

Theme B: Specific Key Interest – Farm size effects on production, distribution and dynamics.

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Most current models for crop responses to climate change and management treat all farms within a focal area (e.g. mapping cell) as being similar. However, production economics of farms vary greatly from large commercial holdings (which tend to have access to the capital required for high mechanisation and agrichemical inputs, and access to national and even global markets) to smallholder and subsistence farms (where access to capital and markets is generally far more limited). The farm management options available to farms of different sizes may be very different, as will be their optimal choice of crops and management methods, and the resultant yields and net incomes. Such disparities occur globally, but they are particularly marked in South Africa, where the agriculture sector is divided between large corporate producers (accounting for the majority of production) and small-holders/subsistence farms (accounting for the majority of farms). Modelling production in this context without incorporating this diversity of production economies may yield misleading patterns.

Our modelling framework will involve including diverse farm sizes within the modelled landscapes; these will initially be modelled as a simple distribution of sizes within each cell, based on known farm size distributions. Field data collection (from Theme A work) will be used to parameterise models with current inputs of labour, agrichemicals, irrigation water and mechanisation (capital), as well as of maize, potato and legume production (and associated income) for farms as a function of size. Ideally, an economic model of optimal behaviour as a function of farm size would be incorporated and parameterised with these same data. This would allow the relative performance of different components of the agricultural system to be modelled under future scenarios.

Ultimately, we hope to extend the model to incorporate a subroutine allowing the distribution of farm sizes to change over time, based either on performance (e.g. profitable farms buying up less profitable neighbours) or government policy (land reform splitting up large farms) or incentive structures (e.g. subsidised loans to smallholders). These in turn would allow interacting policy and climate scenarios to be modelled.