# Are Plant Functional Types Fit for Purpose?

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Ecosystem climate and flux regimes do not accurately predict site PFT class, irrespective of the classification scheme chosen.

PFT classes do not add much predictive power when using climate regimes to predict flux regimes and vice versa.

Motivation
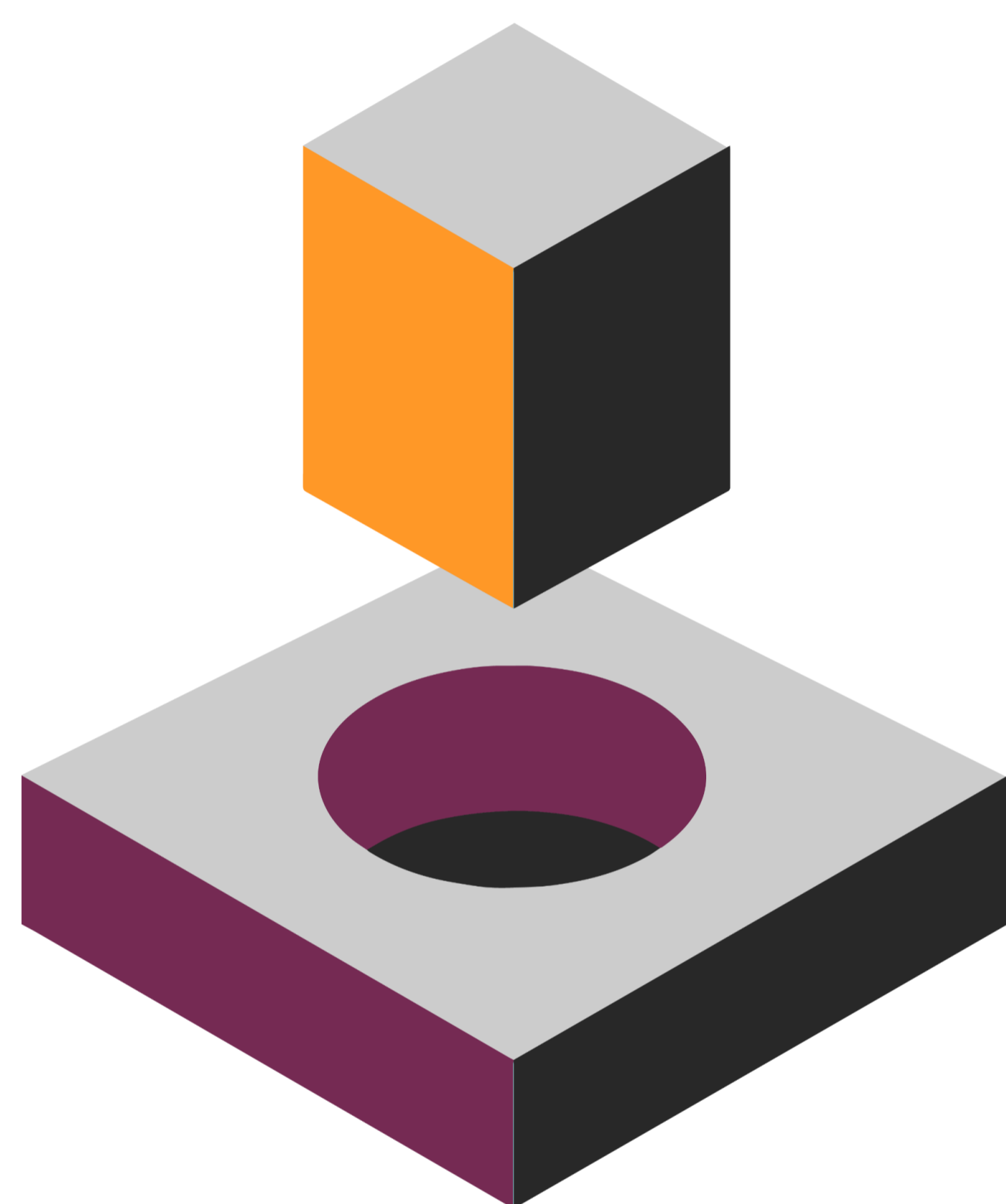
In the field of terrestrial fluxes, there is an assumption that PFT classes (the IGBP scheme, particularly) accurately discretise the infinitely heterogeneous land surface into groups of similar behaviour. That is, sites in the same PFT exposed to the same climate regime will exhibit the same flux regimes.

However, many studies find small or no differences in behaviour across PFTs. Are we using the correct simplifying lens when studying terrestrial fluxes?
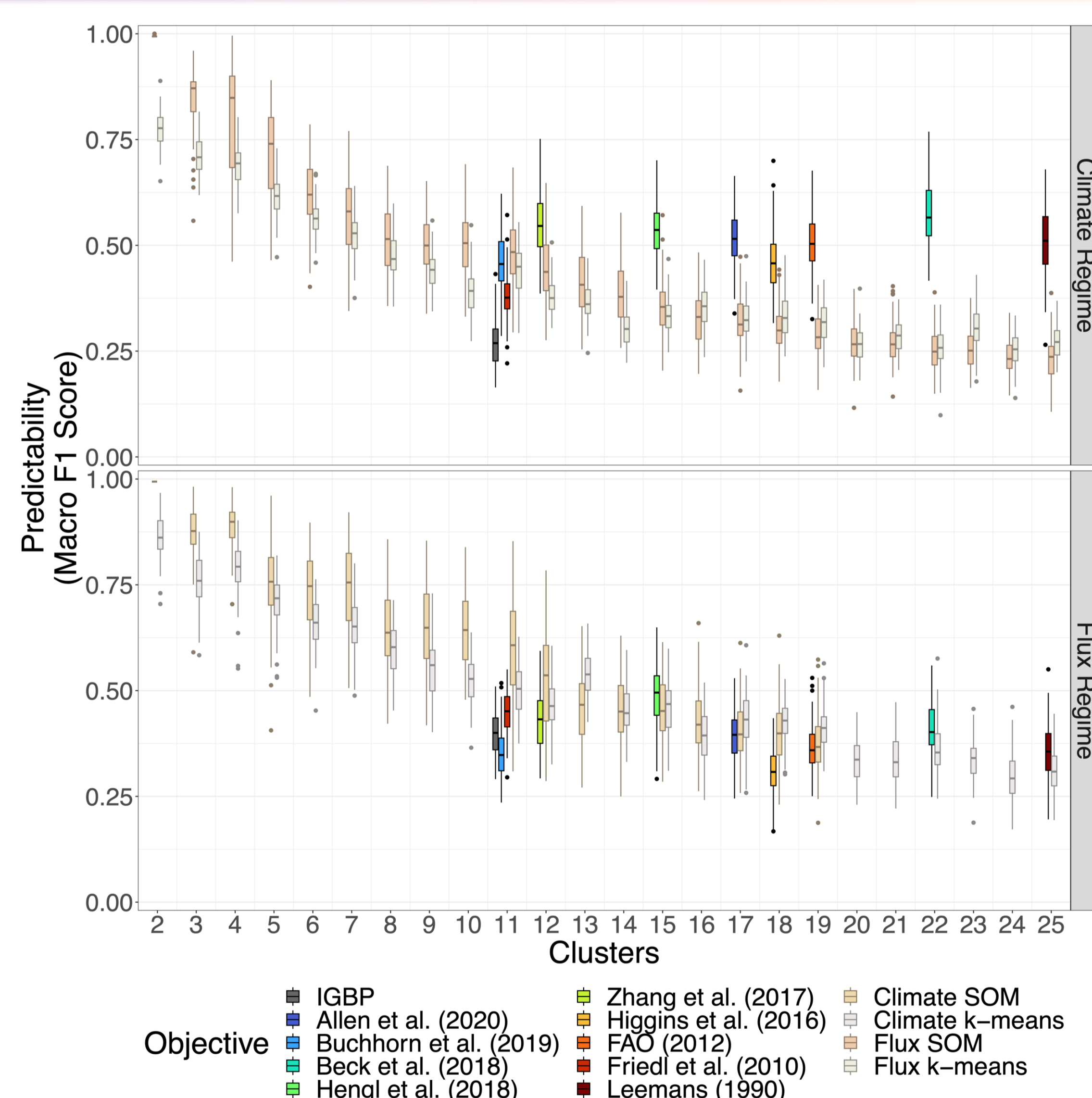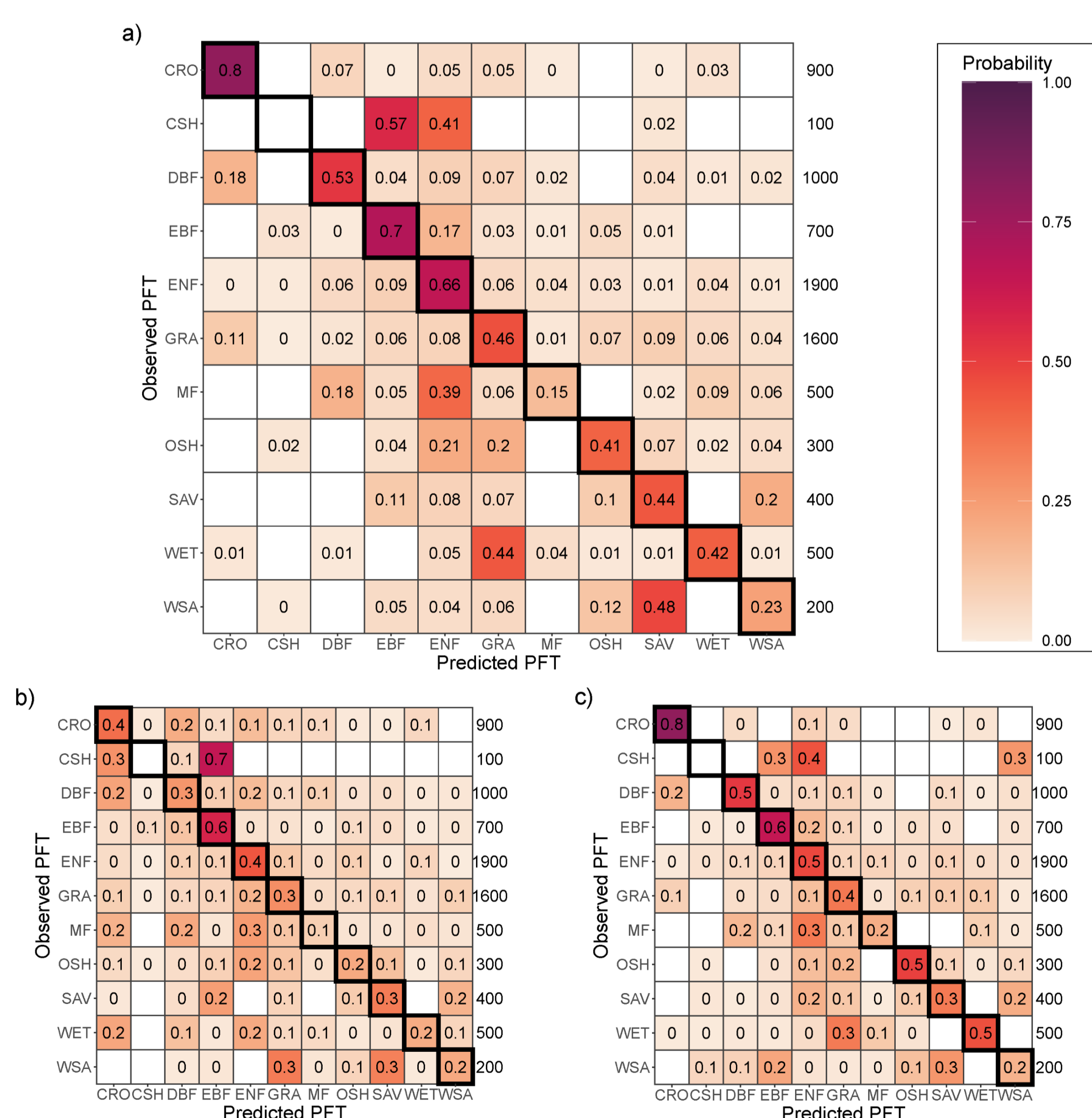
Methodology
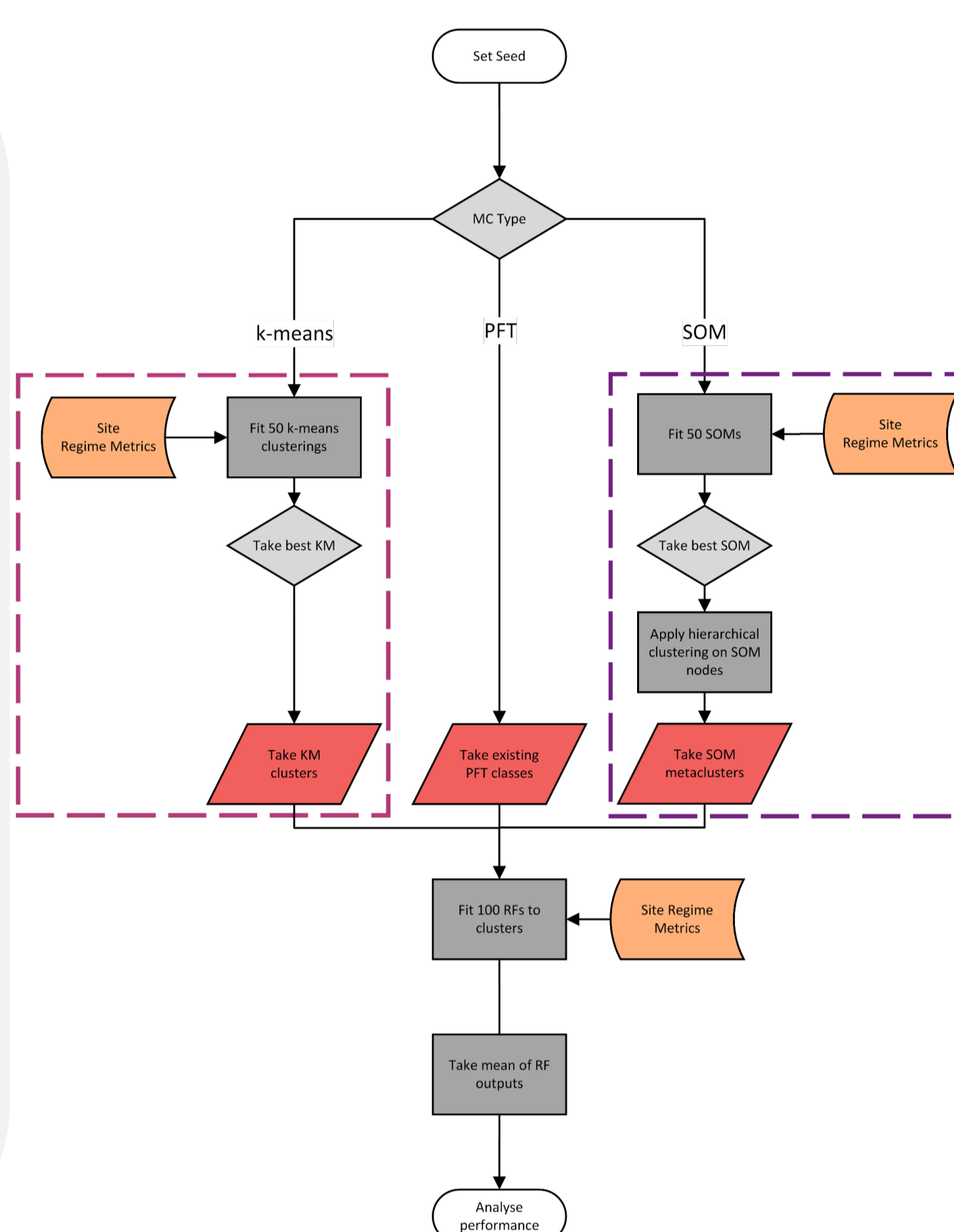
For 245 flux towers, we calculated site climate and flux regimes using metrics capturing magnitude and variability.
We assigned the sites to "metaclusters" in three ways: various PFT schemes including IGBP, and two clustering techniques applied to the climate and flux regimes.
Random forest models were trained on 66% of the sites and then used to predict the metacluster assignment of the remaining sites.

IGBP class cannot be predicted by flux or climate regimes

Aggregated confusion matrices for random forests predicting site IGBP class when the model inputs are a) climate and flux regimes, b) flux regimes only, and c) climate regimes only. A higher number indicates an observed (y axis) – predicted (x-axis) pair of classes that is more commonly assigned by the random forests.
No classes have an accuracy of more than 0.8 and many are noticeably much worse! Median accuracy is 0.53 (a), 0.33 (b), and 0.47 (c).

Are other PFT schemes better?

F1 scores for predicting 10 PFT schemes using the climate regime (top) and flux regime (bottom) as the random forest inputs. Boxplots indicate the range over 100 random forest models that were trained independently. The grey/brown boxplots show the performance for predicting regime metaclusters.
Notice how there is no increase in performance for greater "resolution" of classes, and no classification scheme outperforms all others.

Any simplifying grouping should be chosen such that it acts across relevant axes of differentiation!