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## Reconstructing Uncertain Crop Yield Data from Multiple Sources with a Bayesian Imputation Framework

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### Abstract

Climate change may threaten agriculture in West Africa by changing temperature regimes and precipitation patterns. Adapting crop management to these new realities may attenuate potential climate impacts. For planning such adaptation measures, reliable information on past and current crop performance is paramount.

There are several data sources on crop management and performance, which could potentially be used for adaptation planning. We explore five independent data sets of crop performance in Ghana: household surveys, satellite measurements, two crop models and official reported yield data. There are few concordances between the five sources. This disagreement questions the usability of a single data source for studying climate impacts and plan adaptation measures. To overcome issues with data reliability, we propose a solution to reconstruct crop performance data from multiple sources using a Bayesian network. Conditional probability tables are learned from data and lead to probabilistic assessments of crop yields. We test our approach in the US mid West, where yield data are deemed reliable, by introducing artificial data gaps and reporting errors.

Our Bayesian approach is partly able to reconstruct missing data or artificially introduced reporting errors, based on different independent data sources. Yet open questions remain, particularly with respect to extreme yields and the more diverse agricultural landscape in Western Africa compared to the US. Our next steps thus comprise the improvement of the reconstruction in the US and the transfer of the approach to West Africa. A successful reconstruction of crop yield data may then guide adaptation planning under current and future uncertainty.

**Keywords:** Bayesian network, crop yield, reconstruction, USA, West Africa