**Linear Mixed-Effects Models (LMM)**

**Model architecture**

*This describes how we selected which mixed effects were included in the model.*

We compared linear models with and without mixed effects. The model without mixed effects included the additive effects of all predictor variables (y=p1+p2+…). Models with mixed effects additionally included the group effect of the country, the year and both country and year respectively (y=p1+p2+…+1|country). Adding a group effects allows the model to set an individual intercept for each class in the group (e.g. each group is allowed to have a different intercept). The best performing model architecture (both R2 and AIC criterion) includes the additive effects of all predictor variables and the mixed effect of the country.

**Predictor variable selection**

*This describes how we selected the variables used to predict MSWC.*

For each income class we created a model using all predictor variables and the mixed effect of the country. We then sequentially removed one predictor variable at a time and checked the model performance using the AIC criterion. The parameter combination with the lowest AIC was retained and used to predict MSWC.

Table 1: Variables that were selected to run the LMM, NNET, and RF models, separated for the global model as well as the income classes. Green boxes represent selected parameters. P1=electricity access, p2=energy consumption, P3=GDP, p4=greenhouse gas, p5=urban population, p6=young population, and p7=MSW recycled

|  |  |  |  |
| --- | --- | --- | --- |
| Model | LMM | NNET | RF |
|  | p1 | P2 | P3 | P4 | P5 | P6 | P7 | p1 | P2 | P3 | P4 | P5 | P6 | P7 | p1 | P2 | P3 | P4 | P5 | P6 | P7 |
| Global  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| UM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| LM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

NNET and RF often used the same predictors while the LMM sometimes uses a different combination. The fraction of MSW recycling was never an important parameter.