40. Climate smart agriculture from field to farm scale: a model based approach for Southern Africa

Berre David[1], Mutenje Munyaradzi J.[1], Corbeels Marc[2], Rusinamhodzi Leonard[3], Thierfelder Christian[1], Lopez Ridaura Santiago[4]

[1]*CIMMYT-Zimbabwe. CIMMYT Regional Office, 12.5 Km Peg Mazowe Road, P.O. Box MP163, Mt Pleasant, Harare, Zimbabwe*

[2]*CIRAD - Agroecology and Sustainable Intensification of Annual Crops (AIDA)C/O Embrapa-Cerrados, Km 18, BR 020 – Rodovia, Brasília/Fortaleza, CP 08223 CEP 73310-970, Planaltina, DF, Brazil*

[3]*CIRAD- Agroecology and Sustainable Intensification of Annual Crops (AIDA)- c/o CIMMYT Regional Office, 12.5 Km Peg Mazowe Road, P.O. Box MP163, Mt Pleasant, Harare, Zimbabwe*

[4]*CIMMYT-CCAFS, Texcoco, Mexico*

Southern Africa (SA) is expected to be particularly impacted by climate change projecting a 40% decrease in rainfall in critical areas over the next 70 years and maize productivity falling by up to 30% by 2030. The high variability in agro-climatic conditions, farming systems and rural livelihoods in SA represents a challenge in the generation of locally adapted climate-smart cropping systems. To explore and test adaptation strategies to climate change at the farm level, and to assess the role of alternative maize-based cropping systems, an interdisciplinary approach was developed that consists of loose coupling of cropping systems and farm household models. Using data from long-term agronomic field trials, the crop growth model APSIM was calibrated to simulate a wide range of maize-based cropping systems for different agro-ecologies and climate change scenarios. At the farm household level, the efficient frontier analysis was used to identify efficient farming systems which minimize their inputs utilization and negative externalities (erosion and greenhouse gases) and at the same time maximize their production. Our approach takes advantage of the prediction potential of field-scale models to generate thousands of simulated maize based cropping systems, and an optimization method to benchmark farm-level performance and eco-efficiency. Compared to common linear programming methods (*e.g.* profit maximization), we simulate more sophisticated farmer's strategies (*e.g.* trade-offs between market sales and food self-sufficiency, between use of crop residues for soil fertility and animal feed) based on data from a 500 farm household survey recently conducted in SA. This framework, taking into account long term cropping systems effects and efficiency frontier analysis at the farm scale, allows identifying practices and pathways for climate smart agriculture in this vulnerable region.