Data Source Prioritization Flowchart for Process-based Plant Model Parametrization

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Abstract

Dynamic process-based plant models are computerized representations of plant growth, development, and productivity that use measurements of environmental and physiological processes as input data to make predictions. However, the use of process-based models in phenotyping programs still faces challenge to parameterization across multiple genotypes, such as (1) the need for extensive and intensive datasets as parameters for running simulations, many of which are obtained using destructive and disruptive sampling, (2) the lack of systematic approaches needed to parameterize across extensive collections of genetically distinct, but often related, individuals that are typical of breeding populations. Remote and proximal sensing are potential alternative sources of data to inform parameters of process-based plant models because they can provide fast and non-destructive estimations of plant biophysical parameters across spatial and temporal scales. Over the years, several approaches have been proposed to leverage sensing for model parameterization, from simple empirical tuning to inverse modeling approaches. Continued inquiry into how best to use remote and proximal sensing data to estimate model parameters is critical to the future scale-out of these models for breeding programs and simulating processes that underlie complex genotype-by-environment interactions. Here, we present a decision flowchart to provide a visual representation of the sources and steps for process-based model parameterization that could be used as a guide for researchers working with remote sensing data and crop modeling across numerous genotypes.

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