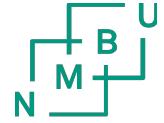
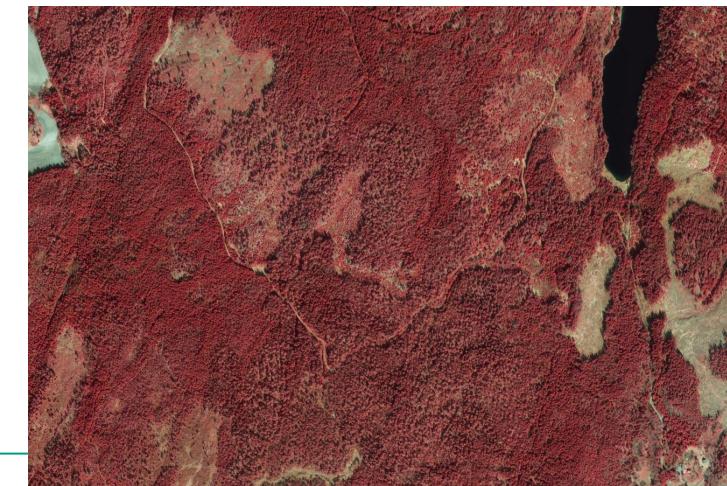
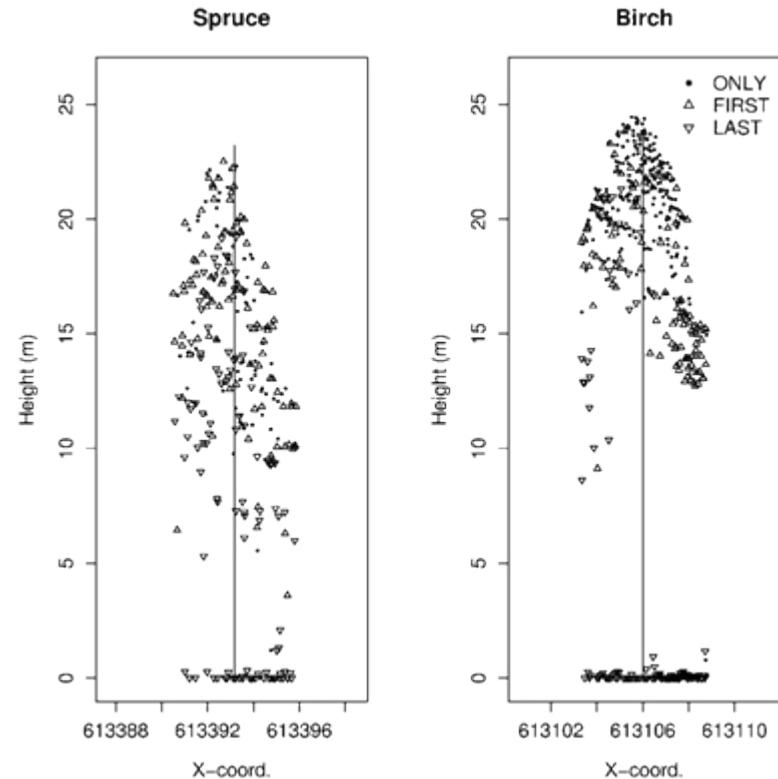
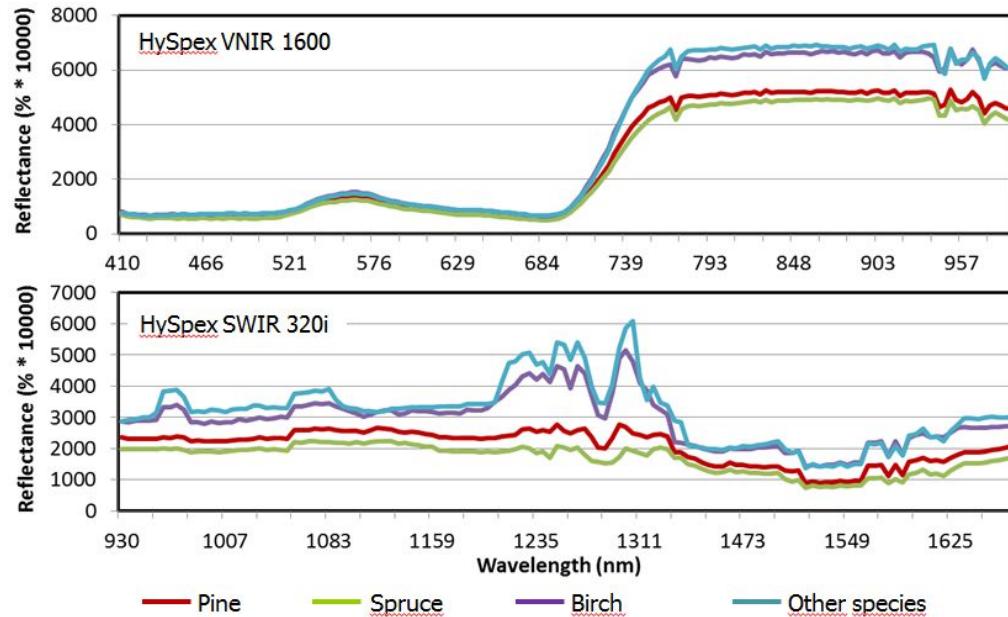


Treslagsinformasjon fra fjernmåling

Jaime Candelas Bielza og Hans Ole Ørka

Takst- og planseminar, Holmen fjordhotell 9. mars 2023

Bakgrunn





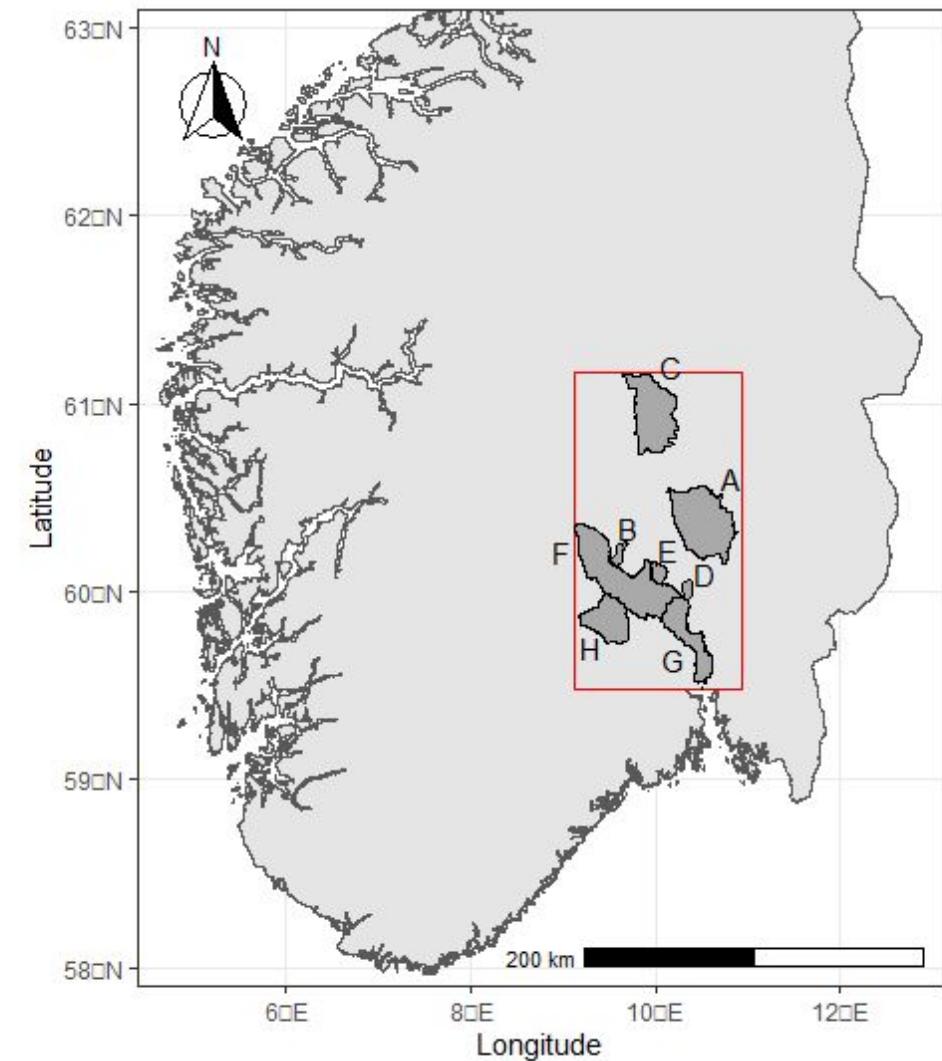
Mål

- Teste ulike fjernmålte datakilder (og metoder) for å predikere treslagsfordeling på bestandsnivå.
- Fjernmålte kilder:
 - Laserdata
 - Sentinel-2
 - (Flybilder)

Studieområder

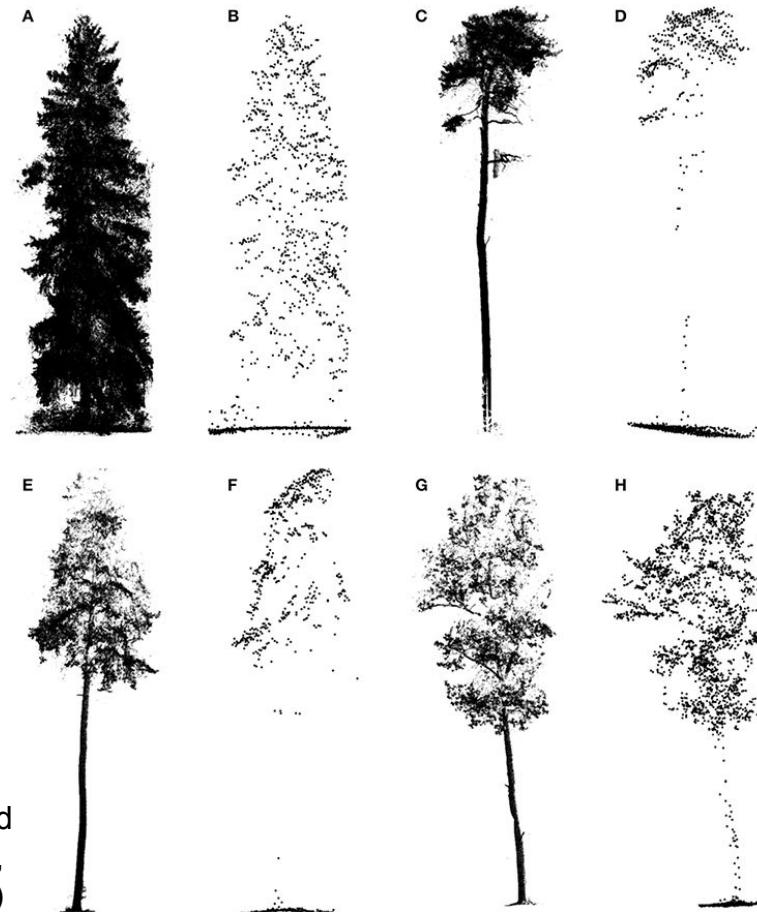
Area	Name	Field inventory (year)	Size of inventory (km ²)	Sample plots						Validation plots			
				n	Size (m ²)	S* (%)	P* (%)	D* (%)	n	Size (m ²)	S* (%)	P* (%)	D* (%)
A	Hadeland	2016	726	289	250	0.74	0.23	0.03	59	500, 1000	0.66	0.31	0.03
B	Krødsherad	2016	50	127	232,9	0.46	0.43	0.11	57	3700	0.54	0.35	0.11
C	Nordre Land	2017	490	194	250	0.77	0.22	0.01	24	1000	0.44	0.56	0.00
D	Hole	2017	45	87	250	0.93	0.05	0.02	28	1000	0.96	0.04	0.00
E	Tyrstrand	2017	60	102	250	0.15	0.83	0.02	-	-	-	-	-
F	Modum, Sigdal	PEN		166	250	0.50	0.45	0.05	-	-	-	-	-
G	Lier, Røyke, Hurum	DI		149	250	0.54	0.45	0.01	24	2000, 3750	PEN	DI	NG
H	Flesberg	NG		129	250	0.34	0.63	0.03	-	-	-	-	-

* S: spruce dominated; P: pine dominated; D: deciduous dominated.



Fjernmålte datakilder - laserdata (ALS)

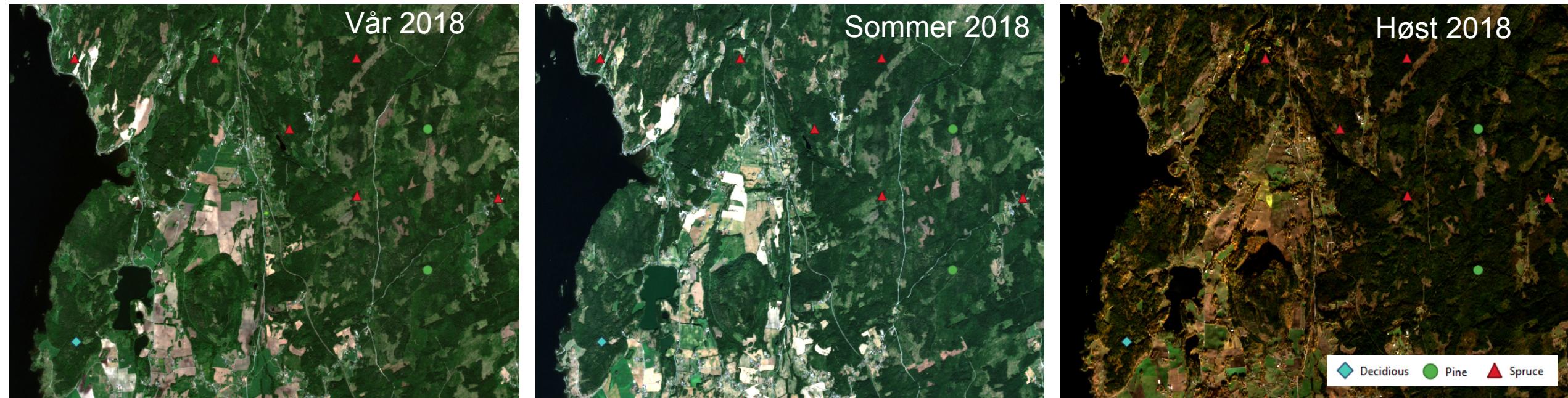
- ALS: høyde, tetthet og intensitetsinformasjon



Illustrations of the sample trees represented by Terrestrial Laser Scanning (A,C,E,G) and ALS (B,D,F,H) data for different tree species: *Picea abies* (A,B), *Pinus sylvestris* (C,D), *Populus tremula* (E,F), and *Quercus robur* (G,H). (Lin et al. 2018)

Fjernmålte datakilder - Sentinel-2

- Sentinel-2: gir multispektral informasjon med en oppløsning på 10 til 60 m i de synlige, nær infrarøde (VNIR) og kortbølge infrarøde (SWIR) spektralonene, inkludert 13 spektralkanaler.



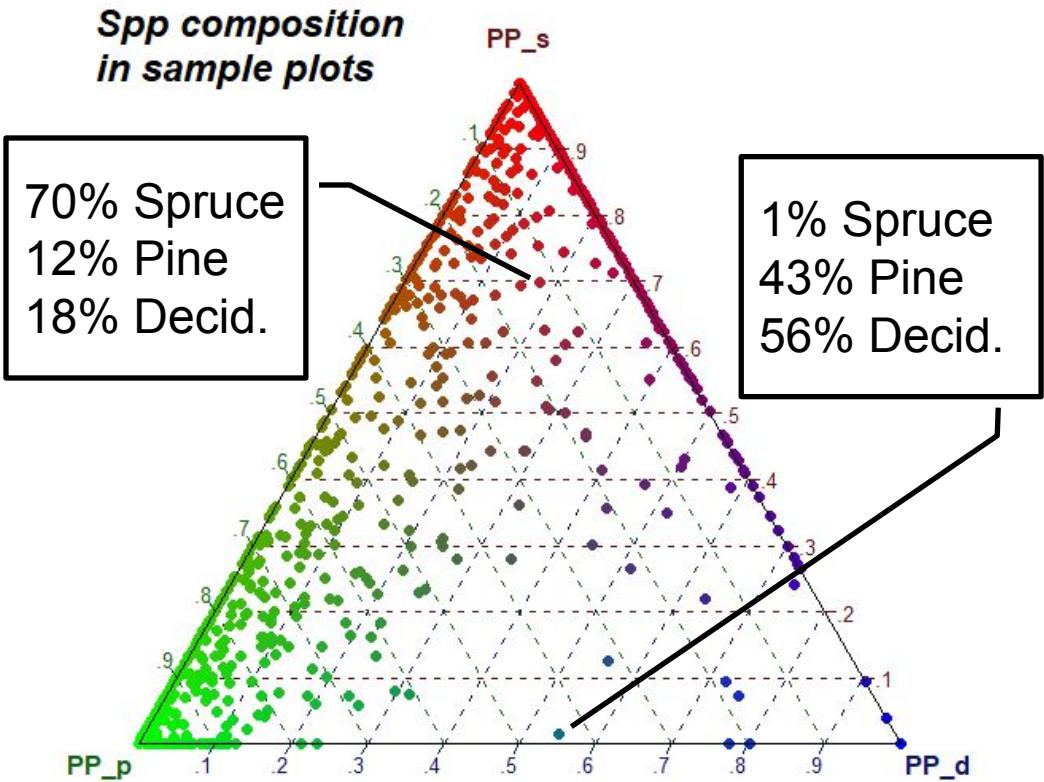
Metoder

1. Modellere og predikere volume (V_{tot}) med ALS variabler og ikke-lineær regresjon.
2. Modellere og predikere treslagsfordeling (PP_{spp}) med fjernmålte datakilder (ALS, Sentinel-2 and Aerial imagery) med Dirichlet regresjon.
3. Prediksjon av dominerende treslag: $\max(PP_{spp})$
4. Prediksjon av treslag spesifikt volum:

$$V_{spp} = V_{tot} * PP_{spp}$$

Metode – Dirichlet regresjon

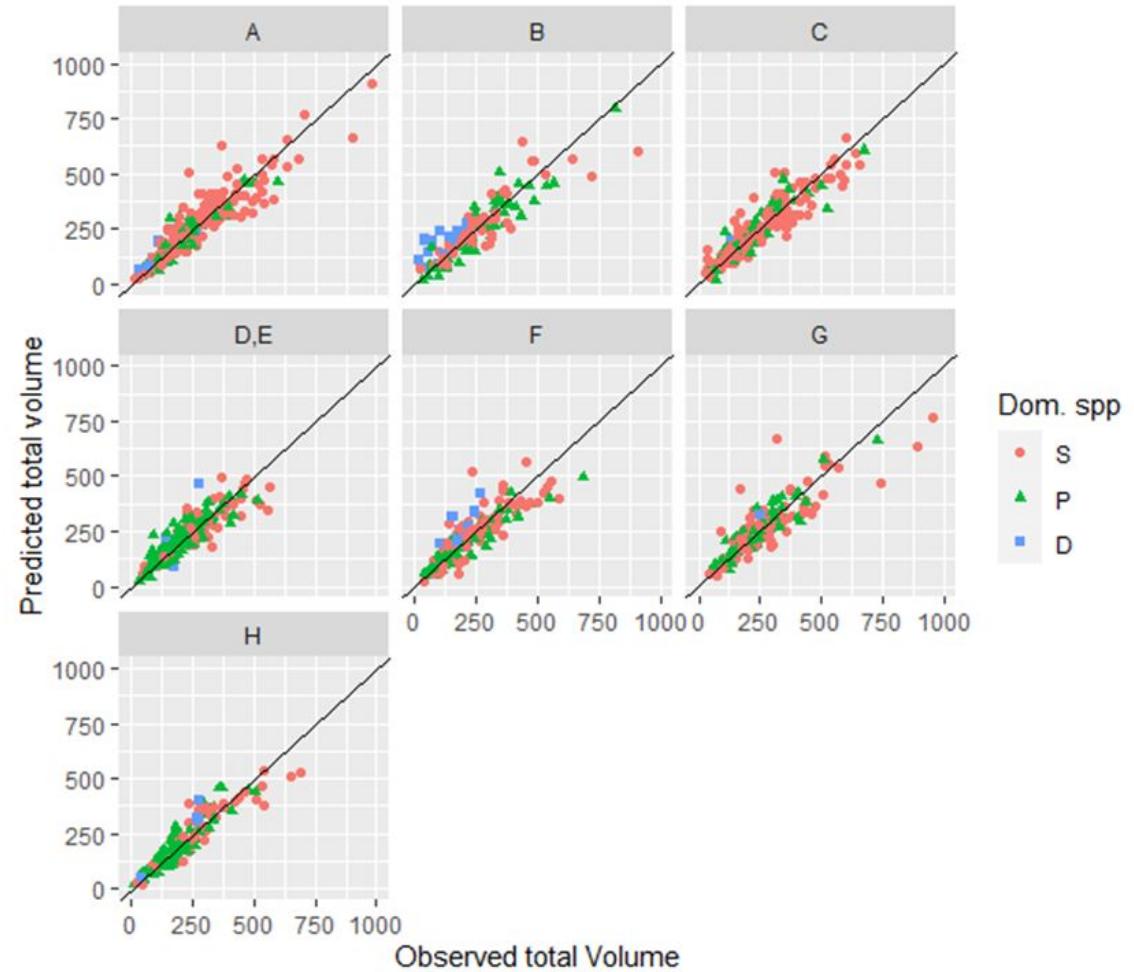
- Dirichlet-fordelingen er en multivariatfordeling hvis komponenter alle tar verdier på $(0,1)$ og som summerer til én.
- I stedet for å forutsi bare én sannsynlighet eller proporsjon, kan den forutsi flere proporsjoner eller sannsynligheter for mer enn to utfall ved en lignende tilnærming.



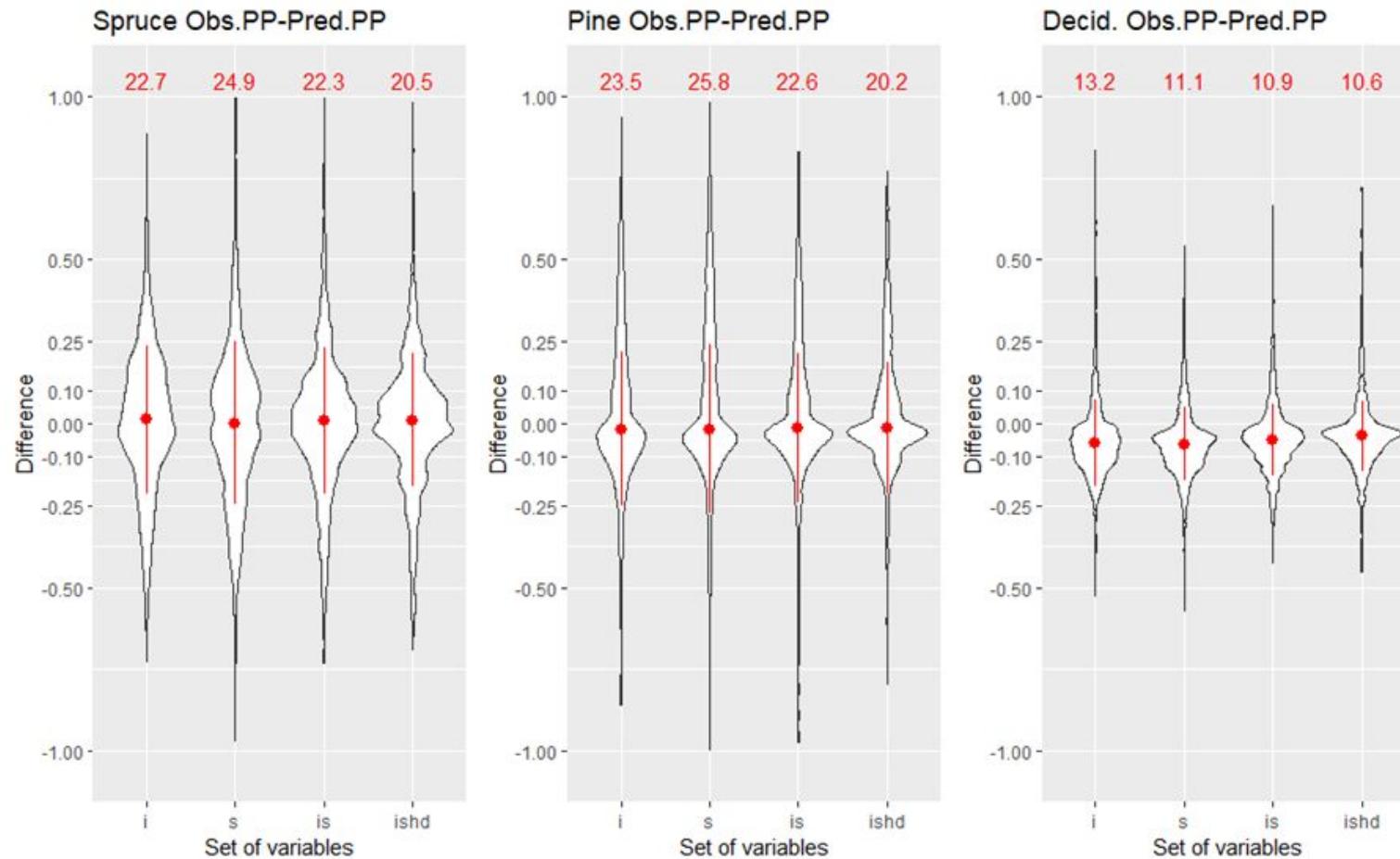
Resultat - totalt volum

Location	RMSD	RRMSD	Mean_Dif	PearsonCorr
A	55.57	0.23	37.52	0.93
B	71.19	0.29	51.71	0.89
C	55.92	0.23	40.67	0.92
D,E	51.79	0.23	37.22	0.88
F	62.45	0.28	44.74	0.87
G	72.08	0.28	49.03	0.87
H	50.15	0.23	37.69	0.92

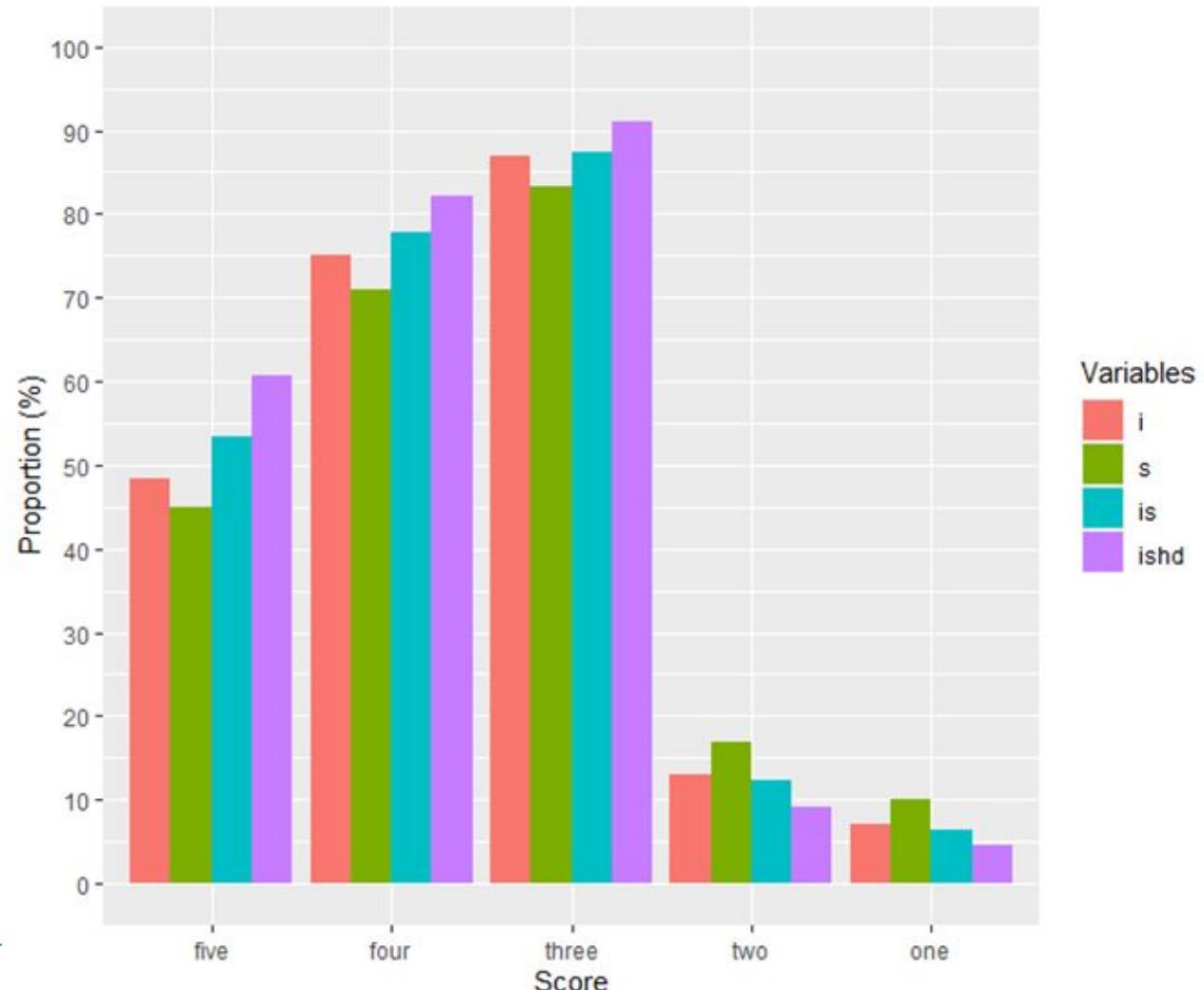
Observed total volume vs Predicted total volume



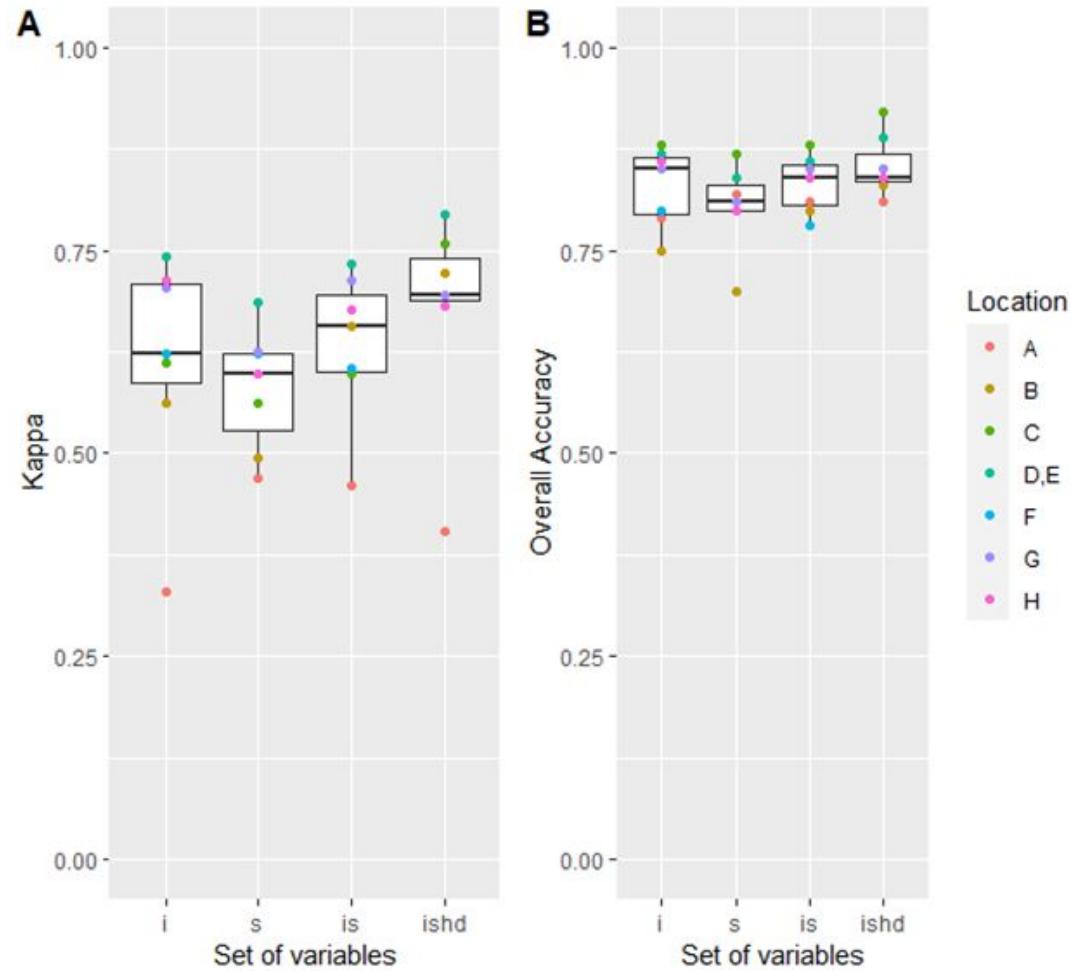
Resultat - treslagsfordeling



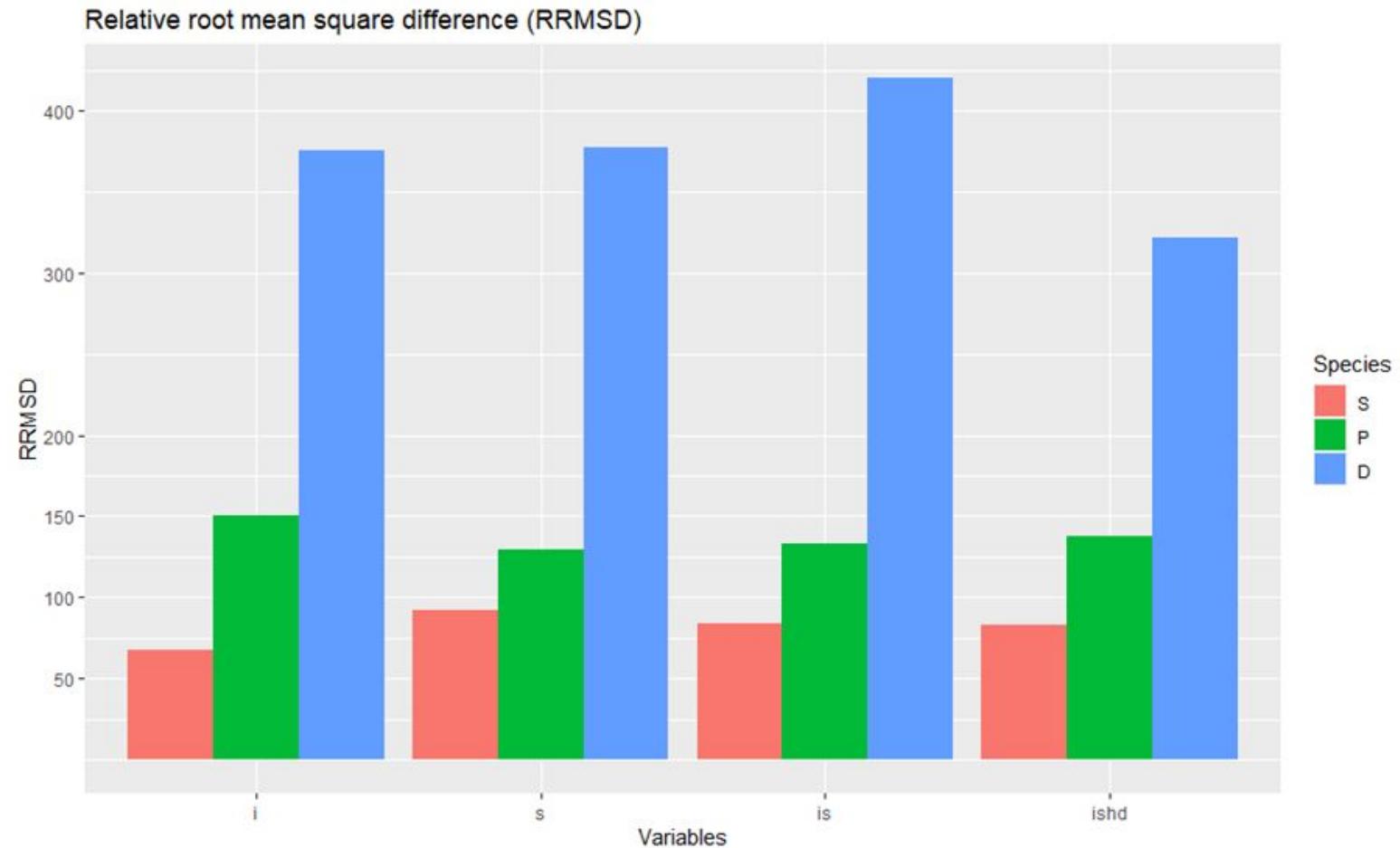
Resultat - Treslagsfordeling tideler

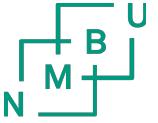


Resultat - dominererende treslag



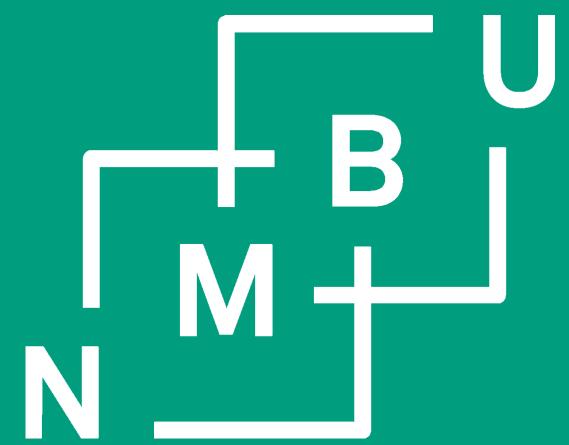
Resultat - treslagsspesifikt volum

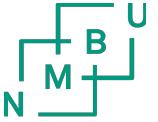




Foreløpig konklusjon

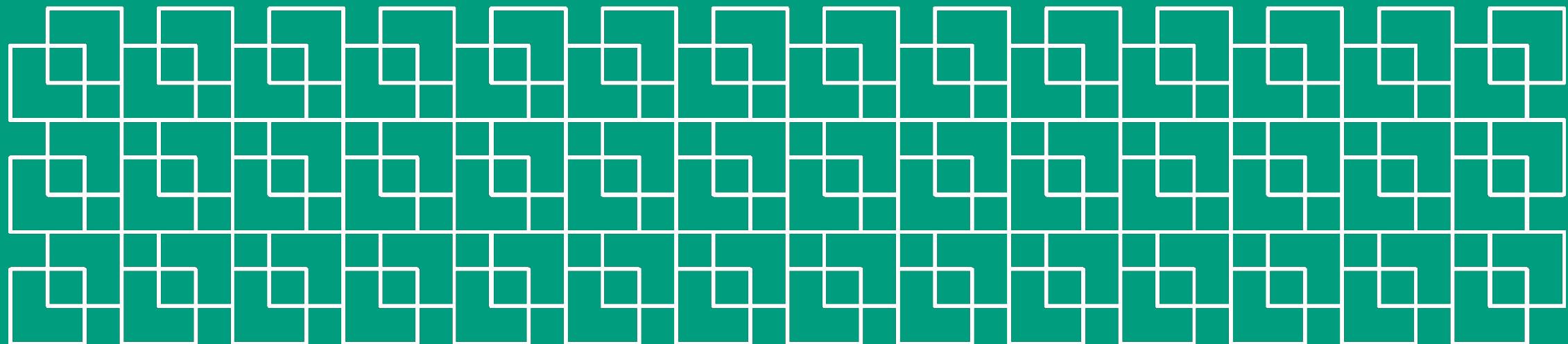
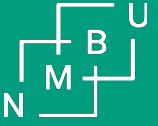
- Intensitet fra ALS noe bedre en Sentinel-2
- Begge datakilder kan brukes
- Dirichlet er en egnet parametrisk metode





References

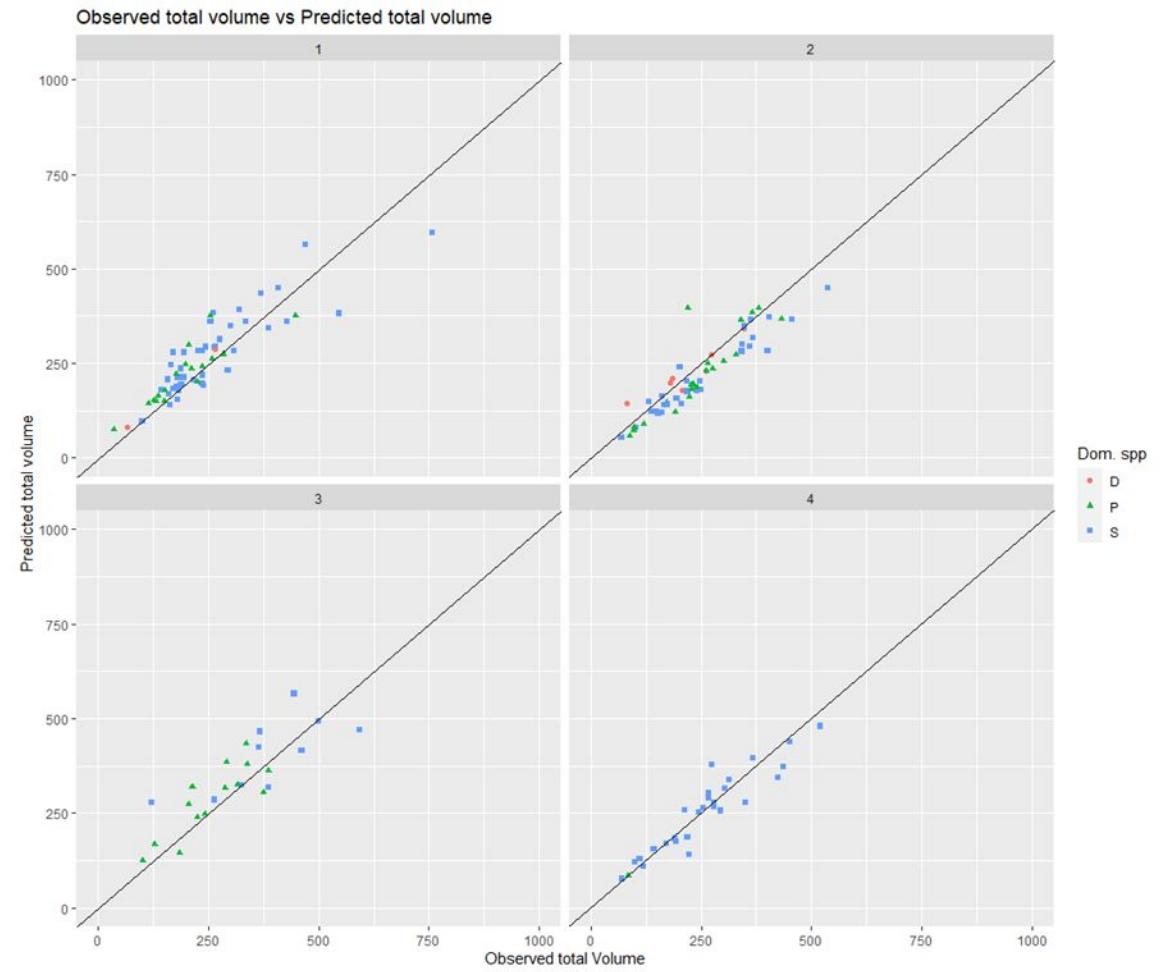
- Lin, Y., Jiang, M., Pellikka, P., & Heiskanen, J. (2018). Recruiting conventional tree architecture models into state-of-the-art LiDAR mapping for investigating tree growth habits in structure. *Frontiers in plant science*, 9, 220. | <https://doi.org/10.3389/fpls.2018.00220>



Results

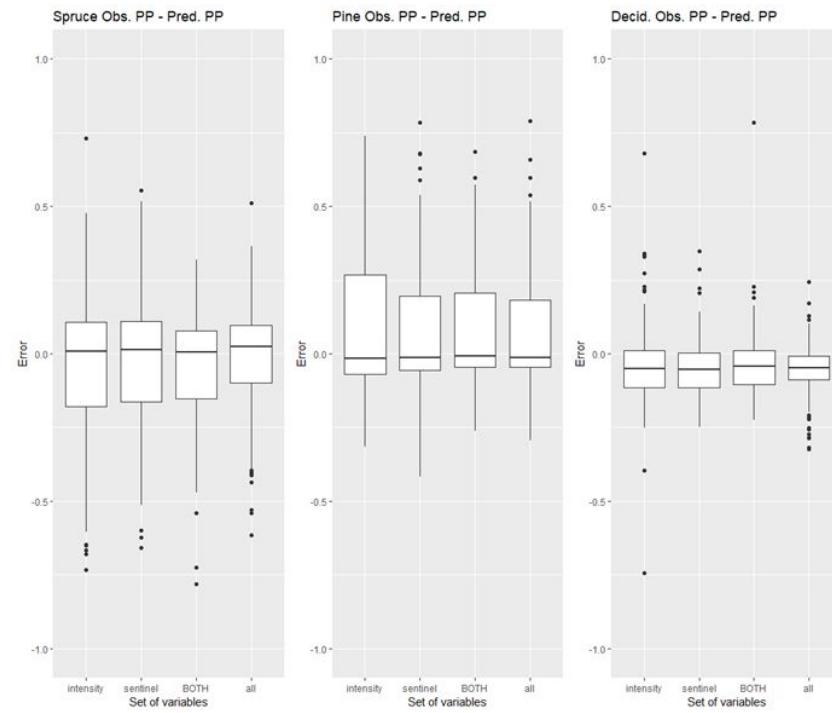
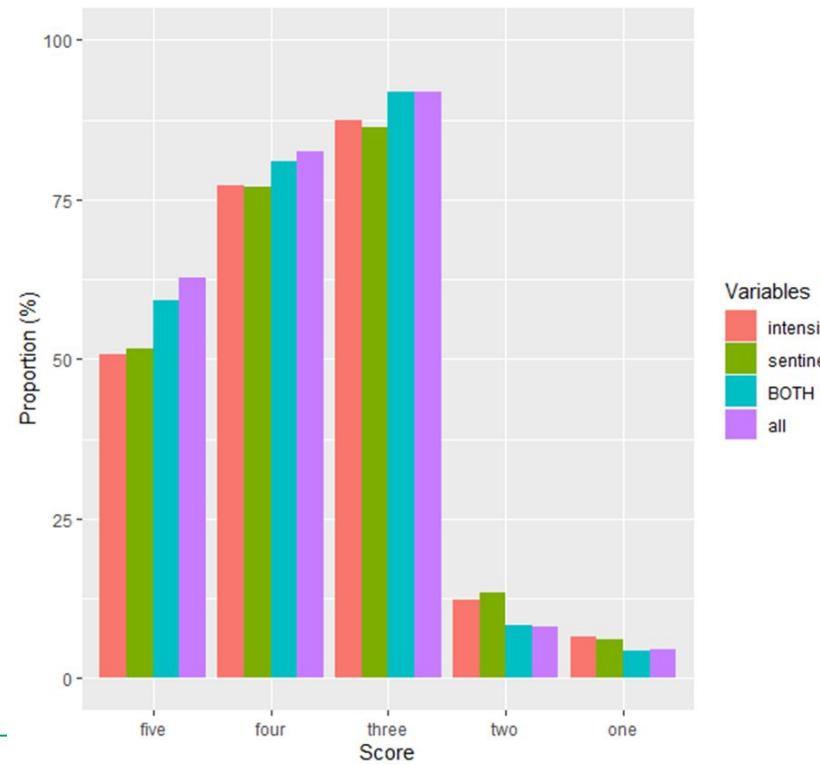
- Total volume prediction
 - Validation with independent data

Location	RMSD	RRMSD	Mean_Dif	PearsonCorr
1	58.65	0.24	45.19	0.88
2	49.72	0.20	40.06	0.91
3	71.10	0.23	56.98	0.84
4	39.78	0.16	29.16	0.94



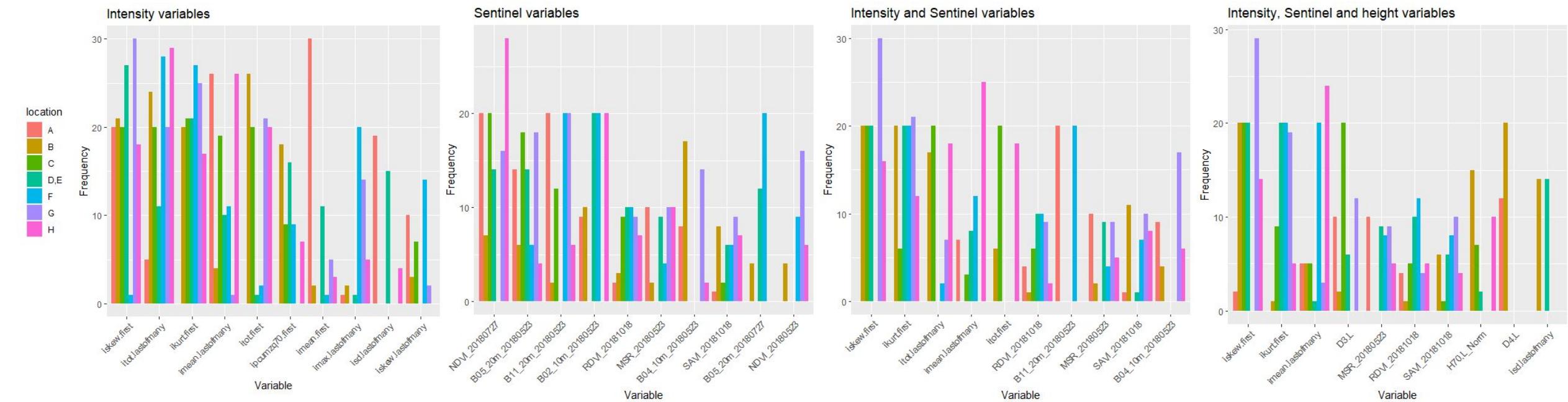
Results

- Species prediction
 - Species proportion from validation with independent data



Results

- Variable importance of CV
- A variable can be present max. 30 times (3 per spp/fold x 10 folds)



Results

- Variable importance of validation with independent data
- A variable can be present max. 3 times (3 per spp)

