Supplementary Materials

Table S1 – S4: Confusion matrices for each level based on UAS data and Random Forest. Each confusion matrix represents the accumulated values over 500 bootstrap iterations

Table S1

Prediction

Basic surface types	Substrate types	Substrate types wet	Water shallow	Vegetation	Vegetation Shadow	Water	Producer Accuracy
Substrate types	41727	5206	143	545	35	0	88%
Substrate types wet	2860	30105	2847	572	0	0	83%
Water shallow	0	3509	23503	3	32	3317	77%
Vegetation	100	802	0	110780	3120	0	96%
Vegetation Shadow	0	0	108	6302	26517	75	80%
Water	0	0	2570	0	76	24820	90%
User Accuracy	93%	76%	81%	94%	89%	88%	

(Reference — row labels)

Table S2

Prediction

Vegetation units	Woody	Grassland	Herbaceous vegetation	Reed	Pioneers	Producer Accuracy
Woody	12367	127	1029	886	437	83%
Grassland	0	4592	242	0	1	95%
Herbaceous vegetation	616	322	38244	1156	513	94%
Reed	755	0	1321	6347	338	72%
Pioneers	49	10	541	525	6109	84%
User Accuracy	90%	91%	92%	71%	83%	

(Reference — row labels)

Table S3

Prediction

Substrate types	Layer of shells	Fine grained material	Wood	Gravel	Sand	Stones	Armour stones	Producer Accuracy
Layer of shells	2092	3	324	337	194	174	132	64%
Fine grained material	1	3566	468	901	284	18	3	68%
Wood	236	750	1716	1068	924	61	483	33%
Gravel	378	779	920	9973	1569	55	39	73%
Sand	41	360	1015	2070	6948	301	4	65%
Stones	234	334	520	399	105	844	595	28%
Armour stones	105	357	345	10	6	242	2863	73%
User Accuracy	68%	58%	32%	68%	69%	50%	70%	

(Reference — row labels)

Table S4

Prediction

Dominant stands	Agrostis stolonifera	Arctium lappa	Brassica nigra	Carduus crispus	Cirsium arvense	Woody	Grassland	Lythrum salicaria	Phalaris arundinacea	Phragmites australis	Populus spp.	Rubus caesius	Salix spp.	Pioneers small	Tanacetum vulgare	Tripleurospermum perforatum	Pioneers	Urtica dioica	Pasture	Producer Accuracy
Agrostis stolonifera	437	1	2	0	1	0	0	2	593	16	44	52	2	0	26	0	185	4	0	32%
Arctium lappa	0	3370	74	306	16	0	0	0	0	0	0	2	0	0	3	0	0	125	1	86%
Brassica nigra	0	10	4509	532	18	0	0	0	3	0	85	0	103	0	93	5	1	570	0	76%
Carduus crispus	0	87	520	6910	37	1	0	0	0	0	0	0	0	0	18	0	0	400	0	87%
Cirsium arvense	0	119	320	646	391	6	0	0	91	4	43	0	0	0	61	2	0	242	0	20%
Woody	0	44	5	59	0	2643	0	0	3	69	202	0	96	0	0	0	0	114	0	82%
Grassland	0	0	0	0	0	0	2201	0	0	0	0	0	0	0	0	0	0	1	104	95%
Lythrum salicaria	10	61	0	0	0	0	0	933	68	246	1	0	37	0	0	0	11	1	0	68%
Phalaris arundinacea	35	0	290	0	40	0	0	6	2742	343	32	72	132	0	13	12	430	149	0	64%
Phragmites australis	68	7	0	0	0	0	0	70	244	3429	7	0	501	0	0	0	0	13	0	79%
Populus spp.	34	72	3	1	4	305	10	0	51	31	4104	45	1806	2	62	11	274	275	149	57%
Rubus caesius	6	0	214	1	3	0	0	0	182	1	5	887	0	0	0	0	252	747	10	38%
Salix spp.	0	0	2	0	0	260	0	0	46	632	850	0	8335	0	0	0	0	3	0	82%
Pioneers small	0	0	0	1	0	0	20	0	0	0	0	0	0	1039	0	0	76	9	33	88%
Tanacetum vulgare	0	415	420	151	34	0	14	0	12	9	130	0	1	1	72	86	66	365	0	4%
Tripleurospermum perforatum	0	0	248	1	31	0	84	0	12	0	16	0	0	0	2	1345	7	22	1	76%
Pioneers	81	0	46	0	0	0	6	1	201	2	24	49	0	199	1	5	2971	14	0	83%
Urtica dioica	0	21	392	323	158	0	0	7	201	302	70	0	35	0	23	40	0	10464	0	87%
Pasture	0	0	0	1	0	0	63	0	0	0	0	19	0	0	0	0	1	203	3103	92%
User Accuracy	65%	80%	64%	77%	53%	82%	92%	92%	62%	67%	73%	79%	75%	84%	19%	89%	70%	76%	91%	

Reference

Figure S1 – S3: Violin plots (density distribution) of variation of producer's and user's accuracy over 500 bootstrap iterations based on UAS data and Random Forest. Sorted decreasing by producer's accuracy. Numbers of reference data are presented on x-axis. Median values over 500 iteration are represented by horizontal lines.
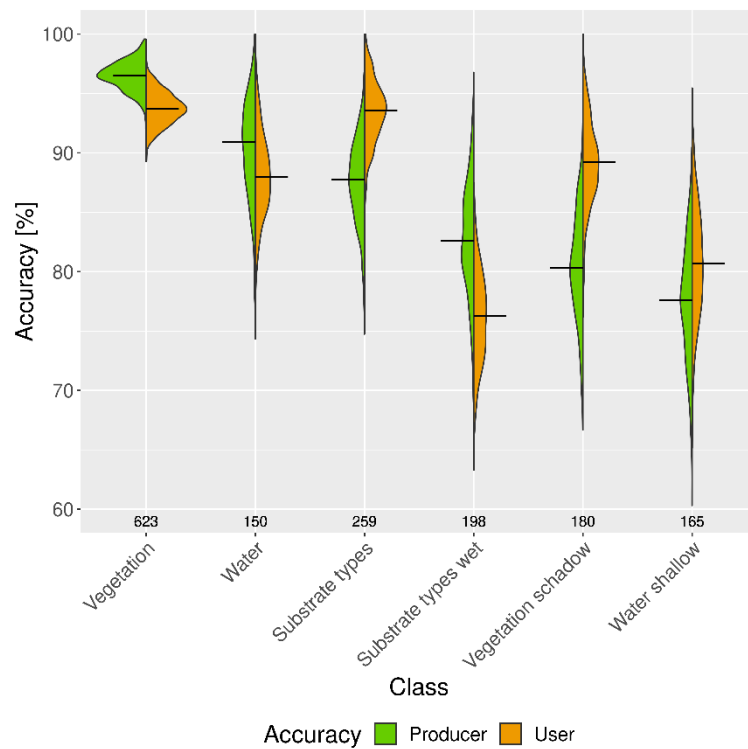

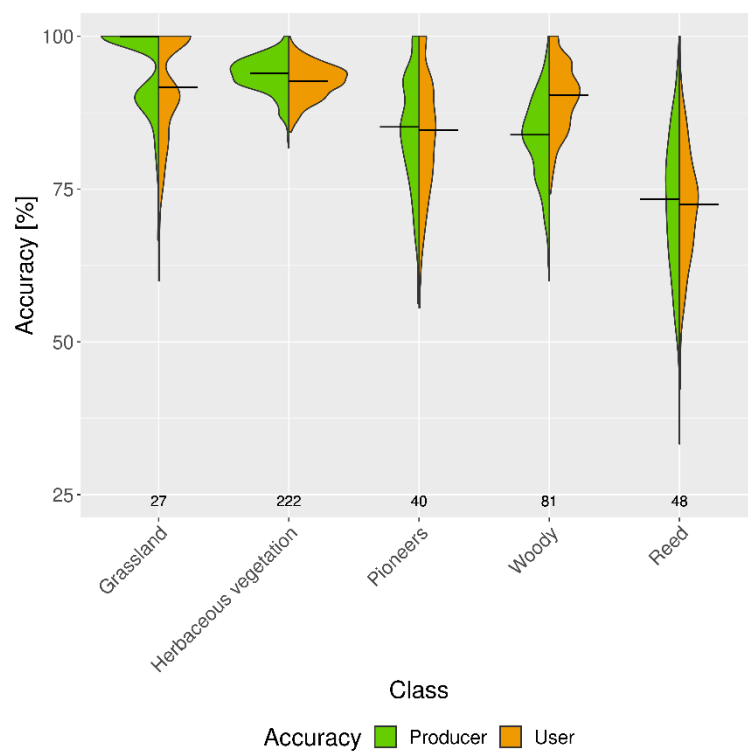Figure S1 Classes of Basic surface types
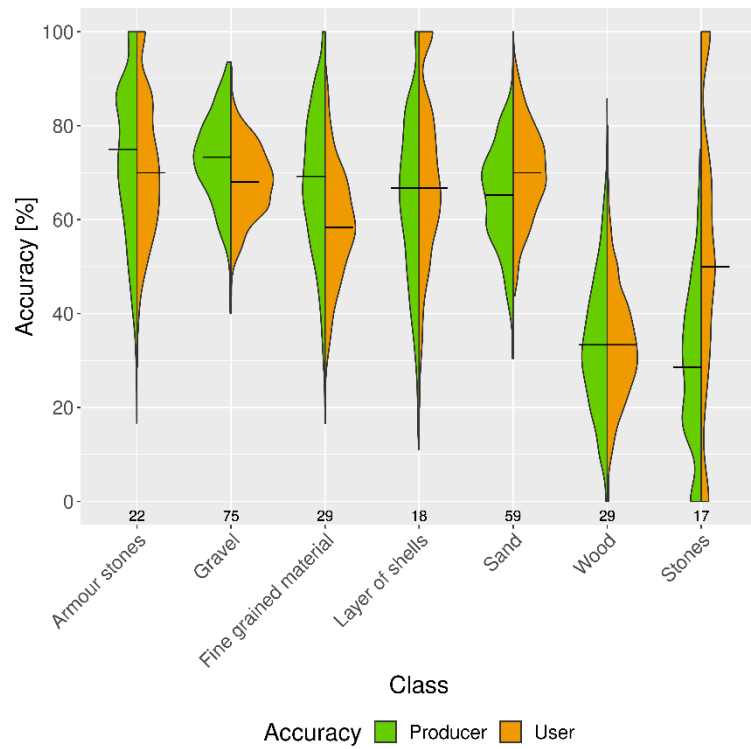

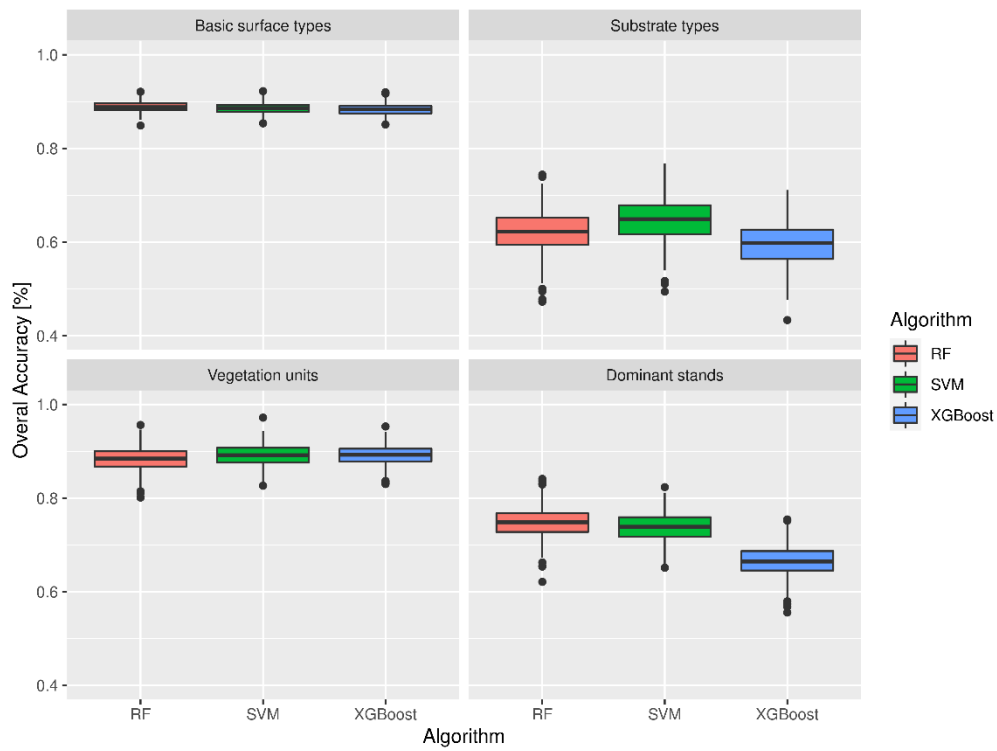Figure S2 Classes of Vegetation units

Figure S3 Classes of Substrate types

Figure S4 Overall Accuracy over 500 bootstrap iterations using UAS data

Figure S5 Computational time for one model over 500 bootstrap iterations using UAS data. The computation was run on a server with 32 CPU's and 126GB RAM

Figure S6 – S9: Feature selection using Gini Index (R package *ranger*) based on Random Forest and UAS data. The optimal number of the 63 available features were determined using forward feature selection. Abbreviations: mean (mn_) and standard deviation (sd_) for each segment; textural features: contrast (cont), dissimilarity (diss), entropy (entr), homogeneity (hom), mean (mean) and angular second moment (sec); textural features: calculation based on red band and 17 x 17 moving window (_17), 3 x 3 moving window (_3), calculated based on near infrared band and segments (_NIR); normalized digital surface model (nDSM), mean and standard deviation values of flood duration model (FDM_mn and FDM_sd); Spectral indices: normalized difference vegetation index (ndviI), green normalized difference index (gndvi), normalized difference red edge index (ndre), normalized difference water index, (ndwi), soil adjusted vegetation index (savi), simple ratio of the near infrared band and red bands (sr), green vegetation index (gvi) and total brightness (totbr); geometrical features: pixel number (no_pix), mean difference to the neighbouring segments based on the nDSM (mdiff_neig);
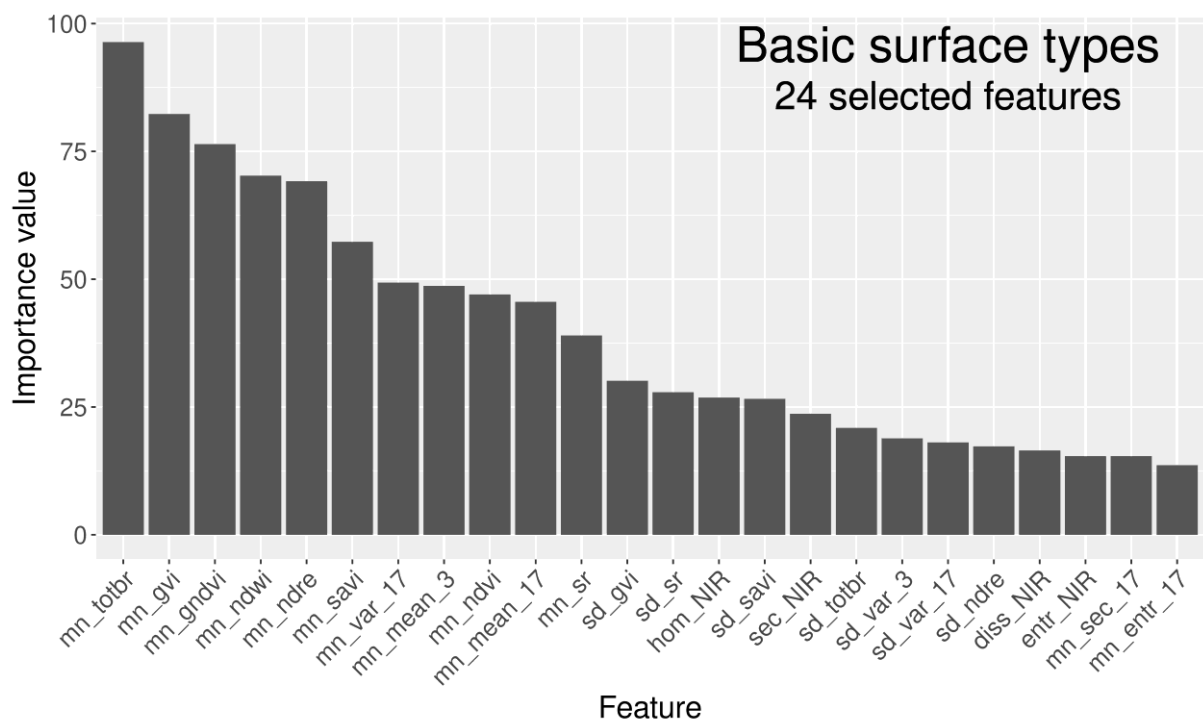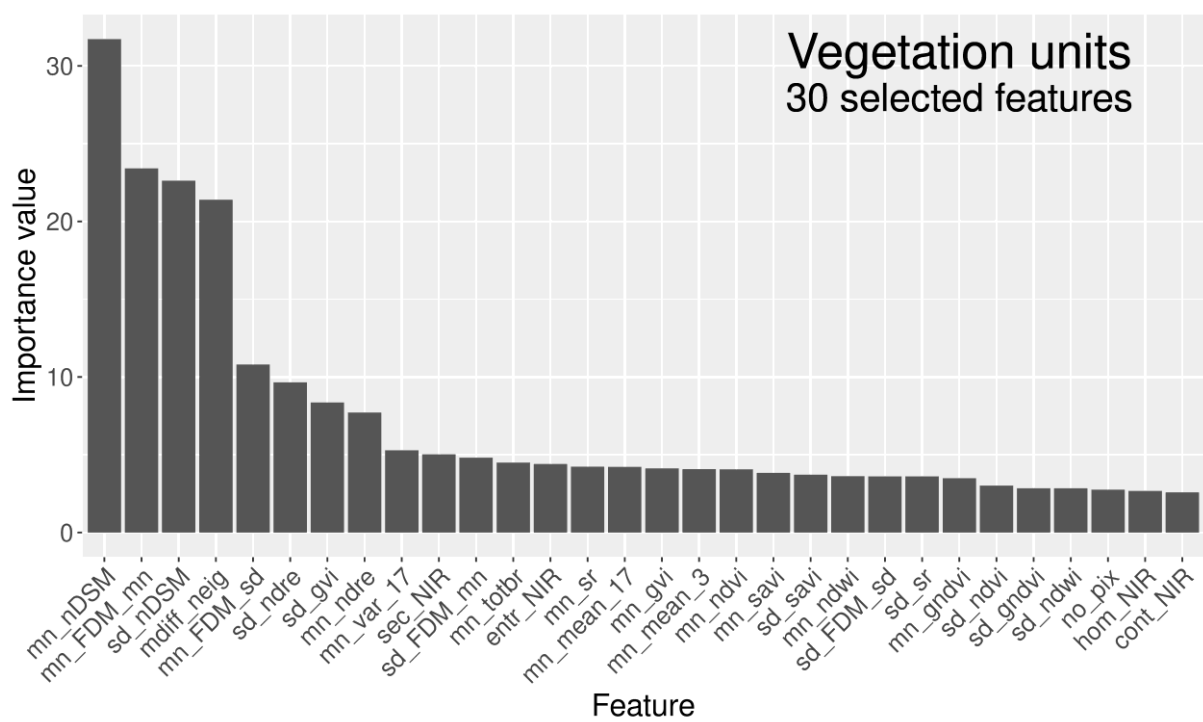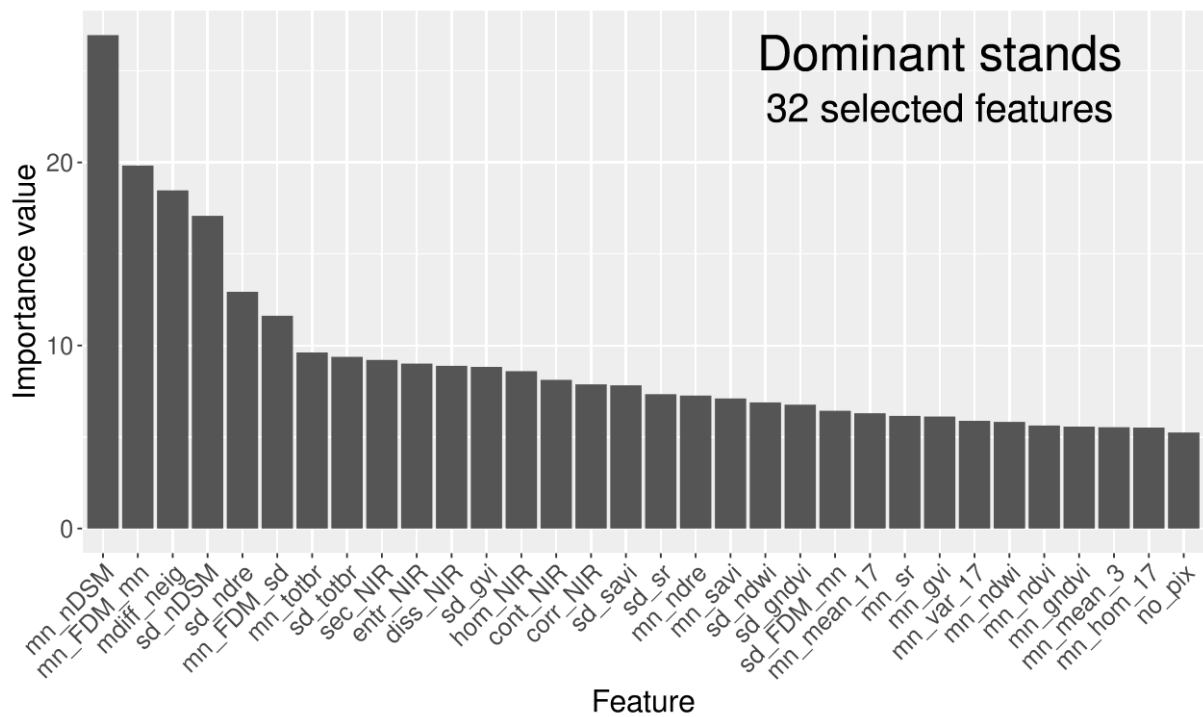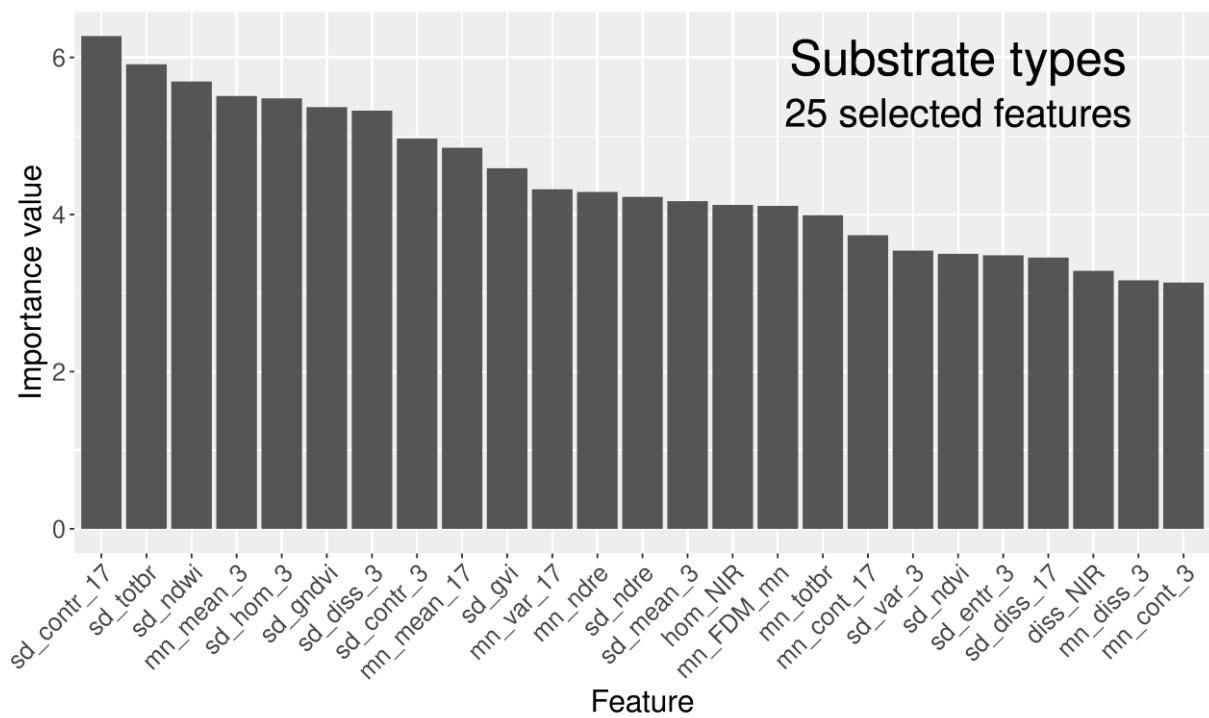
Figure S6

Figure S7

Figure S8

Figure S9