Climate change impacts on agriculture & agricultural economies: The example of Senegal

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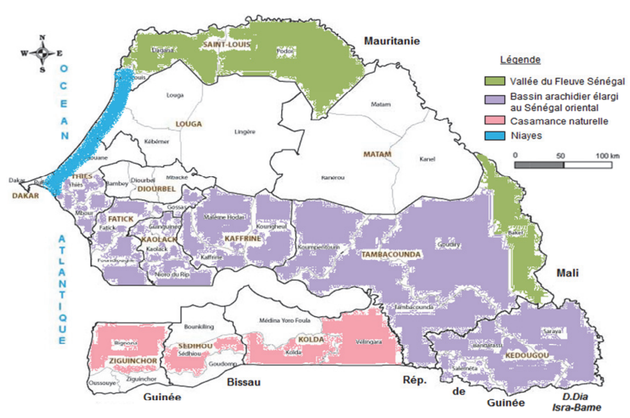
Backgroung, study region & data

In Senegal, 60% of active population works in agricultural sector but it contributes less than 10% of GDP due to low level of fertilizer use, old agricultural equipment, poor seeds and climate conditions (Jalloh et al., 2013, chap.11) that affect productivity.

West Africa will cover almost 7% of world's population in 2050 (Jalloh et al., 2013, chap.1) ==> higher demand for food challenged by climate perturbation that alters production conditions. In this study, we assess the future impact of **climate change on** farmers' **production practices** and their **net returns (NR).**

Future temperatures are expected to increase and non smooth changes in rainfall patterns are predicted (McSweeney et al., 2010, Jalloh et al., 2013) while studies pointed out agriculture vulberability to climate changes (Roudier, 2012)

Study region: Peanut Basin



Data

Farming practices: mixed crop-livestock systems

Peanut Basin
Crops acitivties : Cereals (Milet/sorghum, Maize, Rainfed rice), legumes (Peanut, Cowpea) and horticultural crops (tomatoe, onion)
Livestock activities: Small ruminants (ovine, goats), poultry, small amount of bovine

Study focuses on small to medium size farms with less than 7ha

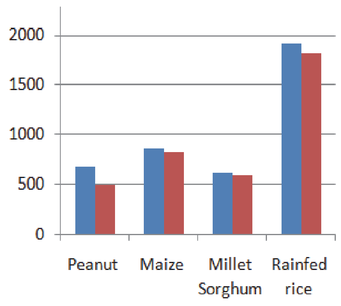
Future yield scenarios (Jalloh et al., 2013)

Crops	Scenarios	
	Pessimistic	Optimistic
Peanut	yield loss of 25%	yield loss of 5%
Maize, Millet Sorghum	yield loss of 5%	yield gain of 5%
Rainfed rice	Yield decrease of 5%	Yield gain of 15%

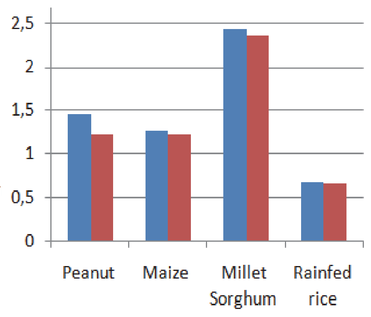
Methodology: complementary models, TOA-MD model & PMP approach

TOA-MD (Trade-Off Analysis model for multi-dimensional impact assessment" of Antle and Valdivia (2011)): population level impact	PMP (farm production modeling approach of Howitt (1995)): farm level impact
- Ex-ante impact of climate change on economic variables in a heterogeneous population of farms by considering two systems representing farmers in two different situations - S1: observed situation (2010) - S2: unobserved situation (2050) with changing climate, social and economic conditions	- Representative profit maximizing farm with exogenous yields - farm-level adaptation behavior is endogenously determined : yield scenarios are imposed to predict land allocation under climate change - Results are inputted into TOA along with yield changes to set system two

Results



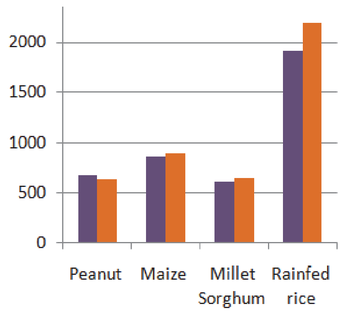
Graph 1: Yield change under pessimistic climate scenario



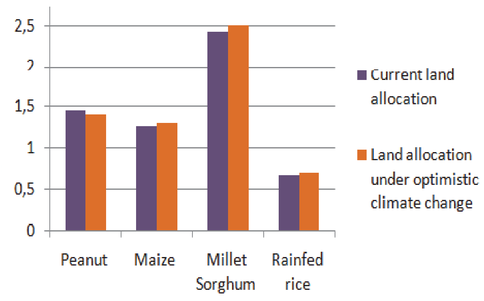
Graph 2: Land allocation under pessimistic climate scenario

Pessimistic scenario==> 10% NR

Optimistic scenario ==> 5% NR



Graph 3: Yield change under optimistic climate scenario



Graph 4: Yield change under optimistic climate scenario

References

Antle, J, Valdivia, R. 2011. Methods for assessing economic, environmental and social impacts of aquaculture technologies: adoption of integrated agriculture-aquaculture-aquaculture in Malawi
Howitt, RE. 1995. Positive Mathematical Programming. American Journal of Agricultural Economics 77: 329 -342
Jalloh A., Nelson G. C., Thomas T. S., Zougmore R. and Roy-Macauley H. 2013. West African Agriculture and Climate Change: A comprehensive Analysis, chapters 1, 2 and 11
McSweeney, C., New, M. & Lizcano, G. 2010. UNDP Climate Change Country Profiles: Senegal. Available: http://country-profiles.geog.ox.ac.uk/ [Accessed 16 December 2013]
Roudier P. 2012. Climat et agriculture en Afrique de l'Ouest : Quantification de l'impact du changement climatique sur les rendements et évaluation de l'utilité des prévisions saisonnières