Table 4.2.1 Extent of bush/graze by region/soil type

Region	Soil type	Total[1] (km^2)	Bush/graze—dense[2] (km^2)	Bush/graze—sparse[2] (km^2)
Northern	Alluvial	2.21 (9.6%)	0.54 (24.4%)	0.37 (16.8%)
	RU1	4.57 (19.8%)	0.15 (3.3%)	0.35 (7.7%)
	RU2	8.14 (35.4%)	0.36 (4.4%)	1.35 (16.6%)
	RU3	1.82 (7.9%)	0.23 (12.8%)	0.62 (34.2%)
	VH	0.29 (1.3%)	0.16 (55.5%)	0.13 (44.5%)
	Valley	5.99 (26.0%)	2.33 (39.0%)	2.23 (37.2%)
	Total	23.01 (54.5%)	3.77 (16.4%)	5.06 (22.0%)
Mbuga	Total	0.73 (1.7%)	0.11 (14.8%)	0.53 (71.8%)
Central	Alluvial	0.02 (0.2%)	0.01 (37.4%)	0.00 (10.3%)
	RL1	4.51 (42.3%)	0.19 (4.3%)	0.50 (11.1%)
	RL2	1.48 (13.9%)	0.06 (3.7%)	0.45 (30.1%)
	Valley	4.65 (43.6%)	1.88 (40.4%)	2.24 (48.2%)
	Total	10.66 (25.2%)	2.14 (20.0%)	3.19 (29.9%)
Southern	Alluvial	0.27 (3.5%)	0.07 (24.4%)	0.07 (25.4%)
	L1	2.68 (34.1%)	0.17 (6.5%)	0.23 (8.7%)
	L2	2.09 (26.6%)	0.38 (18.2%)	1.13 (53.8%)
	Valley	2.81 (35.8%)	0.82 (29.1%)	1.08 (38.6%)
	Total	7.85 (18.6%)	1.44 (18.3%)	2.51 (32.0%)
Village		42.26	7.45 (17.6%)	11.28 (26.7%)

[1] Percentages in "total" column are relative to each soil type's extent within its region, except in "total" row where they are relative to the entire village.
[2] Percentages in "bush/graze" types are relative to each soil type's/region's total area.

The 1989 NSS report stated that 56% of the village was suitable for mechanized agriculture, 26% was suitable for grazing and/or afforestation, and the remaining 18% was not suitable for either practice (due to factors such as slope and stoniness) and should thus remain as dense, natural vegetation. Although the 1989 report did not give current land use estimates, it would seem that the village has reached its natural carrying capacity for the amount of land that can be used for cultivation and grazing: 54.7% of the village is cultivated, 26.7% is sparse bush/graze, and 17.6% is dense bush/graze (the remaining 1.0% is bare areas, e.g., roads, in and around the village center).

Table 4.2.2 Extent of fields and residue management by region/soil type

Region	Soil type	Total[1] (km^2)	Residues[2] (km^2)	Bare[2] (km^2)
Northern	Alluvial	1.30 (58.8%)	0.47 (35.8%)	0.84 (64.2%)
	RU1	3.95 (86.4%)	1.41 (35.7%)	2.54 (64.3%)
	RU2	6.44 (79.1%)	2.84 (44.1%)	3.60 (55.9%)
	RU3	0.95 (52.1%)	0.65 (69.0%)	0.29 (31.0%)
	VH	n/a	n/a	n/a
	Valley	1.39 (23.3%)	1.16 (83.3%)	0.23 (16.7%)
	Total	14.02 (61.7%)	6.53 (46.6%)	7.49 (53.4%)
Mbuga	Total	0.10 (13.4%)	0.08 (80.8%)	0.02 (19.2%)
Central	Alluvial	0.01 (52.3%)	0.00 (14.3%)	0.01 (85.7%)
	RL1	3.69 (81.8%)	2.64 (71.5%)	1.05 (28.5%)
	RL2	0.86 (58.0%)	0.57 (66.2%)	0.29 (33.8%)
	Valley	0.59 (12.6%)	0.40 (68.8%)	0.18 (31.2%)
	Total	5.15 (48.3%)	3.61 (70.2%)	1.54 (29.8%)
Southern	Alluvial	0.11 (39.8%)	0.06 (58.6%)	0.05 (41.4%)
	L1	2.27 (84.7%)	1.40 (61.6%)	0.87 (38.4%)
	L2	0.58 (27.6%)	0.35 (61.0%)	0.23 (39.0%)
	Valley	0.91 (32.3%)	0.72 (79.2%)	0.19 (20.8%)
	Total	3.86 (49.2%)	2.53 (65.6%)	1.33 (34.4%)
Village		23.13 (54.7%)	12.75 (55.1%)	10.38 (44.9%)

[1] Percentages in "total" column are relative to each soil type's/region's total area (from Table 4.2.1).
[2] Percentages in residue management columns are relative to each soil type's/region's total field area.

SLA-NDVI

SLA-NDVI outperformed all other commonly used vegetation indices in terms of correctly classifying the greatest proportion of land use types from the October image (Table 4.2.3). SLA-NDVI was most successful at correctly classifying bush/graze land use types. Apart from SLA-NDVI, MSAVI classified the greatest proportion of land use types correctly. Figure 4.2.6 compares the classifications generated by SLA-NDVI and MSAVI against the actual land use map; a difference map between MSAVI and SLA-NDVI appears as Figure 4.2.7. These figures show that SLA-NDVI is a better predictor than MSAVI mainly for fields in the Northern and Southern regions and bush/graze in the Central region.

Table 4.2.3 Percentage of land use types correctly classified in post-harvest (October) image using vegetation indices

Vegetation index	Fields	Sparse – bush/graze	Dense – bush/graze	Total
NDVI	74.21%	38.31%	60.43%	62.82%
SAVI	74.05%	38.22%	60.43%	62.70%
SAVI (input slope)	73.68%	38.54%	60.43%	62.57%
OSAVI	73.68%	38.82%	60.33%	62.63%
TSAVI	73.42%	38.61%	60.01%	62.37%
MSAVI	74.53%	38.30%	60.37%	62.98%
SLA-NDVI	76.12%	46.77%	65.16%	66.97%

It was predicted that, in general, fields with residues in the October image would be healthier in the pre-harvest (June) image and thus have higher SLA-NDVI and lower MSI values than fields without the protective cover of residues. Table 4.2.4 shows that this hypothesis only appears true to a significant degree ($p < 0.0001$) in the Northern region and for the alluvial soil type; whereas, the opposite appears to hold for the Southern region. Table 4.2.5 shows the degree to which fields' vegetative density increases from the October to the June image by region/soil type. While SLA-NDVI values in both images exhibit a general decline with elevation (i.e., from the Northern to the Southern region), October-June declines maintain a fixed, linear ratio ($r^2 = 0.94$) or, in other words, they differ by an average SLA-NDVI offset of 0.39. Based on this finding, the amount by which October-June values differ (column 5 in Table 4.2.5) parallels certain regional trends in crop productivity: e.g., the Southern region has the highest maize productivity (less alluvial fields) and the greatest seasonal difference, whereas, the Central region has the lowest maize productivity and the smallest seasonal difference. Although the alluvial soil type has the highest productivity and the smallest seasonal difference, it also has especially high SLA-NDVI values in the October image. This is likely due to the fact that weeds and grasses quickly sprout after harvesting because of the high fertility of these