

Supplemental Information

Table 1: Summary statics for all random forest models. Values are means for 100 runs of each model. OOB MSE = out-of-bag mean squared error, RMSE = root mean squared error, MAE = mean absolute error, OTU = Operational taxonomic unit.

| Model name | OOB MSE | RMSE | MAE | \hat{r}^2 | Marker | Taxonomic Level | Environmental parameters |
|-----------------------|-----------|----------|---------|-------------|---------|-----------------|--------------------------|
| bact_phylum_env | 1444615.5 | 959.422 | 804.178 | 0.466 | 16S | Phylum | yes |
| bact_order_env | 1244806.8 | 930.053 | 811.916 | 0.539 | 16S | Order | yes |
| bact_ITS_order_noenv | 1189663.7 | 967.077 | 812.353 | 0.547 | 16S-ITS | Order | no |
| bact_order_noenv | 1255877.9 | 926.515 | 816.699 | 0.522 | 16S | Order | no |
| bact_ITS_order_env | 1111697.3 | 987.116 | 820.109 | 0.589 | 16S-ITS | Order | yes |
| bact_class_env | 1431031.2 | 1001.965 | 830.211 | 0.471 | 16S | Class | yes |
| bact_ITS_phylum_env | 1177324.2 | 1047.794 | 836.237 | 0.564 | 16S-ITS | Phylum | yes |
| bact_ITS_otu_noenv | 1384491.8 | 1009.739 | 847.294 | 0.473 | 16S-ITS | OTU | no |
| bact_phylum_noenv | 1534529.4 | 1058.541 | 851.782 | 0.416 | 16S | Phylum | no |
| bact_class_noenv | 1527864.0 | 1055.698 | 861.749 | 0.419 | 16S | Class | no |
| bact_ITS_otu_env | 1320722.5 | 1037.352 | 862.051 | 0.511 | 16S-ITS | OTU | yes |
| bact_otu_noenv | 1452233.1 | 1026.675 | 867.529 | 0.447 | 16S | OTU | no |
| ITS_order_env | 1103379.9 | 1086.955 | 872.164 | 0.592 | ITS | Order | yes |
| bact_ITS_phylum_noenv | 1258265.1 | 1093.221 | 874.592 | 0.521 | 16S-ITS | Phylum | no |
| bact_ITS_class_noenv | 1209584.0 | 1073.396 | 879.000 | 0.540 | 16S-ITS | Class | no |
| ITS_phylum_env | 1150272.6 | 1117.697 | 880.792 | 0.574 | ITS | Phylum | yes |
| ITS_order_noenv | 1205103.7 | 1106.394 | 887.004 | 0.541 | ITS | Order | no |
| bact_otu_env | 1427895.5 | 1053.325 | 889.806 | 0.472 | 16S | OTU | yes |
| bact_ITS_class_env | 1133573.6 | 1091.332 | 890.940 | 0.581 | 16S-ITS | Class | yes |
| ITS_class_env | 995536.1 | 1123.586 | 901.115 | 0.632 | ITS | Class | yes |
| ITS_otu_env | 1255170.8 | 1099.313 | 903.487 | 0.536 | ITS | OTU | yes |
| ITS_class_noenv | 1100420.9 | 1137.310 | 907.111 | 0.581 | ITS | Class | no |
| ITS_otu_noenv | 1355602.1 | 1130.897 | 928.257 | 0.484 | ITS | OTU | no |
| ITS_phylum_noenv | 1427807.1 | 1253.355 | 996.800 | 0.457 | ITS | Phylum | no |