Total Phytolith Content

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** Response: Total phytolith content

Some Definitions

- **Phytolith** : Phytoliths are microscopic, weathering-resistant particles of silica formed in certain plant taxa that are released from decomposing litter and accumulate over time in the soil
- **rondel_cells** : Exotic grasses only produce rondel-type phytoliths
- **bilobate cells** : only produced by proposed native bunch grasses (not produced by natives)
- **short cells** : specialized silica accumulating cells found only in grasses. These strongly correlate to total phytolith mass (in evett 2013), indicating that most of the phytoliths produced were from grass cells.
- **total phytolith** : Total mass of phytoliths. Evett et al. (2012) proposed distinguishing sites with substantial long-term grass cover from other sites by using a ??? 0.3% soil phytolith weight threshold
- **bilobate ratio** : Percentage dominated by stipa and /or Danthonia
- ***Stipa pulchra*** : Proposed dominant grass species in Central Valley
- ***Danthonia californica*** : proposed dominant grass in Coastal areas

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Model Validation

initial kfold

	cor	SSE	MSE	RMSE	ME	MAE	moran lower	moran upper
OLS	0.3937506	210.3320	1.752767	1.323837	-0.0236692	1.0056904	0.2466667	0.7576667
CT	0.2337805	263.2525	2.193770	1.480999	-0.0390695	1.1508914	0.3306667	0.6610000
RF	0.3797447	187.5084	1.562570	1.249753	-0.0041887	0.9834912	0.2223333	0.7800000
ridge	0.4178762	183.1779	1.526483	1.235311	-0.0049474	1.0100189	0.9080000	0.1000000
lass	0.6202192	134.7350	1.122791	1.059619	-0.0001407	0.8372288	0.2543333	0.7400000
ens	0.4755839	168.1697	1.401414	1.183785	-0.0144031	0.9412351	0.3160000	0.6896667

Second kfold

	cor	SSE	MSE	RMSE	ME	MAE	moran lower	moran upper
OLS	0.2840612	257.7667	2.148056	1.465625	0.0166064	1.1286468	0.377	0.647
CT	0.2321476	265.8722	2.215602	1.488490	0.0635644	1.2059351	0.223	0.738
RF	0.4057833	181.8523	1.515436	1.231030	0.0132588	0.9831815	0.218	0.783

	cor	SSE	MSE	RMSE	ME	MAE	moran lower	moran upper
ridge	0.3548032	192.9044	1.607536	1.267887	-0.0096865	1.0423212	0.920	0.072
lass	0.6227179	133.7189	1.114324	1.055615	-0.0003434	0.8310451	0.229	0.764
ens	0.4873943	166.0367	1.383639	1.176282	0.0125411	0.9582594	0.306	0.689

Fitted correlations

```
##      OLS       CT        RF       ridge     lass      ens
## [1,] 0.6152851 0.7795098 0.957386 0.3221748 0.6242073 0.8131259
```

Moran MC

```
##      OLS       CT        RF       ridge     lass      ens
## [1,] 0.6152851 0.7795098 0.957386 0.3221748 0.6242073 0.8131259
```

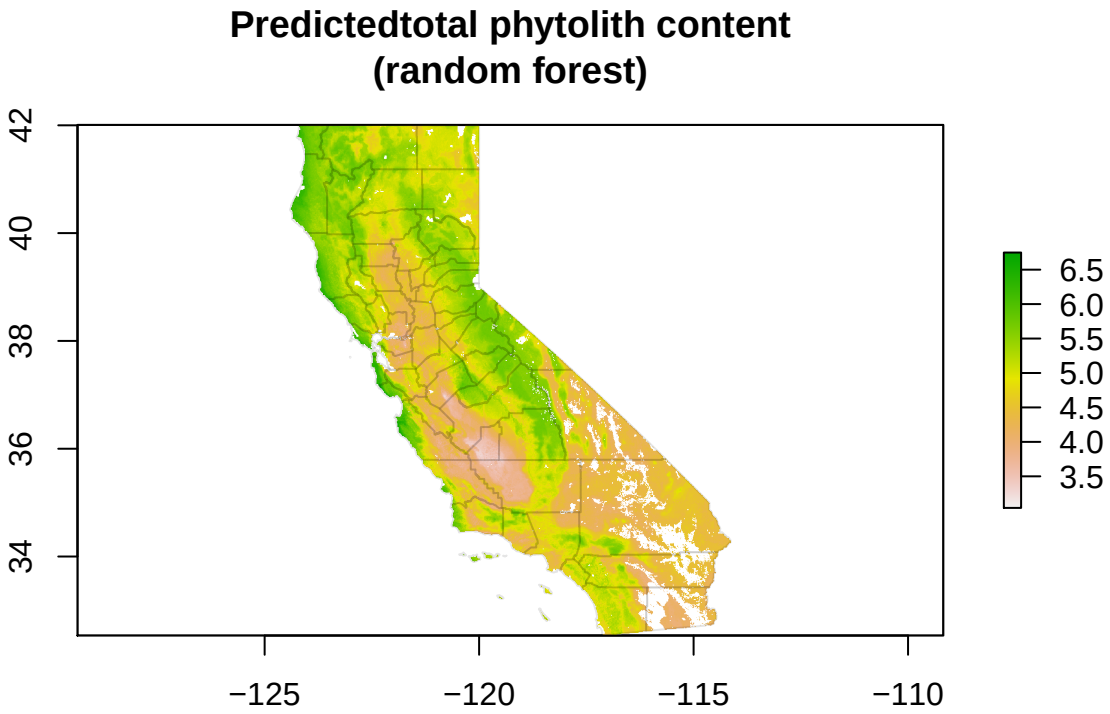
Model Correlations

	OLS	CT	RF	ridge	lass	ens
OLS	1.0000000	0.6152944	0.9004638	0.8191534	0.9599217	0.9502343
CT	0.6152944	1.0000000	0.6955572	0.6311713	0.6271469	0.7332666
RF	0.9004638	0.6955572	1.0000000	0.8997217	0.9203061	0.9627060
ridge	0.8191534	0.6311713	0.8997217	1.0000000	0.8590506	0.9343457
lass	0.9599217	0.6271469	0.9203061	0.8590506	1.0000000	0.9704526
ens	0.9502343	0.7332666	0.9627060	0.9343457	0.9704526	1.0000000

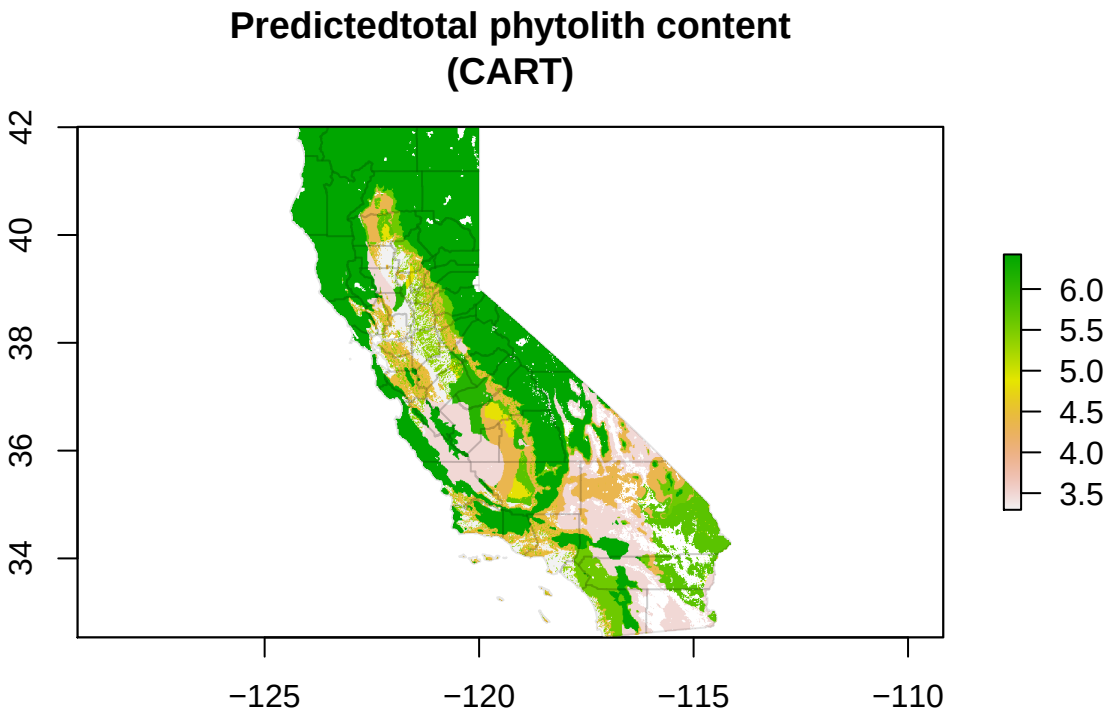
Predictions

predictions

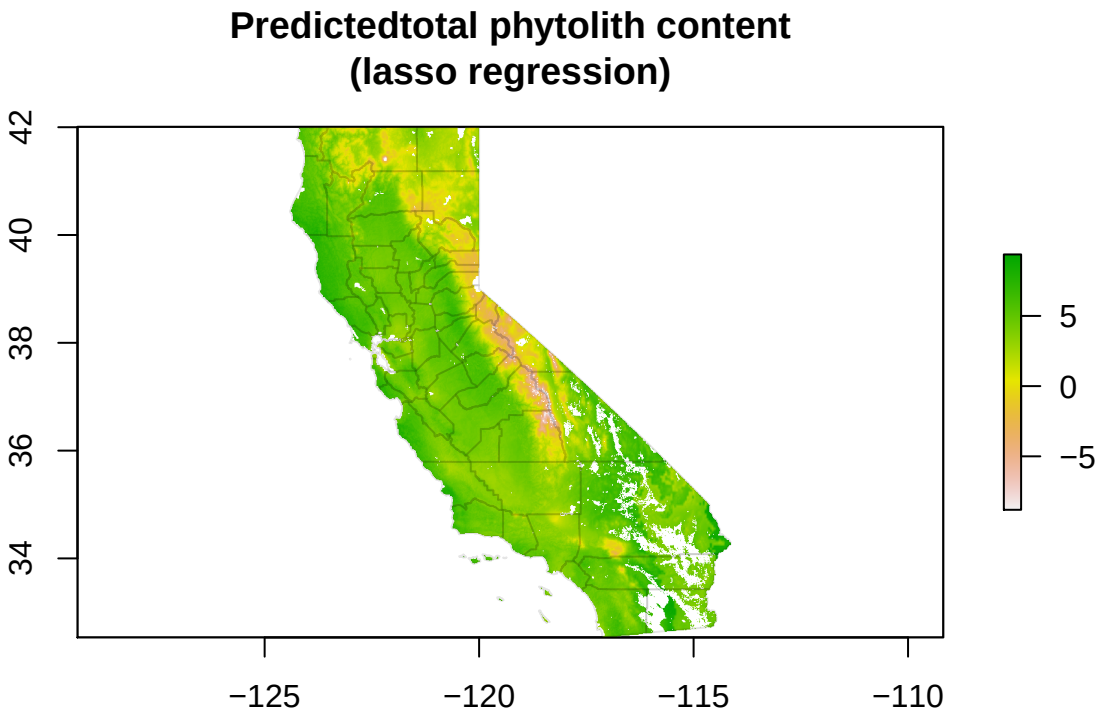
Random Forest



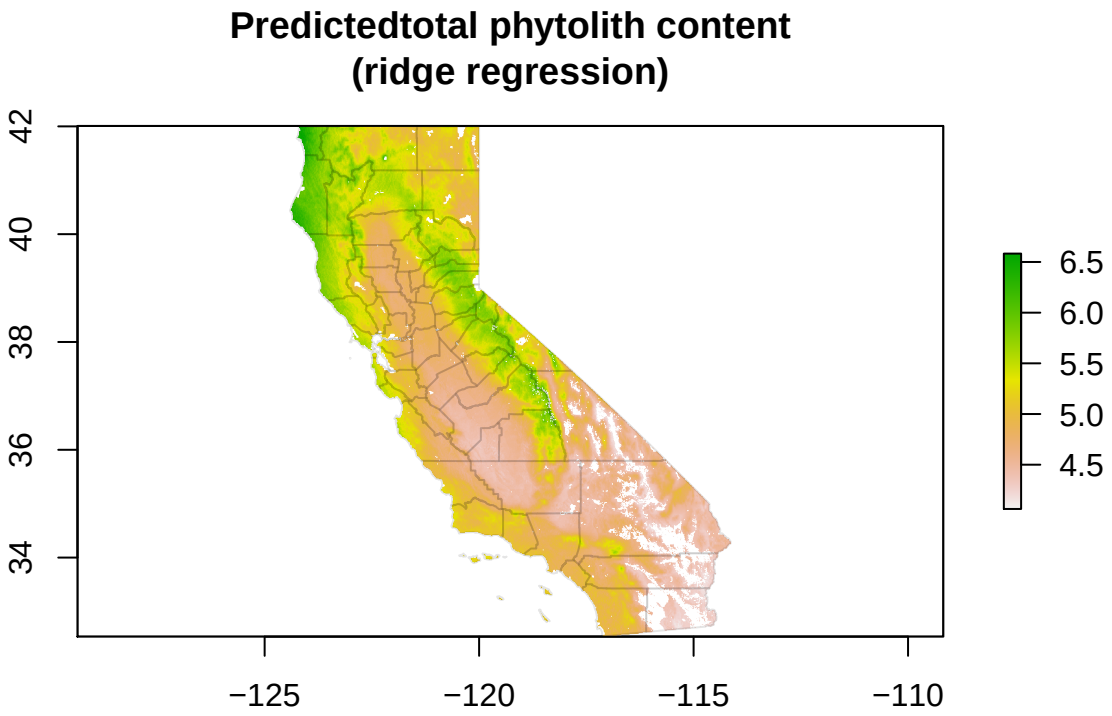
CART

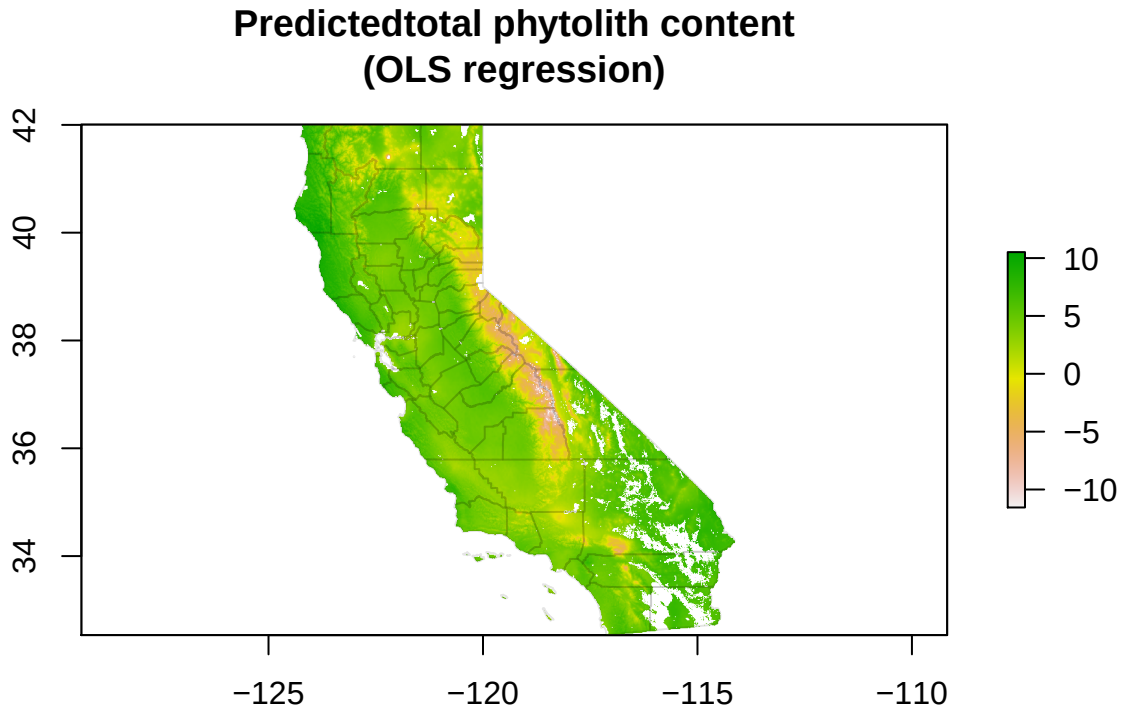

Predictedtotal phytolith content
(CART)
42
40
38
36
34
−125
−120
−115
−110
6.0
5.5
5.0
4.5
4.0
3.5

Lasso

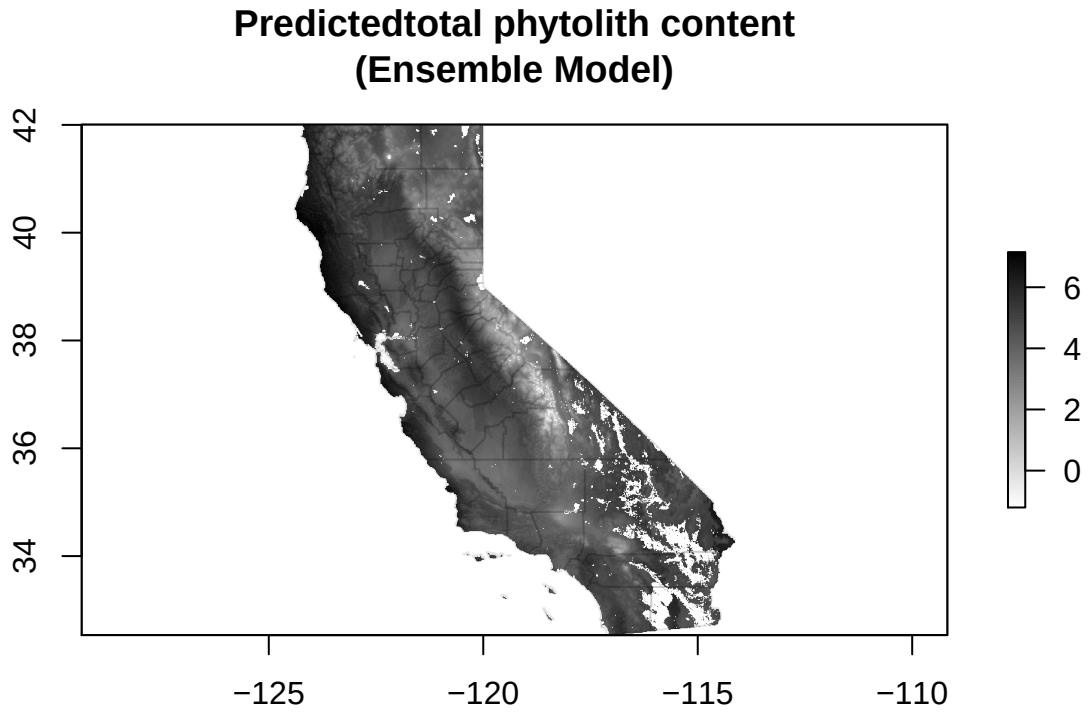

Predictedtotal phytolith content
(lasso regression)
42
40
38
36
34
−125
−120
−115
−110
5
0
−5

Ridge


Predictedtotal phytolith content
(ridge regression)
42
40
38
36
34
−125
−120
−115
−110
6.5
6.0
5.5
5.0
4.5


Predictedtotal phytolith content
(OLS regression)
42
40
38
36
34
−125
−120
−115
−110
10
5
0
−5
−10

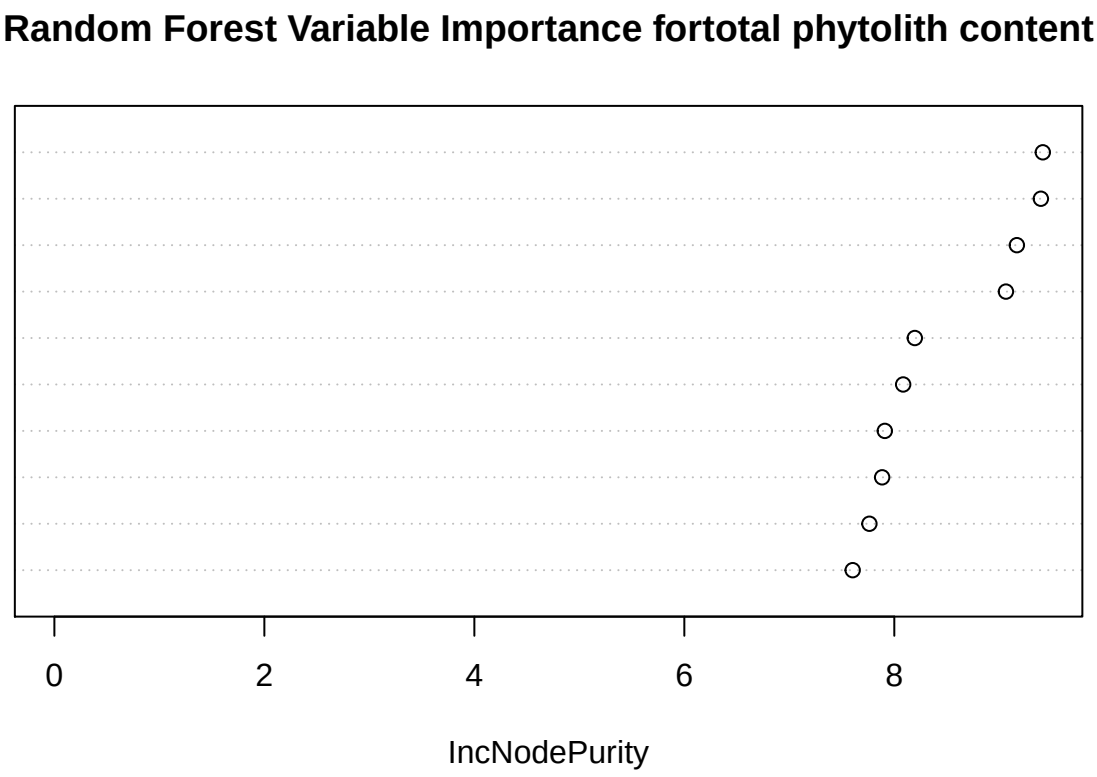
OLS


Predictedtotal phytolith content
(Ensemble Model)
42
40
38
36
34
−125
−120
−115
−110
6
4
2
0

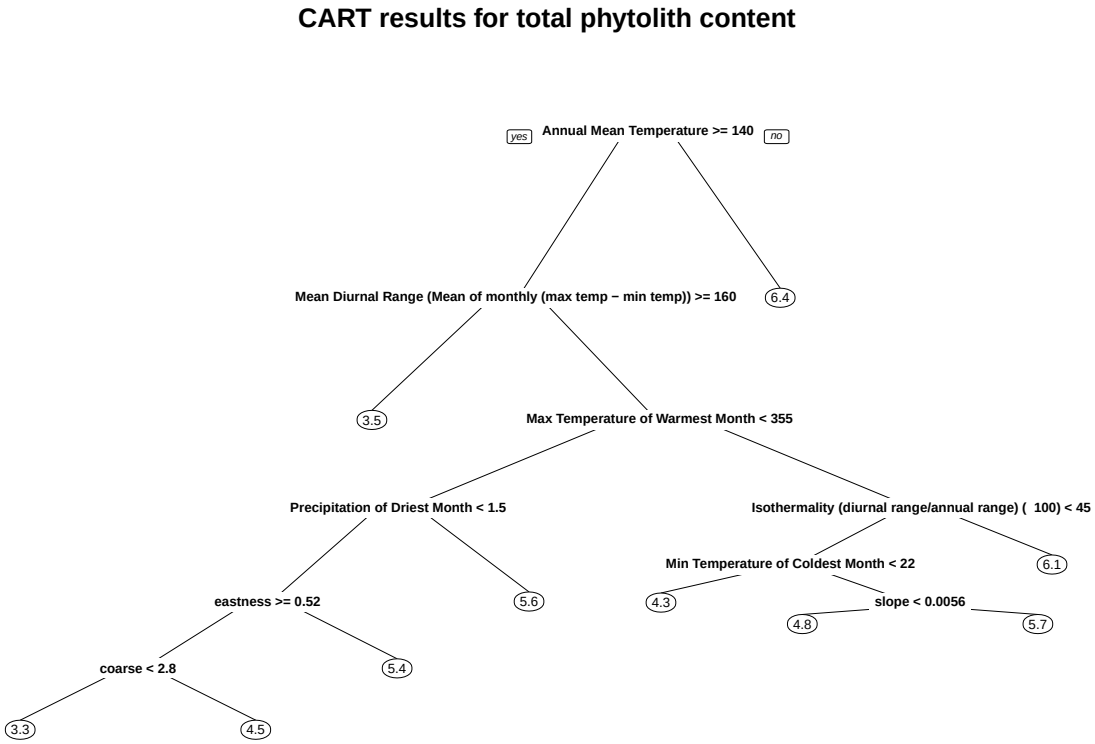
Ensemble

Variable Importance

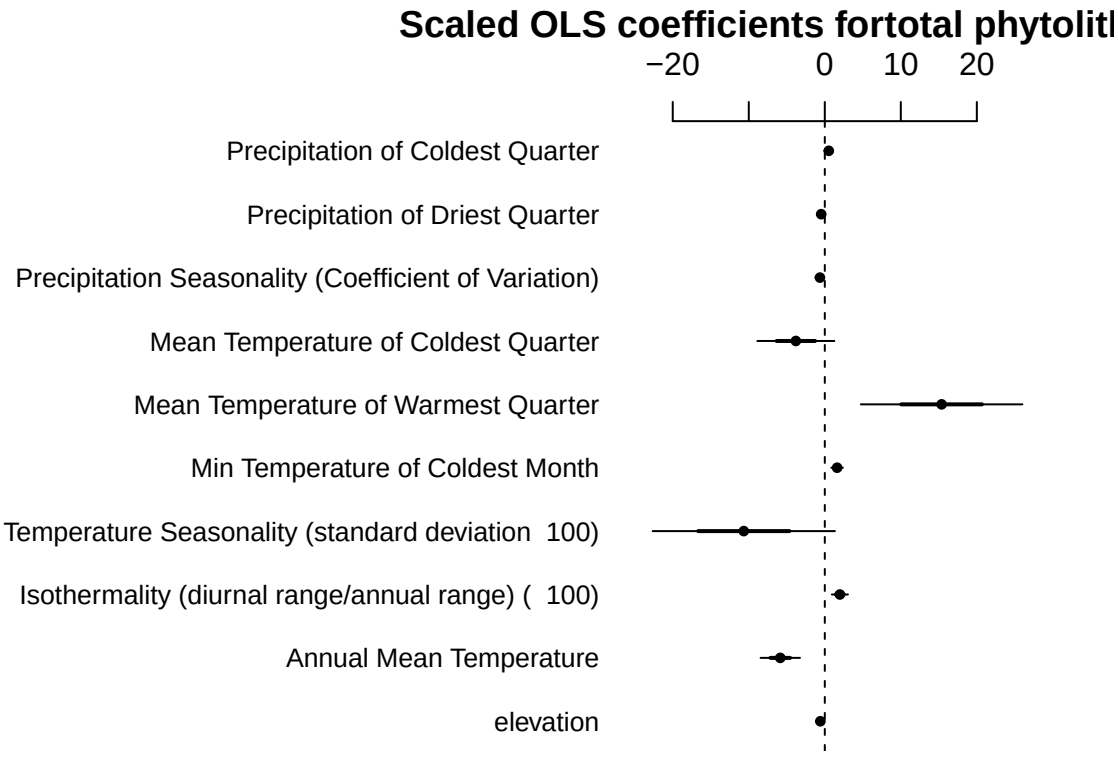
Random Forest



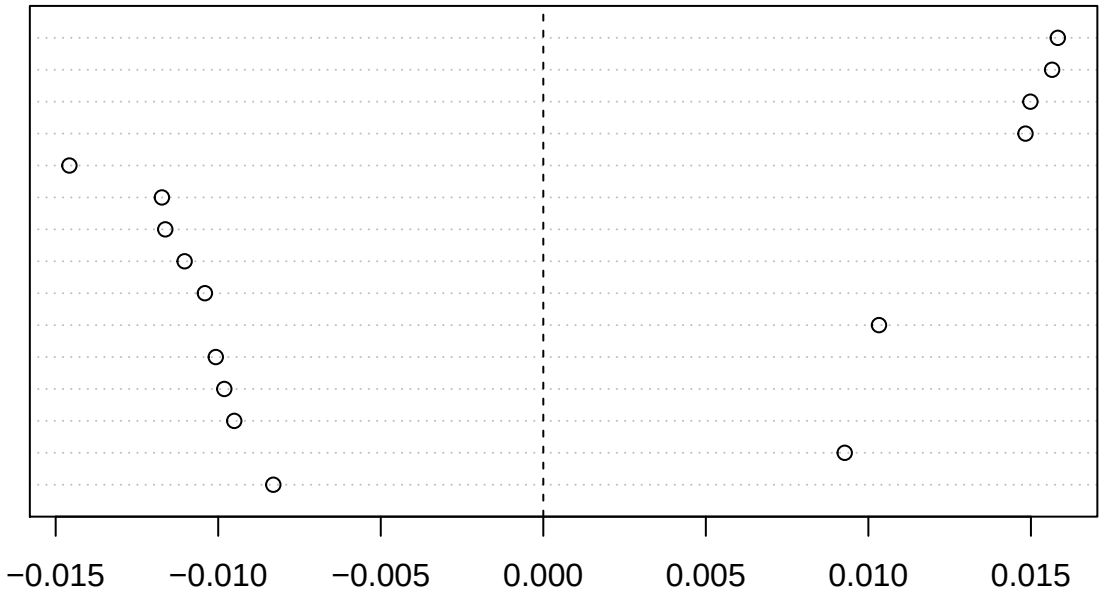
Cart


CART results for total phytolith content
yes
Annual Mean Temperature >= 140
no
Mean Diurnal Range (Mean of monthly (max temp − min temp)) >= 160
6.4
3.5
Max Temperature of Warmest Month < 355
Precipitation of Driest Month < 1.5
Isothermality (diurnal range/annual range) (100) < 45
Min Temperature of Coldest Month < 22
6.1
eastness >= 0.52
5.6
4.3
slope < 0.0056
4.8
5.7
coarse < 2.8
5.4
3.3
4.5

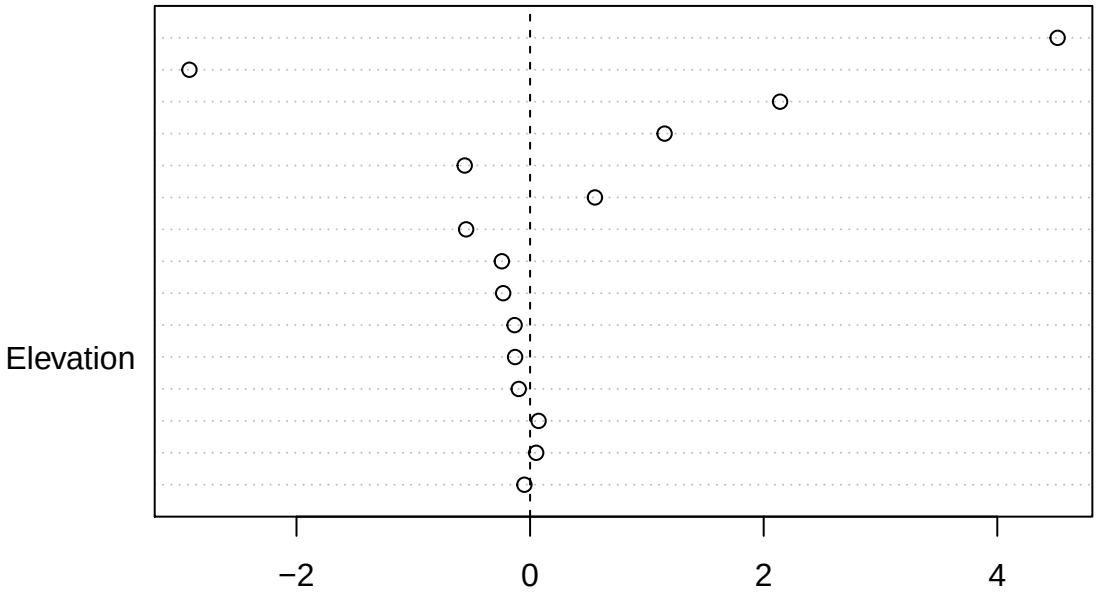
OLS


Scaled OLS coefficients fortotal phytolit
−20
0
10
20
Precipitation of Coldest Quarter
Precipitation of Driest Quarter
Precipitation Seasonality (Coefficient of Variation)
Mean Temperature of Coldest Quarter
Mean Temperature of Warmest Quarter
Min Temperature of Coldest Month
Temperature Seasonality (standard deviation 100)
Isothermality (diurnal range/annual range) (100)
Annual Mean Temperature
elevation

scaled ridge regression coefplot



scaled Lasso Coefplot



changes due to climate

```
save(p, p.ct, ens, p.rf, p.ols, p.lasso, p.ridge, p.ens, file = paste0(depvarname,'.Rmd'))
```