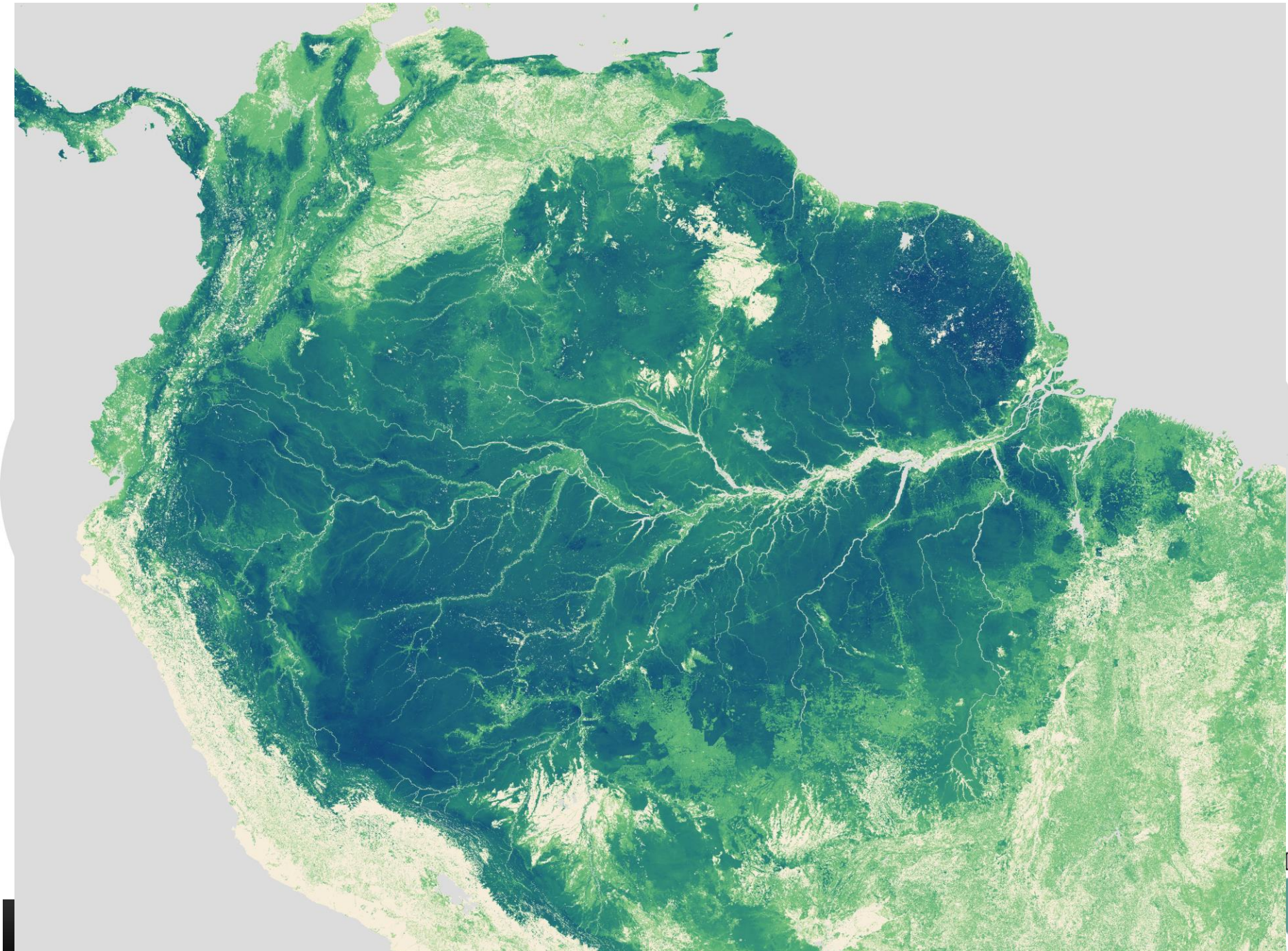
Forest Ecosystems
a SpringerOpen Journal

RESEARCH ARTICLE Open Access

Estimating forest aboveground biomass by low density lidar data in mixed broad-leaved forests in the Italian Pre-Alps

Antonio Montagnoli^{1*}, Sara Fusco¹, Mattia Terzaghi¹, Alan Kirschbaum², Dirk Pflugmacher³, Warren B Cohen⁴, Gabriella S Scippa² and Donato Chiatante¹





M. Simard et al. 2012

RS

DIC

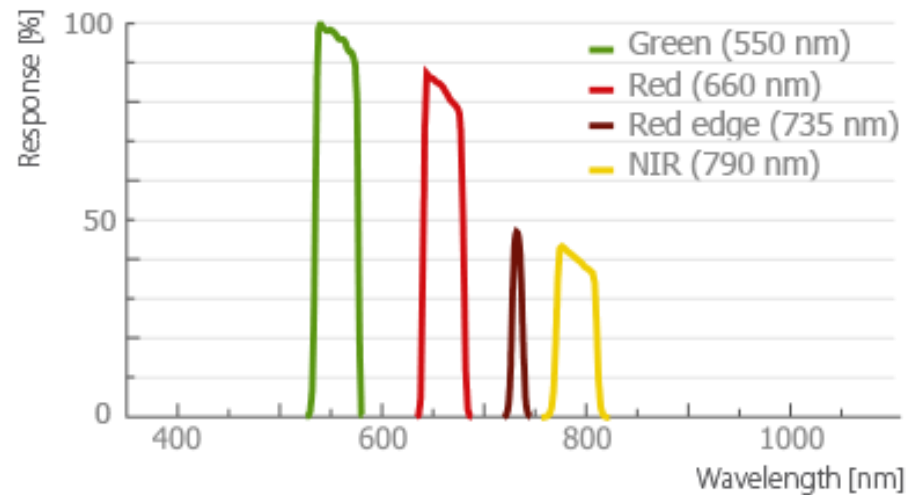


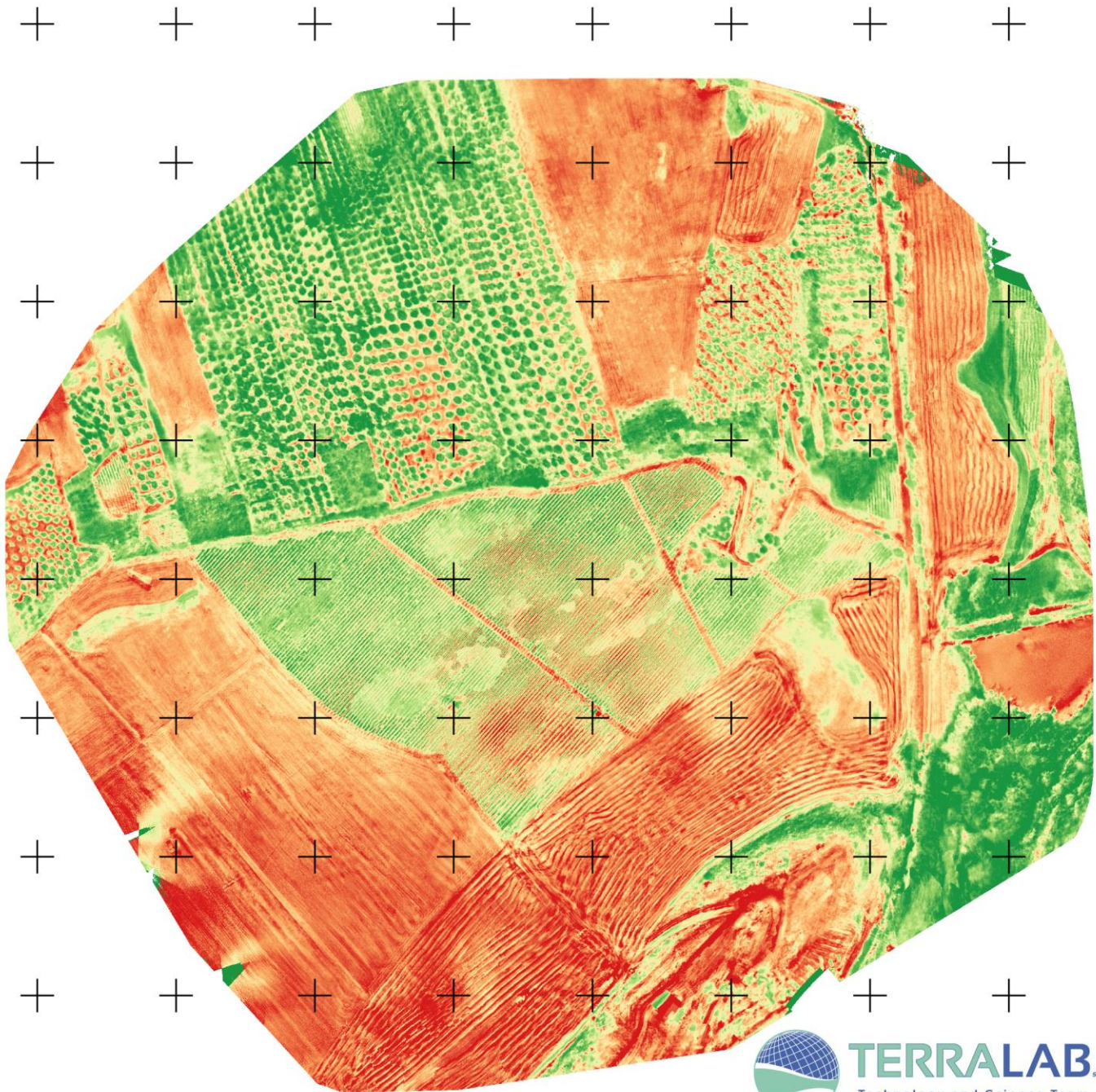
SenseFly Ebee



Resolution: 1.2 Mp x 4
Ground resolution at 100m: 10 cm/px
Sensor size: 4.8 x 3.6 mm per sensor
Pixel pitch: 3.75 μm
Image format: RAW
Upward looking irradiance sensor

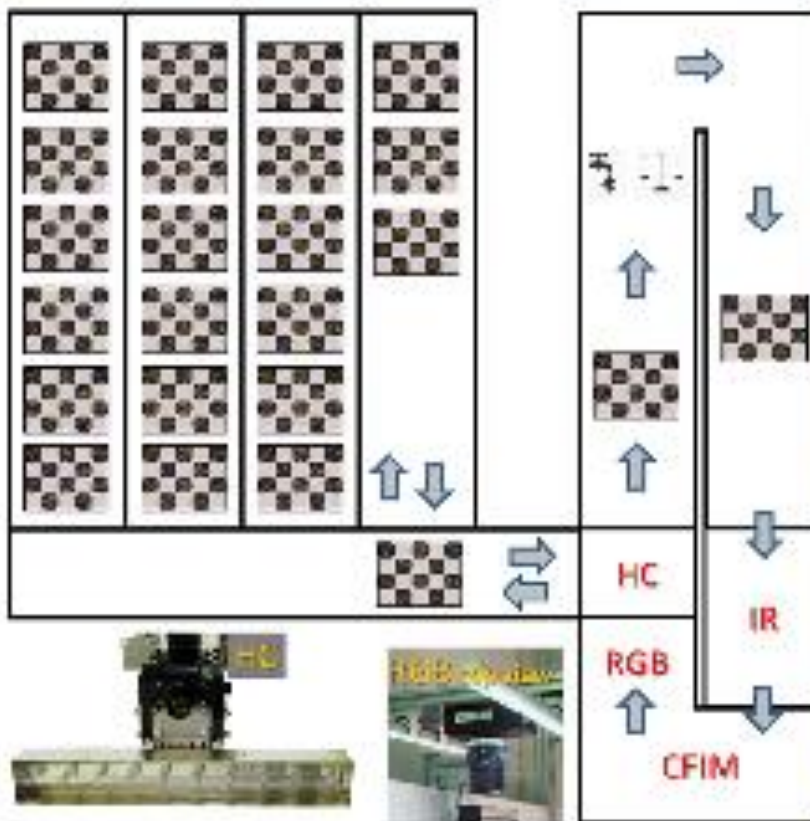
Airinov Multispec 4c

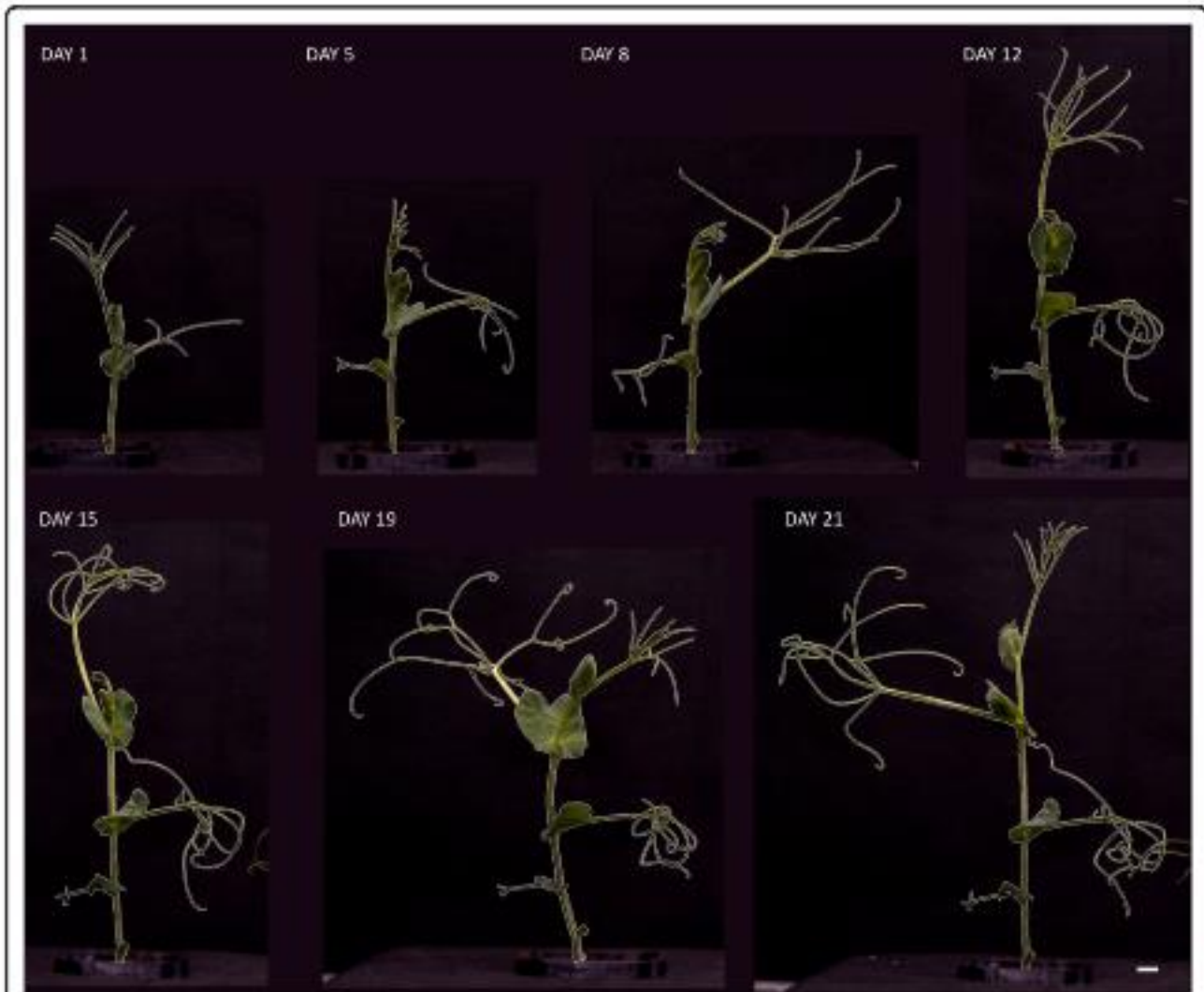


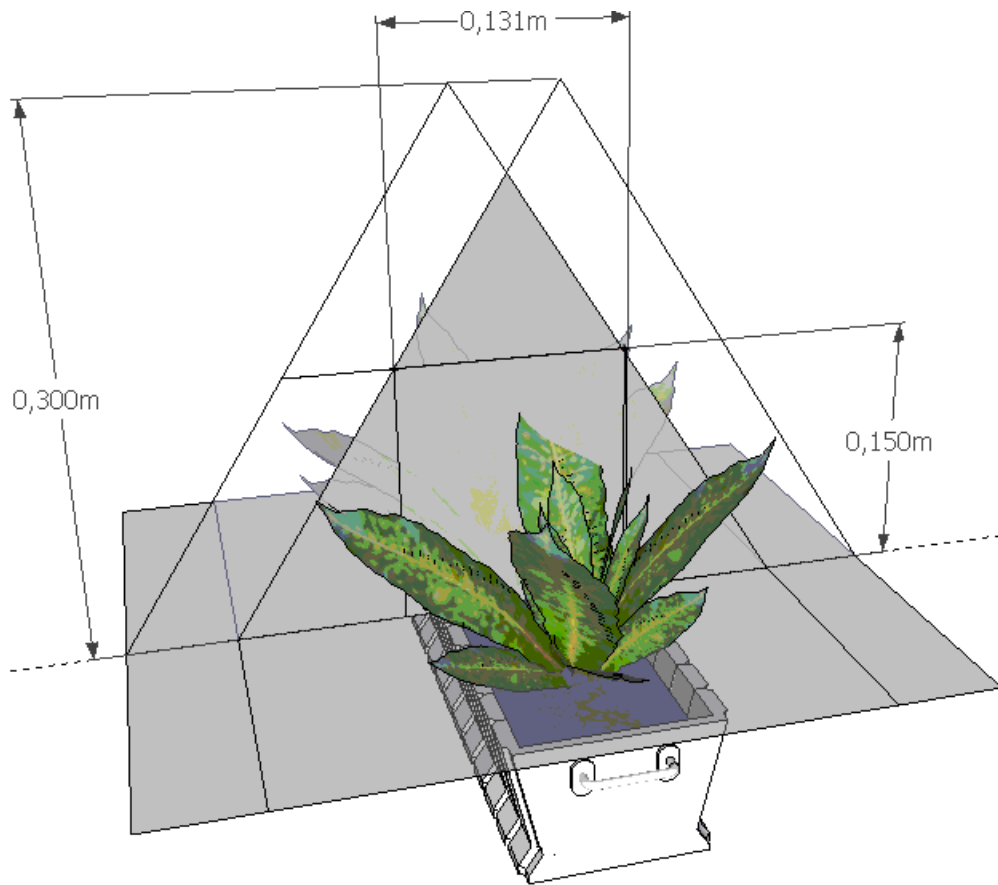


Legend

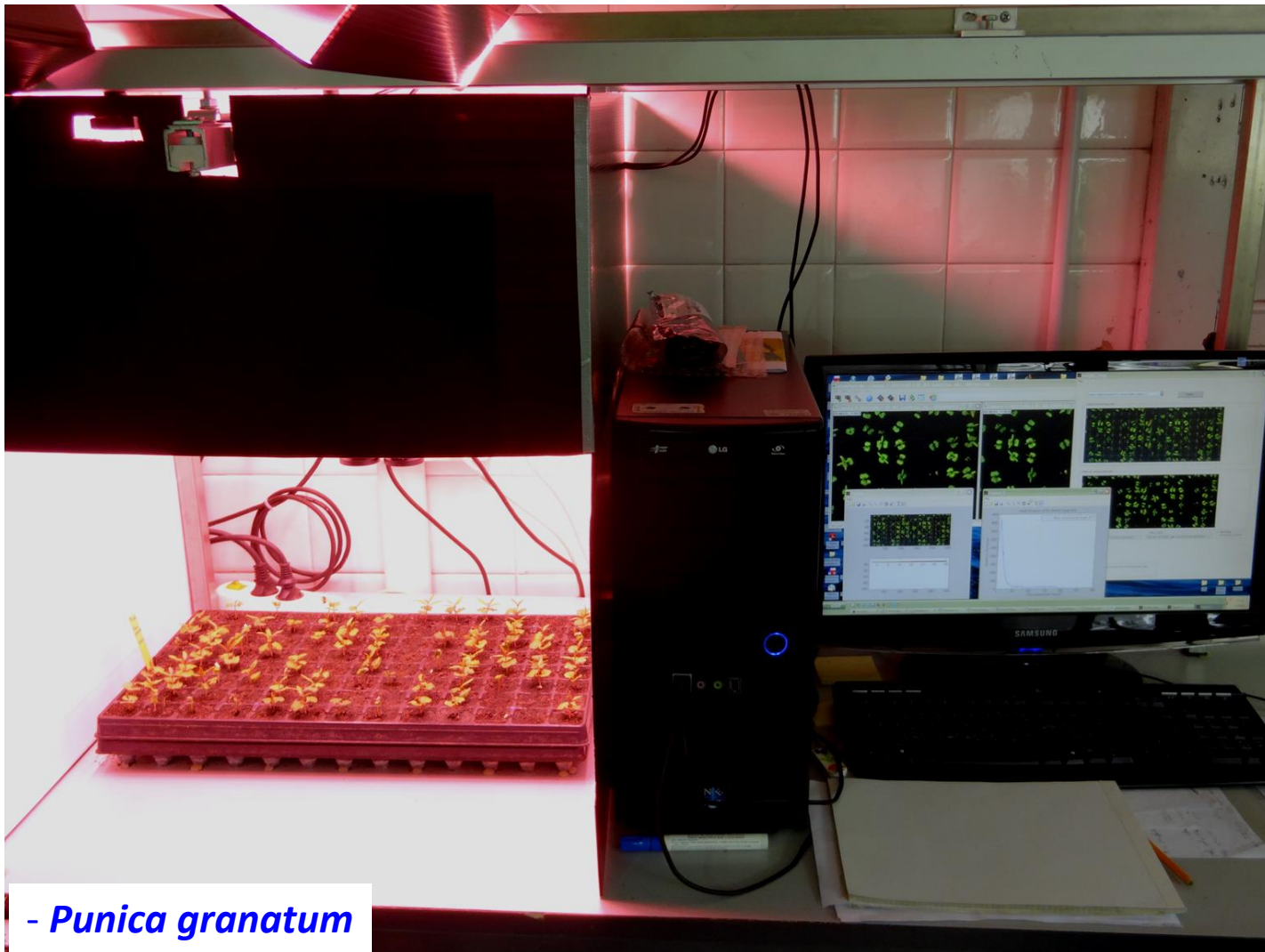
- NDVI
- 0.070000
 - 0.148889
 - 0.227778
 - 0.306667
 - 0.385556
 - 0.464444
 - 0.543333
 - 0.622222
 - 0.701111
 - 0.780000







Stereoscopic photo acquisition of plant tray



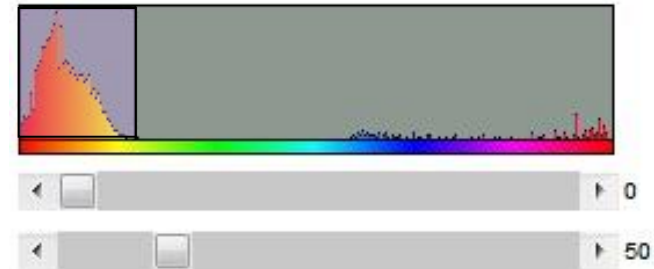
- *Punica granatum*

Software analysis

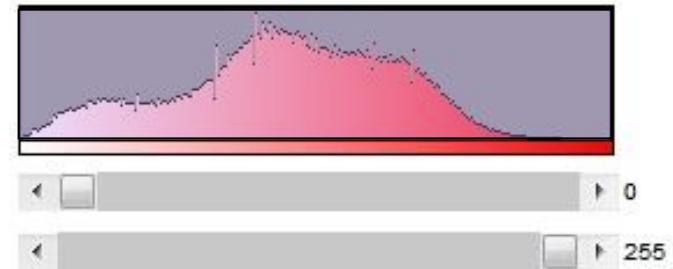
Pomegranate (*Punica granatum L.*)



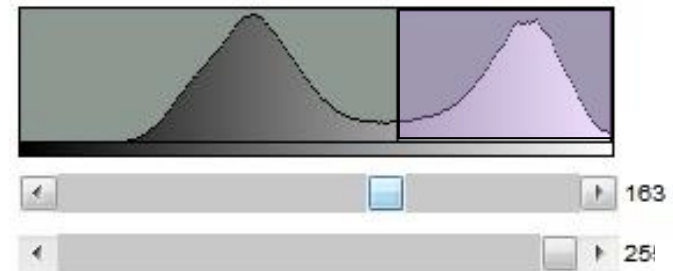
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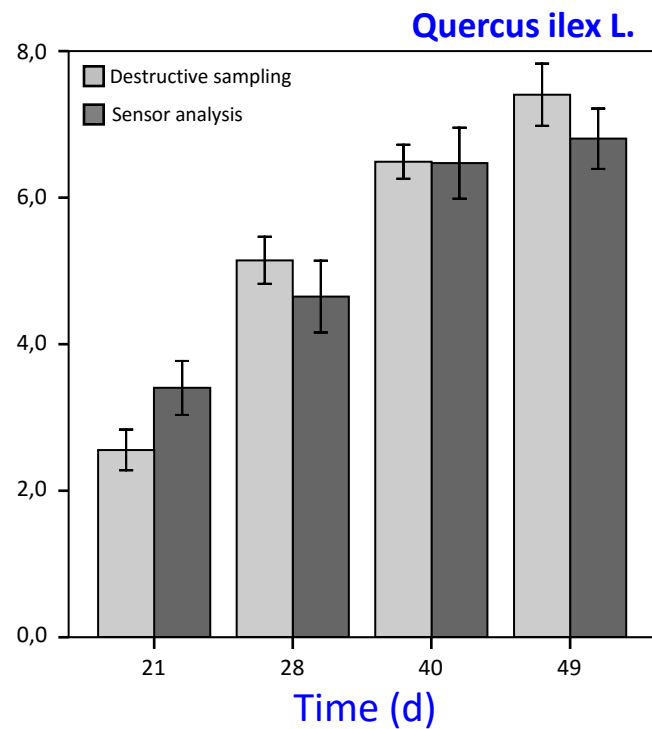
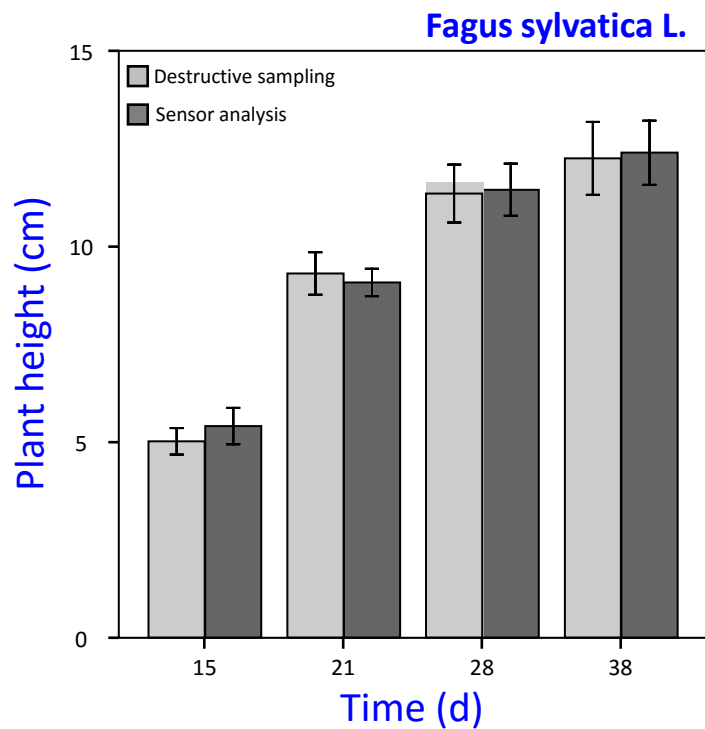
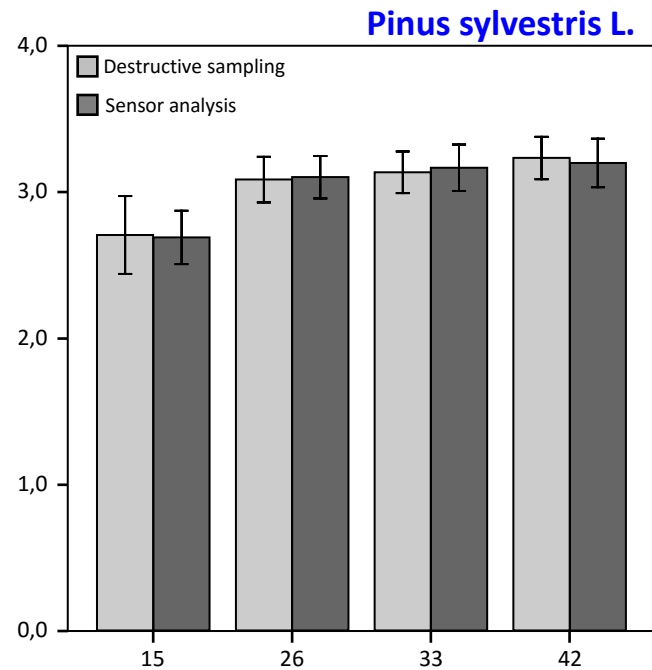
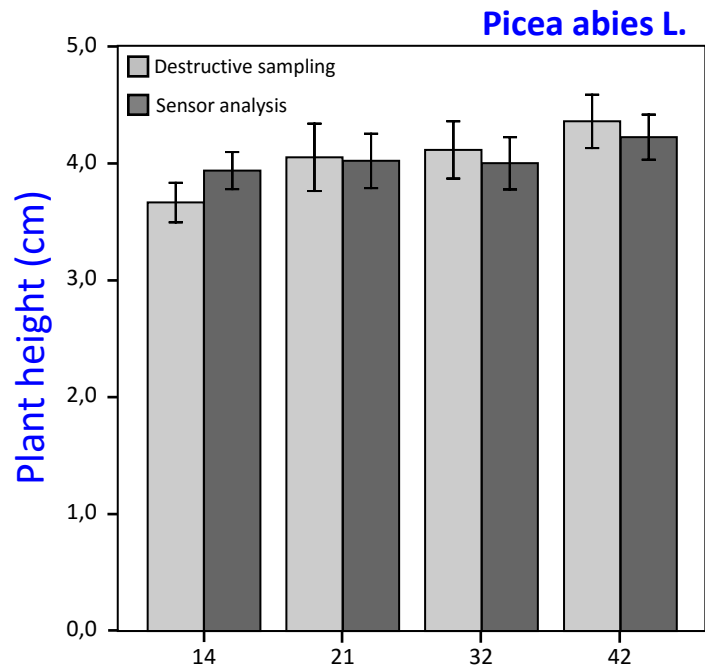


Saturation

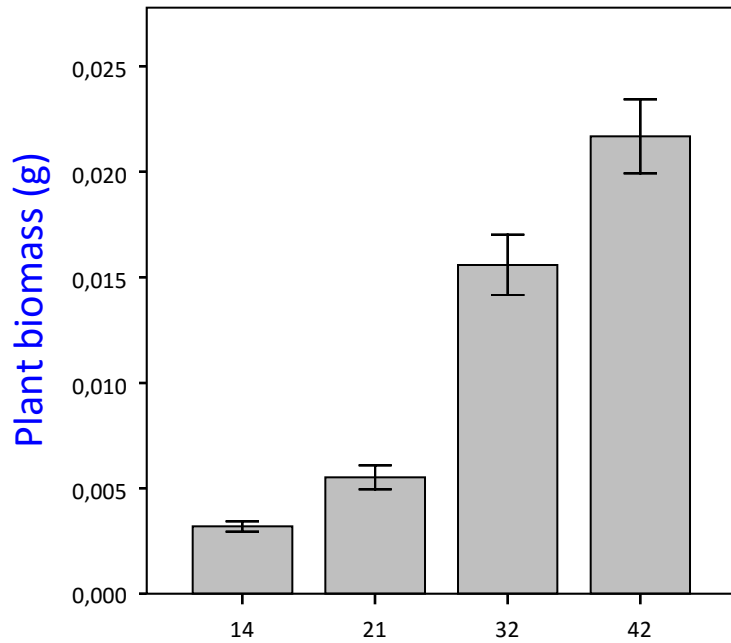


Brightness

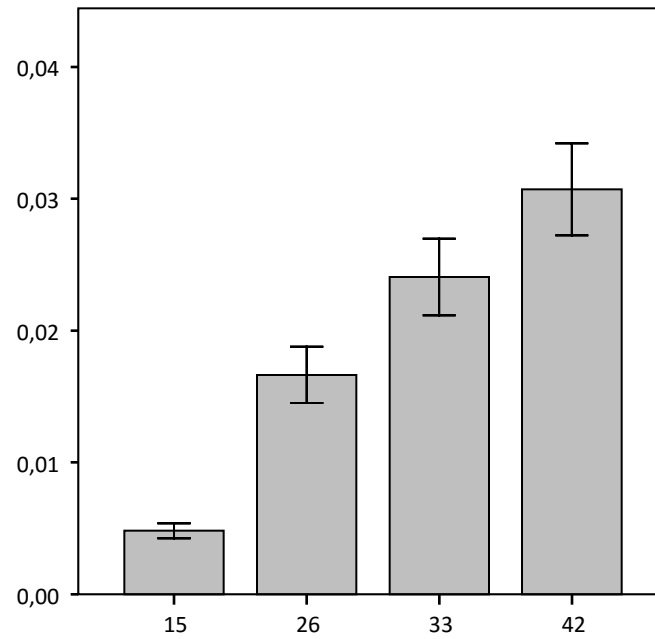




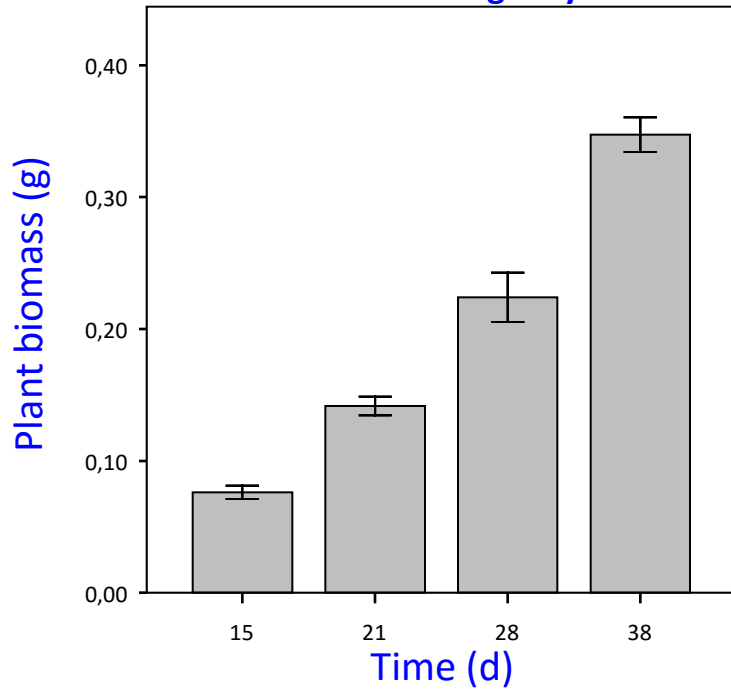
Picea abies L.



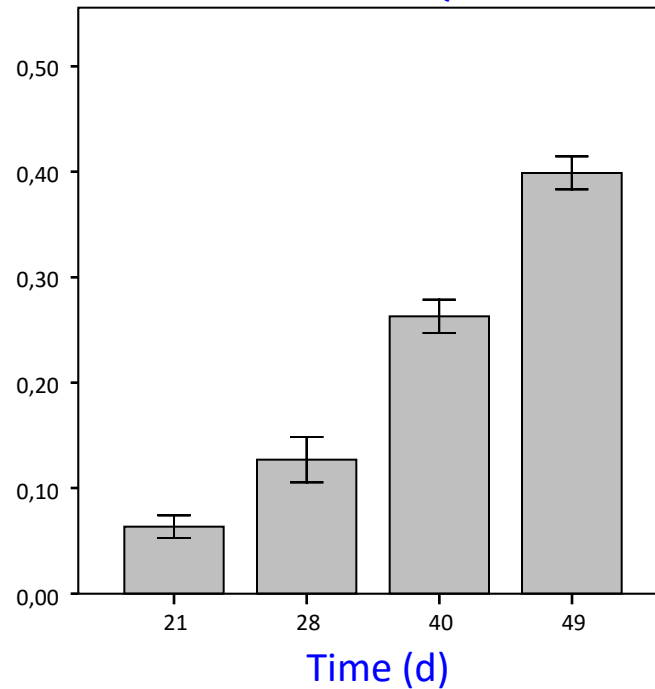
Pinus sylvestris L.



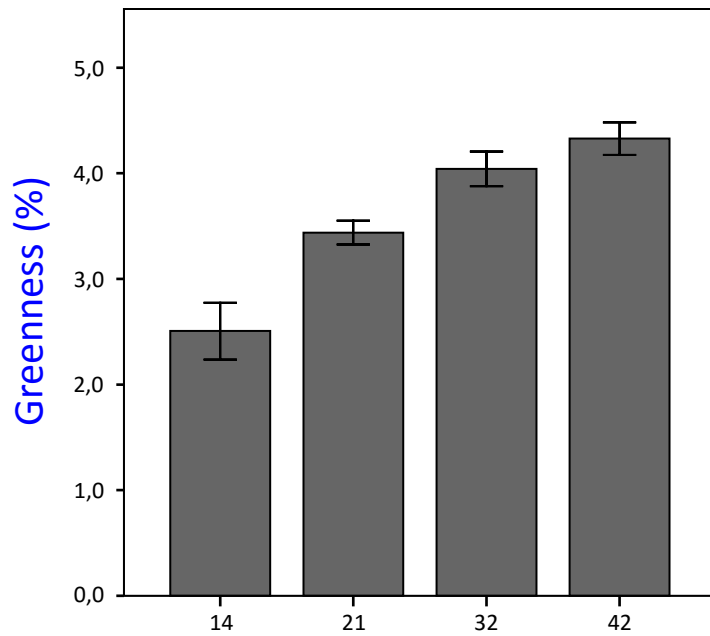
Fagus sylvatica L.



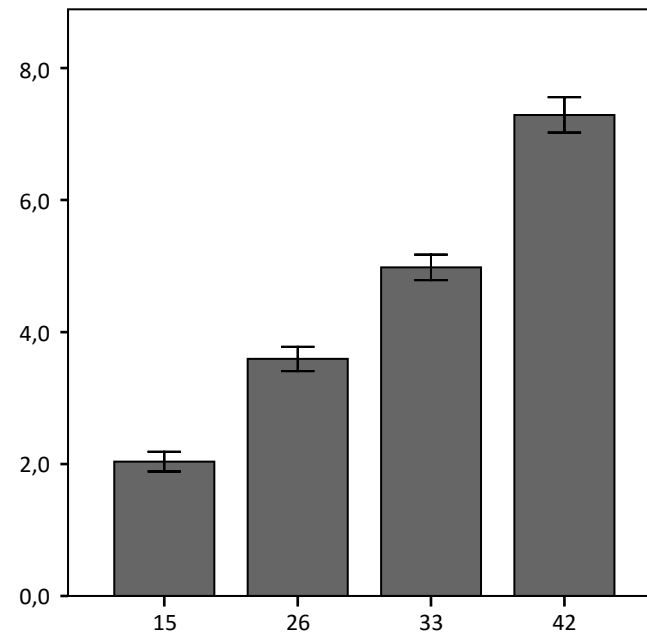
Quercus ilex L.



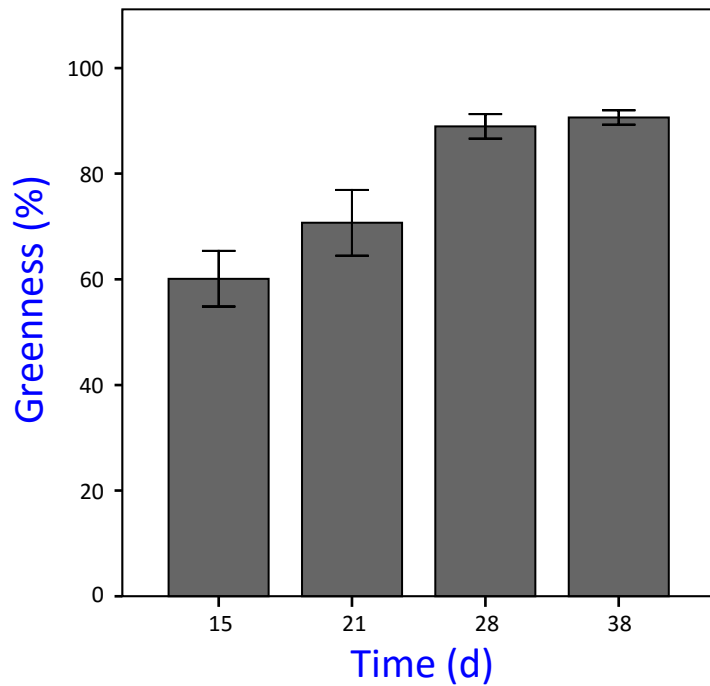
***Picea abies* L.**



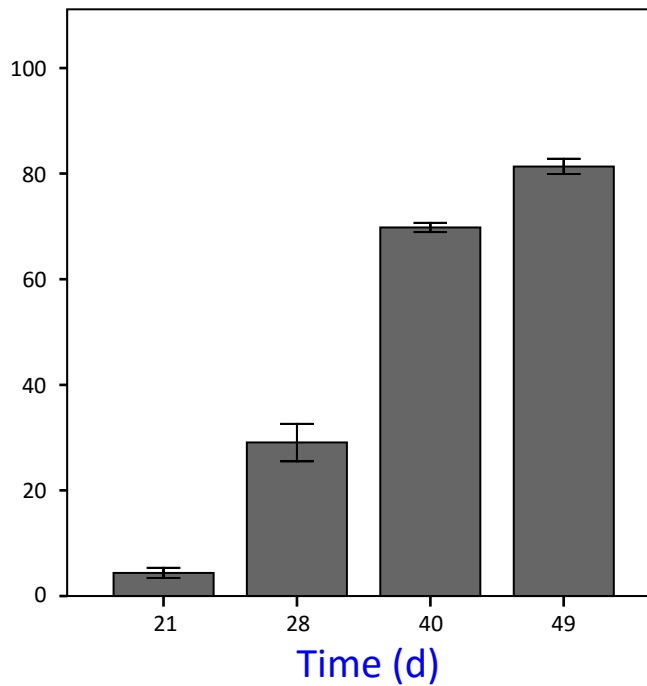
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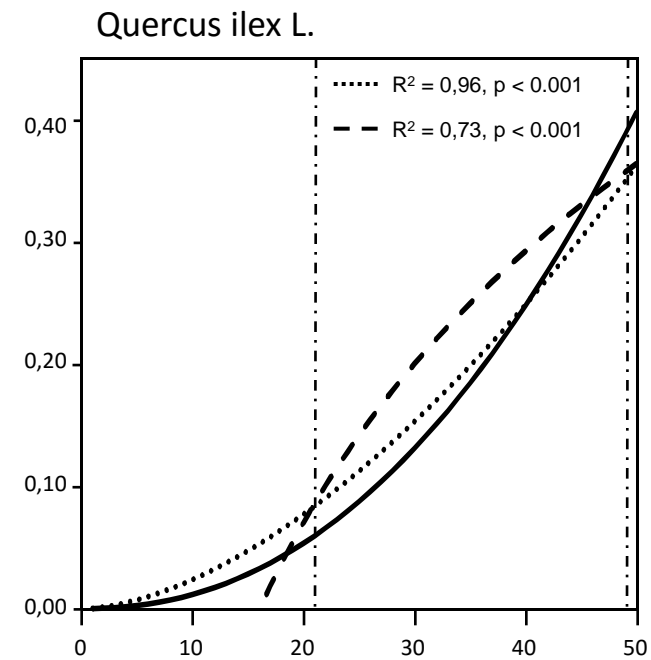
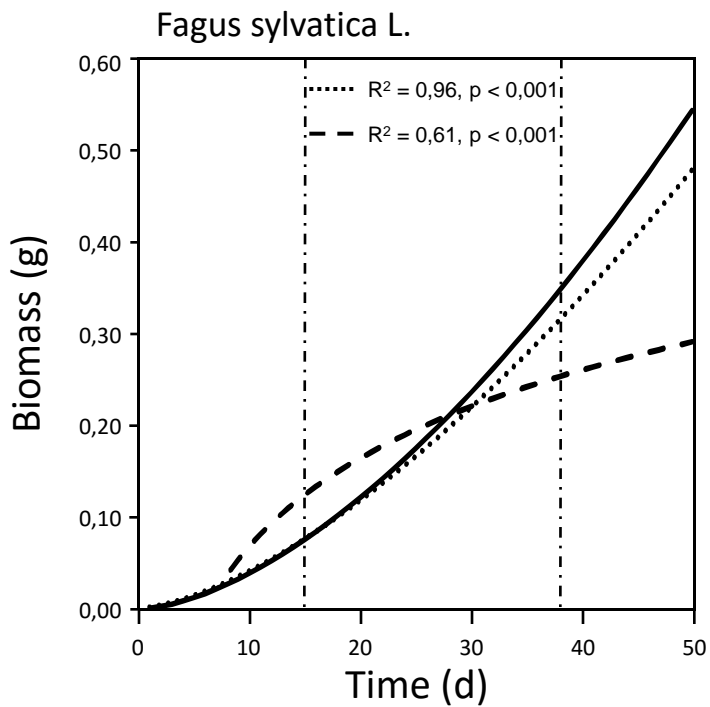
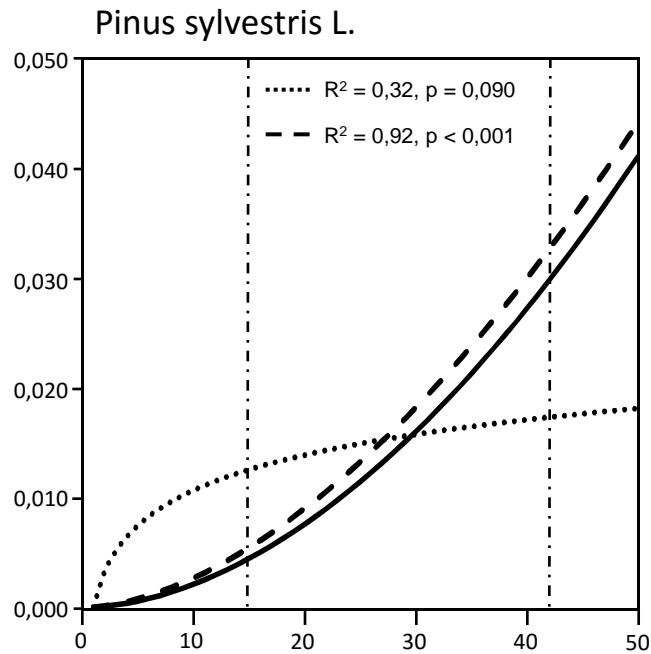
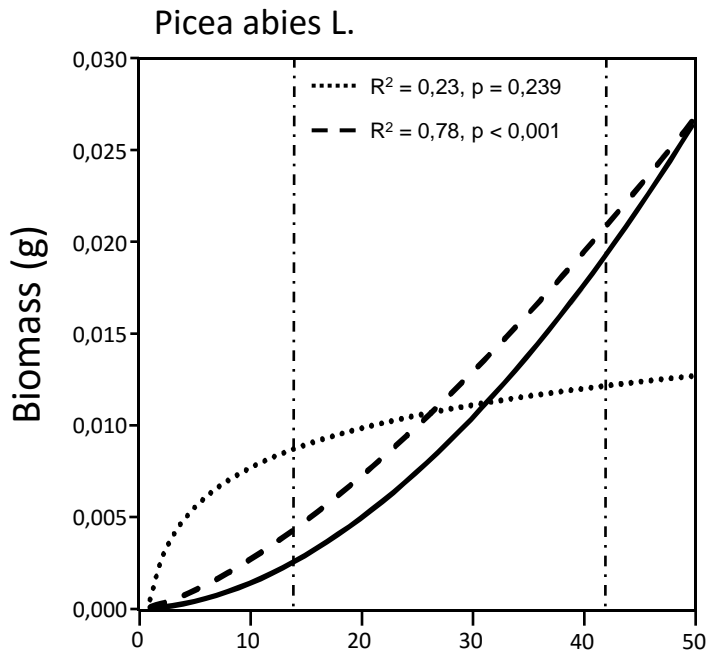


***Fagus sylvatica* L.**



***Quercus ilex* L.**

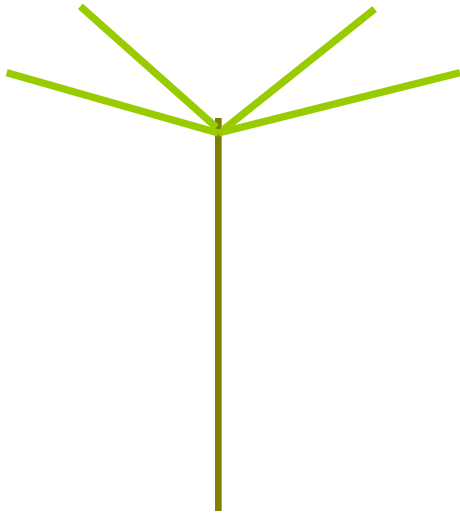




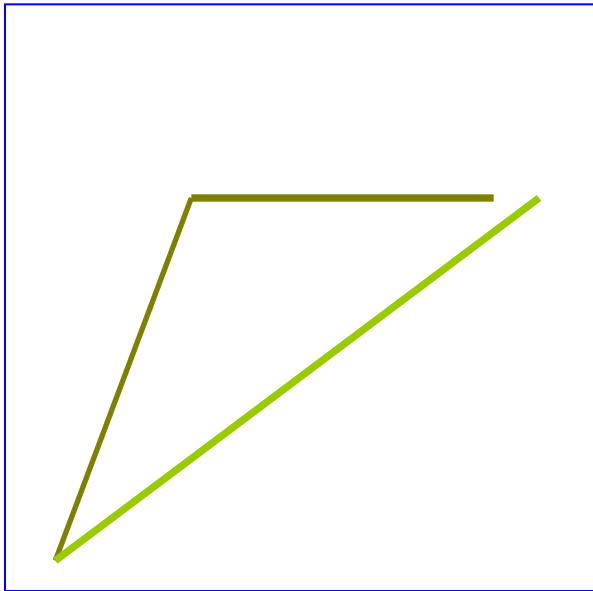
- Obtained from destructive sampling
- Calculate from plant height
- - - Calculate from greenness



Picea abies L.

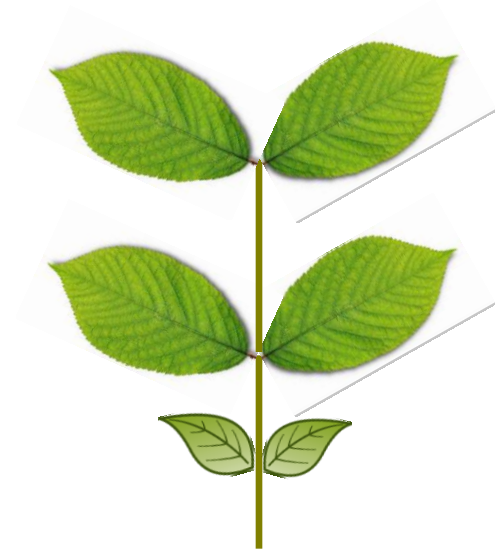


Greenness (%)
Height (g)

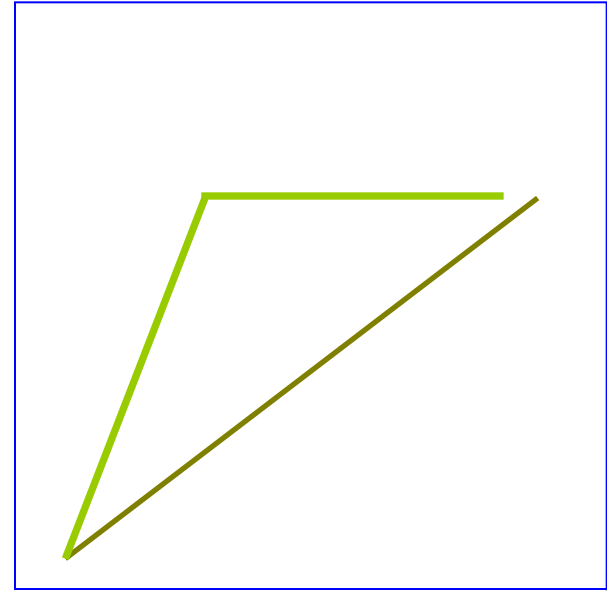


Time (d)

Fagus sylvatica L.



Height (g)
Greenness (%)



Time (d)

Acknowledgment



Regione Lombardia



UNIVERSITÀ
DEGLI STUDI DELLA
Tuscia



azorina



robosoft

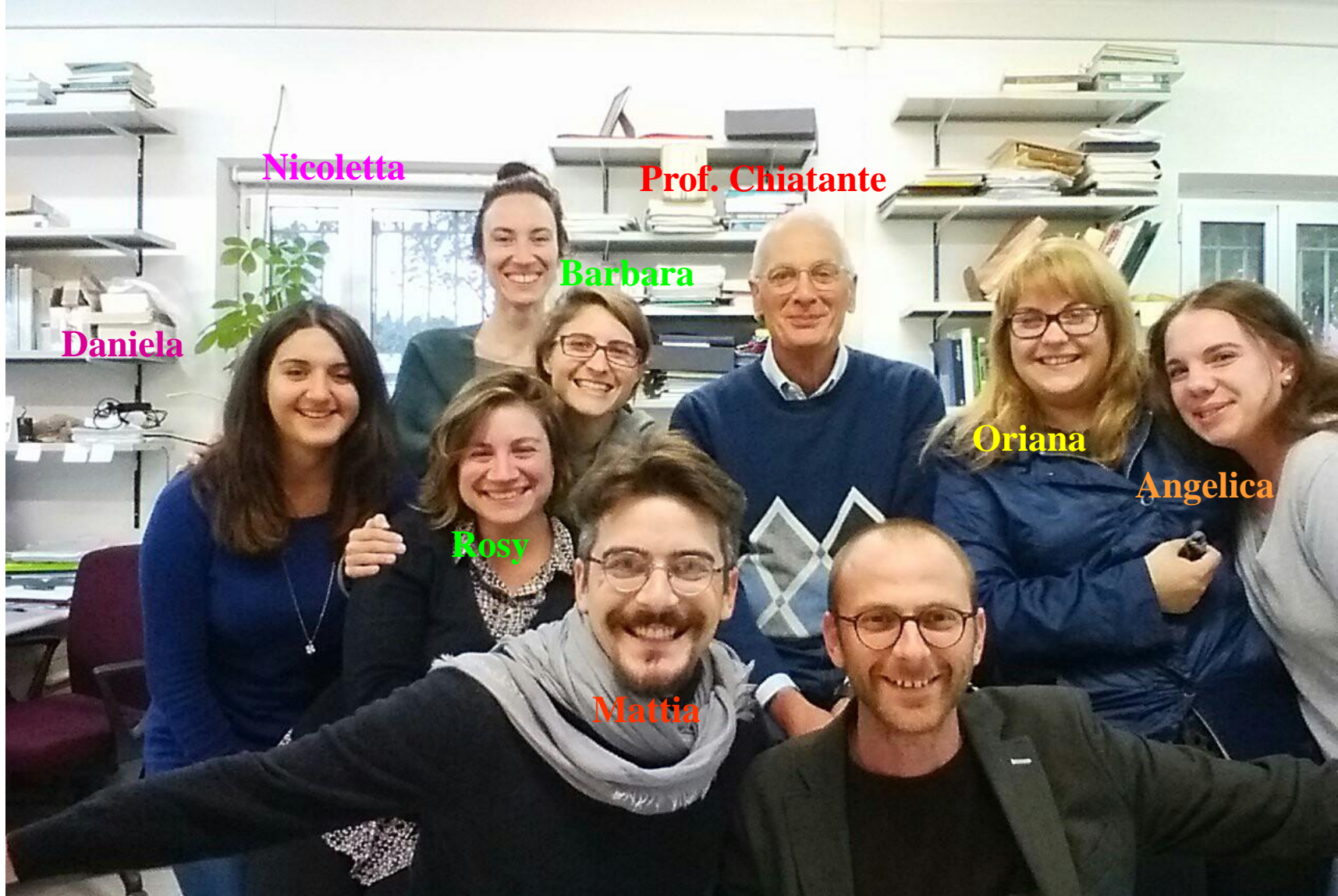
Valoya

advanticsys

exergy



Laboratorio di Botanica Ambientale ed Applicata



Nicoletta

Prof. Chiatante

Barbara

Daniela

Oriana

Angelica

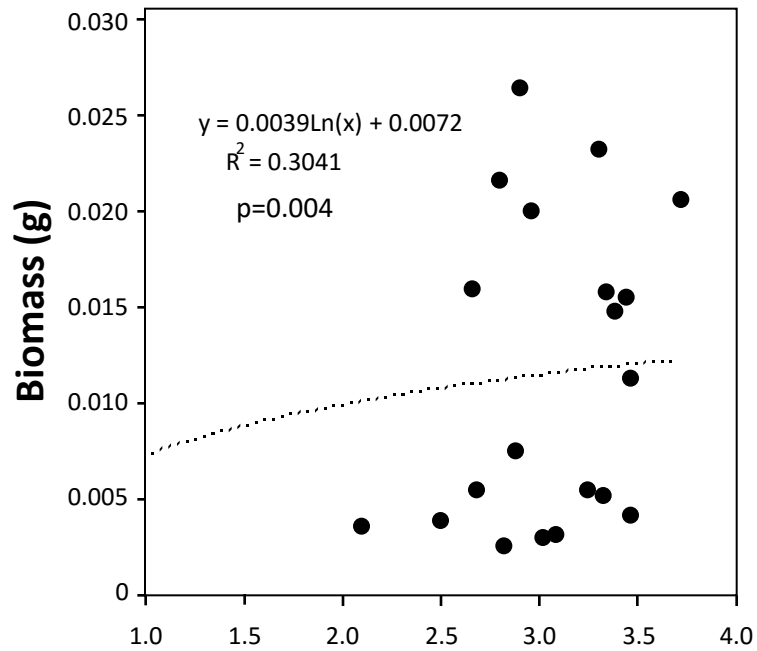
Rosy

Mattia

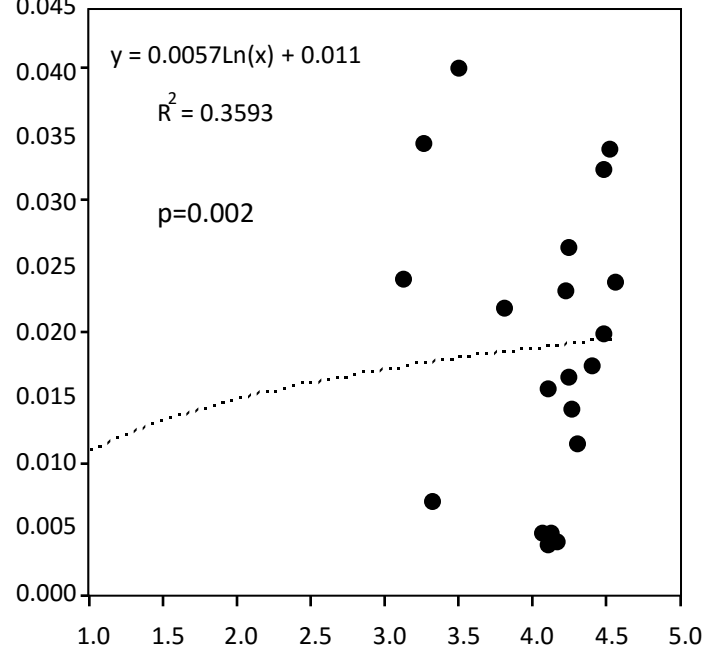
Thanks for your attention



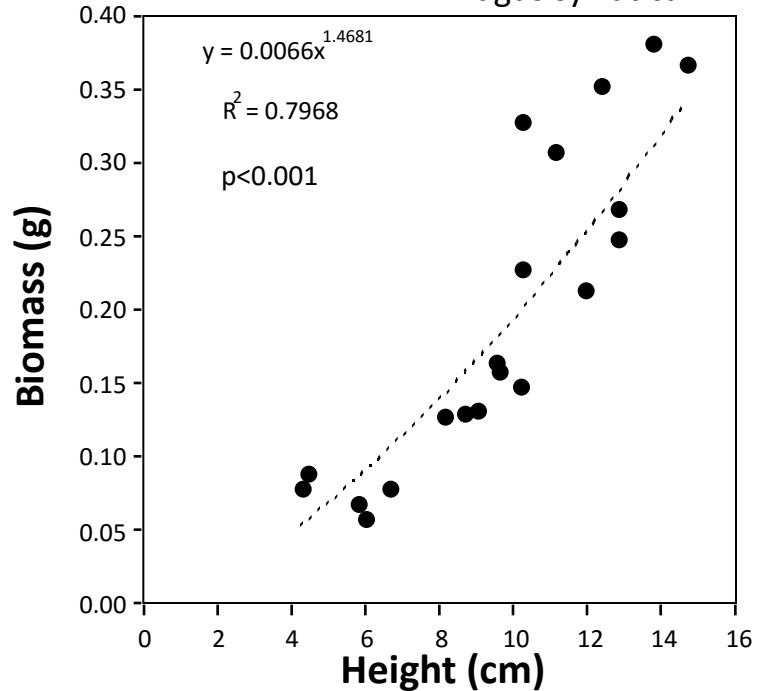
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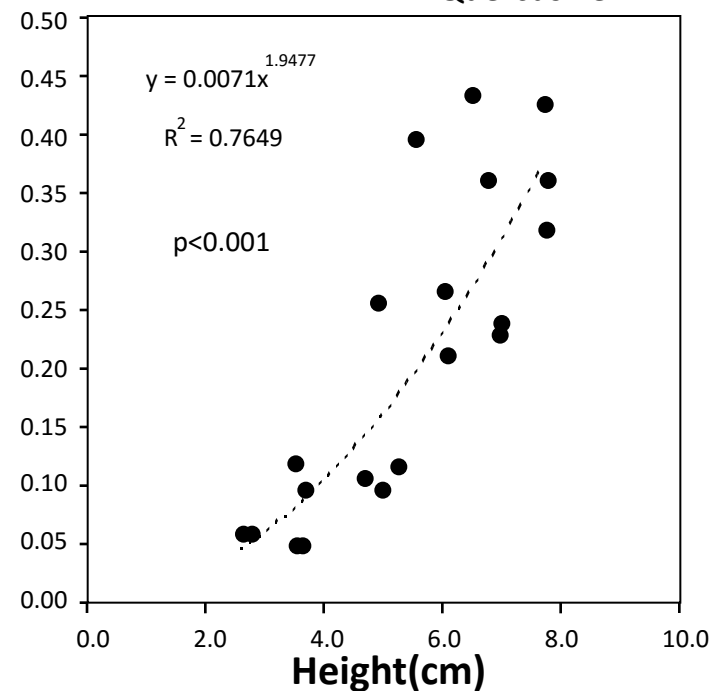
Pinus sylvestris L.



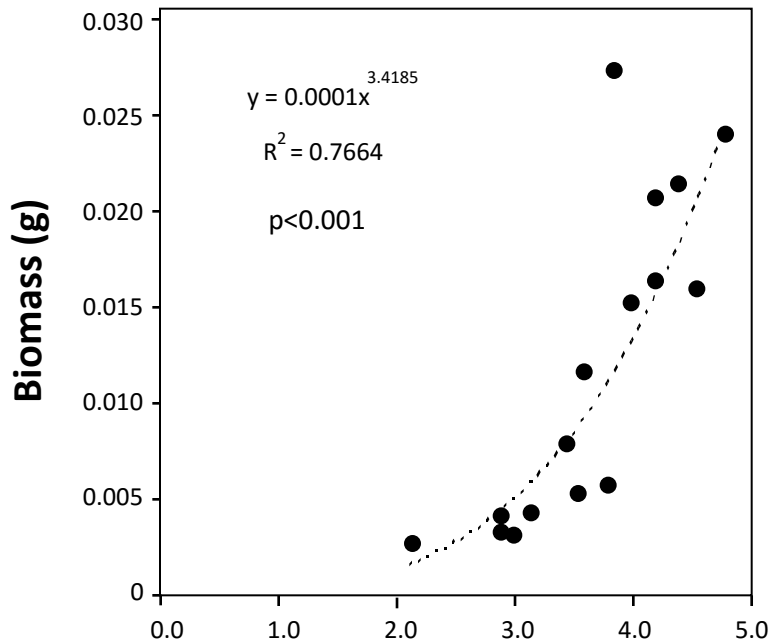
Fagus sylvatica L.



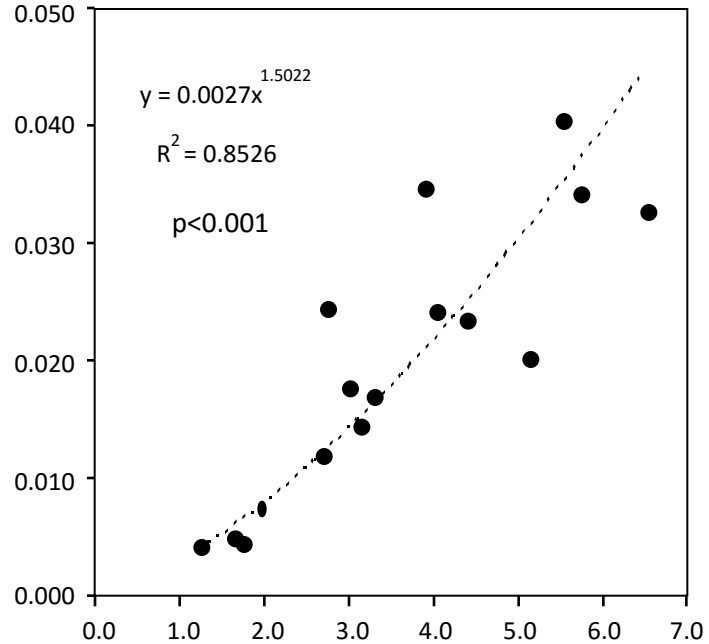
Quercus ilex L.



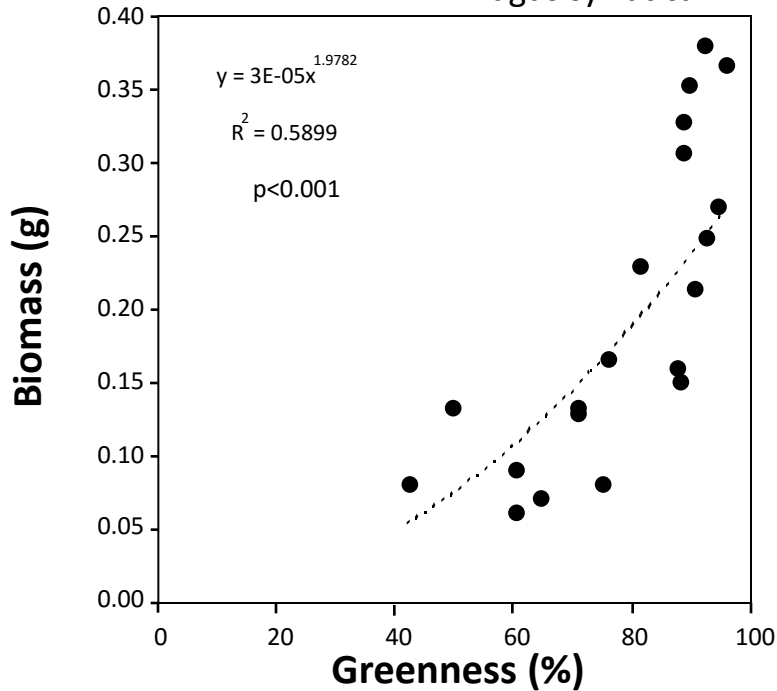
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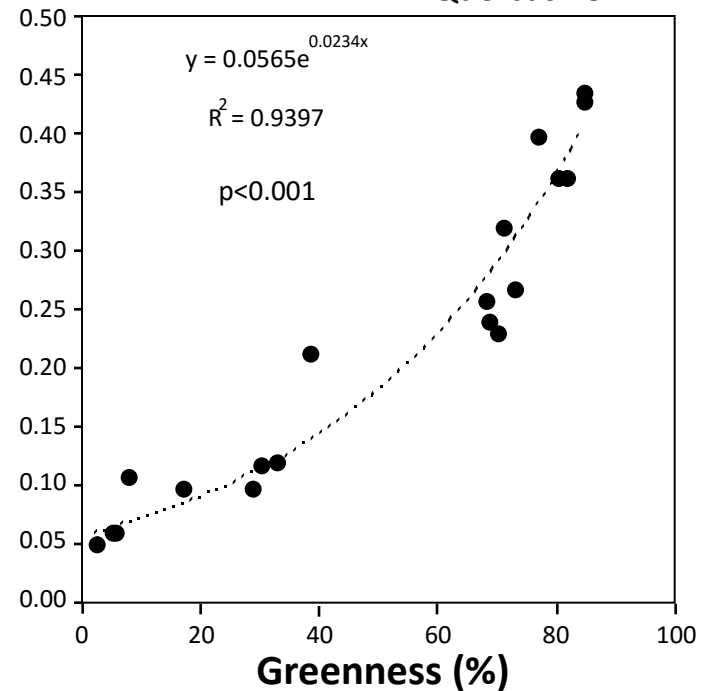
Pinus sylvestris L.



Fagus sylvatica L.



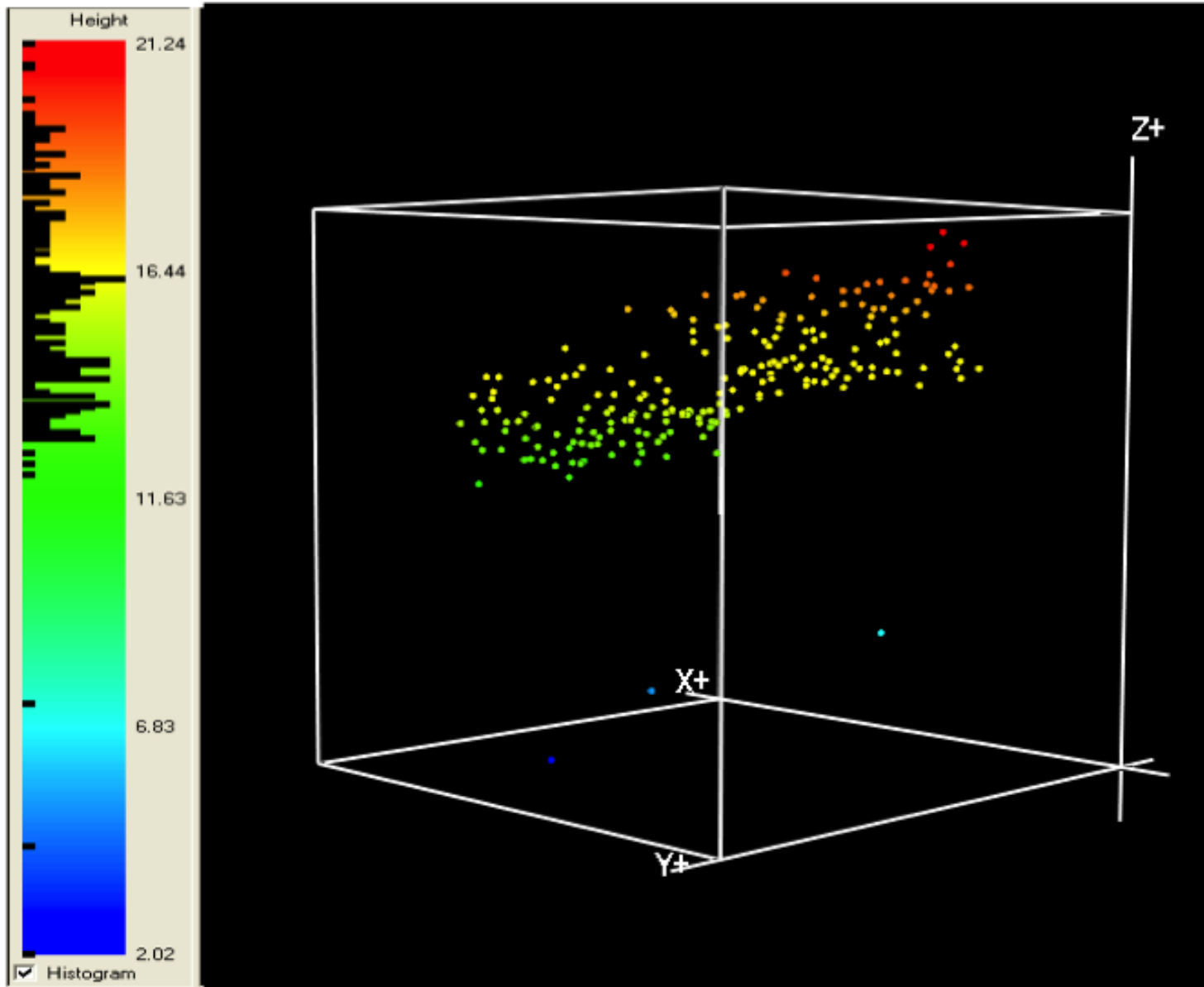
Quercus ilex L.



Phenotype: different environment (sport) + different genotype (body)







Stereoscopic photo of plant tray



- *Punica granatum*