Geo-Statistical Analysis of the Main Determinants of Maize Yield Variation for Small-Scale Farmers in Sauri, Kenya

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BACKGROUND

Sub-Saharan Africa is a region characterized by depleted soil fertility, low use of farming inputs, and high rates of both poverty and food insecurity. The weathered soils are depleted of nitrogen and other nutrients essential for crop production and yields of a variety of crops have lagged behind world averages for decades.

In order to improve crop production for small-scale farmers, the agriculture sector of the Millennium Village Project has promoted various interventions and trained farmers in appropriate management practices for plant growth. This training and support has been coupled with research to understand biophysical constraints to production.

DATA COLLECTION AND METHODOLOGY

Spatially explicit crop yield information was collected for each cropping season in four Millennium Village Sites: Sauri (Kenya), Mwandama (Malawi), Mayange (Rwanda) and Sada (Ghana). In several locations, detailed soil and land use monitoring data were also collected. Data from micro-level household surveys was organized, cleaned and merged to create a dataset of accurate, up-to-date, and spatially referenced soil information, agricultural practices and biophysical constraints to production.

Kriging is the Gaussian process regression method of interpolation for which interpolated values are modeled by prior covariances.

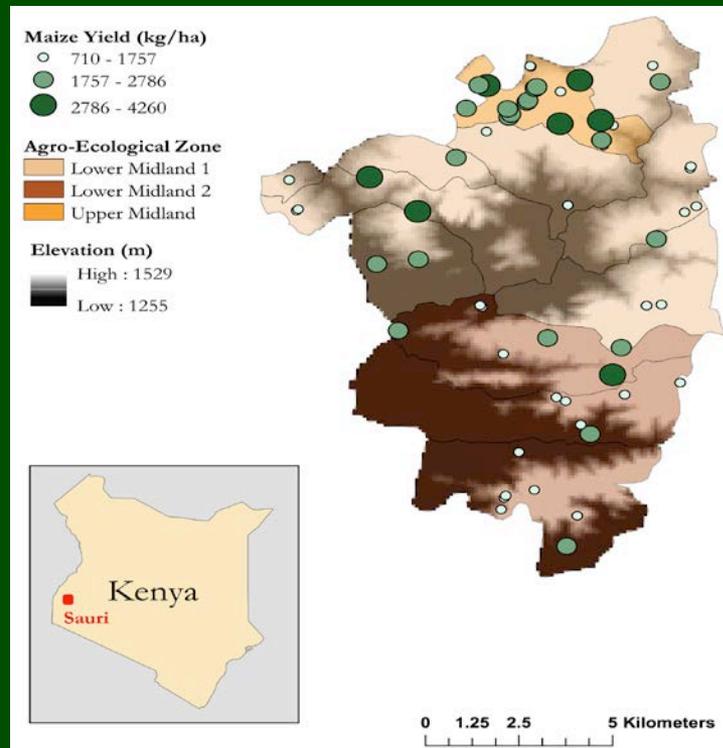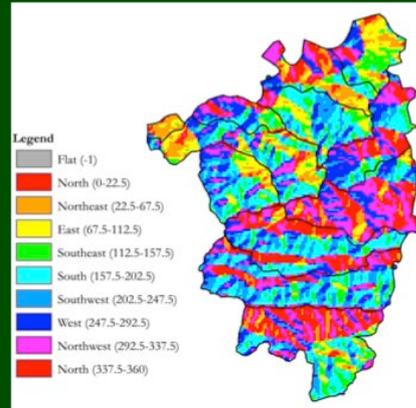Figure 1: Raster data showing land aspect prior to kriging.

Legend
- Flat (-1)
- North (0-22.5)
- Northeast (22.5-67.5)
- East (67.5-112.5)
- Southeast (112.5-157.5)
- South (157.5-202.5)
- Southwest (202.5-247.5)
- West (247.5-292.5)
- Northwest (292.5-337.5)
- North (337.5-360)

Maize Yield (kg/ha)
- 710 – 1757
- 1757 – 2786
- 2786 – 4260

Agro-Ecological Zone
- Lower Midland 1
- Lower Midland 2
- Upper Midland

Elevation (m)
- High : 1529
- Low : 1255

Kenya
Sauri

0 1.25 2.5   5 Kilometers

Figure 2: Variation in Maize Yields across Agro-ecological zones

PRELIMINARY ANALYSIS AND RESULTS

Dependent Variable: Crop Yield (kg/ha)	I	II	III
Slope	-26.08 (0.92)		253.81 (0.21)
Elevation	4.32 (0.568)		3.74 (0.56)
pH level	1107.46 (0.289)		692.11 (0.44)
Nitrogen[1]	-5971 (0.736)		-2086.43 (0.09)*
Clay	37.785 (0.82)		127.18 (0.26)
Agro-Ecological Zone	-635.74 (0.83)		-347.09 (0.26)
Planting Density[1]		0.03 (0.02)**	1253.71 (0.00)***
Plot Area		535.50 (0.759)	442.72 (0.76)
Improved Seeds + Basal Fertilizer		1122.64 (0.000)***	1285.31 (0.00)***
Intercropping		302.863 (0.24)	333.06 (0.23)
R-squared	**0.14**	**0.47**	**0.61**

[1] Variables appear in the form ln(variable)
P-values using robust standard errors are reported in parentheses where *** 1% level, ** 5% level, * 10% level.

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