

1 Preparation

Static inputs

NDVI, NDWI, Slope, Aspect, LC, TWI, TPI

Dynamic inputs

AT, TDD, PAR

2 Model training

- Train **RF**, **GBM**, **SVR**, and **GAM** with different settings.
- Assess model performance with RMSE, MAE, and R^2 to select best models.

5 Variable importance

Extract predictor importance from all models to compare relevance across methods and resolutions.

3

Spatial prediction

- Apply best-performing models (RF and GBM) at both 1 m and 10 m resolutions.
- Dynamic predictors updated every 3 h for each day in **July 2019–2024**.
- **Total:** 248 time steps \times 2 models \times 2 resolutions \times 6 years = 5,952 CH_4 flux rasters.

4

Temporal aggregation

- Compute **yearly and multi-year** July CH_4 fluxes (2019–2024).
- Assess **interannual variability** and model/resolution **uncertainty**.
- **Correlate** flux differences with predictor layers.