Modeling of relative Yield, P-Uptake and P-Balance

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RES <- readRDS("data/RES.rds")  
Dmlr <- RES$nlme.coef.mrg  
Dmlr$soil\_0\_20\_P\_CO2\_log[is.infinite(Dmlr$soil\_0\_20\_P\_CO2\_log)] <- NA   
Dmlr$soil\_0\_20\_P\_AAE10\_log

[1] NA 3.0773123 NA 2.9069011 NA 2.9601051 NA  
 [8] 2.9069011 NA 3.9815491 NA 3.7954892 3.5973123 NA  
 [15] NA 3.5890591 NA 4.4485164 NA 4.2541933 3.9926809  
 [22] NA NA 4.4578296 1.8870696 2.1162555 2.3321439 2.2300144  
 [29] 2.4069451 2.3321439 2.3887628 NA 2.1972246 1.8245493 NA  
 [36] 2.3795461 2.4849066 2.3223877 2.3418058 2.3418058 2.1400662 2.2925348  
 [43] 0.8329091 1.9878743 1.7047481 2.9069011 1.7047481 1.1939225 1.7917595  
 [50] NA 1.6292405 1.7749524 2.6461748 1.4586150 NA 1.9878743  
 [57] 2.1282317 2.1162555 1.8870696 2.1162555 3.1441523 3.4111477 3.2425924  
 [64] NA 3.1863526 3.4045252 3.1945831 3.1863526 3.1045867 NA  
 [71] 2.7850112 2.7972813 2.9014216 2.8449094 2.8094027 2.7850112 3.2580965  
 [78] 3.0007198 2.4069451 2.6026897 2.8033604 2.6026897 2.5726122 2.7663191  
 [85] 2.7343675 NA 2.9069011 2.8903718 NA 3.0587071 2.9069011  
 [92] 2.9069011 3.1045867 2.8390785 2.6741486 3.3809947 4.2017031 4.3907386  
 [99] 4.3000028 4.0412953 NA 4.1697612 4.0656021 4.2640873 4.0656021  
[106] 3.1822118 2.6461748 3.3809947 3.0540012 NA 3.0726933 3.0955776  
[113] 2.6461748 3.0056826 NA 3.4873751 3.5945688 3.7424202 3.8044378  
[120] 3.5945688 3.4531571 4.0412953 3.6480575 2.7013612 2.7472709 2.8507065  
[127] 2.7472709 NA 2.6100698 2.4069451 2.6390573 2.7013612 3.1223649  
[134] 2.8622009 NA 2.9123507 3.1223649 2.8507065 3.0106209 3.0492730  
[141] 2.1860513 2.9391619 2.9014216 2.9652731 2.9391619 2.8903718 3.1570004  
[148] NA 3.1045867 3.1570004 2.7972813 2.4336134 2.8033604 2.7146947  
[155] 2.3608540 2.2407097 2.7146947 2.3702437 NA 3.4468079 3.2580965  
[162] NA 3.4011974 3.3534067 3.3141860 3.0056826 3.5055574 3.2580965  
[169] 3.1986731 3.5025499 3.3741687 3.4812401 NA 3.3741687 3.3741687  
[176] 3.4750672 3.3393220 NA 3.6163088 3.4719665 3.6988298 3.6788291  
[183] 3.4242627 3.5496174 3.5496174 3.2542430 NA 2.7343675 3.1223649  
[190] 2.8390785 2.8033604 2.7343675 2.8390785 3.1267605 2.7972813 3.2771447  
[197] 3.5973123 NA 3.5751507 3.5695327 3.5695327 3.8712010 3.1441523  
[204] 3.6163088 4.0741419 3.7352858 3.8329798 3.9039908 3.6584202 3.6635616  
[211] 3.6635616 3.7376696 NA 3.8133070 3.6963515 3.6963515 3.7954892  
[218] 3.5890591 NA 3.9512437 3.9160150 3.7773481 NA 3.6737658  
[225] 3.8372995 3.7447871 3.6813512 3.6838669 3.4307562 3.7954892 3.6838669  
[232] 2.9338569 2.4765384 2.7911651 2.7725887 2.6741486 2.9338569 2.7725887  
[239] 2.5649494 NA 2.6741486 2.6672282 2.9123507 2.6878475 2.7013612  
[246] 2.9704145 NA 2.6878475 2.6390573 2.9123507 2.7600099 2.8213789  
[253] 3.0540012 2.8903718 3.2228678 3.0252911 NA 3.2228678 3.2695689  
[260] 3.0106209 3.0106209 2.7911651 NA 2.4510051 2.4423470 2.2823824  
[267] 2.5416020 2.6461748 2.2823824 2.7911651 2.4510051 3.5174978 3.6609943  
[274] 3.9019727 3.4843123 NA 3.4078419 3.4372078 3.9019727 3.6323091  
[281] 3.4078419 3.4499875 3.6813512 3.3741687 3.2733640 3.3286267 NA  
[288] 3.3877744 3.6813512 3.3741687 3.4307562 4.1541846 3.5263605 3.5467397  
[295] NA 4.1541846 3.8649314 3.4339872 3.6296601 3.5263605 3.8372995  
[302] 3.0955776 3.2386785 3.4594663 3.2386785 3.3178158 3.4339872 3.1484534  
[309] 3.6712245 3.6712245 NA 3.7062281 3.6349511 3.6428355 3.7977339  
[316] 4.2766661 NA 3.6349511 3.7424202 4.2766661 3.8607297 3.6712245  
[323] NA 3.4339872 3.7208625 3.7352858 3.6323091 3.9569964 3.5174978  
[330] 3.4339872 3.9569964 3.4688560 4.1125119 3.5204608 3.6661225 3.6082116  
[337] 3.7887248 3.4688560 4.1125119 NA 3.6270041 4.0758411 4.0621657  
[344] 4.1447208 NA 3.9627161 3.9926809 3.9627161 4.1447208 4.2556127  
[351] 4.0360090 2.9856819 2.5095993 3.0301337 NA 3.0301337 2.7013612  
[358] 2.7212954 2.8094027 2.6810215 2.9856819 2.9177707 2.7408400 NA  
[365] 2.8213789 2.9177707 3.0155349 2.9549103 2.5572273 2.9549103 2.9014216  
[372] 3.5263605 NA 3.6136170 3.4563167 3.2958369 3.4563167 3.6216707  
[379] 3.5234150 3.5263605 3.3286267 2.9014216 2.9391619 2.7663191 2.9391619  
[386] 2.6246686 2.8390785 2.5014360 2.7663191 NA 3.1696856 4.1383614  
[393] NA 3.8501476 4.1141472 4.0342406 4.1141472 4.1383614 3.9759363  
[400] 3.9239516 4.2253728 3.9180051 NA 3.8351420 4.2061840 3.9796817  
[407] 3.9376908 3.8774316 4.2061840 3.9852735 3.9852735 3.6686767 3.5723456  
[414] 3.6686767 3.2228678 3.5695327 3.3568971 3.2347492 NA 3.5582011  
[421] 3.5723456 3.7037681 4.2106450 3.6054978 3.8066625 3.8416005 3.7013020  
[428] 3.8066625 4.2106450 NA 3.5582011 4.3832759 4.6288867 4.3502779  
[435] 4.2499228 4.3956830 4.3832759 4.3254563 NA 4.6288867 4.3385971  
[442] 4.3770141 4.5358201 4.3081110 4.2282925 NA 4.3515674 4.3515674  
[449] 4.5358201 4.5174313 4.4601444 4.2668963 4.1972019 4.2456340 4.3294167  
[456] 4.3993753 4.3993753 4.2456340 4.2668963 NA 4.1287460 3.9702919  
[463] 3.7376696 3.9702919 4.0758411 3.9039908 4.0656021 4.1972019 NA  
[470] 3.9473901 4.1972019

# d <- RES$data

## Setup

library(mlr3verse, quietly = TRUE)  
  
mse <- msrs(c("regr.mse"))  
  
if (!interactive())  
 lgr::get\_logger("mlr3")$set\_threshold("warn")  
  
get\_benchi\_table <- function(tasks, nfolds = 5) {  
 set.seed(123)  
 learners <- lrns(c("regr.featureless", "regr.lm", "regr.xgboost", "regr.ranger"))  
 learners$regr.xgboost$param\_set$set\_values(  
 eta = 0.04,   
 nrounds = 300,   
 max\_depth = 2  
 )  
  
 benchi <- xfun::cache\_rds({  
 benchmark(benchmark\_grid(  
 tasks,   
 learners,   
 rsmp("cv", folds = nfolds)  
 ))  
 },   
 file = "benchmark.rds",   
 dir = "cache/",  
 hash = list(tasks, nfolds)  
 )  
   
 res <- tidyr::pivot\_wider(benchi$aggregate(mse),   
 id\_cols = task\_id,  
 names\_from = learner\_id,  
 values\_from = regr.mse  
 ) |> as.data.frame()  
   
 rownames(res) <- res$task\_id  
 res <- res[, -1]  
 colnames(res) <- gsub("regr.", "", colnames(res))  
 stopifnot(any(colnames(res) == "featureless"))  
 res <- 1 - res / res$featureless  
 res[, -1, drop = FALSE] |> round(3)  
}

Testing prediction quality using

* Linear models
* Random forests (default parameters)
* XGBoost (with parameter tuning)

**Weather Variables:**

[1] "anavg\_temp" "ansum\_prec" "juvdev\_prec" "juvdev\_sun" "ansum\_sun"   
[6] "juvdev\_temp"

**Phosphor Variable sets:**

**Response Variables**

Y\_vars <- c("Ymain\_rel", "annual\_P\_uptake", "annual\_P\_balance")

## With Weather data

### TODO: Group - cross validation

\(nam){  
 mytsk <- as\_task\_regr(  
 Dmlr[complete.cases(Dmlr$Ymain\_rel), c(y, Weather\_vars, P\_var\_sets[[nam]], "Site")],  
 target = y,  
 id = nam)  
 mytsk$set\_col\_roles("Site", "group")  
 mytsk  
}

Algorithm learns to predict location from weather since we do not do stratified cross-validation (leaving out locations).

### Ymain\_rel

y <- "Ymain\_rel"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, Weather\_vars, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.138 | 0.544 | 0.542 |
| k | 0.107 | 0.553 | 0.505 |
| PS | 0.195 | 0.572 | 0.596 |
| kPS | 0.141 | 0.570 | 0.618 |
| AAE10 | 0.255 | 0.605 | 0.598 |
| CO2 | 0.200 | 0.645 | 0.638 |
| AAE10\_CO2 | 0.222 | 0.651 | 0.647 |
| AAE10\_CO2\_kPS | 0.197 | 0.663 | 0.625 |
| CO2\_kPS | 0.183 | 0.663 | 0.627 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.201 | 0.518 | 0.520 |
| k | 0.186 | 0.476 | 0.487 |
| PS | 0.234 | 0.603 | 0.585 |
| kPS | 0.265 | 0.569 | 0.555 |
| AAE10 | 0.294 | 0.530 | 0.582 |
| CO2 | 0.259 | 0.569 | 0.578 |
| AAE10\_CO2 | 0.288 | 0.515 | 0.594 |
| AAE10\_CO2\_kPS | 0.347 | 0.596 | 0.607 |
| CO2\_kPS | 0.275 | 0.530 | 0.575 |

### annual\_P\_uptake

y <- "annual\_P\_uptake"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, Weather\_vars, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.414 | 0.784 | 0.782 |
| k | 0.380 | 0.763 | 0.766 |
| PS | 0.397 | 0.757 | 0.816 |
| kPS | 0.434 | 0.777 | 0.814 |
| AAE10 | 0.489 | 0.822 | 0.834 |
| CO2 | 0.472 | 0.797 | 0.846 |
| AAE10\_CO2 | 0.468 | 0.852 | 0.855 |
| AAE10\_CO2\_kPS | 0.488 | 0.796 | 0.819 |
| CO2\_kPS | 0.457 | 0.808 | 0.840 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.468 | 0.649 | 0.648 |
| k | 0.456 | 0.564 | 0.609 |
| PS | 0.477 | 0.594 | 0.617 |
| kPS | 0.459 | 0.560 | 0.474 |
| AAE10 | 0.503 | 0.619 | 0.621 |
| CO2 | 0.481 | 0.615 | 0.642 |
| AAE10\_CO2 | 0.484 | 0.566 | 0.580 |
| AAE10\_CO2\_kPS | 0.465 | 0.528 | 0.423 |
| CO2\_kPS | 0.487 | 0.536 | 0.428 |

### annual\_P\_balance

y <- "annual\_P\_balance"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, Weather\_vars, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.027 | 0.103 | 0.102 |
| k | 0.045 | 0.565 | 0.243 |
| PS | 0.627 | 0.864 | 0.774 |
| kPS | 0.639 | 0.837 | 0.860 |
| AAE10 | 0.392 | 0.597 | 0.561 |
| CO2 | 0.490 | 0.707 | 0.695 |
| AAE10\_CO2 | 0.471 | 0.760 | 0.732 |
| AAE10\_CO2\_kPS | 0.630 | 0.852 | 0.827 |
| CO2\_kPS | 0.645 | 0.881 | 0.866 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| onlyweather | 0.011 | 0.120 | 0.121 |
| k | -0.008 | 0.313 | 0.127 |
| PS | 0.310 | 0.647 | 0.608 |
| kPS | 0.282 | 0.609 | 0.617 |
| AAE10 | 0.225 | 0.510 | 0.524 |
| CO2 | 0.225 | 0.532 | 0.591 |
| AAE10\_CO2 | 0.225 | 0.546 | 0.585 |
| AAE10\_CO2\_kPS | 0.335 | 0.617 | 0.596 |
| CO2\_kPS | 0.302 | 0.626 | 0.631 |

## Without Weather data

if("onlyweather" %in% names(P\_var\_sets))  
 P\_var\_sets <- P\_var\_sets[-1]

xgboost & ranger are no good in this setting since only very few variables available

### Ymain\_rel

y <- "Ymain\_rel"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | -0.010 | 0.058 | -0.008 |
| PS | 0.035 | -0.018 | -0.124 |
| kPS | 0.024 | 0.001 | -0.060 |
| AAE10 | 0.124 | 0.064 | -0.107 |
| CO2 | 0.092 | -0.009 | -0.137 |
| AAE10\_CO2 | 0.116 | 0.082 | 0.095 |
| AAE10\_CO2\_kPS | 0.117 | 0.109 | 0.069 |
| CO2\_kPS | 0.051 | -0.032 | -0.044 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | -0.005 | -0.200 | -0.312 |
| PS | 0.060 | -0.141 | -0.221 |
| kPS | 0.054 | -0.343 | -0.353 |
| AAE10 | 0.099 | 0.104 | -0.009 |
| CO2 | 0.068 | -0.086 | -0.226 |
| AAE10\_CO2 | 0.073 | 0.067 | 0.064 |
| AAE10\_CO2\_kPS | 0.072 | -0.045 | -0.059 |
| CO2\_kPS | 0.023 | -0.168 | -0.196 |

### annual\_P\_uptake

y <- "annual\_P\_uptake"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | -0.028 | -0.103 | -0.170 |
| PS | 0.012 | -0.024 | -0.123 |
| kPS | 0.064 | -0.152 | -0.199 |
| AAE10 | 0.065 | -0.129 | -0.254 |
| CO2 | 0.058 | -0.078 | -0.176 |
| AAE10\_CO2 | 0.070 | -0.012 | -0.058 |
| AAE10\_CO2\_kPS | 0.099 | -0.066 | -0.008 |
| CO2\_kPS | 0.095 | -0.059 | -0.083 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | -0.006 | -0.265 | -0.434 |
| PS | -0.006 | -0.278 | -0.485 |
| kPS | -0.006 | -0.225 | -0.317 |
| AAE10 | 0.021 | -0.139 | -0.398 |
| CO2 | 0.005 | -0.126 | -0.276 |
| AAE10\_CO2 | 0.017 | -0.194 | -0.310 |
| AAE10\_CO2\_kPS | 0.020 | -0.229 | -0.363 |
| CO2\_kPS | -0.054 | -0.206 | -0.295 |

### annual\_P\_balance

y <- "annual\_P\_balance"  
lapply(names(P\_var\_sets), \(nam) as\_task\_regr(  
 Dmlr[complete.cases(Dmlr[,c("Ymain\_rel",Weather\_vars,P\_var\_sets$AAE10\_CO2\_kPS)]),c(y, P\_var\_sets[[nam]])],  
 target = y,  
 id = nam)) |>  
 get\_benchi\_table() |> knitr::kable()

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | 0.016 | 0.499 | 0.629 |
| PS | 0.598 | 0.695 | 0.666 |
| kPS | 0.598 | 0.681 | 0.667 |
| AAE10 | 0.338 | 0.288 | 0.224 |
| CO2 | 0.438 | 0.436 | 0.401 |
| AAE10\_CO2 | 0.447 | 0.495 | 0.498 |
| AAE10\_CO2\_kPS | 0.594 | 0.703 | 0.700 |
| CO2\_kPS | 0.589 | 0.686 | 0.680 |

|  | lm | xgboost | ranger |
| --- | --- | --- | --- |
| k | 0.011 | 0.175 | 0.160 |
| PS | 0.309 | 0.274 | 0.178 |
| kPS | 0.305 | 0.279 | 0.244 |
| AAE10 | 0.147 | 0.062 | -0.102 |
| CO2 | 0.189 | 0.170 | 0.085 |
| AAE10\_CO2 | 0.192 | 0.062 | 0.015 |
| AAE10\_CO2\_kPS | 0.313 | 0.235 | 0.201 |
| CO2\_kPS | 0.313 | 0.274 | 0.243 |

cor(Dmlr$annual\_P\_balance, Dmlr$PS) # 0.54389

[1] 0.5611764

cor(Dmlr$fert\_P\_tot, Dmlr$PS) # 0.48236

[1] 0.5455537

cor(Dmlr$annual\_P\_uptake, Dmlr$PS) # 0.070678

[1] 0.09920453

We did manage to have high predictive power for weather. This could also be due to our regression models recovering location&year from it and hence still overfitting on the test set.

Without Weather data we only managed for annual balance to get some predictive power (30%). Since we the balance is uptake - fert\_P, this means that we mostly predicted fert\_P. Interestingly PS is best to predict this quantity

### Legacy Code

# Get parameter estimates for XGBoost  
t <- as\_task\_regr(  
 subset(Dmlr[complete.cases(Dmlr$annual\_P\_balance),],   
 select = c("annual\_P\_balance", P\_var\_sets$AAE10\_CO2\_kPS#, Weather\_vars  
 )),  
 target = "annual\_P\_balance"  
)  
  
l <- lrn("regr.xgboost",  
 nrounds = 500 # More iterations due to lower learning rate  
)  
  
# Create search space  
ps <- ps(  
 max\_depth = p\_int(2, 4),  
 eta = p\_dbl(0.001, 0.3, tags = "logscale")  
)  
  
# Setup tuning  
instance <- ti(  
 task = t,  
 learner = l,  
 resampling = rsmp("cv", folds = 3),  
 measure = msr("regr.mse"),  
 terminator = trm("none"),  
 search\_space = ps  
)  
  
# Grid search  
tuner <- mlr3tuning::tnr("grid\_search")  
tuner$optimize(instance)  
instance$result

Ymain\_rel max\_depth eta learner\_param\_vals x\_domain regr.mse 1: 2 0.067444 <list[5]> <list[2]> 177.18

P uptake max\_depth eta learner\_param\_vals x\_domain regr.mse 1: 2 0.034222 <list[5]> <list[2]> 137.41

annual\_P\_balance max\_depth eta learner\_param\_vals x\_domain regr.mse 1: 2 0.034222 <list[5]> <list[2]> 145.21

# nlme.coef$kPS <- nlme.coef$k \* nlme.coef$PS  
#   
#   
# nlme.coef.mrg <- merge(nlme.coef,allP[allP$year>=2017,],by = "uid")  
# # add log-transformed versions  
# Dmlr$kPS\_log <- log(Dmlr$kPS)  
# Dmlr$PS\_log <- log(Dmlr$PS)  
# Dmlr$soil\_0\_20\_P\_AAE10\_log <- log(Dmlr$soil\_0\_20\_P\_AAE10)  
# Dmlr$soil\_0\_20\_P\_CO2\_log <- log(Dmlr$soil\_0\_20\_P\_CO2)  
#   
# Dmlr$k  
  
  
  
subset(Dmlr, select = c("Ymain\_rel", P\_var\_sets$AAE10\_CO2\_kPS, Weather\_vars))

Ymain\_rel soil\_0\_20\_P\_AAE10\_log soil\_0\_20\_P\_CO2\_log PS\_log k  
1 178.42 NA NA -2.7715938 0.10467464  
2 NA 3.0773123 -1.386294361 -2.7715938 0.10467464  
3 179.72 NA NA -3.0042091 0.12262173  
4 NA 2.9069011 -1.771956842 -3.0042091 0.12262173  
5 190.64 NA NA -2.7693913 0.10448023  
6 NA 2.9601051 -1.469675970 -2.7693913 0.10448023  
7 178.51 NA NA -2.9077724 0.11568444  
8 NA 2.9069011 -1.514127733 -2.9077724 0.11568444  
9 210.05 NA NA -2.3473051 0.12628437  
10 NA 3.9815491 -0.843970070 -2.3473051 0.12628437  
11 209.45 NA NA -2.1364490 0.11502207  
12 NA 3.7954892 -0.941608540 -2.1364490 0.11502207  
13 NA 3.5973123 -0.941608540 -2.6235787 0.09040112  
14 215.86 NA NA -2.6235787 0.09040112  
15 218.63 NA NA -2.6642037 0.08666599  
16 NA 3.5890591 -1.171182982 -2.6642037 0.08666599  
17 219.32 NA NA -1.3169035 0.08586286  
18 NA 4.4485164 -0.105360516 -1.3169035 0.08586286  
19 234.23 NA NA -1.5753641 0.08620806  
20 NA 4.2541933 -0.527632742 -1.5753641 0.08620806  
21 NA 3.9926809 -0.562118918 -1.7576162 0.08640235  
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# Methods

we used machine learning methods to assess how much information different sets of variables (c.f. P\_var\_sets) have each on the dependent variable (Puptake, Y-rel, P-balance), how redundant this information is. The machine learning methods to quantify the predictive power of different variable sets are: i) ordinary least squares (OLS) as a baseline; ii) XGBoost (gradient boosting with tree-based models and hyperparameter tuning for learning rate and tree depth) (arxiv:1603.02754); iii) Random Forests (with default parameters) (doi:10.1023/A:1010933404324). Computations were performed using the mlr3 framework (doi:10.21105/joss.01903). Performance was measured as percentage of explained variance on hold-out data via 5-fold cross-validation, calculated as (1 - MSE/Variance(y)), where MSE represents mean squared error.

We tried adjusting for weather variables but it seems that the ML-methods rather reconstruct the site-specific patterns….