# The Dynamics of Land-use Change in Kilombero Valley FloodPlain: Characterization of Agents

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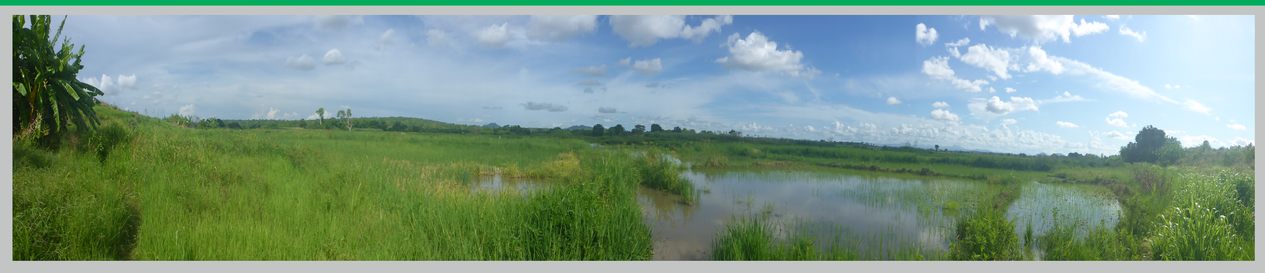
## Introduction and Objective



- The Kilombero floodplain wetland supports the livelihoods of many households mainly through agriculture for both food production and income generation and its major focal area for the Tanzanian government to transform the farming system and eradicate poverty in the country.
- However, in the recent decades, driven by different economic, social and environmental disturbances, land-use change through rapid expansion of crop-land, grazing-land and commercial agriculture endeavor at the expense of wetlands is threatening the stability of the system and hence, its function to support the livelihood of the users[1].
- The general focus of this study is to understand the dynamics of land use decision by different actors and the consequences on agents land-use, livelihood and the resilience of the wetland landscape. Our first step here is to empirically characteriz farmer agents using Agricultural Sample Surveys and individual interviews with 304 farmers in the valley.

## Study Area

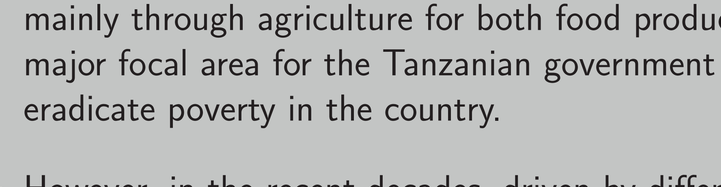
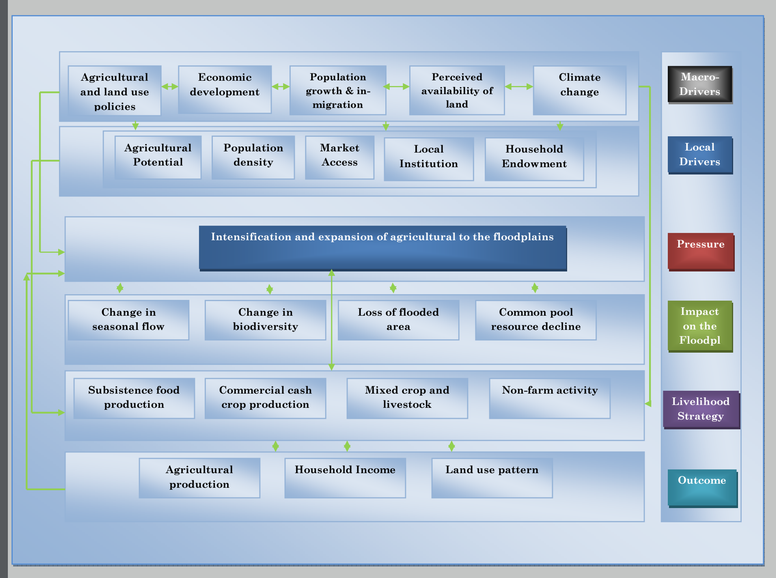



Figure 1: Study Area

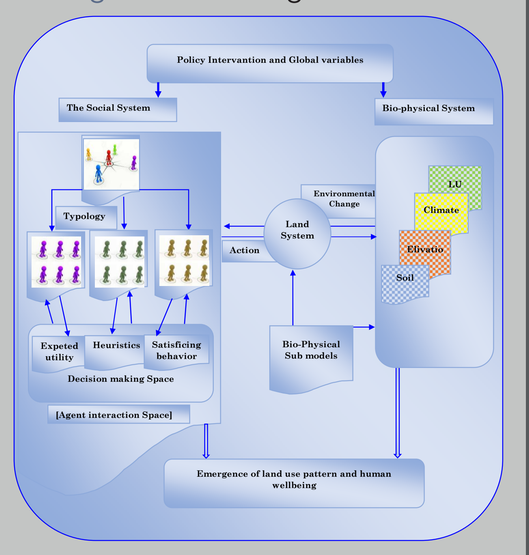
## Conceptual and Modeling Framework

Figure 2: Conceptual Framework




Based on [2, 3]

Figure 3: Modeling Framework




Based on [4]

## Materials and Method

- To capture farmer heterogeneity and elicit the diversity of livelihoods and strategies, an attribute-based typology was created based on their livelihood and land use.
- Statistical method: Non parametric Multivariate Analysis [5, 6]
- Principal Component Analysis and Hierarchical Clustering for reducing the dimensionality and grouping respectively.
- 304 farmers were interviewed across 21 villages, on a wide range of topics designed to discover the farming system in terms of resource availability and use, livelihood source. [Supplementary data from Agricultural Sample survey]

## Result: Agent Characterization

Figure 4: Variables Factor Map

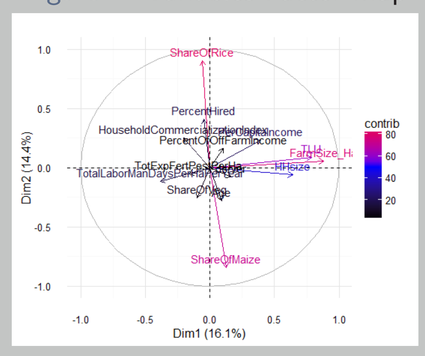



Figure 5: Cluster Dendrogram

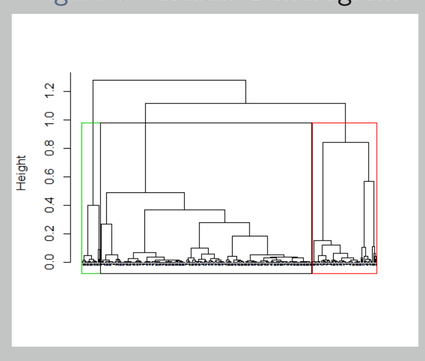



Figure 6: Factor Map

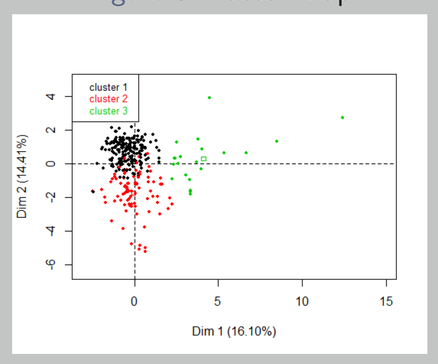



Figure 7: Cluster Plot

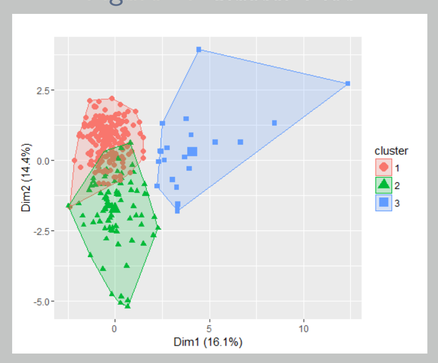



Table 1: Main Characteristics of Farming Groups

| | V.test | Mean in Category | Overall Mean | SD in category | Overall SD | P.value |
|---|---|---|---|---|---|---|
| **Group 1[Rice based Subsistence Farmers][65%]** | | | | | | |
| ShareOfRice | 12.89 | 91.82 | 78.88 | 10.72 | 23.89 | 0.00 |
| PercentHired | 3.66 | 42.23 | 37.12 | 33.62 | 33.19 | 0.00 |
| HouseholdCommercializationIndex | 2.18 | 48.95 | 46.65 | 23.77 | 25.06 | 0.03 |
| PerCapitaIncome[000 Tsh] | -2.33 | 382.31 | 492.17 | 516.01 | 1122.49 | 0.02 |
| Disriver | -2.35 | 2.23 | 2.59 | 2.60 | 3.65 | 0.02 |
| HHsize | -2.97 | 4.83 | 5.11 | 1.69 | 2.18 | 0.00 |
| TLU | -4.33 | 0.29 | 1.48 | 0.91 | 6.53 | 0.00 |
| ShareOfVeg | -5.51 | 1.11 | 3.91 | 4.23 | 12.12 | 0.00 |
| FarmSize_Ha | -5.98 | 1.92 | 2.63 | 1.46 | 2.82 | 0.00 |
| ShareOfMaize | -11.67 | 3.40 | 13.74 | 7.37 | 21.08 | 0.00 |
| **Group 2 [ Diversifier][28%]** | | | | | | |
| ShareOfMaize | 12.16 | 37.38 | 13.74 | 24.46 | 21.08 | 0.00 |
| ShareOfVeg | 6.36 | 11.02 | 3.91 | 20.17 | 12.12 | 0.00 |
| Age | 2.20 | 49.15 | 46.53 | 13.50 | 12.92 | 0.03 |
| PercentHired | -2.98 | 27.99 | 37.12 | 30.52 | 33.19 | 0.00 |
| ShareOfRice | -14.02 | 48.01 | 78.88 | 19.24 | 23.89 | 0.00 |
| **Group 3 [Large-scale Agro-Pastoralists][7%]** | | | | | | |
| FarmSize_Ha | 12.86 | 10.27 | 2.63 | 3.94 | 2.82 | 0.00 |
| TLU | 11.00 | 16.63 | 1.48 | 18.74 | 6.53 | 0.00 |
| HHsize | 8.48 | 9.00 | 5.11 | 2.47 | 2.18 | 0.00 |
| PerCapitaIncome[000 Tsh] | 4.91 | 1653.81 | 492.17 | 3517.52 | 1122.49 | 0.00 |
| HouseholdCommercializationIndex | -2.06 | 35.78 | 46.65 | 26.11 | 25.06 | 0.04 |
| TotalLaborManDaysPerHaPerYear | -2.60 | 133.38 | 320.52 | 123.92 | 340.82 | 0.01 |

- Group 1 Farmers: Rice based, relatively higher labor purchase, higher market participation , lower income and small family size
- Group 2 Farmers: diversify crop choices, lower hired labor
- Group 3 Farmers: larger farms, livestock rearing , higher income

## Conclusion and Outlook

- Subsistence rice farmers are the dominant farm types in the area, followed by farmers with high tendency of diversifying their crop production and large-scale mixed crop and livestock farming farmers.
- In addition to the three farming systems identified in the valley, large-scale commercial venture and migrant pastoralist are the main agents in the KVFP.
- Based on the conceptual and modeling framework outlined in Figure 2 & 3 , a spatially explicit Agent based model that integrates both the agent's decision making mechanism and biophysical process of wetlands through specification of feedbacks and interdependencies among agents and their environment is under development.
- ABM will serve as a virtual laboratory to experiment the effect of different agricultural policy interventions, management options and environmental changes

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