ClieNFarms
Climate Neutral Farms

ClieNFarms Practice Abstracts

Applicability of Models and Tools in Environmental Analysis

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The application of models requires data. The quality of the results and the ability of using modelling is strongly linked to data availability and data quality. In ClieNFarms, consistent communication, support, and trust-building enable access to a wide range of farm data. No single model is best for simulating or monitoring greenhouse gas emissions (GHGE) – tool selection depends on objectives, data availability, resolution, ability to account for offsets, and inclusion of relevant variables.

The tools and models used in ClieNFarms were developed for different objectives, and thus, showed a range of advantages and disadvantages to support climate neutral farming. The quality of results strongly depended on the context of application. Most tools were not sufficiently accurate to estimate changes for economic decision-making (e.g. subsidies or carbon credit trading), as the error margins and uncertainties at field or farm scale remained too high. To account for varying complexity of methodologies, the IPCC (Intergovernmental Panel on Climate Change) introduced a three-step tier-system, with Tier 1 indicating a basic method with an equation and default emissions factors, Tier 2 using the same equation but country- / region- specific emission factors and Tier 3 any more complex method, ranging from alternative equations to process-based models. Even Tier 3 models, despite their complexity, were affected by input data heterogeneity, aggregation effects, and intrinsic models' errors, all of which limited their reliability at fine spatial scales.

As for non-CO_2 fluxes (N_2O and CH_4), measurements are technically complex and carry high uncertainty; in these cases, modelling can offer comparable – or even greater – accuracy, particularly for emissions barns.
Remote-sensing-driven models (e.g. ORCHIDEE for albedo, SAFYE-CO_2+AMG for biomass inputs) can provide robust estimates, especially for large-scale applications – though their accuracy still relies on the quality of special input data.
When comparing Field vs Farm scale models, Tier 1-2 methods can yield results comparable to Tier 3, albeit with wider confidence bounds. In relation to stakeholder uses, most tools still require modellers; or an advisor-friendly user interfaces, training, and sustainable funding.
The primary objectives of Monitoring, Reporting and Verification (MRV) systems is to track changes in soil organic carbon (SOC) over time. Tier 1 and Tier 2 farms tools, generally designed for farm-level assessments did identify trends linked to management changes but were not accurate enough to predict precise emissions changes. Nonetheless, modelling could be used to estimate potential emissions offsets by N_2O or CH_4. These tools may reflect generic impacts of practices, functioning more like support for action-based payments rather than impact-based compensation. At larger scales, the diversity of farm types and practices tended to balance out extremes, resulting in acceptable accuracy, provided that the sample of farms reflects the heterogeneity of the wider farming landscape.

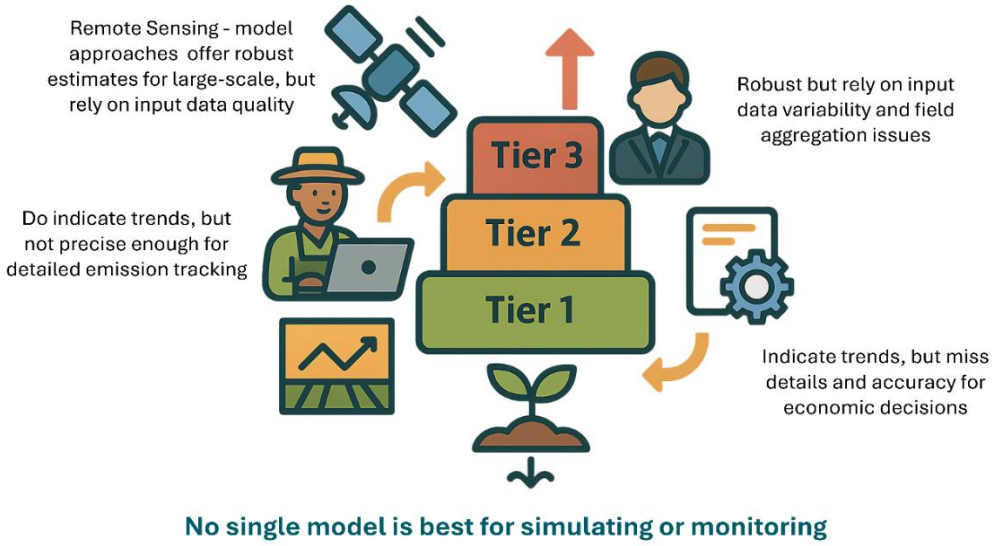

Figure 1 : Considerations when applying models and tools in environmental analysis.

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