Høgskulen på Vestlandet

13. januar 2026
bransjeseminar
«skred i bratt terreng»

Startpunktanalyse for jordskred utløst under ekstremværet 'Hans'

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1. Bakgrunn


Landslide News

Landslides
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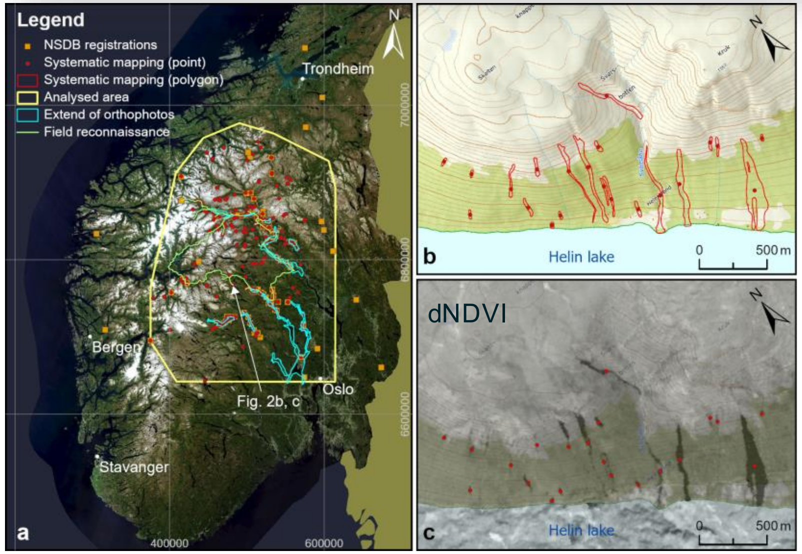
Denise Christina Rüther · Erin Lindsay · Martine Sagen Slåtten

Landslide inventory: 'Hans' storm southern Norway, August 7–9, 2023



Random forest


Høgskulen på Vestlandet

MASTER'S THESIS

Testing the Significance of Vegetational Parameters on Shallow Landslide Occurrence

For Landslides triggered in August 2023 during the Extreme Weather Event Hans

Iris Louisa Johanna Peeters

Gradient boosting


SOIL INDICATORS AND FOREST ATTRIBUTES EXPLAIN LANDSLIDES RELEASED DURING 'HANS' STORM SOUTHERN NORWAY IN AUGUST 2023

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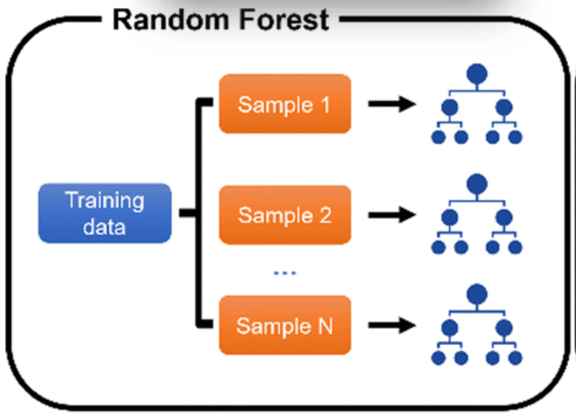
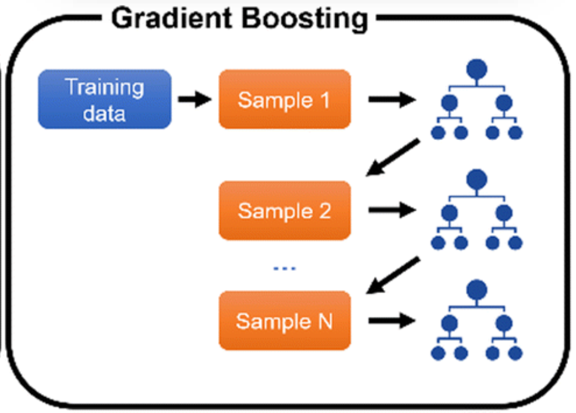


Parallell training



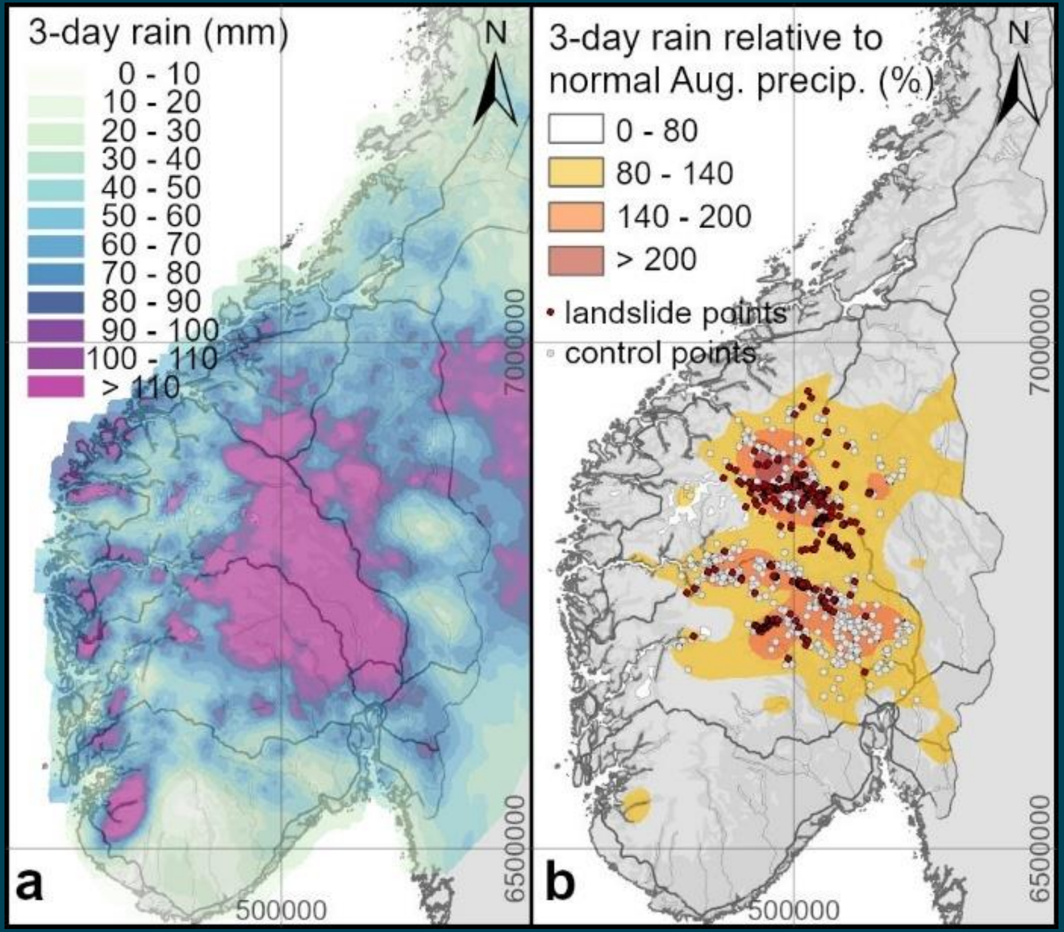
Sekvensiell training

Lindsay et al. (2022), Rüther et al. (2024)

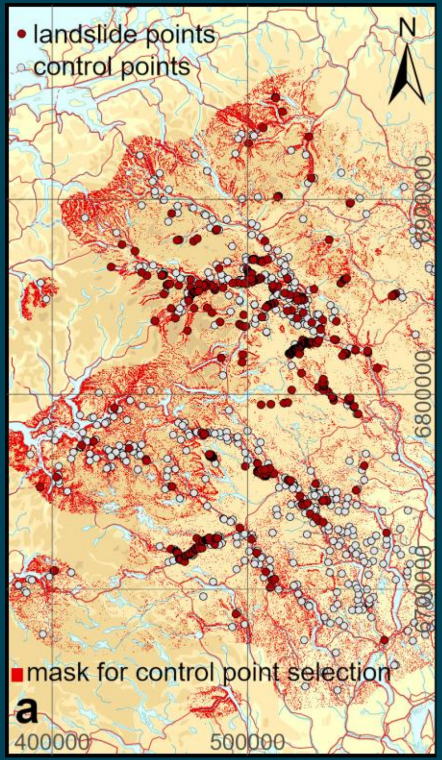
Peeters (2024)

Rüther et al. (to be submitted)

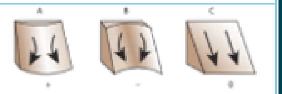
2. Punkt-datasett



- **Skredpunkt**
  - Rüther et al. (2024):
    648 kartlagte polygoner (56 debris floods, 388 debris flows and 204 debris slides)
  - Gjennomgang av kartlegging → 571 skredstartpunkt
- **Kontrollpunkt**
  - semi-tilfeldig utvalg fra en maske med samme variasjonsbredde for høyde, helning og relativ nedbør som skredpunktene
  - 571 kontrollpunkt

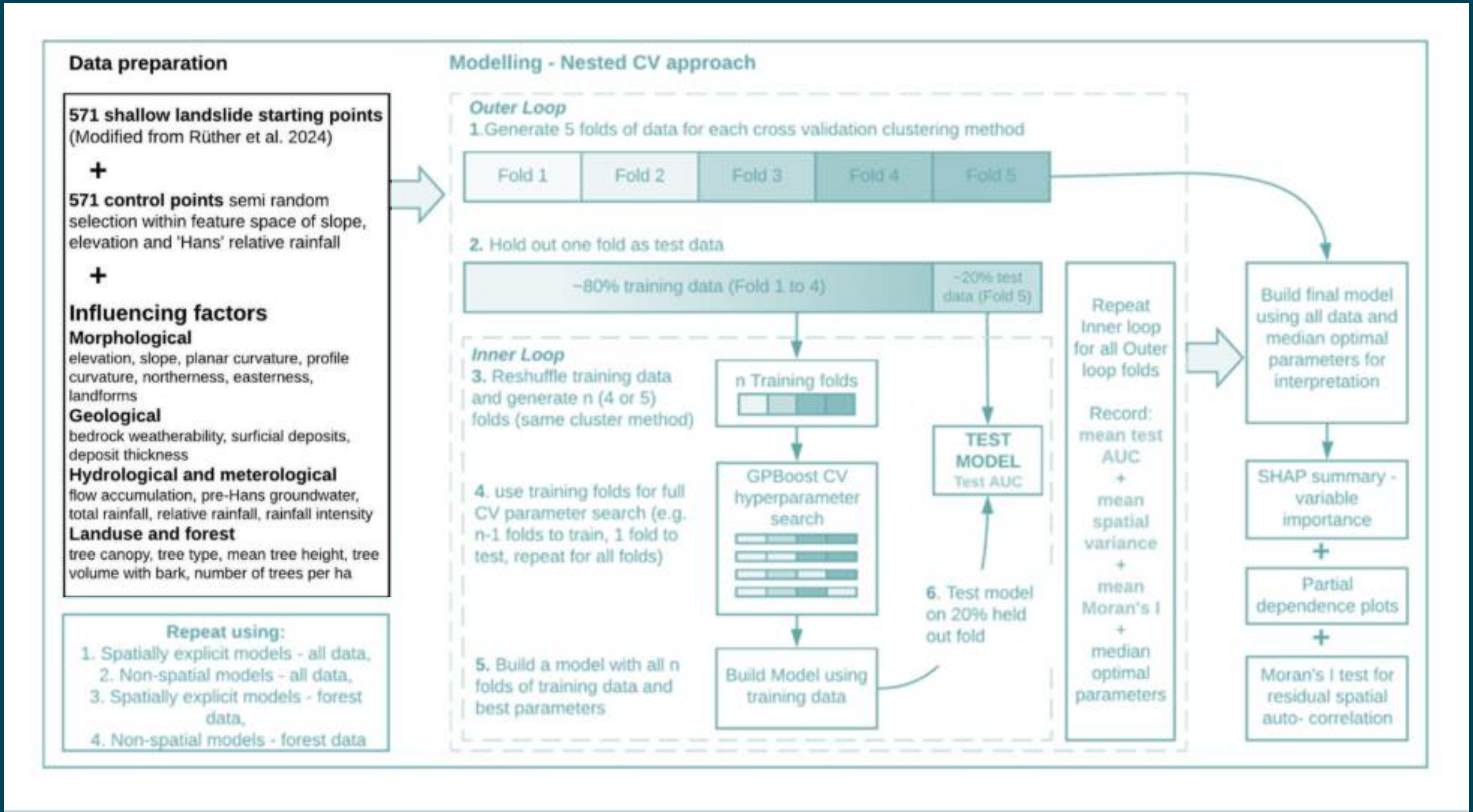


3. Attributtdata som forklarende faktorer

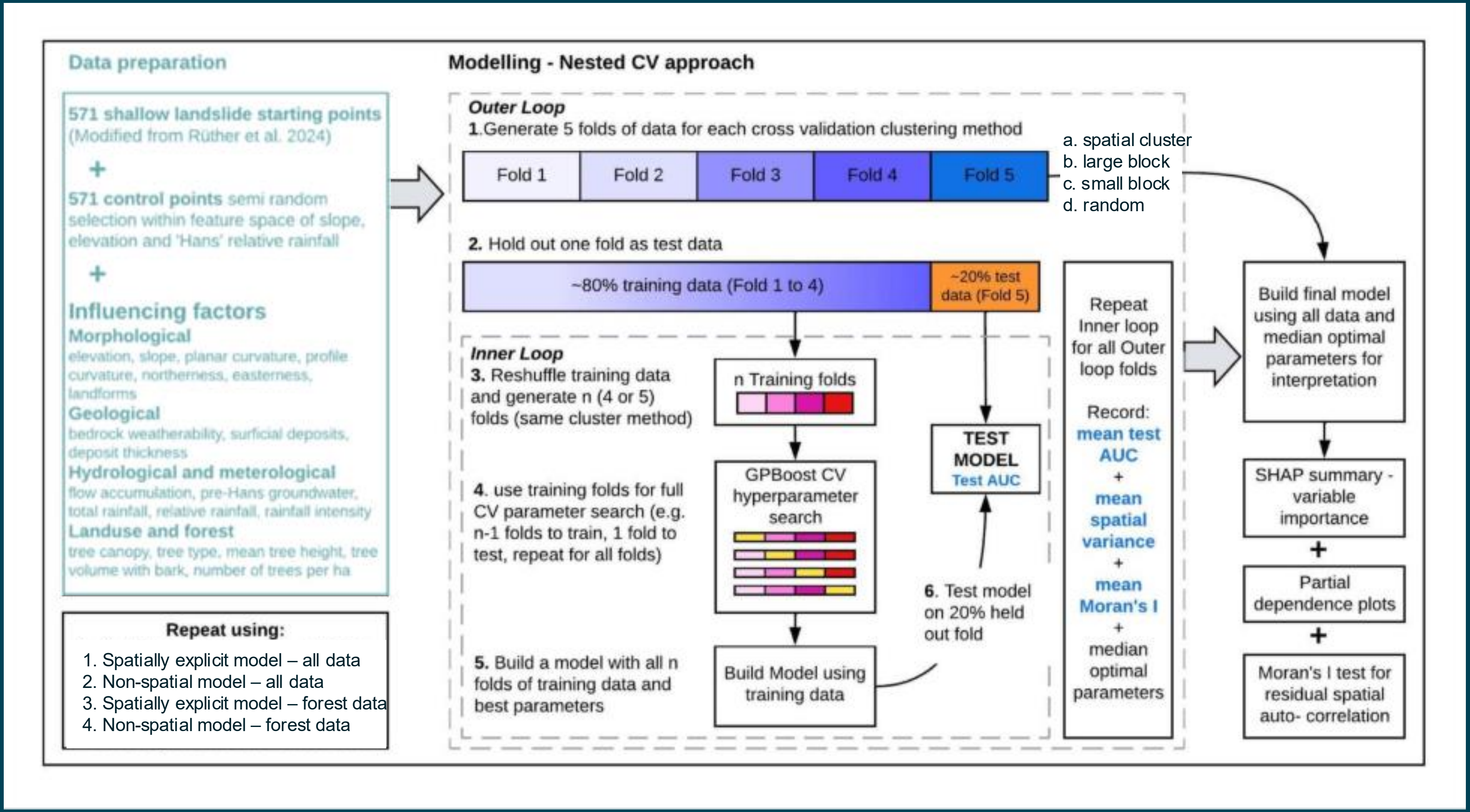
	Variables/ influencing factors	Data source and resolution	Notes
Morphological	Elevation (m asl)	DTM 5m	National DTM curated by NGU
	Slope (degrees)	DTM 5m	
	Planar Curvature	DTM 5m	
	Profile Curvature	DTM 5m	
	Aspect (two rasters: northerness=cosine and easterness=sine)	DTM 5m	Cosine: -1 (south) to 1 (north) Sine: -1 (west) to 1 (east)
	Terrain Ruggedness Index TRI square root of the average of the squared differences between a cell's elevation and its 8 surrounding cells	DTM 5m	Strong correlation with slope
	Landforms (based on Topographic Position Index 300 and 2000)	DTM 5m	1: canyons, 2: valleys, 3: headwaters, 4: u-valleys, 5: plains, 6: open slopes, 7: upper slopes, 8: ridges, 9: hills, 10: high ridges
Geological	Bedrock (Berggrunn)	NGU 1:250 000	1: carbonate rocks, 2: shale, phyllite, 3: mafic plutonics, 4: others, 5: quartz-rich
	Quaternary deposits (Løsmasse)	NGU 1:50 000	
	Quaternary deposit thickness (Løsmassemektighet)	NGU 1:20 000 – 1:500 000	1: bare rock, 2: thin deposits (< 0.5m) and unspecified thickness, 3: thick deposits (> 0.5m)
	Soil condition (grunnforhold)	NIBIO 1:1000	dataset does not have coverage in mountainous areas

	Variables/ influencing factors	Data source and resolution	Notes
Hydrological and Meteorological	Log (Flow accumulation) max value in a buffer with r=15m	DTM 5m	
	Topographic Wetness Index TWI ln(Specific Catchment Area / tan(slope))	DTM 5m	Strong correlation with flow accumulation and slope
	Stream Power Index SPI ln(Specific Catchment Area * tan(slope))	DTM 5m	Strong correlation with flow accumulation and slope
	Pre-Hans relative groundwater level	Senorge v2018, 1km	Continuous 0.48-2.27
	Hans rainfall (acc. 3 days, mm)	Senorge v2018, 1km	Continuous 38.8-185.0
	Hans rainfall/ normal Aug (%)	Senorge v2018, 1km	Continuous 44.9-235.5
	Hans rainfall intensity 1 hour (mm)	MET Nordic Operational, 1km	Less even dispersion compared to 3 h intensity
	Hans rainfall intensity 3 hours (mm)	MET Nordic Operational, 1km	Continuous
Landuse and forest	Landuse AR50 + AR5 (arealtype)	NIBIO 1:1000	20 agriculture, 30: forest, 50: «open» - excluded
	Forestloss	GEE 30m	0: no forest loss 01-22: Year 20xx
	Tree canopy (kronedekning, %)	Nibio SR16 16m	0-100
	Tree type (dominerende treslag)	Nibio SR16 16m	1: Gran (spruce), 2: Furu (pine), 3: Lauv (deciduous)
	Mean tree height (dm)	Nibio SR16 16m	
	Tree volume with bark (m^3/ ha)	Nibio SR16 16m	
	Number of trees per hektar (#/ ha)	Nibio SR16 16m	

4. Maskinlæringsmodellene



4. Maskinlæringsmodellene

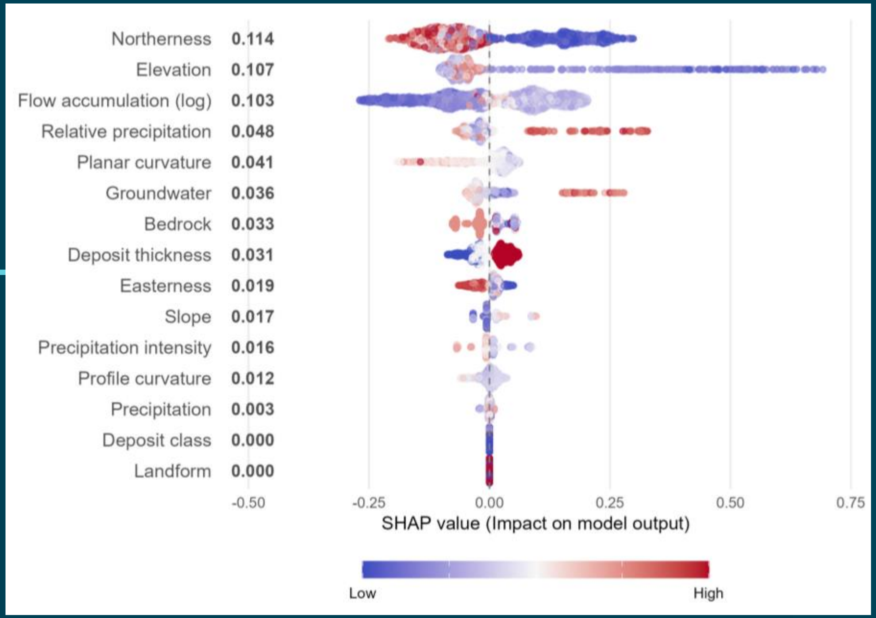


16 modell gjennomkjøringer

- 1a-d: Romlig modell for hele datasett
- 2a-d: Ikke-romlig modell for hele datasett
- 3a-d Romlig modell for skogsdatasett
- 4a-d Ikke-romlig modell for skogsdatasett

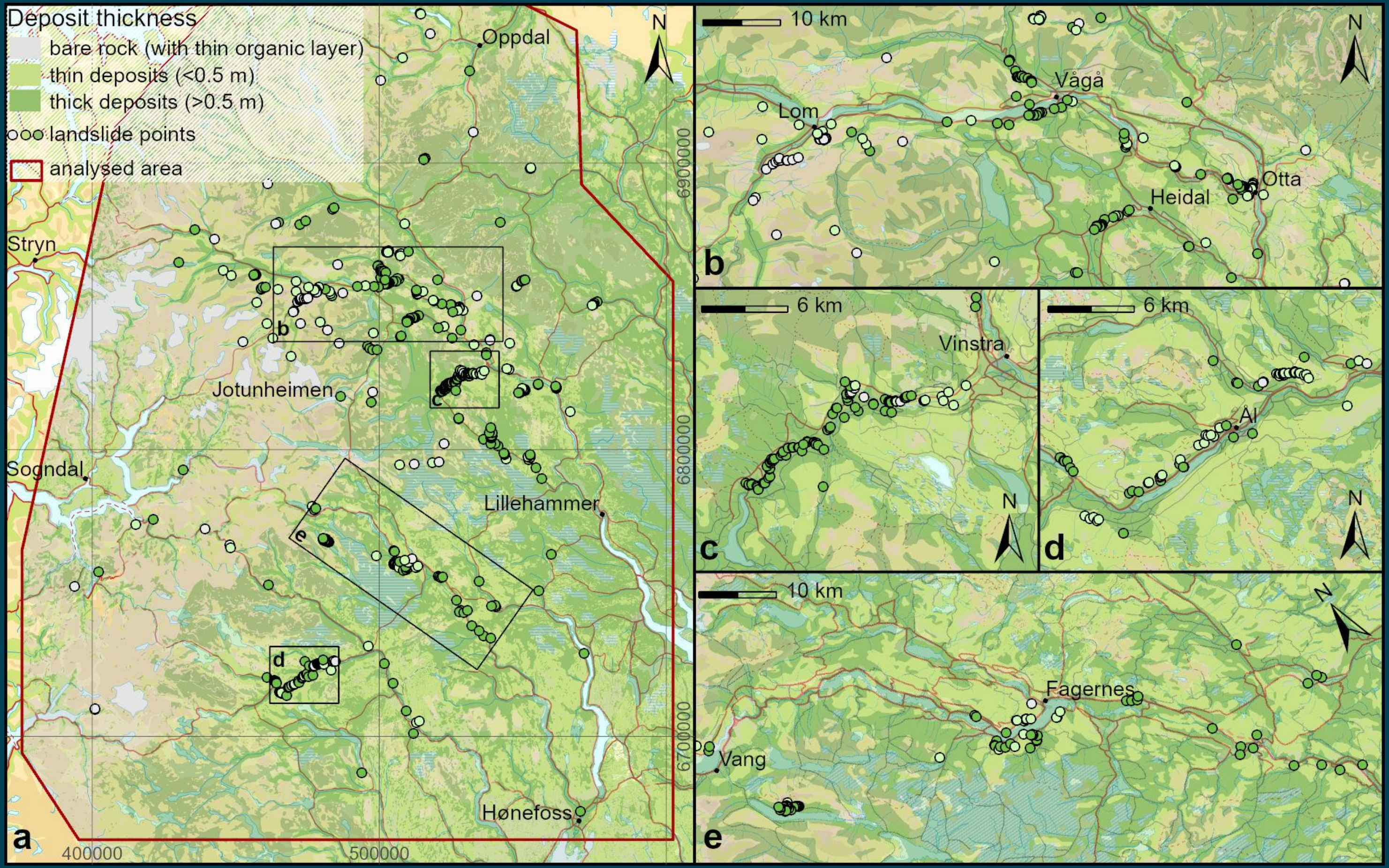
- **Underfitting**
  modellene 1a og 3a
- **Overfitting**
  modellene 2d og 4d
- **Kompromiss**
  modellene 1c og 3c

5. Innflytelse av løsmasse



Model 1c. Romlig modell for hele datasettet med små blokk CV

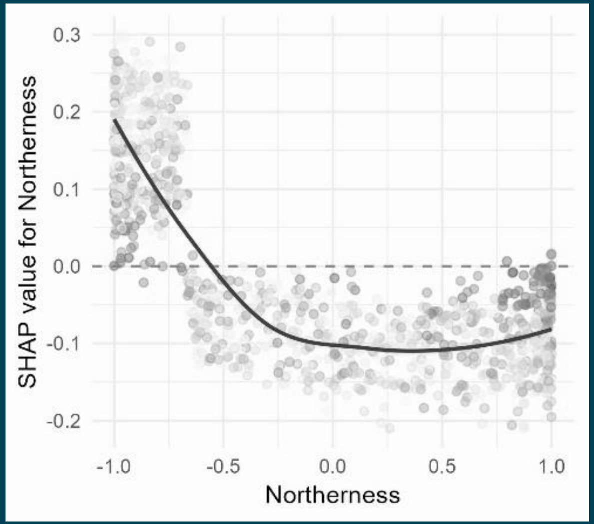
Deposit thickness - løsmassemektighet



5. Innflytelse av løsmasse

Model 1c. Romlig modell for hele datasettet med små blokk CV

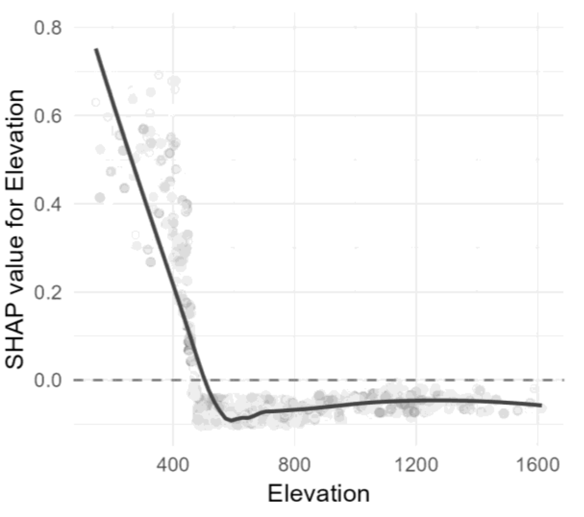
1. Northerness – cos (aspect)



Mer skred i sørvendt enn nordvendt terreng

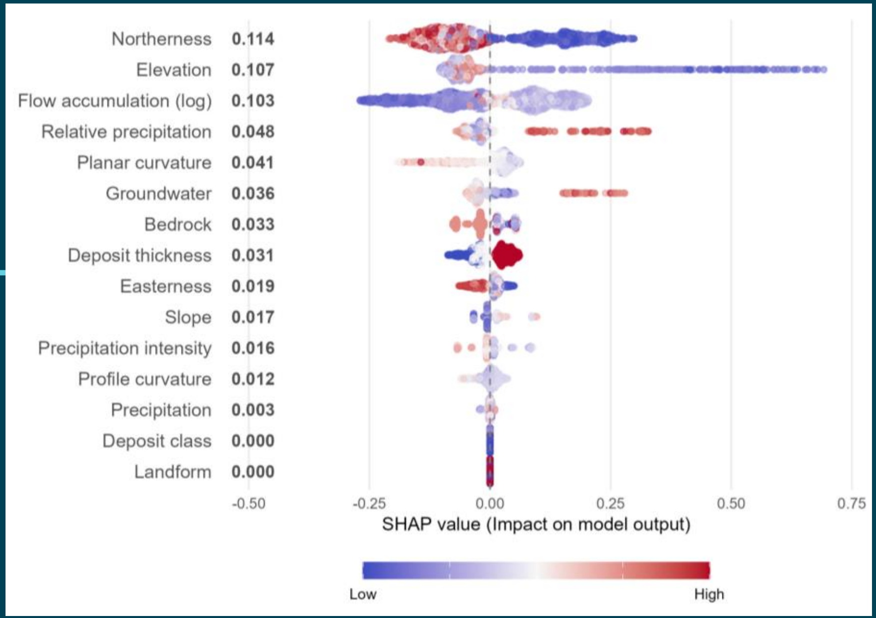
→ Plassholder
for høyere forvitringsaktivitet i sørvendte fjellsider som gir noe tykkere, mer lagdelt jord

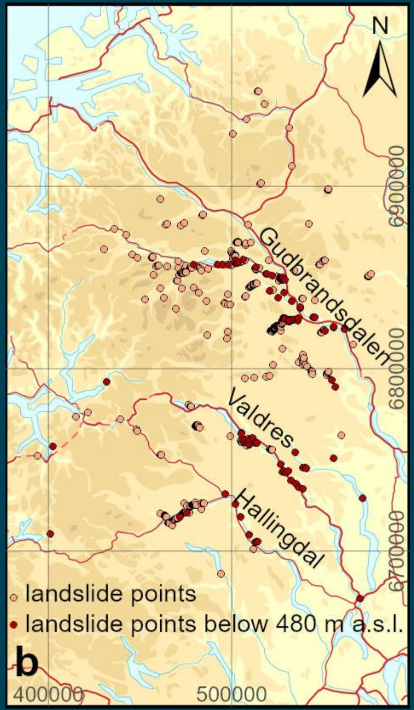
2. Elevation



Høyde forklarer skredforekomst under 480 moh

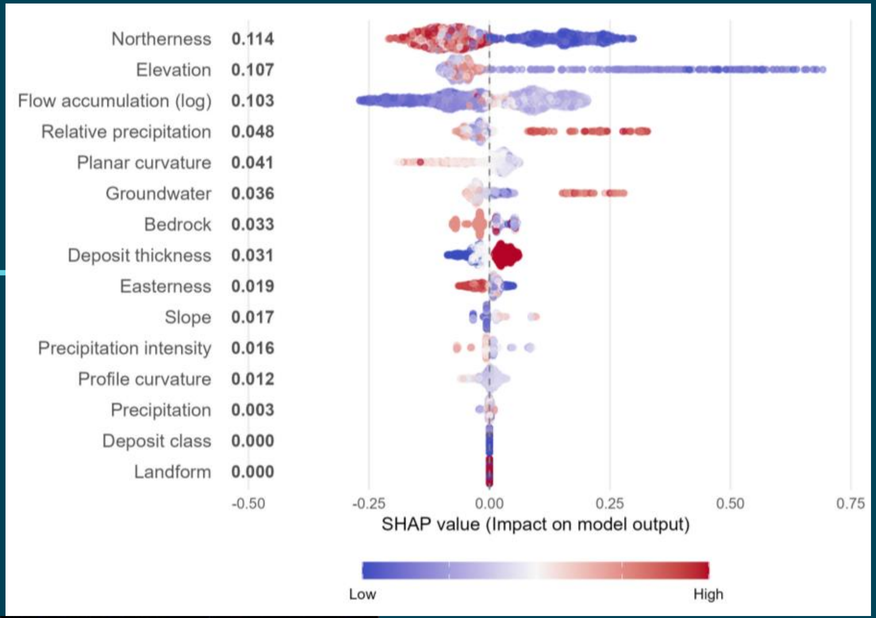
→ Plassholder
for tykkere, mer lagdelt løsmasse i dalførene





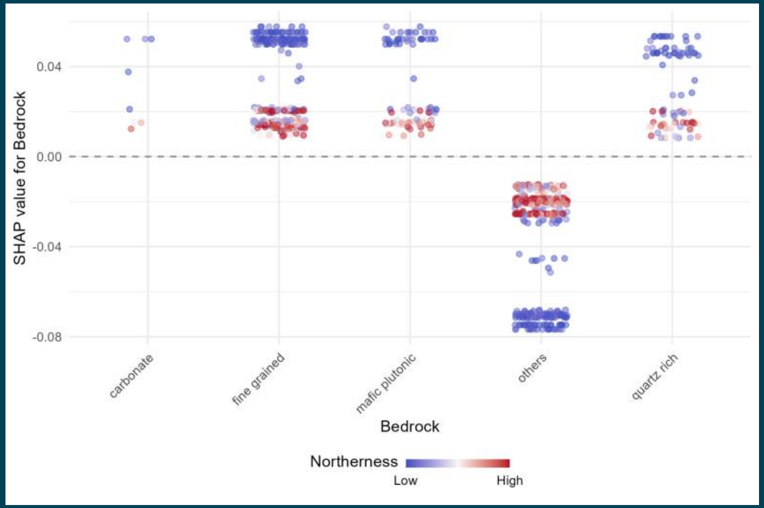
5. Innflytelse av løsmasse

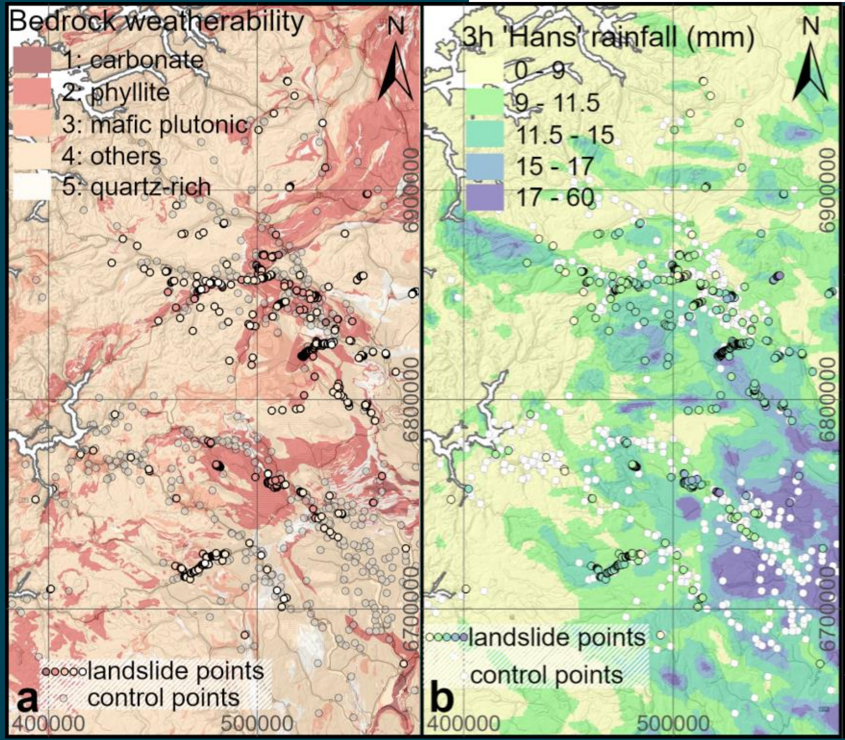
Model 1c. Romlig modell for hele datasettet med små blokk CV

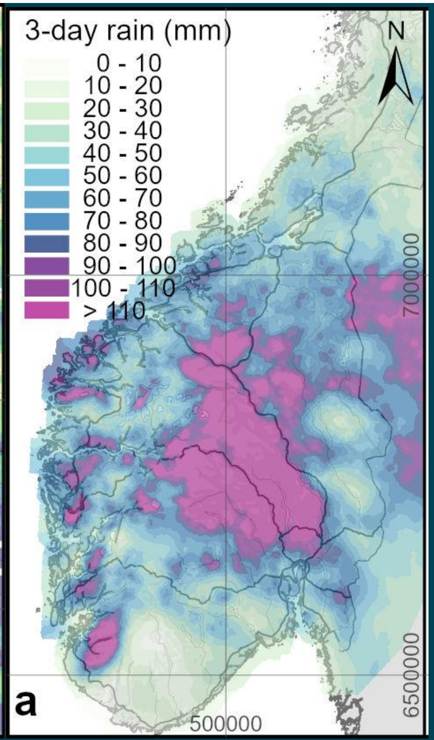


7. Bedrock weatherability

1: very easily (carbonate rocks)
2: easily (shale, phyllite)
3: relatively easily (mafic plutonic rocks)
4: slowly (sandstones, conglomerates and felsic volcanic rocks, i.e. granites and metamorphic rocks, i.e. gneiss)
5: very slowly (quartzite and quartz sandstones)



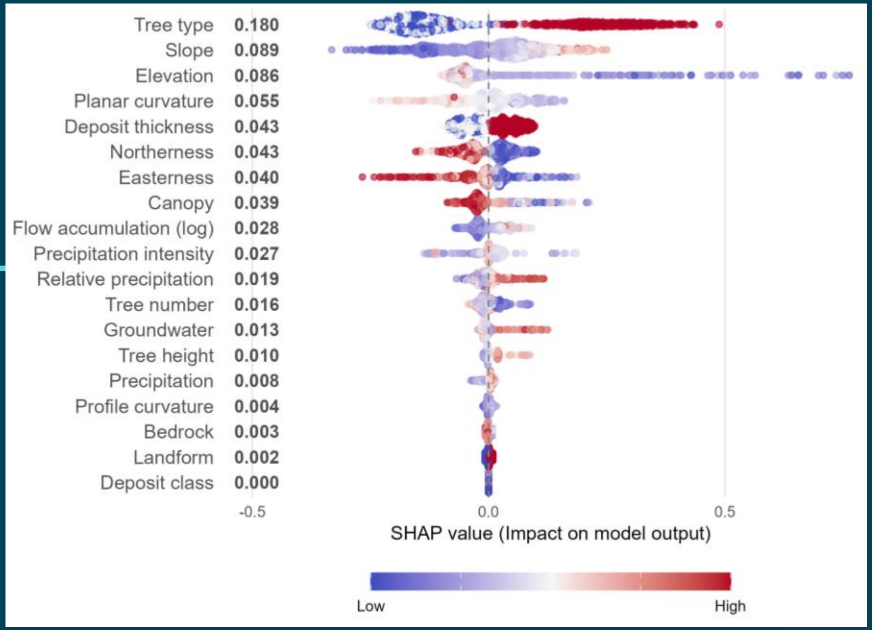




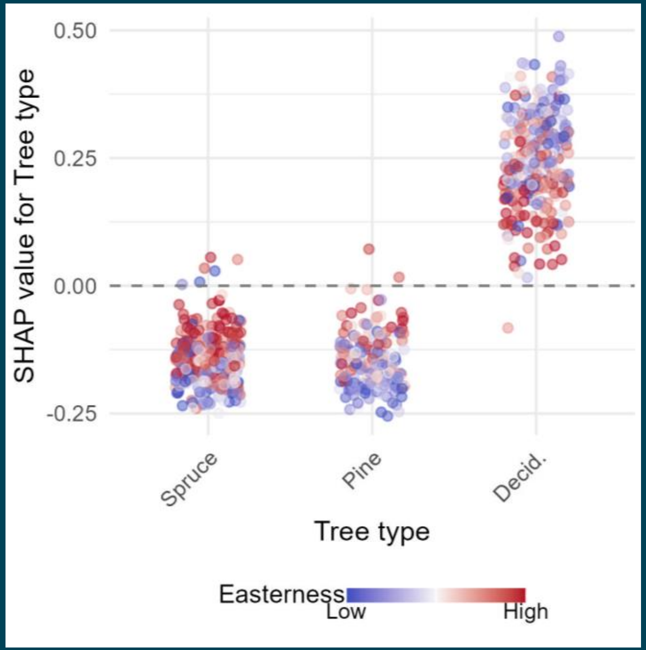
Forvitringsklasse 4 er vanlig i områdene hvor det ikke gikk skred til tross for høy totalnedbør og høy nedbørintensitet

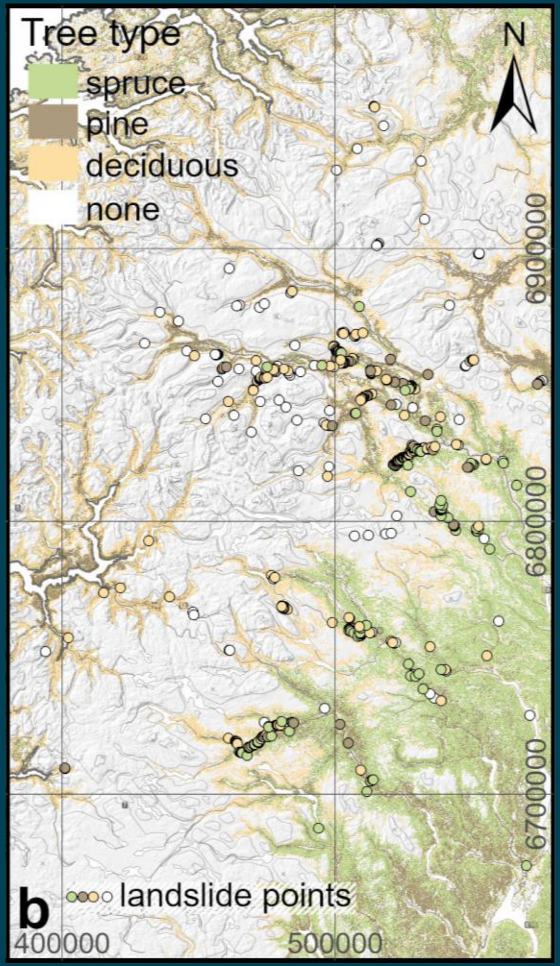
6. Innflytelse av skog

Model 3c. Romlig modell for skogs-datasettet med små blokk CV



1. Tree type

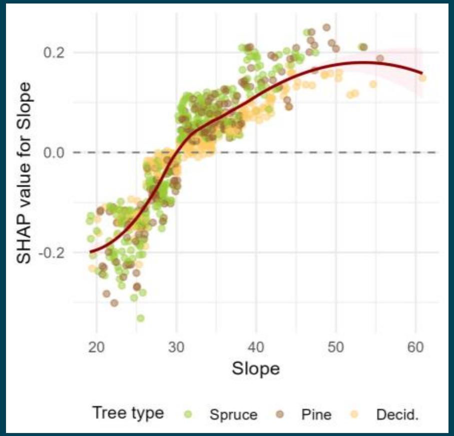




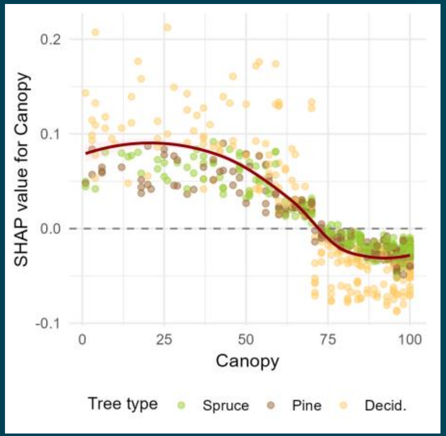
Treslag forklarer skredpunktene i skogen best, blandingsskog gjør skred mer sannsynlig, spesielt i vest-vendt terreng

Både gran og furuskog gjør skred mindre sannsynlig, spesielt i vest-vendt terreng

2. Slope



8. Canopy cover



7. Oppsummering

- Stort behov for et forbedret nasjonalt datasett for løsmassetykkelse og egenskap
- Skogen bør tas hensyn til i fremtidige aktsomhetskart for jord- og flomskred
- Stort potensial for data-drevet produksjon av aktsomhetskart

Takk for meg.