



UNIVERSITÀ
DEGLI STUDI
FIRENZE

GESAAF

DEPARTMENT OF AGRICULTURAL
FOOD AND FORESTRY SYSTEM



Use of UAV photogrammetric 3D data for forestry inventory: a case of study

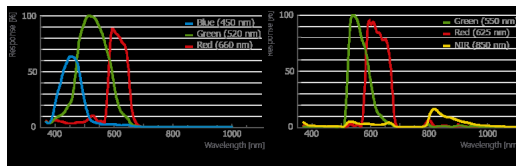
**Giannetti Francesca,
Travaglini Davide, Chirici Gherardo**

**XI CONGRESSO NAZIONALE SISEF – LA FORESTA CHE CAMBIA
Roma, 10-13 ottobre 2017**

Acquisizione SAPR



Camera RGB Camera NIR



eBee

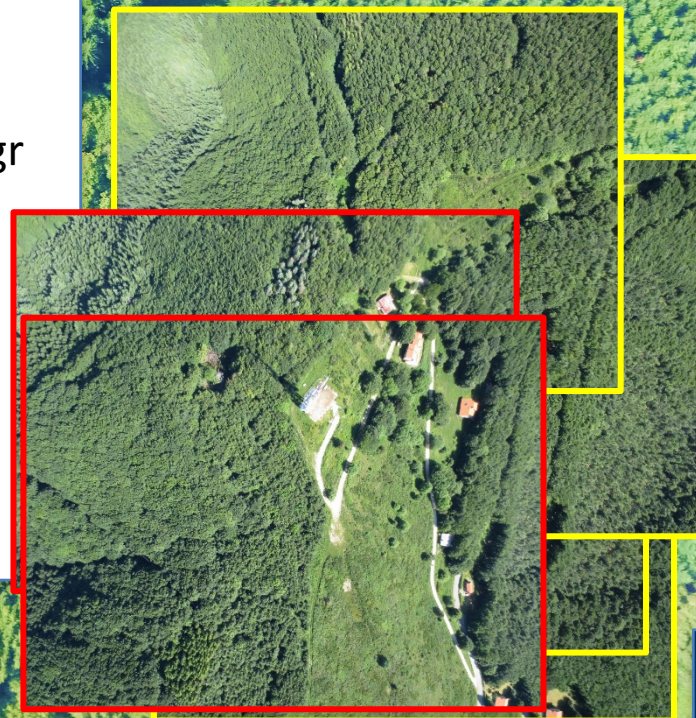
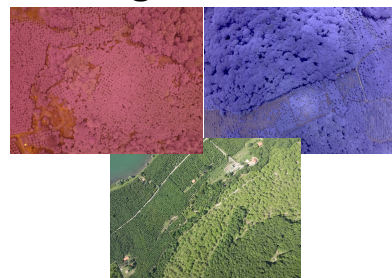
Caratteristiche:

Autonomia 40'

Peso al decollo 750 gr

Missione:

Fotogrammetria



Acquisizione UAV eBee

Volo a quota costante

Abbracciamento



Aree coperte e risoluzione finale dell'ortofoto generata

Esempio:

Quota di volo 140 m sopra la superficie terrestre

Risoluzione a terra di 4 cm

Focale 3.3

Sovrapposizione fotogrammi sulla striscia 75% (overlap)

Sovrapposizione fotogrammi tra le strisciate 65% (sidelap)

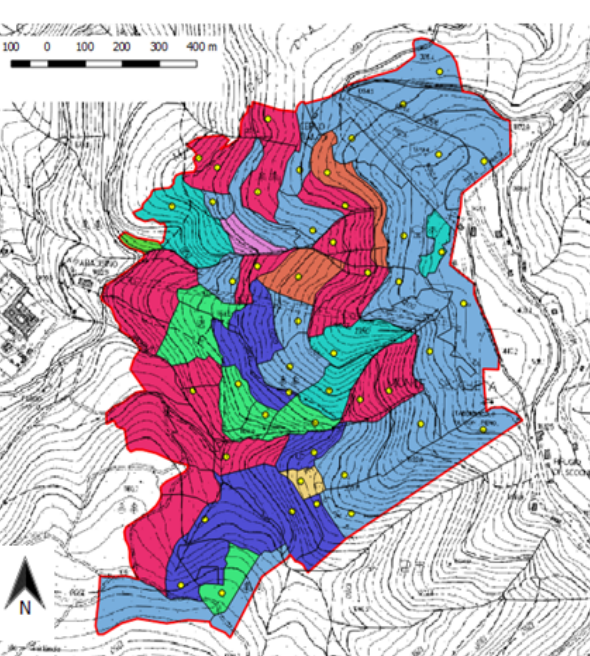
Durata volo 31 minuti

Superficie coperta 74.4 ha

Superficie coperta dal volo 23.1 km

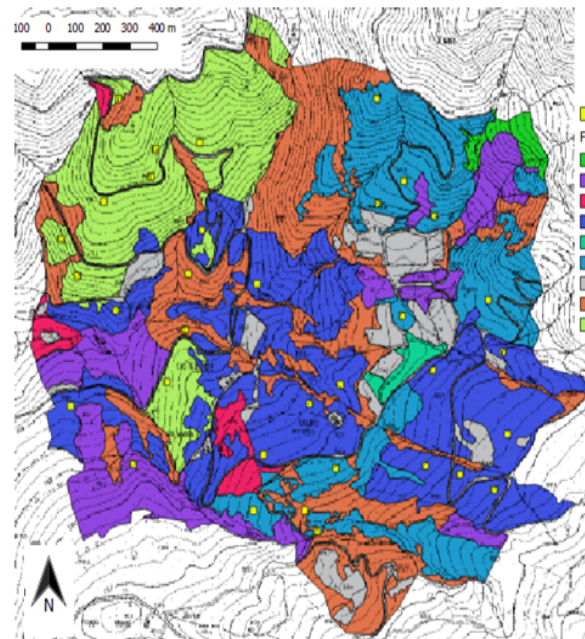
Velocità di volo 10 m/s

Aree di studio



A – Vallombrosa Reserve

- Sampling Plot
- Forest Types
 - Silver Fir
 - Silver Fir and other conifer
 - Silver Fir and mixed deciduous broadleaves
 - Mixed deciduous broadleaves
 - Douglas Fir
 - Beech Forest
 - Chamaecyparis
 - Black pine with deciduous broadleaves
 - Black pine with other conifer



B – Rincine District

- Sampling Plot
- Forest Types
 - Apennine-Corsican mountainous beech forest
 - Chestnut forest
 - Downy oak forest
 - Introduced tree species forest
 - Italian alder forest
 - Mediterranean and Anatolian Black pine forest
 - No forest
 - Other thermophilous deciduous forests
 - Turkey oak, Hungarian oak and Sessle oak forest

Introduzione

Structural index and Forest biophysical proprieties	Study area	Minimum	Average	Maximum
G [m²ha⁻¹]	Natural Reserve Forest	13	58.9	99
	Managed Forest	10.2	47.8	69.1
DBH_{mean}[cm]	Natural Reserve Forest	14.47	27.9	37.2
	Managed Forest	9.6	27.2	46.8
σ_{dbh}[cm]	Natural Reserve Forest	7.5	12.1	22.2
	Managed Forest	3.4	7.5	15.1
Gini [0,1]	Natural Reserve Forest	0.29	0.46	0.76
	Managed Forest	0.11	0.33	0.71
H_{dom} [m]	Natural Reserve Forest	11.2	24.8	39.0
	Managed Forest	12.7	25.1	38.4
H_l [m]	Natural Reserve Forest	6.7	17.1	11.4
	Managed Forest	9.68	21.3	35.6
σ_h[m]	Natural Reserve Forest	2.9	7.1	14.7
	Managed Forest	1.2	3.7	6.7
V [m³ha⁻¹]	Natural Reserve Forest	154.2	602.8	1013.2
	Managed Forest	79.1	495.8	1052.9

Acquisizione UAV

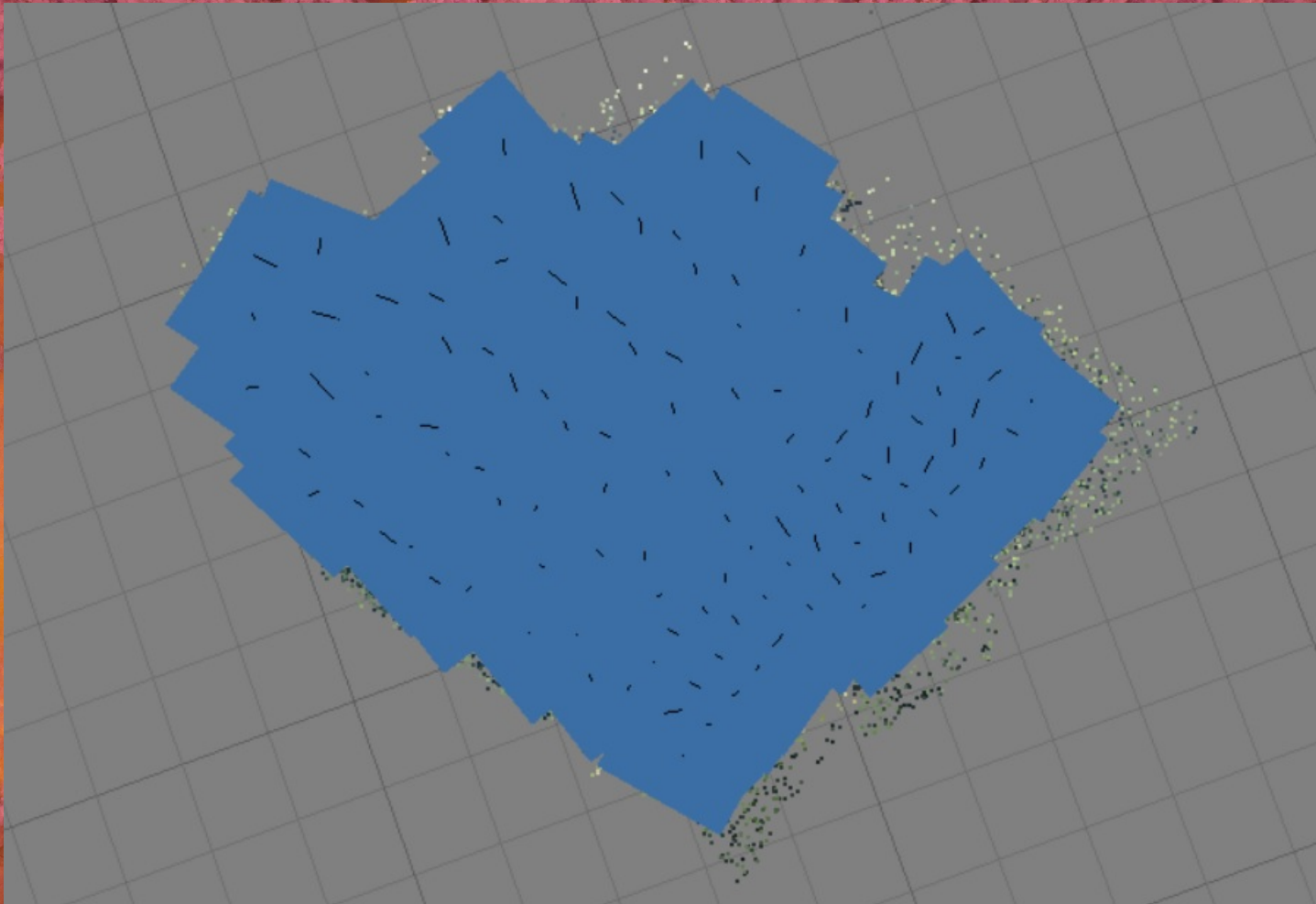
Natural Reserve

- ✓ 2 voli
- ✓ Quota di volo 145 m
- ✓ Overlap= 80 %
- ✓ Sidelap= 75%
- ✓ Camera=RGB
- ✓ Focale= 4.4 mm
- ✓ Tempo acquisizione=1h10'

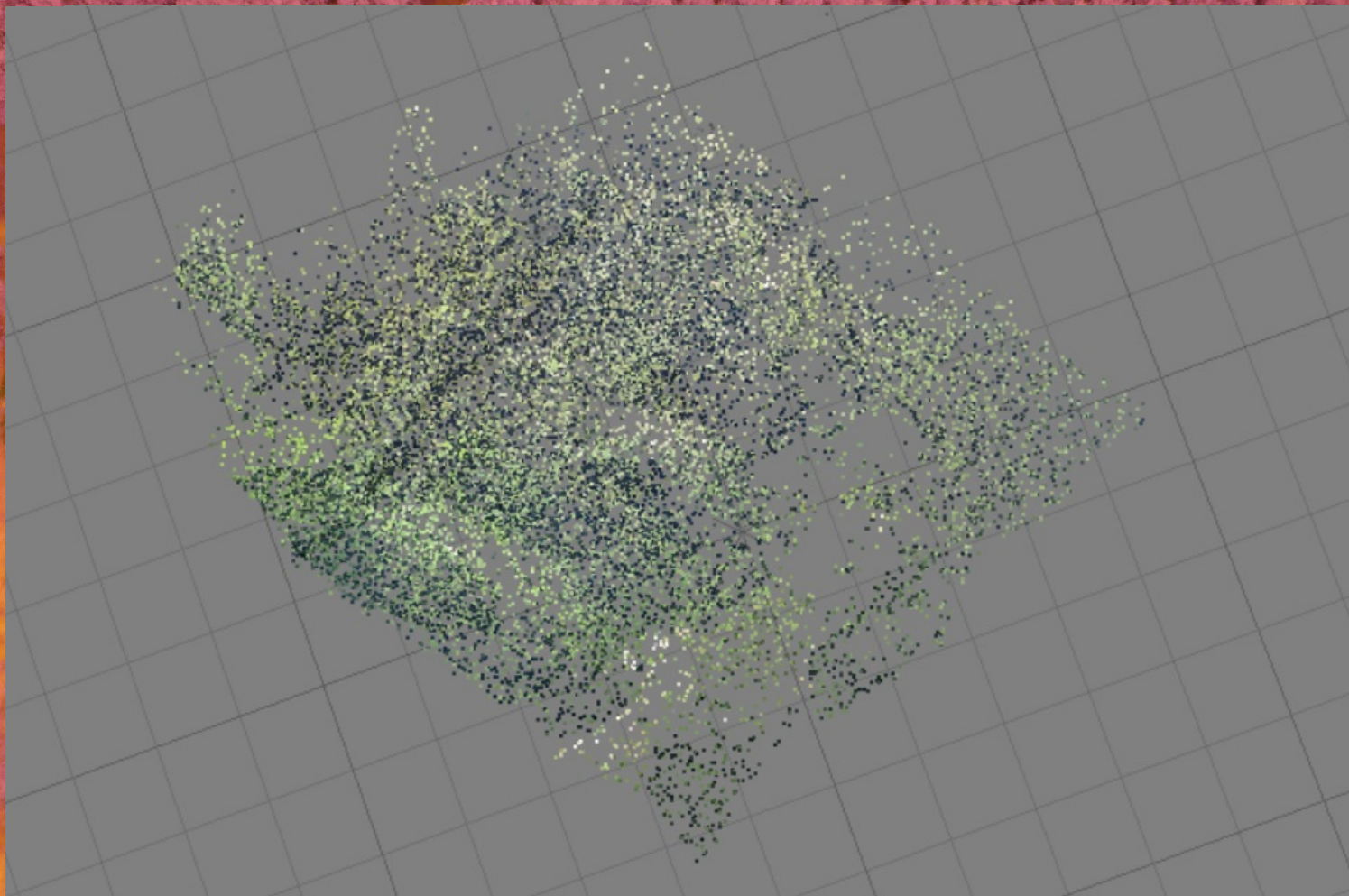
Managed Reserve

- ✓ 4 voli
- ✓ Quota di volo 142 m
- ✓ Overlap= 80 %
- ✓ Sidelap= 75%
- ✓ Camera= RGB
- ✓ Focale= 4.4 mm
- ✓ Tempo acquisizione= 2h30'

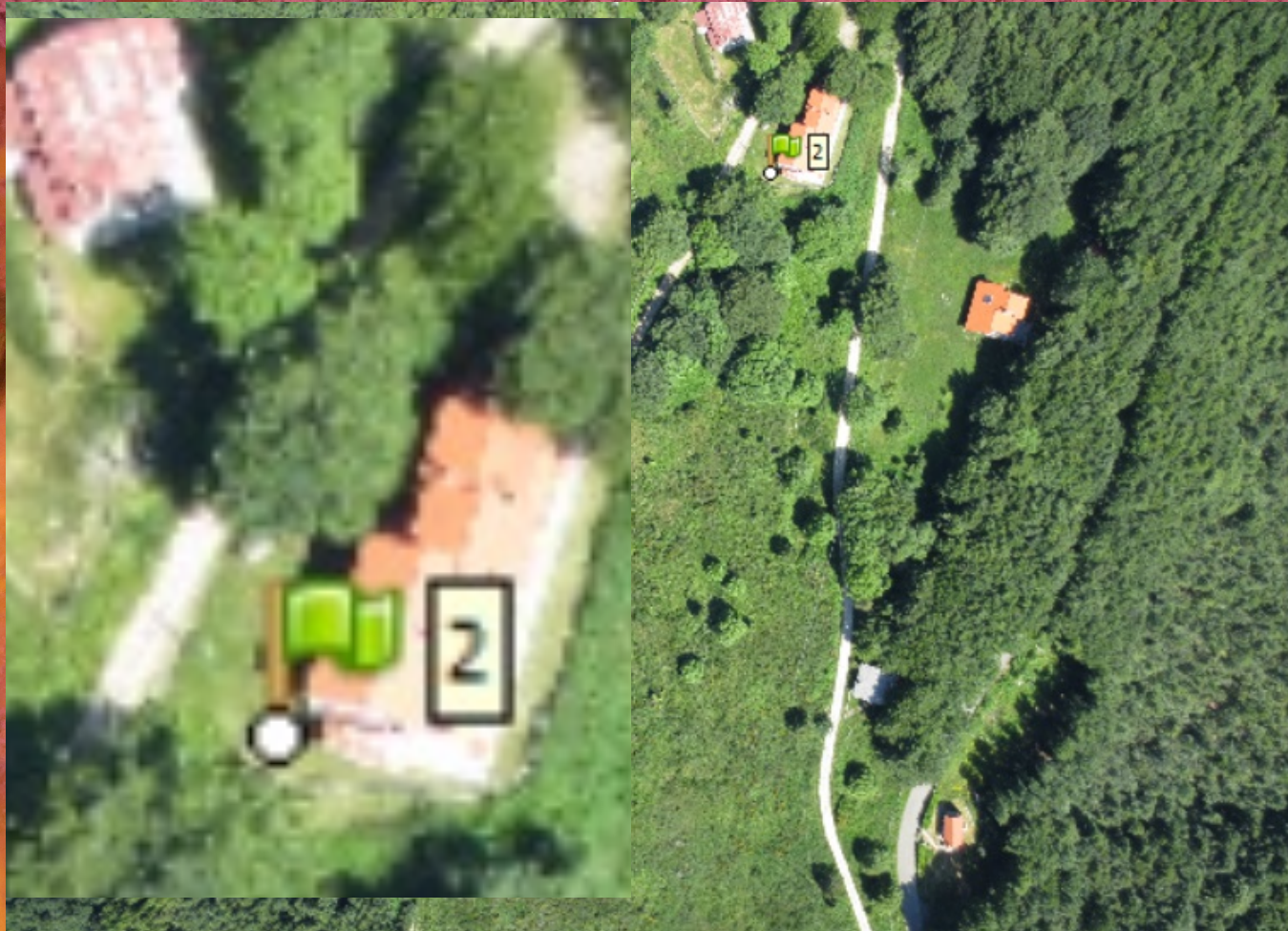
SfM Photogrammetry



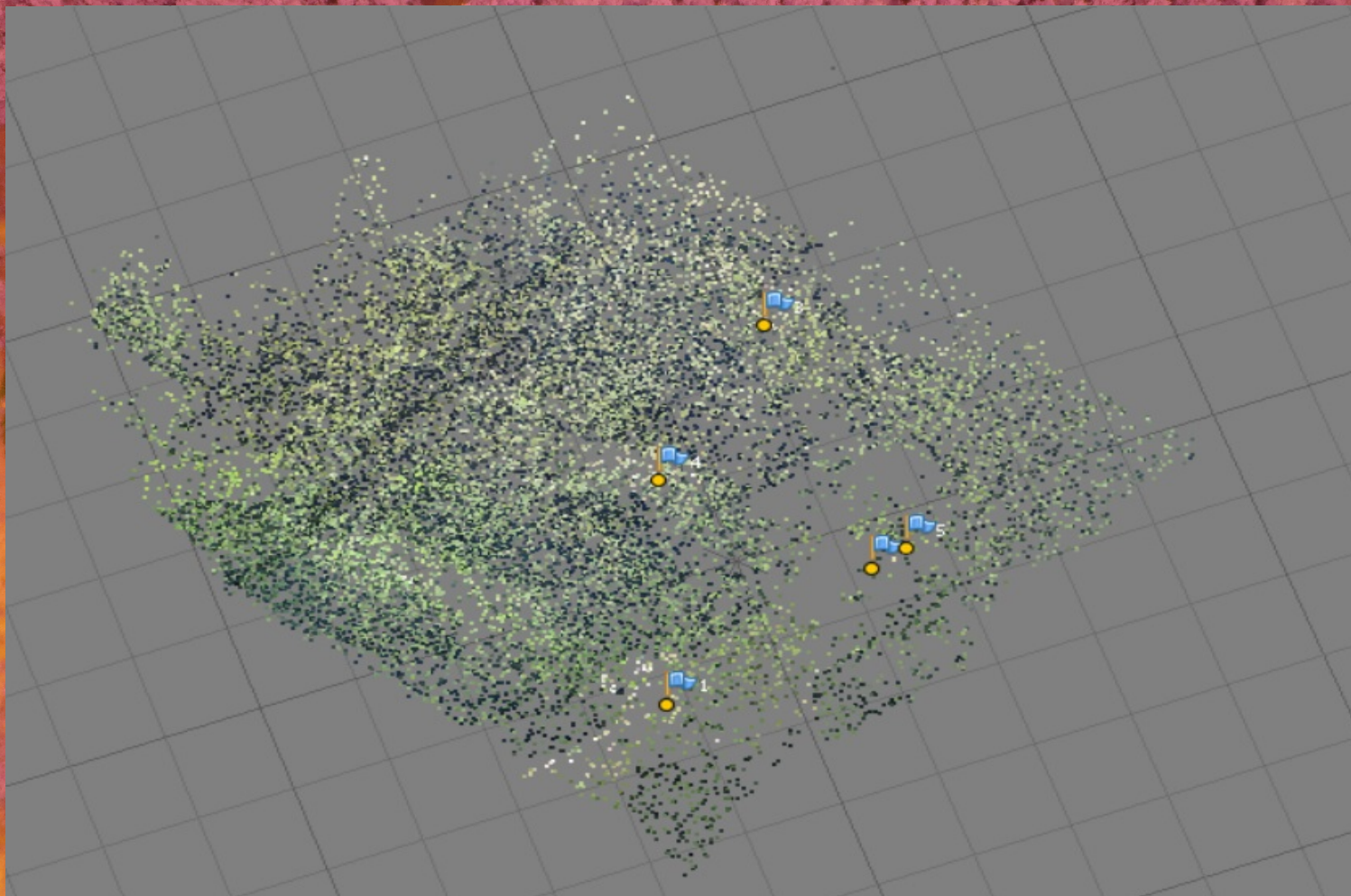
SfM Photogrammetry



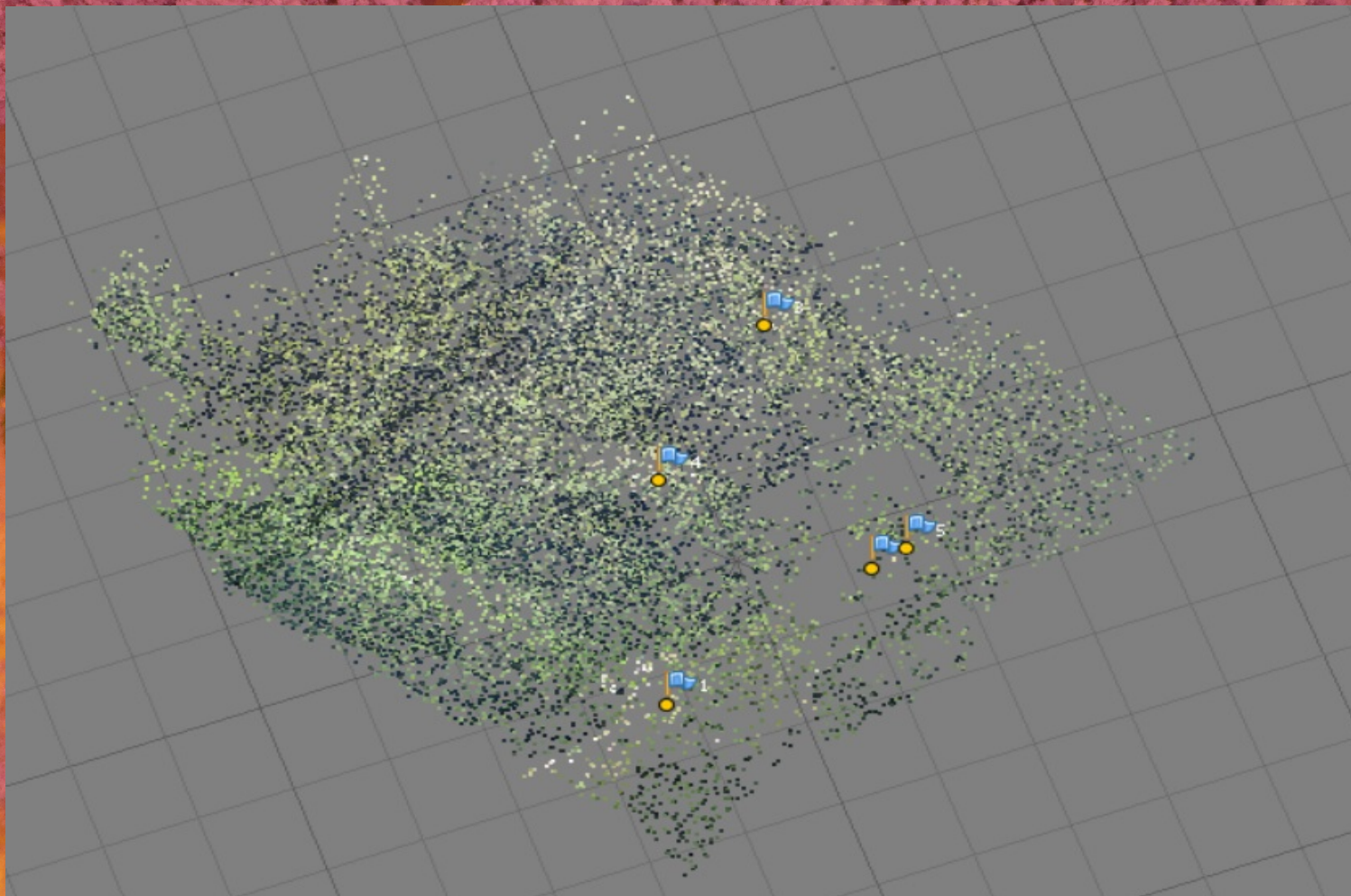
SfM Photogrammetry



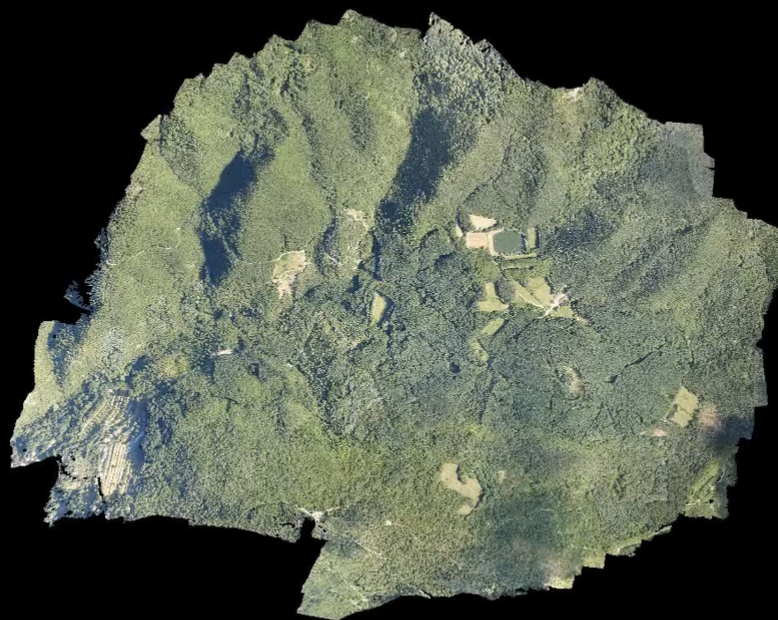
SfM Photogrammetry



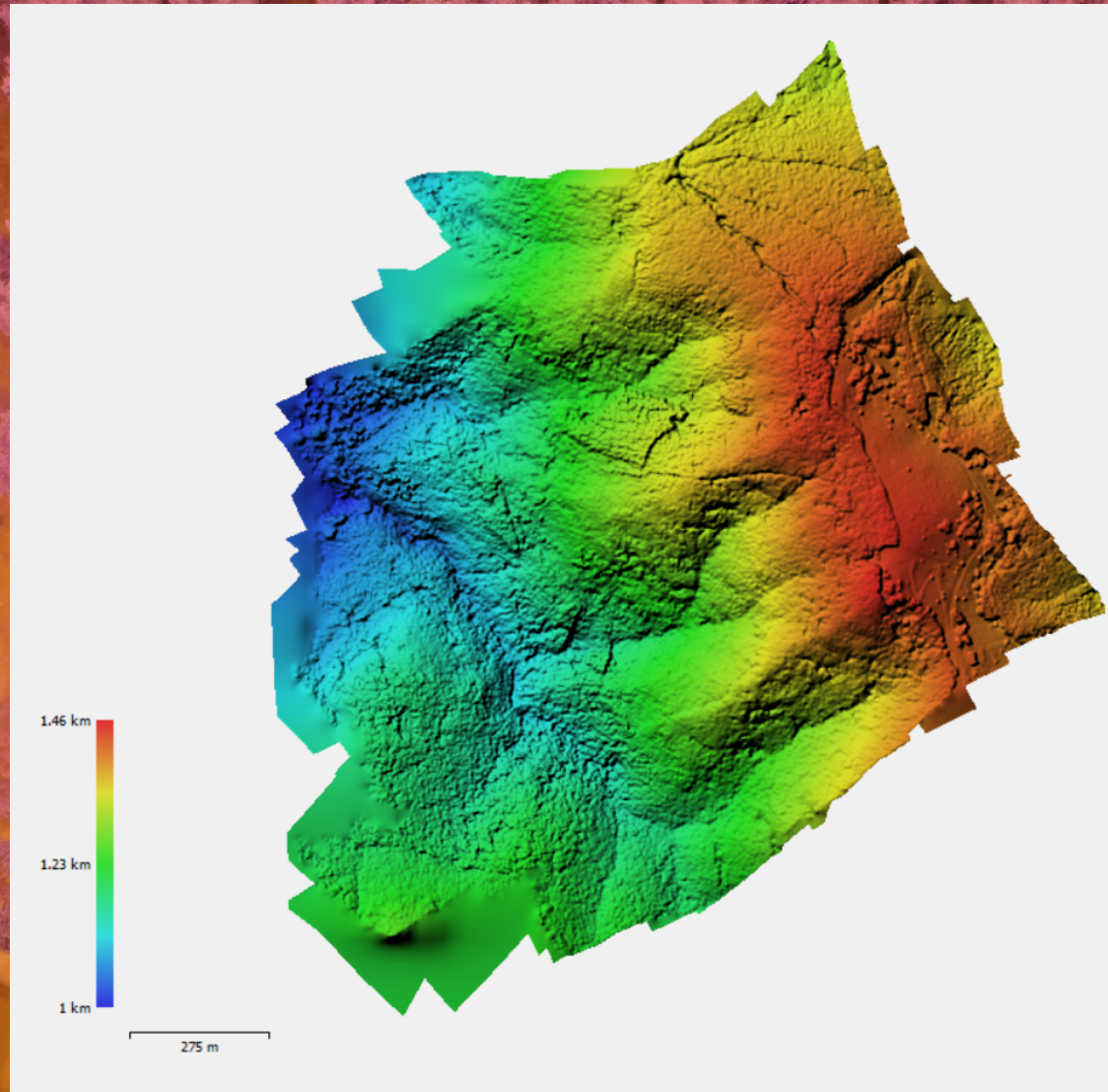
SfM Photogrammetry



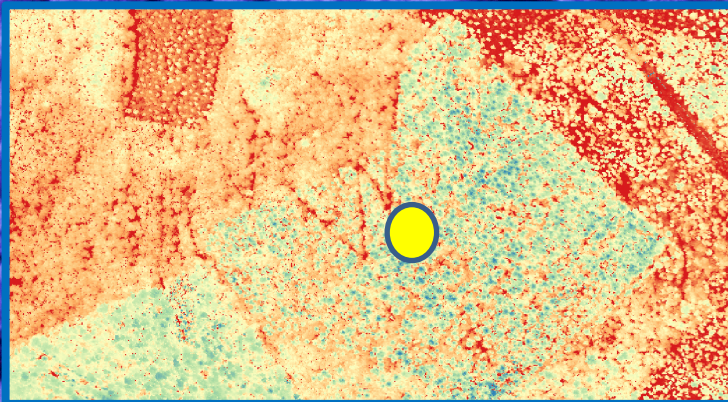
SfM Photogrammetry



SfM Photogrammetry



Materiali e Metodi

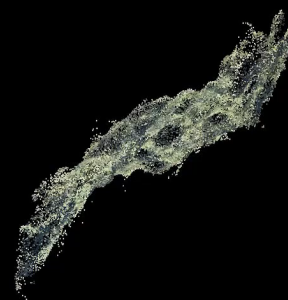


Modelli Lineari
Multivariati

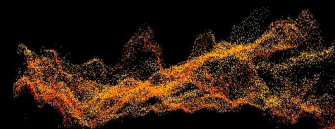
Variabili inventariali
+
2 tipi di metriche

Leave one out
ADJ. R^2 - RMSE - RMSE% - MD - MD%

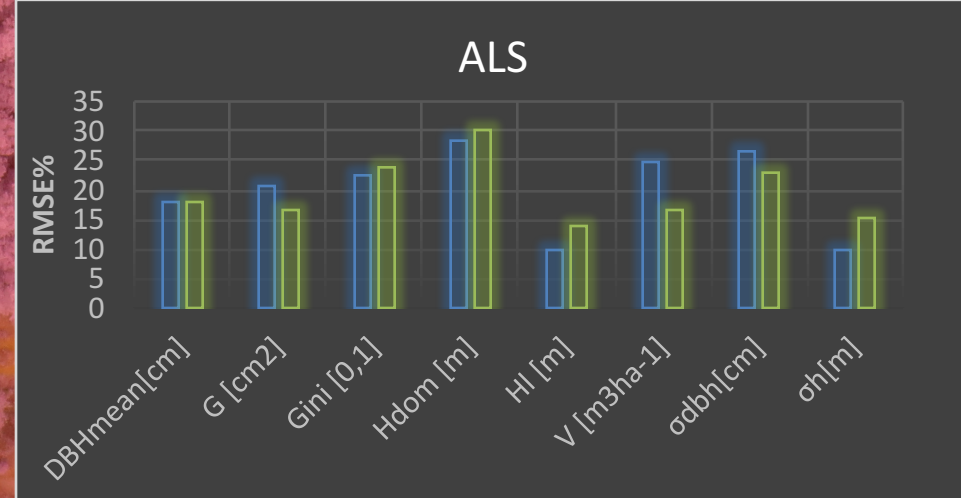
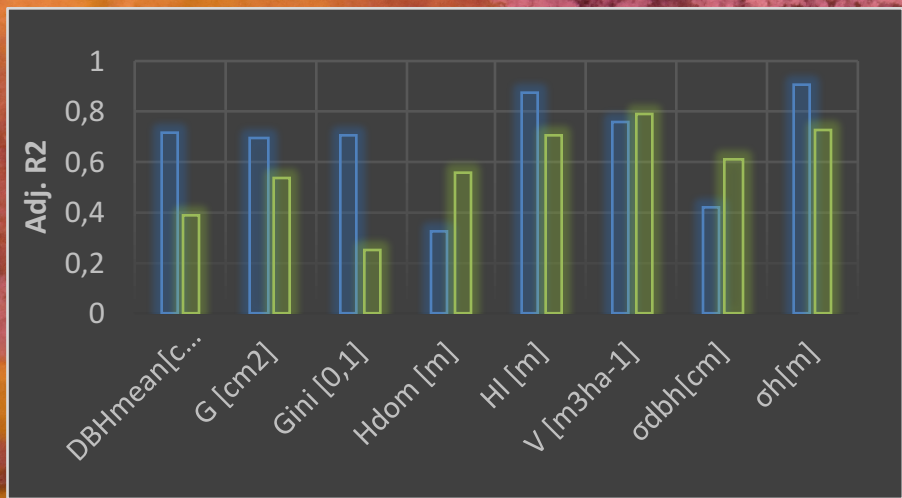
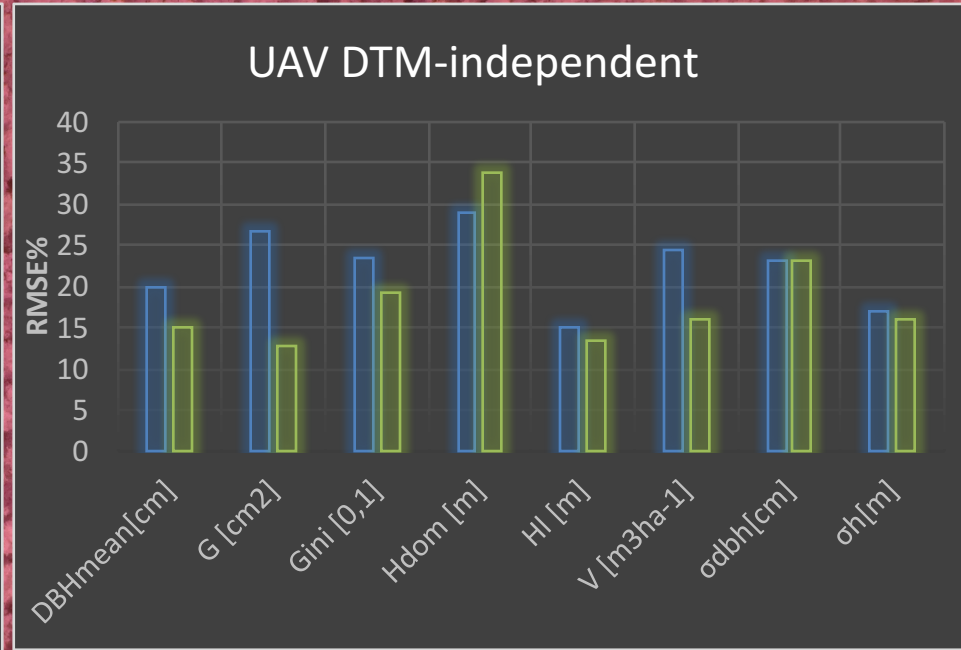
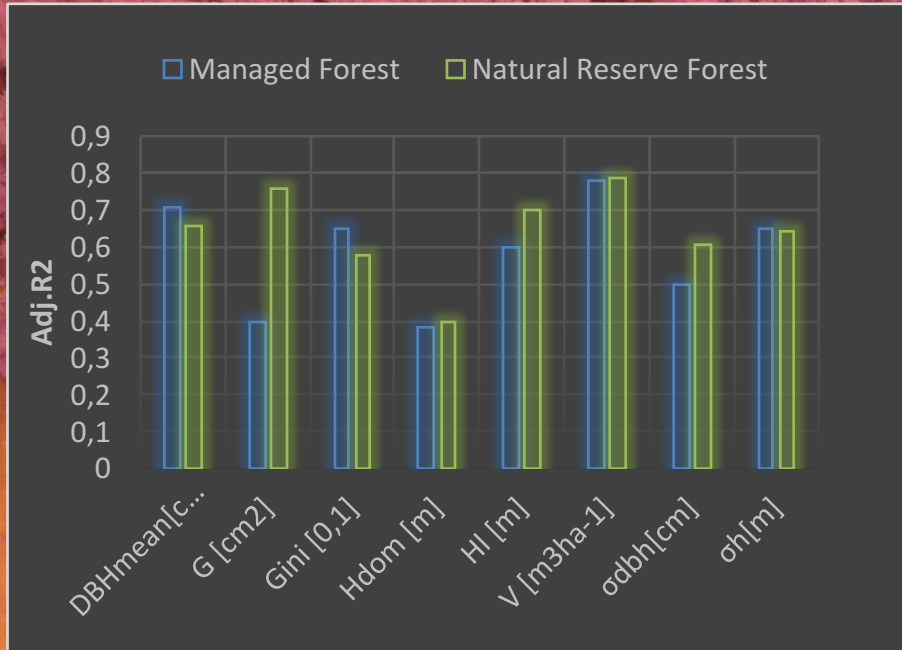
DTM-independent



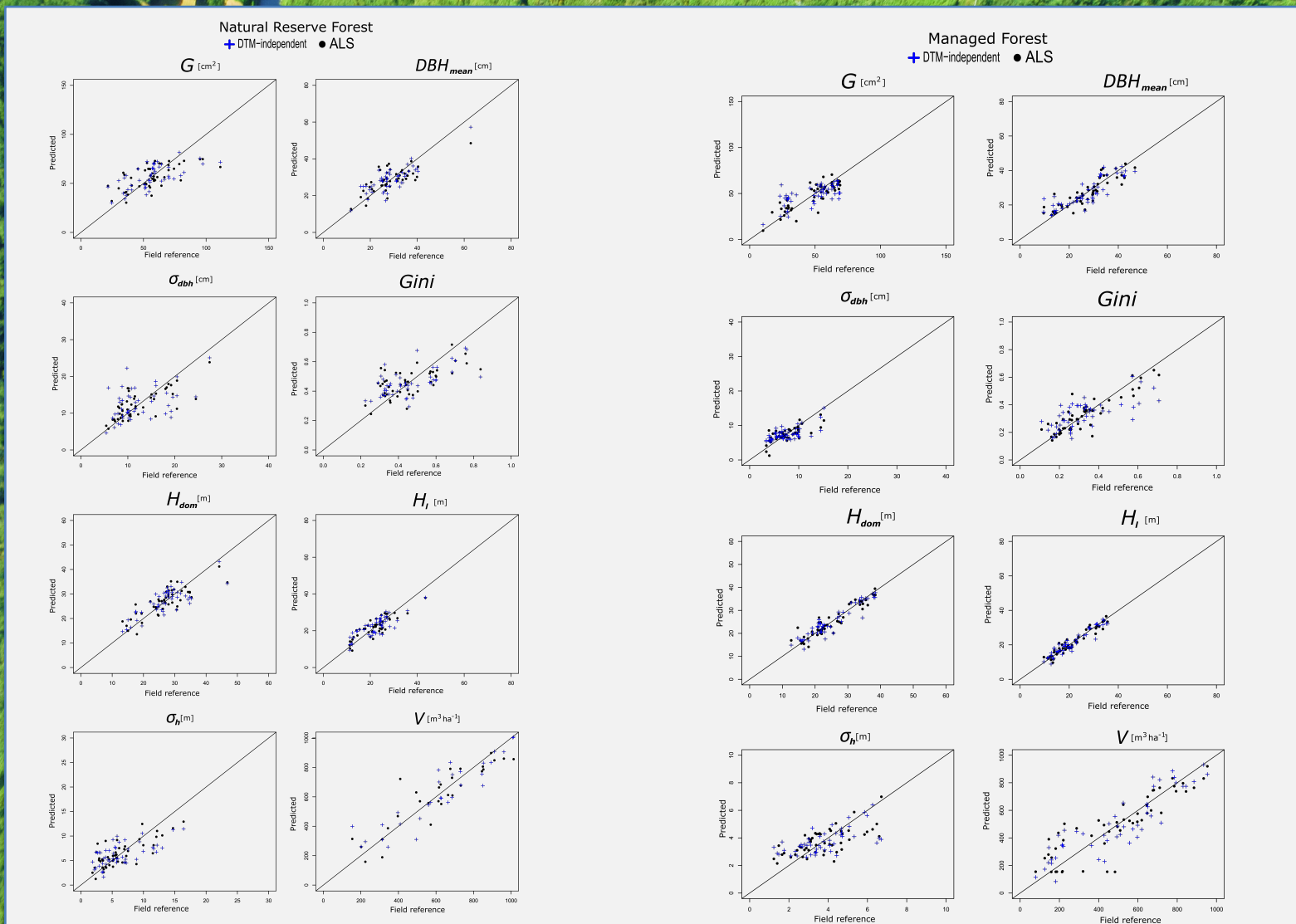
ALS



Risultati



Risultati e discussioni



Mappe

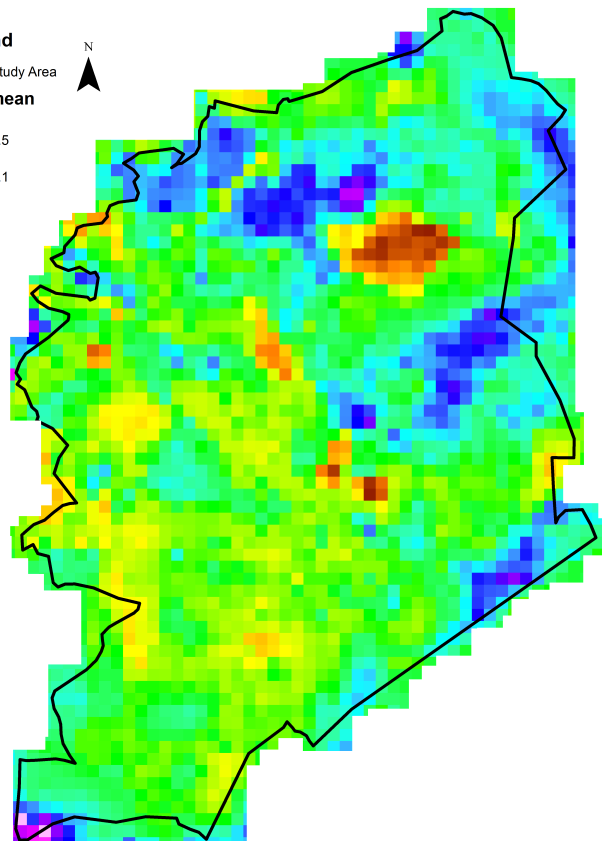
Natural Reserve Forest

Legend

Study Area

DBH mean

cm



0 175 350 700 1,050 1,400 m

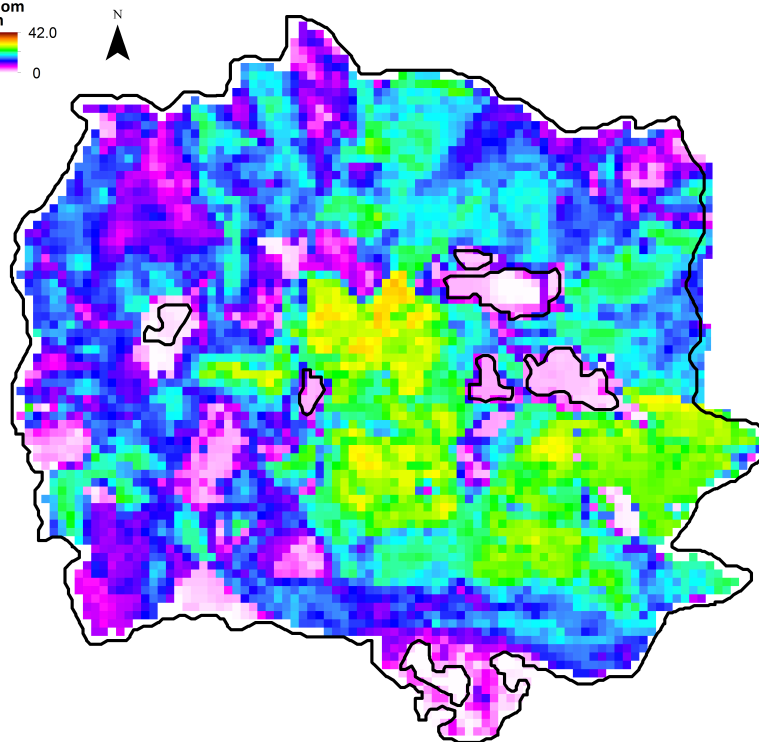
Natural Reserve Forest

Legend

Study area

H_{dom}

m



0 175 350 700 1,050 1,400 m

Conclusioni

✓ Dati UAV utili per la spazializzazione degli indici forestali

✓ Utili per la generazione di mappe



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