

**ZONATION AND INTEGRATED PLANT NUTRIENT MANAGEMENT
STRATEGIES AND OPTION IN TANZANIA**

Volume IV. EXTRAPOLATION OF IPNM STRATEGIES AND TECHNICAL OPTIONS BY
AGRO-ECOLOGICAL ZONES AND DESCRIPTIONS OF MAPPING UNIT

W.J. Veldkamp

NSS Publication no.

Mlingano ARI, P.O. Box 5088
Tanga, Tanzania
Tel: 027-2647647
E-mail: mlingano@twiga.com

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1. INTRODUCTION

The NCU database showed constraints for each of their units. These data were recorded and used for the present mapping units wherever possible. By determining the suitability of maize, as exercise to study the usefulness of the agro-ecological zone, some more constraints were added and more constraints were distinguished for each agro-ecological zone.

In this volume the various constraints are mentioned. The extent and occurrence of such constraints within the agro-ecological zone is discussed. Thereafter, for each mapping unit a description of the correlations to other works and studies is given. Also the major soil units are given. In a table the likely constraints are shown and for each constraint the appropriate IPNM strategies and the associated technical options are given. These options refer to either a particular group of soil fertility manager or to any type of farmer.

2. CONSTRAINTS

Table 2-1. List of constraints, their occurrence, extent and importance

Constraint	Abbreviation	Occurrence	Extent, importance (by broad AEZ)
Acidity, acidification (chemical degradation)	ac	All climatic zones, except most dry one; acidifying soil types especially 361-368, 391, 451-455	Most important zones: Gn, Ka-I, Ka-II, Lw-I, Lw-II, Me-I, Me-II; less important zones: Vo-II, Me-III, Co-II
Capping, surface sealing (physical degradation)	ca	All climatic zones; soil types 421-425, 461-462, 471-473	Vo-I, Gn, Ka-I/II, La-I/II, Lw-II, Me-I/II, Co-II
Compaction (physical degradation)	co	Climatic zones more than 600 or 700 mm and variable drought risk; soil types 541-544	Sa-II
Soil depth (limited, rooting, extra drought stress)	de	All climatic zones	Most important zones: Gn, Ka-I, Sa-I, Lw-I; less important zones: Vo-I/II, La-II, Sa-II, Lw-II, Me-I/II
Soil degradation, gully erosion (dry climate)	dg	Climatic zones with 400 to 700 mm or more	Most important zones: Gn, Me-I/II; less important zones: Vo-II, La-I/II, Lw-II, Se
Drainage (waterlogging, shallow groundwater)	dn		
Drought (soil moisture stress)	dr	Could be divided in total rainfall, length of season and drought hazard. All climatic zones, but less in cooler and zones with 800 mm or more and a low drought risk	
Erosion (sheet, rill, gully)(wet climates)	er	Climatic zones with 600 mm or more	Most important zones: Vo-II, Gn, Ka-I, Sa-I, Me-I; less important: Vo-I, Ka-II, Sa-II
Fertility (major plant nutrients)	fe	All climatic zones. To be sub-divided in: P, N, P+N, N+P+K, N+K or K (needs verification (table 4-1))	All zones
Flooding (waterlogging)	fl		
Humidity (incl. excess rainfall)	hu	Climatic zones with 700 mm or more	Important: Me-I; less important: Ka-II
Leaching (chemical degradation)	le	Climatic zones with 1000/1200 mm or more	Important: Ka-II, Co-I (?); less important: Vo-I?, Ka-I, Co-II(?)
Organic matter, topsoil fertility and structure (biol degradation)	om	Climatic zones 500 to 800 mm or more, especially 600 to 700 mm or more	Important: Me-II/III, Co-II ; less important: Gn, La-I/II, Sa-I/II, Lw-I/II, Se(?), Me-I, Co-I
Radiation, light	ra	Climatic zones with 600 mm or more, altitude > 1000 m	Important: Vo-I/II, Gn, Ka-I/II, Me-I
Salinity, sodicity (accumulation of salts (dry clim.))	sa	Climatic zones with 400 to 700 mm or more, especially 500 mm or more	Important: Gn, Me-I; less important: Vo-II, La-I/II, Sa-II, Se, Co-I
Land slides	sl		Important: Gn
Temperature	te	Climatic zones with 600 mm or more and altitude above 1000 m	Important: Vo-I/II, Gn, Ka-I/II, Me-I

Wind erosion	wi	Climatic zones with 500 to 700 mm or more	Important: Vo-II
Workability	wo	All climatic zone	Important: Se; less important: Vo-II, Gn, La-I/II, Sa-II, Lw-II, Me-I/II, Co-I/II

3. IPNM STRATEGIES

These strategies were formulated on the basis of available IPNM options. Table 3-1 shows the list of IPNM strategies, based on the experience gained in the selected study areas in Northern and Lake zone during period 1999-2001.

Table 3-1. List of integrated plant nutrient management (IPNM) strategies

Num-ber	Constraints	Description of IPNM strategy
LABOUR STRATEGIES		
Strategies for shallow soils		
<i>- To create soil depth</i>		
1	Soil depth	Ridges on shallow soils
Strategies for restoration of soil fertility		
<i>- To restore infertile and sandy and poorly structured topsoils</i>		
2	Fertility, low organic matter	Organic matter (residues, manure, compost, green manure) on infertile soils
3	Low organic matter	Organic matter (green manure, manure, compost) on sandy topsoils
4	Workability, low organic matter	Organic matter (manure, residues, compost) on poorly structured topsoils
5	Fertility	Digging planting holes for perennial crops in acid, low cation exchange capacity (CEC) soils
Strategies concerning grazing		
<i>- To improve grazing practices, in and outside the farm area</i>		
6	Fertility	Grazing outside farm area and kraaling inside the farm
7	Fertility, erosion	Grazing control within farm area
LABOUR AND KNOWLEDGE STRATEGIES		
Strategies to improve the soil fertility		
<i>- To reduce losses</i>		
8	Fertility	Reduction of gaseous losses (especially nitrogen) by better manure storage, proper compost making, proper (split and timely) nitrogen applications
9	Fertility	Manure storage management to reduce leaching losses and proper decomposition
<i>- For better internal nutrient utilisation</i>		
10	Fertility	Compost making, faster and better recycling of crop residues (addition of ashes, green manure, bonemeal)
11	Fertility	More manure application
12	Fertility	Manure production with dairy cattle
13	Fertility	Manure production with ruminants
14	Fertility	Internal nutrient flow management within the farm (in/out fields, toposequential approach)
15	Fertility	Combined vegetable cultivation rotated with cash or food crops or combined rotations
16	Fertility	General agronomy measures (pest/disease (IPM) control, timely planting and weeding)(mulching for weed control), proper crop rotation and diversification, intercropping)
17	Fertility	Improved cattle and ruminant management
18	Fertility	Nitrogen fertilizer application in accordance with rainfall conditions

Strategies to increase the organic matter content of the topsoil
 - *To restore the low fertility by adding organic matter or by fallow*

19	Fertility, low organic matter	Organic matter (nitrogen fixing green manure, manure) on soils low in nitrogen
20	Fertility, low organic matter	Improved fallow

- *To improve the nitrogen content of the topsoil*

21	Fertility, low organic matter	Nitrogen fixing legumes (and Azolla in rice)
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Strategies to combat wind erosion, uncontrolled wind speed on soils with loose or fluffy topsoil

- *To reduce losses and improve the environment*

22	Wind erosion	Reduce wind erosion by tree line planting, hedges around fields, relay cropping, leave residues as mulch to be ploughed under during land preparation
23	Wind erosion	Erosion control, ridging, contourbunds with perennials, mulch

- *For better internal nutrient management*

24	Fertility, wind erosion	Plant multi-purpose trees for organic matter production, shade, nitrogen fixation, nitrogen uptake near kraal sites, field boundary markation
25	Fertility, low organic matter, wind erosion	Green manure production
26	Fertility, low organic matter, wind erosion	Relay cropping for soil protection and organic matter production

Strategies to combat water erosion, uncontrolled run-off on less permeable soils

- *To reduce losses*

27	Water erosion	Erosion control, ridging, contourbunds with perennials, mulch, perennial crops
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- *For better internal nutrient utilisation*

28	Fertility, low organic matter, water erosion	Relay cropping for soil protection and organic matter production
29	Water erosion	Green manure production

Strategies for permeable soils in high rainfall zone, subject to leaching

- *To reduce losses and restore the exchange capacity of the soil*

30	Fertility, leaching	Organic matter (manure, compost, residues) on low exchange capacity soils
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- *For better internal nutrient utilisation*

31	Fertility, leaching	Enrichment of compost with ashes or direct application of ashes
32	Fertility, leaching	Shift kraal site regularly or build kraal site near fields

Strategies for shallow soils

- *For better internal nutrient management*

33	Soil depth	Ridging for run-off, erosion control
34	Soil depth	Choice of drought-resistant crops and varieties for shallow soils

Strategies for dry soils

- *For better internal nutrient utilisation*

35	Drought	Water harvesting, irrigation management
36	Drought	Tied-ridging in drier areas

Strategies for flooded soils

- *For better internal nutrient utilisation*

37	Flooding	Adaptation of drainage conditions (mounds in wet soils, higher ridges on wet land)
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Strategies for poorly or imperfectly drained soils

- *For better internal nutrient utilisation*

38	Drainage	Crop choice on wet land or land with fluctuating groundwater level within the rooting zone
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Strategies for sodic or alkaline soils

- *For better internal nutrient utilisation*

39	Sodicity	More manure and organic matter application in case of sodic soils
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EXTERNAL INPUT STRATEGIES

Nitrogen fertilizer strategies on nitrogen poor soils, including its effect on acidity, requiring external inputs

- *To improve yields*

40	Fertility	Nitrogen fertilizers on high response crops (possibly to be combined with manure application)(to be split in relation to rainfall)
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- *For better internal nutrient utilisation*

41	Sodicity	More acidifying nitrogen fertilizer use on sodic or alkaline soils
42	Fertility	Application (topdressing) of organic or inorganic fertilizers (in combination with basal dressing)
43	Fertility	Nutrient application on cash crops as compared to food crops (if food sufficiency has been reached)
44	Fertility, acidity	Using appropriate (non acidifying) type of fertilizers

Rock-phosphate strategies on acidic soils, especially in combination with cultivation of legumes as well as on phosphorus deficient soils in dry areas, requiring external inputs

- *To restore the soil fertility*

45	Fertility	Rock-phosphate on acidic soils with low phosphorus content
46	Degradation, low organic matter content	Improvement of biologically degraded soils by inoculation of nitrogen fixing legumes, by application of mycorrhiza, manure and compost applications, improvement of phosphorus content of the soil by rock-phosphate application

- *To improve yields*

47	Fertility	Enrichment of compost and manure with rock-phosphate
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- *For better nutrient utilisation*

48	Fertility	Ensure proper phosphorus content and pH (possibly apply rock-phosphate) when planting nitrogen fixing legumes
49	Drought	Choice of drought-resistant early maturing crops and varieties or mixture and adapted fertilizer use (smaller quantities, ensure rooting depth is not limited by subsoil acidity or very low phosphorus and calcium levels)

Phosphorus fertilizer strategies on phosphorus poor soils, requiring external inputs

- *To restore the soil fertility*

50	Fertility	TSP or SSP application on poor phosphorus or high phosphorus retention soils (such as Andosols and possible red Ferralsols)
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- *To improve yields*

51	Fertility	Phosphate fertilizer application on phosphorus-responsive crops
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- *For better nutrient utilisation*

52	Sodicity	More phosphorus application on sodic soils
53	Fertility	Placement of phosphorus fertilizer

Potassium fertilizer strategies on potassium poor soils, requiring external inputs

- *To restore the soil fertility*

54	Fertility	Potassium on (acid, high organic matter containing, high rainfall zone, low CEC, high P-retention due to positively charged amorphous oxides) leached soils (eg. Bukoba)
55	Fertility	Potassium application on mined soils after long period of cultivation

- *To improve yields*

56	Fertility	Potassium fertilizer on potassium-responsive crops
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Combined **nitrogen-phosphorus-potassium** input strategies for poor soils or application on cash crops, requiring costly external inputs

- *To restore the soil fertility*

57	Degradation	Improvement of chemically mined/degraded soils by a combination of alkaline mixture of dolomitic lime, ashes, organic matter (compost, manure, green manure, cover crop) and possibly some plant nutrients like phosphorus (rock-phosphate), and potassium or NPK mixture), with later applications of nitrogen
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- *To improve yields*

58	Fertility	Use of NPK fertilizers on cash crops (especially vegetables)
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- *For better internal nutrient utilisation*

59	Fertility, low organic matter	Application (basal dressing) of organic and inorganic fertilizers before tillage
60	Fertility	Basal nutrient application on cash crops as compared to food crops (if food sufficiency has been reached)

Soil fertility strategies concerning **micro-nutrients and magnesium** deficient soils, requiring costly external inputs, which are difficult to get

- *To restore the soil fertility*

61	Fertility	Micro-nutrient sprays or application on perennials in deficient areas (eg. copper on coffee)
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- *To improve yields*

62	Fertility	Magnesium on magnesium-deficient crops
63	Fertility	Boron application, if manure, compost, rock-phosphate, lime applications are not effective
64	Fertility	Copper application, if manure, compost, rock-phosphate, lime applications are not effective
65	Fertility	Zinc application, if manure, compost, rock-phosphate, lime applications are not effective
66	Fertility	Use of cattle licks in areas with micro-nutrient deficiencies in cattle

Liming or other alkaline material strategies for leached and/or acid and/or exhausted soils

- *To restore the soil fertility*

67	Leaching, acidity	Lime (or dolomitic lime) on acidic or acidified soils
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- *For better internal nutrient utilisation*

68	Leaching	Reduce leaching (increase cation exchange capacity) by application of manure, compost, lime or ash, mulching, cover crops during rainy periods, deep rooted agro-forestry species, tillage
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69	Fertility, acidity	Increase soil pH by liming with certain quantities of ashes, bonemeal, rock-phosphate to increase mineralisation and nutrient availability
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MECHANISATION OR DRAUGHT STRATEGIES

Mechanisation or animal draught strategies in case of topsoils with low organic matter, after severe erosion, with heavy texture and poor structure or degraded soils (with ploughpan) or very dry soils (low or erratic rainfall), requiring fuel or feed

- *To restore physically degraded soils*

70	Degradation	Improvement of physically degraded soils by deeper tillage or subsoiling, improvement of tillage implements, minimum tillage methods, deep rooted legume cultivation, tree planting
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- *For better internal nutrient utilisation in low organic matter topsoils*

71	Low organic matter, erosion	Residue recycling, mulching, underploughing
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- *For better internal nutrient utilisation in heavy textured topsoils*

72	Workability	Sufficient tillage for proper deep rooting conditions, without destroying topsoil structure
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- *To reduce soil moisture losses*

73	Drought	Dry ploughing or harrowing after harvest
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COMMUNITY STRATEGIES

Organisational (communal) strategies for irrigated or banded rice and salinity affected irrigation systems (maybe costly)

- *For better internal nutrient utilisation*

74	Fertility	Proper water control together with nitrogen application to banded rice
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- *For better growth of crops*

75	Salinity	More irrigation water application for leaching of salts
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Communal strategies in order to increase crop production and improve livelihoods

- *For higher crop production and improved livelihoods*

76	Crop production, knowledge	Training of farmers, extension staff and production of leaflets and other extension material in local language
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77	Crop production, knowledge	Farmer's experimentation
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78	Transport	Use of wheelbarrow
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RESEARCH AND EXTENSION STRATEGIES

Strategies by research and extension to increase crop production and improve livelihoods

- To improve crop production and livelihoods

79	Fertility	Knowledge about response by yield level (potential yield minus present yield divided by quantity of application to be maximised at present input and produce prices, to be determined per type of field within the farm)
80	Fertility	Reduce burning, especially in sulphur-deficient areas
81	Fertility	Crop choice, varieties and combinations (mixture of crop with green manure)
82	Soil knowledge	Simple soil testing methods for extension staff (eg. pH-paper for acid soils)
83	Soil knowledge	Recognition of particular soil types and their appropriate management
84	Economics	Ensure sufficient returns for labour input
85	Economics	Ensure sufficient returns to investment (purchased inputs)

GOVERNMENT STRATEGIES

Strategies (governmental) to protect the land and to prevent severe damage in case of flooding, landslides or severe erosion in sloping land (most difficult and costly)

- To prevent disasters

86	Landslides	Prevention and protection of land vulnerable to landslides by proper land use methods (eg. perennials only)
87	Flooding	Improved flood control by dikes, bunds, better knowledge to predict flooding and measures to prevent flooding of productive land
88	Erosion	Storm drain construction in case of massive rains over a long period in sloping areas causing high discharge of drains, streams and rivers

- To increase crop production and improve livelihoods

89	Retail	Availability of required quantity and quality of fertilizers and other inputs
90	Credit	Short-term credit facilities with relative low interest on loans (get input now, pay later, when cash crop has been harvested)

4. IPNM TECHNICAL OPTIONS

The technical options were formulated on basis of working papers, dealing with descriptions of the selected study areas, the way farmers deal with soil fertility, the elaboration of nutrient balances and finally the conclusions on which options are feasible for what category of farmer or rather soil fertility manager. The list of options for Sukumaland, Bukoba and Arumeru/Hai is rather long and given as annex 6 in Vol. V.

In Table 4-1 the appropriate strategies and options for each constraint or combination of constraints is given. The type of strategy (labour, labour and knowledge, external inputs, mechanisation/drought power, community, research/extension or government) is also given. The category of farmers, whether good, medium or poor soil fertility managers) is also shown in Table 4-1.

Table 4-1. IPNM strategies and options appropriate for each soil fertility constraint

Constraint(s)	IPNM strategy	Type of strategy	Options	Categories of farmers
Acidity, fertility (ac,fe)	44,69	External inputs	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Acidity, fertility, leaching (ac,fe,le)	31	Labour/knowledge	Bukoba: Re 4, A/l 1 Sukuma: K/N 1b, 1c, 10 NZ: Cml	Specific by category
Acidity, leaching (ac,le)	67	External inputs	Bukoba: A/l 1 Sukuma: K/N 1c, 10	Specific by category
Capping/surface sealing (ca)	4,19,27	Labour/knowledge	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Compaction (co)	70	Mechanisation/draught	NZ: Cs 5	Specific by category
Soil depth (de)	1,33,34	Labour/knowledge	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (dg)	27,29,49 81	Labour/knowledge	NZ: Cs 2,9, 10, Rl 1	Any farmer
Overgrazing (dg,dr,fe_)	6,7	Labour	Sukuma: Lu5, K/N 5, M/C 4, re 5 NZ: Cs 10	Any farmer
Drainage (dn)	38	Labour/knowledge	not specified	?
Drought (dr)	35,73	Labour/knowledge, draught power	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought (dr)	49	External inputs	Sukuma: K/N 5, Rc 6, M/C 4 NZ: Cs 2, 10	Any farmer
Erosion (er)	27,29,88	Labour/knowledge/government	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1	Any farmer, communal approach (Ma 7 and In 1 specific by

			NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	category)
Erosion, low organic matter (er,om)	71	Mechanisation/ draught power	Bukoba: Cl 1, Re 1, 2, 3, Mu 1, 2, Gm 1, 2 Sukuma: Rc 8, Re 1, 2, 4, Rd 4 NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter (er,fe,om_	28	Labour/knowledge	Bukoba: Gm 2 Sukuma: Lu 4, 5, K/N 5, 6, Rc 6, M/C 4, In 2 NZ: Rl 1	Any farmer
Fertility (fe) (restoration)	5	Labour	Bukoba: Ma 4	Specific by category
Fertility (fe) (low CEC)	8,9	Labour/knowledge	Bukoba: Ma 1, Re 3 Sukuma: M/C 1, Re 2 NZ:Ma 4	Any farmer, but good and medium managers for option Ma 1
Fertility (fe) (general, involving labour, knowledge))	10-18	Labour/knowledge	Bukoba: Co 1, Ma 2, 3, 5, 6, Mu 2 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, 4, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (fe) (nitrogen)	40,42,43	External inputs (nitrogen)	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6 Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (fe) (rock-phosphate)	45,47,48	External inputs (rock-phosphate)	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (fe) (phosphate)	50,51,53	External inputs (phosphate)	Sukuma: Lu 1c, 8, K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (fe) (potassium)	54,55,56	External inputs (potassium)	Bukoba: Fe 2, 4 Sukuma: Lu 1d, 8, K/N 2, Rc 2 NZ: Fe 4	Specific by category
Fertility (fe) (NPK)	58,60	External inputs (NPK)	Bukoba: Ma 6, 7, Rw 2, Fe 2 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility (fe) (special	61-66	External inputs (special)	Bukoba: Fe 2, 3, 4, Rw 3, A6, A7, A8	Specific by category

inputs			Sukuma: A8	
Fertility (fe) (general, involving research, extension)	74,79-81	Research/extension	Bukoba: Fe 1, 2, 4, Gm 1, 2 Sukuma: Lu 3, 4, 5, K/N 4, 5, 6, Rc 3, 5, Re 3, M/C 4, In 1, 2 NZ: Fe 1, 2, 3, 4, 5, Rl 1	Specific by category
Fertility, leaching (fe,le)	30	Labour/knowledge	Bukoba: Ma 6, 7, Co 1, Rw 1 Sukuma: M/C 2, 3	Specific by category
Fertility, low organic matter (fe,om)	2,19,20,21	Labour/knowledge	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. cat. for option K/N 1a)
Fertility, low organic matter (fe,om)	59	External inputs	Bukoba: Ma 4, 7, Rw 1, Fe 2, A/l 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility, low organic matter, drought, wind erosion (fe,om, (wi,dr))	25,26	Labour/knowledge	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility, wind erosion (fe,wi)	24	Labour/knowledge	Sukuma: Lu 7, K/N 9, Rc 5, M/C 4 NZ: Cs 1, Fo 1	Any farmer
Flooding (fl)	37,87	Labour/knowledge, government	A9	Any farmer, but esp. good managers
Leaching (le)	57,68	External inputs	Bukoba: A/l 1, Mu 1 Sukuma: Lu 4, 5, K/N 1b, 5, 6	Any farmer, but spec. cat. for options A/l 1 and K/N 1b
Low organic matter (om)	3,46	Labour, external inputs	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, but spec. cat. for options Lu 1a and In 1
Low organic matter, workability (om,wo)	4	Labour	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Salinity (sa)	75	Community	NZ: A10	Good manager
Land slides (sl)	86	Government	All	?

Sodicity (so)	39,41,52	Labour/knowledge, external inputs	Sukuma: A12, A13 NZ: Fe 3, 5	Good and medium managers
Wind erosion (wi)	22,23	Labour/knowledge	Sukuma: Rd 1, 3 NZ: Cs 1, 3, 4, 6, 7, 9, Fo 1	Any farmer
Workability (wo)	72	Mechanisation/draught power	NZ: Cs 5 A14	Good and medium managers

[Additional options:

A1: Water harvesting methods

A2: Improvements in irrigation system, water quality, cemented channels

A3: Run-off water use on Itogolo soils

A4: Transport and labour solutions for manure application

A5: Fodder collection from lowlands

A6: Zinc application

A7: Copper application to coffee

A8: Boron application (cotton)

A9: Drainage of wet areas

A10: Diminishing salinity by percolation with increased quantity of irrigation water

A11: Prevention and prediction of landslide hazard

A12/13: Manure and organic matter addition to sodic soils

A14: Use disc ploughs and disc harrows

[Explanation of abbreviations of the options as can be found in more detail in annex 5

For Bukoba (FSZ 7): A/L= Ash/lime; Co=Compost; Fe=Fertiliser; Gm=Green manure; Ma=Manure; Mu=Mulch; Re=Residue; Rw=Rweya

For Sukumaland (FSZ 1 and 2): In=Intercropping; K/N=Kikungu/Nduha;

Lu=Luseni; Ma=Manure; Mb=Mbuga; M/C=Manure/compost; Rc=Rice; Rd=Ridging;

Re=ressidue; Ve=vegetables

For Arumeru/Hai (FSZ Mc2): Ca=cattle; Cm=Compost; cr=Cropping;

Cs=Conservation; Fe=Fertiliser; Fo=Fodder; In=Inoculant; Ma=Manure;

M/C=Manure/compost; Rl=Relay cropping; Ru=Ruminants

5. CONSTRAINTS, STRATEGIES AND OPTIONS PER AGRO-ECOLOGICAL ZONE; CHARACTERISTICS OF MAPPING UNITS

For each agro-ecological zone the different constraints were used to identify the appropriate IPNM strategies and the technical options as found in the study areas in Lake and Northern zone, as well as the category of farmers for which these options apply. Those options that are specific for a particular study area have been left out for other areas, as they are only applicable within the farming system of the study area.

For each agro-ecological zone a description of the mapping units follows. Further selection and adaptation of IPNM strategies and technical options depends on research of identifying possible options to overcome the particular constraint or combination of constraints. The farming systems maps can give important information about socio-economic data as well as bio-physical data.

Some of the technical options are specific for the particular mapping unit. They have been left out for other areas or are only indicated when assumed appropriate. It concerns the following options:

- Bukoba: Ma 4, 5, 6, Re 1, 2, 4, Rweya, Rw 1, 2, Fe 1, 2, 3, Rw 3, Mu 1, 2
- Sukuma: Lu 5, 6?, K/N 6, 7?, 8, Ve 1, 2, Rc 1-8, Rd 2, Re 1, 4, Mb
- NZ: Ma 3, Cr 1, Cs 5, 6, 9, Fe 2, 3, 4, 5, Io 1

Tentatively the fertility constraint (concerning the main nutrients nitrogen, phosphorus and potassium) have been dealt with as given in Table 5-1). Crop response data can be used to qualify and quantify requirements for plant nutrients (in combination with manure and compost)

Table 5-1. Tentative selection of IPNM strategies concerning external inputs of the main nutrients and manure

Input	N	RP	P	K	NPK	Manure	Special inputs
IPNM strategies	40,42 43	45,47 48	50,51 53	54,55 56	58 60	10-18	61-66
Per agro-ecological zone group (agro-ecological zones)							
Co-1 (Co-1a,2a)	x						
Co-2 (Co-1b,2b,3a,3b)	x	x					
Gn (Gn1-6, Vo-4b,Me-6b*)	x	x	x		x	x	
Gn (Vo-5c)	x	x	x				
Ka-1 (Ka-1)	x	x	x		x	x	x
Ka-1 (Ka-3a)	x		x		x		
Ka-1 (Ka-4a)	x		x		x		
Ka-1 (Ka-4b)	x	x					
Ka-2 (Ka-2)	x			x		x	x
Ka-2 (Ka-3b, Lw-1a)	x	x	x	x	x	x	x
Ka-2 (Ka-4c)	x	x	x	x	x	x	x
La-1+2	x		x				
Lw-1+2	x	x	x	x	x	x	
Me-1+2+3	x	x				x*	
Sa-1+2	x		x			x*	
Se	x						
Vo-1 (Vo-1a,1b,2,4a)	x	x	x				
Vo-2 (Vo-1c,3,5b)	x	x	x		x		

Note: * on light textured soils

In annex 1 the list of agro-ecological zones and mapping units is shown, while in annex 2 the database on mapping units and their characteristics is given.

5.1. COAST (Co)

Agro-ecological zone Co-1a, mapping unit A3c

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard, length of season)			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Leaching?	57,68	Bukoba: A/1 1, Mu 1 Sukuma: Lu 4, 5, K/N 1b, 5, 6	Any farmer, spec. category options A/1 1 and K/N 1b
Fertility, leaching ?	30	Bukoba: Ma 7, Co 1 Sukuma: M/C 2, 3	Specific by category
Drought	35,73	Sukuma: A1 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 11, Ve 2, Rc 2, 3, 7; NZ: Fe 1, 2	Spec. category (esp. when dealing with cash crops)

A3c: Humid Zanzibar-Pemba-Mafia islands (eastern parts of Zanzibar and Pemba as well as Mafia island)

Altitude (m)	< 100
Annual rainfall (mm)	1000-1200
Geology	Pleistocene (2) sandstone, marl, coralline limestone
Physiographic unit	CP1, CP2 (C6, C7)
CMU (coffee map) unit	A3
Climatic unit	SC3
Farming system	Cassava-Trees
Farming system group	2e1
Agro-ecological zone	Co-1a
Soil group	19
Soil types - dominant	144, 522
- associated	401
- inclusion	301, 333, 542, 721

Agro-ecological zone Co-1b, mapping unit A3b

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard)			
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Leaching?	57,68	Bukoba: A/l 1, Mu 1 Sukuma: K/N 1b, 5, 6	Any farmer, spec. category options A/l 1 and K/N 1b
Fertility, leaching	30	Bukoba: Ma 7, Co 1 Sukuma: M/C 2, 3	Specific by category
Acidity, fertility, leaching	31	Bukoba: A/l 1; Sukuma: K/N 1b, 1c, 10; NZ: Cm1	Specific by category
Acidity, leaching	67	Bukoba: A/l 1 Sukuma: K/N 1c, 10	Specific by category
Drought	35,73	Sukuma: A1 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. category (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category

A3b: Humic Zanzibar-Pemba islands, western Zanzibar, western Pemba

Altitude (m)	< 100
Annual rainfall (mm)	1000-1200
Geology	Plio-Pleistocene (1) Neogene sandy clays, sandstone
Physiographic unit	CH1 (C6, C7)
CMU (coffee map) unit	A4
Climatic unit	DM2
Farming system	Cassava-Trees
Farming system group	2j1
Agro-ecological zone	Co-1b
Soil group	27
Soil types - dominant	331
- associated	-
- inclusion	523, 643, 676

Agro-ecological zone Co-2a, mapping units B3m1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard)			
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Salinity	75	NZ: A10	Good manager
Workability	72	A14	Good and medium managers
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2; NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, R11	Any farmer (good and medium for option Rc 8; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 11, Ve 2, Rc 2, 3, 7; NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)

B3m1: Very low, semi-humid, Southern and Eastern coastal plains on Quarternary sediments (northern part)

Altitude (m)	< 200
Annual rainfall (mm)	800-1000-1200?
Geology	Pleistocene (2) limestone, marl, clay
Physiographic unit	CP1 (C1)
CMU (coffee map) unit	A3
Climatic unit	SM1(u)
Farming system	Maize-Sorghum (2a) and sisal estates
Farming system group	2e1
Agro-ecological zone	Co-2a
Soil group	19
Soil types - dominant	522
- associated	675, 721
- inclusion	144, 301, 333, 401,

B3m2: Very low, semi-humid, Southern and Eastern coastal plains on Quaternary sediments (southern part)

Altitude (m)	< 100
Annual rainfall (mm)	800-1000
Geology	Pleistocene (2) limestone, marl, clay
Physiographic unit	CP1 (C2)
CMU (coffee map) unit	A3
Climatic unit	SM1(u)
Farming system	Rice-Coconut-Cassava and sisal estates
Farming system group	2e1
Agro-ecological zone	Co-2a
Soil group	19
Soil types - dominant	522
- associated	675, 721
- inclusion	144, 301, 333, 401

Agro-ecological zone Co-2b, mapping units B311-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length)			
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Workability	72	A14	Good and medium managers
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, R11	Any farmer (good and medium managers for option Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec.cat. (esp. when dealing with cash crops)

B311: Very low, semi-humid, Eastern and Southern hinterland plains on old sedimentary rocks (southern part)

Altitude (m)	< 100 (-500?)
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (1) Neogene sandstone, Cretaceous clays, shale, limestone
Physiographic unit	CH1, CH4 (C2)
CMU (coffee map) unit	A4
Climatic unit	SM1(u)
Farming system	Cashew (1)
Farming system group	2j1
Agro-ecological zone	Co-2b
Soil group	27
Soil types - dominant	331, 451
- associated	-

- inclusion	523, 643, 676
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B312: Very low, semi-humid, Eastern hinterland plains on Quarternary and Tertiary sediments (northern part)

Altitude (m)	< 200/500
Annual rainfall (mm)	500/800-1000
Geology	Plio-Pleistocene (1) limestone, sandstone, marl, clays and old alluvium
Physiographic unit	CH1 (C1)
CMU (coffee map) unit	A4
Climatic unit	DM3
Farming system	Maize-Sorghum (2a)
Farming system group	2j1
Agro-ecological zone	Co-2b
Soil group	27
Soil types - dominant	331
- associated	-
- inclusion	523, 643, 676

Agro-ecological zone Co-3a, mapping units B3k, C3e

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 7, Fo 1	Any farmer (option Ma 1 specific by category)
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Specific by category
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category

B3k: Very low, semi-humid, Eastern and Southern hinterland hills and dissected uplands on old sedimentary rocks

Altitude (m)	200
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (2) (and Jurassic-Paleogene ?) Neogene sandy clays, Jurassic sandstone, shale, limestone, Paleogene limestone
Physiographic unit	CD1, CD2 (C3)
CMU (coffee map) unit	A4d
Climatic unit	SM1(u)
Farming system	Maize-Sorghum-pastoralism (2) and citrus plantations
Farming system group	1h2
Agro-ecological zone	Co-3a
Soil group	24
Soil types - dominant	471 (472)
- associated	-
- inclusion	524 (525), 644 (645)

C3e: Very low, semi-arid, Eastern hinterland hills and dissected uplands on old sedimentary rocks

Altitude (m)	200
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (2) Neogene sandy clay, Jurassic sandstone, shale, limestone, Paleogene limestone
Physiographic unit	CD1 (C3)
CMU (coffee map) unit	A4d
Climatic unit	SM1(u)
Farming system	Maize-Sorghum-Pastoralism (2)
Farming system group	1h2
Agro-ecological zone	Co-3a
Soil group	24
Soil types - dominant	471
- associated	-
- inclusion	524, 644

Agro-ecological zone Co-3b, mapping unit C3f

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (length of season)			
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, R11	Any farmer (good and medium managers for option Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, R1 1	Specific by category

C3f: Very low, semi-arid, Eastern hinterland plains on old sedimentary rocks

Altitude (m)	<100/200-500
Annual rainfall (mm)	800
Geology	Plio-Pleistocene (1) Neogene sandy clay, sandstone, Cretaceous clays, shale, limestone
Physiographic unit	CH1, CH4 (C2)
CMU (coffee map) unit	A4
Climatic unit	SM1(u)
Farming system	Rice-Coconut-Cassava
Farming system group	2j1
Agro-ecological zone	Co-3b
Soil group	27
Soil types - dominant	331
- associated	-
- inclusion	523, 643, 676

5.2. GNEISS (Gn)

Agro-ecological zone Gn-1a, mapping unit Alh3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 7, 6, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1; Sukuma: K/N 1b, 1c, 4, 10, M/C 5; NZ: Ma 1, 6	Specific by category
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

Alh3: High, humid to very humid, Rungwe highland in Southern highlands on gneiss (CMU-D6d part)

Altitude (m)	600-(>1000?)-2000
Annual rainfall (mm)	1000-2600
Geology	Ubendian gneiss
Physiographic unit	HU2 (H5)
CMU (coffee map) unit	D6d
Climatic unit	SC8
Farming system	Coffee-Banana (2)
Farming system group	2a1
Agro-ecological zone	Gn-1a
Soil group	3
Soil types - dominant	-
- associated	275, 364
- inclusion	111

Agro-ecological zone Gn-1b, mapping units Ald1-7, Alj1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard, length of season), radiation and temperature			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Workability	72	A14	Good and medium managers
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Land slides	86	All	?(government)
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (rock phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

Ald1: High to very high, humid to very humid areas in Southern Highlands on gneiss, South Tukuyu area west of Kyela area

Altitude (m)	nd
Annual rainfall (mm)	1000-1600
Geology	Ubendian gneiss
Physiographic unit	HU1 (H5)
CMU (coffee map) unit	D5d
Climatic unit	nd
Farming system	Maize-Forest (1a)
Farming system group	2c2
Agro-ecological zone	Gn-1b

Soil group	5a
Soil types - dominant	146, 272
- associated	111
- inclusion	-

Ald2: High to very high, humid areas in Southern Highlands on gneiss, Livingstone mountains

Altitude (m)	1500-2800
Annual rainfall (mm)	1400
Geology	Mocambique gneiss
Physiographic unit	RT
CMU (coffee map) unit	D4
Climatic unit	nd
Farming system	Maize-Forest (1a)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	111
- associated	-
- inclusion	-

Ald3: High to very high, humid, dissected, humid Eastern Iringa highlands on gneiss

Altitude (m)	1700-2200
Annual rainfall (mm)	1000-1400
Geology	Mocambique gneiss
Physiographic unit	HM2, HP2 (H7)
CMU (coffee map) unit	D5d
Climatic unit	SH3
Farming system	Maize-Potato (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272a, 362?
- associated	-
- inclusion	111, 237, 501

Ald4: Intermediate to high, humid highlands on gneiss, Mahenge highlands

Altitude (m)	800-1700
Annual rainfall (mm)	1000->1500
Geology	Mocambique gneiss
Physiographic unit	EM5 (E15)
CMU (coffee map) unit	D4
Climatic unit	SH5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	111, 363, 461
- inclusion	-

Ald5: Intermediate to high, humid to very humid highlands on gneiss, West Usambara (Lushoto) highlands

Altitude (m)	800-2000
Annual rainfall (mm)	1000->1500
Geology	Mocambique gneiss

Physiographic unit	EM5 (E12)
CMU (coffee map) unit	D4
Climatic unit	SC5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	111, 363
- inclusion	-

Ald6: Intermediate to high, humid highlands on gneiss, Eastern Usambara highlands

Altitude (m)	800-2000
Annual rainfall (mm)	1000-1300
Geology	Mocambique gneiss
Physiographic unit	EM2, EM5 (E13)
CMU (coffee map) unit	D4
Climatic unit	SC5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272, 412
- associated	111, 363
- inclusion	-

Ald7; Intermediate to high, humid to very humid highlands on gneiss, Morogoro highlands

Altitude (m)	500-2000
Annual rainfall (mm)	1000->1500
Geology	Mocambique gneiss
Physiographic unit	EM4, EF (E14)
CMU (coffee map) unit	D4
Climatic unit	SC2
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	111, 363, 412
- inclusion	-

Alj1: Intermediate to high, humid Matengo highlands, Wino ward, on gneiss

Altitude (m)	1300-1600
Annual rainfall (mm)	1200-1500
Geology	Mocambique gneiss
Physiographic unit	HM4 (H3)
CMU (coffee map) unit	D4
Climatic unit	SH5
Farming system	Coffee-Maize-Bean (3a)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	-
- inclusion	208, 649

Alj2: Intermediate to very high, humid areas in Southern highlands on gneiss, Mavanga flats, Lugarawa valley (Amani-Ibumi flats), Mlangali-Mawenga-Ludewa valleys, Upanga mountains

Altitude (m)	1000-2200
Annual rainfall (mm)	1000-1300
Geology	Mocambique gneiss
Physiographic unit	HM3, HM4 (H3)
CMU (coffee map) unit	D4
Climatic unit	nd
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	-
- inclusion	111, 208, 649

Alj3: Intermediate to high, humid Ludewa plateau on gneiss

Altitude (m)	1000-2000
Annual rainfall (mm)	1000-1200
Geology	Ubendian gneiss
Physiographic unit	HM3 (H3)
CMU (coffee map) unit	D4
Climatic unit	SH5
Farming system	Maize-Potato (2)
Farming system group	2c2
Agro-ecological zone	Gn-1b
Soil group	5a
Soil types - dominant	272
- associated	-
- inclusion	111

Agro-ecological zone Gn-2, mapping units A2d1-3, 5-7

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard, length of season) and radiation			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Workability	72	A14	Good and medium managers
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Land slides	86	A11	?(government)
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

A2d1: Low to intermediate, humid Mbinga area on gneiss

Altitude (m)	500-1500
Annual rainfall (mm)	1000-1500
Geology	Mocambique gneiss
Physiographic unit	HM3 (H3)
CMU (coffee map) unit	D4
Climatic unit	SH5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	272
- associated	-
- inclusion	111

A2d2: Intermediate to high, humid Lupemba-Niave hills on gneiss

Altitude (m)	900-1600
Annual rainfall (mm)	1600
Geology	Mocambique gneiss
Physiographic unit	EF (E7)
CMU (coffee map) unit	B5h

Climatic unit	SH5, SC8
Farming system	Maize-Potato (2a)
Farming system group	2c2 (2i1?)
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	-
- associated	363, 412
- inclusion	111

A2d3: Intermediate to very high, humid Songea plateau and Madaba-Mahanje area on gneiss

Altitude (m)	1000-2200
Annual rainfall (mm)	1000-1500
Geology	Mocambique gneiss
Physiographic unit	EPh6 (E7)
CMU (coffee map) unit	B5h
Climatic unit	SH3 (SH5)
Farming system	Maize-Bean 2)
Farming system group	2c2
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	412
- associated	362, 421
- inclusion	111, 335

A2d5: Low, humid Ruhuhu escarpment, shallow soil area on gneiss

Altitude (m)	700-1000
Annual rainfall (mm)	1200
Geology	Mocambique gneiss
Physiographic unit	RT (H3)
CMU (coffee map) unit	D4
Climatic unit	SH3
Farming system	Maize-Forest (1a)
Farming system group	2c2
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	111
- associated	-
- inclusion	-

A2d6: Low, semi-humid south-eastern Songea-west Tunduru area on gneiss

Altitude (m)	500-800
Annual rainfall (mm)	> 1000
Geology	Mocambique gneiss
Physiographic unit	EPh6 (E7)
CMU (coffee map) unit	B5h
Climatic unit	SH3
Farming system	Maize-Bean (2), Cashew (1)
Farming system group	2c2 (2i1)
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	412
- associated	362
- inclusion	111, 335

A2d7: Low, humid Songea plateau granite hills

Altitude (m)	750-1000
Annual rainfall (mm)	1000-1500
Geology	Granite
Physiographic unit	EI2 (E7)
CMU (coffee map) unit	B5h
Climatic unit	SH3 (SH5)
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-2
Soil group	5a
Soil types - dominant	111
- associated	421
- inclusion	-

Agro-ecological zone Gn-3, mapping units B1b1-6, B2c, B2i

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1; NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 1, 2, 3, Mu 2, Gm 1, 2 Sukuma: Rc 8, Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, low organic matter, fertility	28	Bukoba: Gm 2; Sukuma: K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7 A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Workability	72	A14	Good and medium managers
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1	Specific by category

		NZ: Ma 6, R1 1	
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7, Rw 2, Fe 2 Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category

B1b1; High, semi-humid to humid Mufindi and Kidugala plateaux on gneiss

Altitude (m)	1700-2000
Annual rainfall (mm)	900-1200
Geology	Mocambique gneiss
Physiographic unit	HP1 (H1)
CMU (coffee map) unit	D5
Climatic unit	SH3, SM4
Farming system	Maize-Potato (2), Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	272, 473
- associated	-
- inclusion	111, 501

B1b2: High, semi-humid to humid East Njombe plateau on gneiss

Altitude (m)	1500-2100
Annual rainfall (mm)	900-1200
Geology	Mocambique gneiss
Physiographic unit	HP1 (H2)
CMU (coffee map) unit	D5
Climatic unit	SH5
Farming system	Maize-Potato (2), and tea and wattle estates
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	473
- associated	272
- inclusion	111, 501

B1b3: High, semi-humid to humid Pare mountains on gneiss

Altitude (m)	1500-2000
Annual rainfall (mm)	800->1000
Geology	Mocambique gneiss
Physiographic unit	EM5 (E12)
CMU (coffee map) unit	D4
Climatic unit	Sc5
Farming system	Maize-Bean (2), little Coffee-Banana (2)
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	272
- associated	111, 363
- inclusion	-

B1d4: High to very high, humid Mpwapwa plateau on gneiss

Altitude (m)	1500-2300
Annual rainfall (mm)	> 1000
Geology	Mocambique gneiss
Physiographic unit	HM1, HM5 (H7)
CMU (coffee map) unit	D4
Climatic unit	SH3
Farming system	Maize-Potato (2)
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	-
- associated	272, 338, 461, 473
- inclusion	-

B1b5: High to very high, humid Eastern Ubena plateau on gneiss

Altitude (m)	1100-1700
Annual rainfall (mm)	1000-1300
Geology	Mocambique gneiss
Physiographic unit	HP1 (H2)
CMU (coffee map) unit	D5
Climatic unit	SH5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	473
- associated	272
- inclusion	111, 501

B1b6: High, semi-humid Northern Ubena plateau on gneiss

Altitude (m)	1600-1800
Annual rainfall (mm)	900-1000
Geology	Mocambique gneiss
Physiographic unit	HP1 (H2)
CMU (coffee map) unit	D5
Climatic unit	SH5
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-3
Soil group	5a
Soil types - dominant	473
- associated	272
- inclusion	111, 501

B2c: Intermediate to high, semi-humid to humid, shallow soil areas in Southern Highlands on gneiss, Lower Livingstone mountains, Lake Tanganyika escarpment, Ruhudji hills

Altitude (m)	500/700-1600
Annual rainfall (mm)	900-1300
Geology	Mocambique gneiss
Physiographic unit	RT, U, H1-3
CMU (coffee map) unit	D4, D5 (G5?)
Climatic unit	SH5?
Farming system	Maize-Bean (2)
Farming system group	2c2
Agro-ecological zone	Gn-3

Soil group	5a
Soil types - dominant	111
- associated	-
- inclusion	-

B2i: Intermediate to high, semi-humid, shallow soil areas in Southern Highlands on gneiss, Chimala scarp, Numbe mountains, Northern Gofio plateau

Altitude (m)	1000/1300-1800(-2700)
Annual rainfall (mm)	900
Geology	Mocambique gneiss (or P4v ?)
Physiographic unit	HP4 (H6)
CMU (coffee map) unit	D5d (or E3h)
Climatic unit	SC8
Farming system	Maize-Forest (1a)
Farming system group	2c2 (?)
Agro-ecological zone	Gn-3
Soil group	5a?
Soil types - dominant	272 (261, 265?)
- associated	111, 473
- inclusion	(105, 111, 275?)

Agro-ecological zone Gn-4, mapping unit B2p2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (drought hazard, length of season)			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Erosion, low organic matter	71	Bukoba: Cl 1, Re 1, 2, 3, Mu 2, Gm 1, 2 Sukuma: Rc 8, Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, low organic matter, fertility	28	Bukoba: Gm 2; Sukuma: K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Drought	35,73	Sukuma: Al, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8 NZ: Cs 1, Io 1, Rl 1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category

Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

B2p2: Low to intermediate, semi-humid Kilosa-west and Mpwapwa medium altitude plains on gneiss

Altitude (m)	750-1500
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	HM3, HM5 (H7)
CMU (coffee map) unit	C4d, C4h
Climatic unit	SM1(u)
Farming system	Coffee-Maize-Bean (3b)
Farming system group	2f1
Agro-ecological zone	Gn-4
Soil group	5b
Soil types - dominant	272
- associated	338, 461
- inclusion	111

Agro-ecological zone Gn-5a, mapping unit Clb

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 1, 2, 3, Gm 1, 2; Sukuma: Rc 8, Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, low organic matter, fertility	28	Bukoba: Gm 2; Sukuma: K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium for options Io 1 and Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Any farmer
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Specific by category (especially when dealing with cash crops)

C1b: High, semi-arid hills and mountains north of Mbeya and around Mbozi plateau on gneiss

Altitude (m)	nd
Annual rainfall (mm)	800
Geology	Ubendian gneiss
Physiographic unit	RT, HP6 (H5)
CMU (coffee map) unit	D6d
Climatic unit	SM4-SH3
Farming system	Maize-Forest (1b)
Farming system group	2a1
Agro-ecological zone	Gn-5a
Soil group	3
Soil types - dominant	111, 473
- associated	682
- inclusion	275

Agro-ecological zone Gn-5b, mapping units C1d1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Mu 1, 2, Gm 1, 2 Sukuma: Rc 8, Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, low organic matter, fertility	28	Bukoba: Gm 2; Sukuma: K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7	Spec. cat. (esp. when dealing with

		NZ: Fe 1, 2	cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

C1d1: Intermediate, semi-humid, upper Lukosi valley on gneiss

Altitude (m)	1200/1300-1400/1700
Annual rainfall (mm)	(600-)900
Geology	Mocambique gneiss
Physiographic unit	HM2 (H7)
CMU (coffee map) unit	D5d
Climatic unit	SH3
Farming system	Maize-Bean (4a)
Farming system group	2c2
Agro-ecological zone	Gn-5b
Soil group	5a
Soil types - dominant	111, 272
- associated	473
- inclusion	-

C1d2: Intermediate, semi-humid, lower Mufindi plateau on gneiss

Altitude (m)	1200-1500
Annual rainfall (mm)	900
Geology	Mocambique gneiss
Physiographic unit	HP1, HU1 (H1,H2)
CMU (coffee map) unit	D5
Climatic unit	SH3
Farming system	Maize-Bean (4a), Sorghum-Fingermillet (1)
Farming system group	2c2
Agro-ecological zone	Gn-5b
Soil group	5a
Soil types - dominant	272
- associated	111
- inclusion	-

C1d3: Intermediate to high, semi-humid, shallow Usanga flat border on gneiss

Altitude (m)	1000-1500/1800
Annual rainfall (mm)	900
Geology	Mocambique gneiss
Physiographic unit	RT (H1)
CMU (coffee map) unit	D5d
Climatic unit	nd
Farming system	Sorghum-Fingermillet (1)
Farming system group	2c2
Agro-ecological zone	Gn-5b
Soil group	5a
Soil types - dominant	111
- associated	-
- inclusion	-

Agro-ecological zone Gn-5c, mapping unit C2b

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Mu 1, 2, Gm 1, 2 Sukuma: Rc 8, Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, low organic matter, fertility	28	Bukoba: Gm 2; Sukuma: K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2,9, 10, Rl 1	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium for options Io 1 and Rc 8; specific by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility	50,51,53	Sukuma: K/N 1c, 7, 11	Specific by

(phosphate,TSP,SSP)		NZ: Ma 6	category
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C2b; Low to intermediate, semi-arid to semi-humid east Handeni, north Morogoro hilly plains and footslopes on gneiss

Altitude (m)	750-1500
Annual rainfall (mm)	600?-1000
Geology	Mocambique gneiss
Physiographic unit	EM1, EM3 (E2/H7
CMU (coffee map) unit	C4h
Climatic unit	SM1
Farming system	Maize-Sorghum-Pastoralism (1a)
Farming system group	2f1
Agro-ecological zone	Gn-5c
Soil group	5b
Soil types - dominant	237, 461
- associated	363, 412
- inclusion	111

Agro-ecological zone Gn-6a, mapping units D1b1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (total rainfall, length of season, drought hazard) and temperature			
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Salinity ?	75	NZ: A10	Good manager
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2,9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

D1b1: High, semi-arid to semi-humid Iringa plain on gneiss

Altitude (m)	1500-1700/2000
Annual rainfall (mm)	600-900
Geology	Mocambique gneiss
Physiographic unit	HP1, HP2 (H1)
CMU (coffee map) unit	D5
Climatic unit	SM4
Farming system	Maize-Bean (4a), Sorghum-Fingermillet (1)
Farming system group	2c2
Agro-ecological zone	Gn-6a
Soil group	5a
Soil types - dominant	272, 473
- associated	-
- inclusion	111, 237, 501

D1b2: High, semi-arid, dissected west Iringa plain on gneiss

Altitude (m)	1500-2000
Annual rainfall (mm)	600-800
Geology	Mocambique gneiss
Physiographic unit	HM1 (H1)

CMU (coffee map) unit	D5d
Climatic unit	SU4?
Farming system	Maize-Bean (4a), Sorghum-Fingermillet (1)
Farming system group	2c2
Agro-ecological zone	Gn-6a
Soil group	5a
Soil types - dominant	111
- associated	473
- inclusion	-

Agro-ecological zone Gn-6b, mapping units D1d1-2, D2a1, D2e, D2g, D2k4, D2m1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (total rainfall, length of season, drought hazard)			
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Salinity ?	75	NZ: A10	Good manager
Soil degradation, gully erosion	27,29,49, 81	NZ: Cs 2,9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Workability	72	A14	Good and medium managers
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 5	Specific by category (especially when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category

D1d1; High, semi-arid, eastern Mbulu area on gneiss (CMU-D4 area, southern part)

Altitude (m)	1500-2500
Annual rainfall (mm)	500-800
Geology	Mocambique gneiss
Physiographic unit	NP1, NP2 (N1)
CMU (coffee map) unit	D4
Climatic unit	SM2 (SH1)
Farming system	Wheat-Barley-Maize-Bean-Pigeon pea and Maize-Bean (5a)
Farming system group	2c2
Agro-ecological zone	Gn-6b
Soil group	5a
Soil types - dominant	273?
- associated	-
- inclusion	111, 322

D1d2: High, semi-arid, eastern Mbulu area on gneiss (CMU-C4h area, northern part)

Altitude (m)	1500-2500
Annual rainfall (mm)	500-800
Geology	Mocambique gneiss
Physiographic unit	NP2, PH2? (N1, P2?)
CMU (coffee map) unit	C4h
Climatic unit	SM2 (SH1)
Farming system	Wheat-Barley-Maize-Bean-Pigeon pea
Farming system group	2f1
Agro-ecological zone	Gn-6b
Soil group	5b
Soil types - dominant	273?, 421
- associated	131
- inclusion	111, 335

D2a1; Intermediate, semi-arid to semi-humid south-eastern Babati, northern Kondoia area on gneiss

Altitude (m)	1200?
Annual rainfall (mm)	600-900
Geology	Mocambique gneiss
Physiographic unit	EPa1 (E2)
CMU (coffee map) unit	C4
Climatic unit	nd
Farming system	Maize-Bean (5b)
Farming system group	2f1
Agro-ecological zone	Gn-6b
Soil group	5b
Soil types - dominant	461
- associated	-
- inclusion	111, 501, 735

D2e: Intermediate, semi-arid Kondoia, Kibaya, west Handeni hills on gneiss

Altitude (m)	1200/1400-1500
Annual rainfall (mm)	600-800
Geology	Mocambique gneiss
Physiographic unit	EH1, EH2 (E2)
CMU (coffee map) unit	C4h
Climatic unit	SU2
Farming system	Maize-Bean (5b), Maize-Sorghum-Pastoralism (3)
Farming system group	2f1 (2g1)
Agro-ecological zone	Gn-6b
Soil group	5b
Soil types - dominant	-
- associated	461
- inclusion	111, 363, 501

D2g: Low to intermediate, semi-arid to semi-humid Northern lowlands on gneiss

Altitude (m)	500-1200
Annual rainfall (mm)	500/550-1000
Geology	Mocambique gneiss (+SR3v?)
Physiographic unit	EPa1, EPa2 (E2)
CMU (coffee map) unit	C4
Climatic unit	SU2

Farming system	Maize-Bean-Pastoralism and bean estate
Farming system group	2f1 (2c1)
Agro-ecological zone	Gn-6b
Soil group	5b (4a?)
Soil types - dominant	461, 735
- associated	-
- inclusion	111, 501, 763

D2k4: High, semi-arid Babati area on gneiss and possibly some volcanic ash

Altitude (m)	nd
Annual rainfall (mm)	nd
Geology	Mocambique gneiss, SR3v (PP5?)
Physiographic unit	NA9, EPA?, EF/EM? (E2)
CMU (coffee map) unit	C4h
Climatic unit	SH1?
Farming system	Wheat-Barley-Maize-Bean-Pigeon pea
Farming system group	2f1 (2c1)
Agro-ecological zone	Gn-6b
Soil group	5b (4a?)
Soil types - dominant	231
- associated	461
- inclusion	111, 363?, 501?, 543, 734

D2m1: Intermediate, semi-arid Pare mountain footslopes on gneiss (CMU-C4, physiographic units EPa1, EPb1 areas)

Altitude (m)	1200/1300-1500/1700
Annual rainfall (mm)	500-800
Geology	Mocambique gneiss and Sub-recent (2) colluvium
Physiographic unit	EPa1, EPb1 (E1, E3)
CMU (coffee map) unit	C4
Climatic unit	SU2
Farming system	Maize-Bean (5b)
Farming system group	2f1
Agro-ecological zone	Gn-6b
Soil group	5b
Soil types - dominant	362, 461
- associated	412
- inclusion	111, 501, 735

D2m2: Intermediate, semi-arid Pare mountain footslopes on gneiss (CMU-C4h, physiographic unit EM1 areas)

Altitude (m)	1300-1700
Annual rainfall (mm)	500-800
Geology	Mocambique gneiss
Physiographic unit	EM1 (E2)
CMU (coffee map) unit	C4h
Climatic unit	SU2
Farming system	Maize-Bean (5b) and sisal estates
Farming system group	2f1
Agro-ecological zone	Gn-6b
Soil group	5b
Soil types - dominant	461
- associated	412
- inclusion	111, 363

Agro-ecological zone Gn-7, mapping units Eb1-2, Ec2, Ed1

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (total rainfall, length of season, drought hazard)			
Capping, surface sealing	4,19,27	no applicable	no cultivation
Fertility, low organic matter, drought	25,26	not applicable	no cultivation
Sodicity	39,41,52	not applicable	no cultivation
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	not applicable	no cultivation
Drought	49	not applicable	no cultivation
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (N?)	40,42,43	not applicable	no cultivation
Fertility (P?)	50,51,53	not applicable	no cultivation

Eb1; Intermediate, arid to semi-arid Kiteto, north Lushoto, north Monduli steppe on gneiss (CMU-C4 areas)

Altitude (m)	1200?
Annual rainfall (mm)	< 500-600
Geology	Mocambique gneiss
Physiographic unit	EPa1, EPa2 (E1)
CMU (coffee map) unit	C4
Climatic unit	SU1
Farming system	Pastoralism (2b)
Farming system group	2f1
Agro-ecological zone	Gn-7
Soil group	5b
Soil types - dominant	461
- associated	735
- inclusion	111, 501, 763

Eb2: Intermediate, arid to semi-arid Kiteto, north Lushoto, north Monduli steppe on gneiss (CMU-C4h areas)

Altitude (m)	1200?
Annual rainfall (mm)	550
Geology	Mocambique gneiss
Physiographic unit	RT (E1)
CMU (coffee map) unit	C4h
Climatic unit	SU1
Farming system	Pastoralism (2b)
Farming system group	2f1
Agro-ecological zone	Gn-7
Soil group	5b
Soil types - dominant	111
- associated	-
- inclusion	461, 501

Ec2: Intermediate, arid to semi-arid, north-western lake Eyasi hill range on granite and gneiss

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Dodoma granite and gneiss
Physiographic unit	RT (P2)
CMU (coffee map) unit	C6h
Climatic unit	SU3(u)
Farming system	Park (1c)
Farming system group	2f1
Agro-ecological zone	Gn-7
Soil group	5b
Soil types - dominant	111
- associated	-
- inclusion	131, 335, 421, 501, 691, 735

Ed1: Intermediate, arid to semi-arid, Western Mbulu, Northern Irambu area on granite and sediments

Altitude (m)	1100-1300
Annual rainfall (mm)	400-600/800
Geology	Basement complex granite
Physiographic unit	PPw1, RT (P2)
CMU (coffee map) unit	H5h
Climatic unit	SU2
Farming system	Pastoralism (2b)
Farming system group	2f1
Agro-ecological zone	Gn-7
Soil group	5b
Soil types - dominant	335, 735
- associated	111, 421
- inclusion	501, 691

5.3. KAGERA-KIGOMA (Ka)

Agro-ecological zone Ka-1, mapping units Ale, Alf

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Acidity, fertility, leaching	31	Bukoba: Re 4, A/l 1 Sukuma: K/N 1b, 1c, 10; NZ: Cm 1	Specific by category
Acidity, fertility	44,69	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Acidity, leaching	67	Bukoba: A/l 1 Sukuma: K/N 1c, 10	Specific by category
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Leaching	57,68	Bukoba: A/l 1, Mu 1 Sukuma: K/N 1b, 5, 6	Any farmer, spec. cat. for options A/l 1 and K/N 1b
Fertility, restoration	5	Bukoba: Ma 4	Specific by category
Fertility, manure	8,9	Bukoba: Ma 1, Re 3 Sukuma: M/C 1, Re 2 NZ: Ma 4	Any farmer, but good and medium managers for option Ma 1
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3, 5, 6, Mu 2; Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, Ca 1, A4, A5	Usually specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6 Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category

Fertillity (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility, (NPK)	58,60	Bukoba: Ma 6, 7, Rw 2, Fe 2; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, special inputs	61-66	Bukoba: Fe 4, Rw 3?, A6, A7, A8; Sukuma: A8	Specific by category
Fertility, leaching	30	Bukoba: Ma 6, 7, Co 1, Rw 1; Sukuma: M/C 2, 3	Specific by category

A1e: High, humid Kigoma highlands on basalts, argilleceous sandstone, limestone, phyllite, quartzite (CMU-D1 part)

Altitude (m)	1500-1700
Annual rainfall (mm)	1000-1500
Geology	Bukoba (2) limestone, sandstone, basalt, argilleceous sandstone
Physiographic unit	W2 (W2)
CMU (coffee map) unit	D1
Climatic unit	SM5
Farming system	Coffee-Maize-Bean (2)
Farming system group	1a2
Agro-ecological zone	Ka-1
Soil group	7a
Soil types - dominant	-
- associated	367, 479
- inclusion	106, 114, 276

A1f: High, humid Kigoma highlands on basalts, argillecous sandstone, limestone, phyllite, quartzite (CMU-D3d part)

Altitude (m)	1500-1700
Annual rainfall (mm)	1000-1500
Geology	Karagwe/Ankolean (2) phyllite, quartzite
Physiographic unit	RT (W2)
CMU (coffee map) unit	D3d
Climatic unit	SM5
Farming system	Coffee-Maize-Bean (2)
Farming system group	2b2
Agro-ecological zone	Ka-1
Soil group	7c
Soil types - dominant	-
- associated	108, 116, 276, 365, 367, 479
- inclusion	685, 686, 687

Agro-ecological zone Ka-2, mapping units A2a1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint radiation			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Acidity, fertility, leaching	31	Bukoba: Re 4, A/l 1	Specific by category
Acidity, fertility	44,69	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1	Specific by category
Acidity, leaching	67	Bukoba: A/l 1	Specific by category
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2	Any farmer, communal approach (Ma 7 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 1, 2, 3, Mu 1, 2, Gm 1, 2	Any farmer
Leaching	57,68	Bukoba: A/l 1, Mu 1	Any farmer, spec. cat. option A/l 1
Fertility, restoration	5	Bukoba: Ma 4	Specific by category
Fertility, manure	8,9	Bukoba: Ma 1, Re 3	Any farmer, but good and medium managers for option Ma 1
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3, 5, 6, Mu 2	Usually specific by category
Drainage	38	A9	Any farmer
Fertility (N?)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6	Spec. cat. (esp. when dealing with cash crops)
Fertility, (K?)	54,55,56	Bukoba: Fe 2, 4	Spec. category
Fertility, special inputs	61-66	Bukoba: Fe 2, 3, 4, Rw 3, A6, A7, A8	Specific by category
Fertility (general)	79,80,82	Bukoba: Fe 1, 2, 4	Spec category
Fertility, leaching	30	Bukoba: Ma 6, 7, Co 1, Rw 1	Specific by category

A2a1: Intermediate to high, humid to very humid Bukoba lake shore area on sedimentary and metamorphic rocks (sandstone, shale)

Altitude (m)	1150-1800
Annual rainfall (mm)	1200-2000
Geology	Bukoba (2) sandstone, quartzite, shale (phyllite) and alluvium/colluvium
Physiographic unit	W3, W4 (W6)
CMU (coffee map) unit	C2h
Climatic unit	SC7
Farming system	Coffee-Banana (3) and tea estates
Farming system group	2b1
Agro-ecological zone	Ka-2
Soil group	29a
Soil types - dominant	341, 368, 391?
- associated	-
- inclusion	106, 108, 704, 784

A2a2: Intermediate, humid Muleba area on sandstone

Altitude (m)	1150-1400
Annual rainfall (mm)	1200 and more
Geology	Bukoba (2) sandstone
Physiographic unit	W4 (W7)
CMU (coffee map) unit	D2
Climatic unit	SM3
Farming system	Coffee-Banana (3)
Farming system group	2b1
Agro-ecological zone	Ka-2
Soil group	29a
Soil types - dominant	341, 391
- associated	108, 704, 784
- inclusion	-

Agro-ecological zone Ka-3a, mapping unit Ble

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation, temperature and drought (length of season))			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6 Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7, Rw 2, Fe 2; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category

Ble: Intermediate, semi-humid to humid Kasuli-Kibombo medium altitude, Western plains on basalt, limestone and sandstone

Altitude (m)	1000-1500
Annual rainfall (mm)	800-1400
Geology	Bukoba (1) basalt, limestone, sandstone
Physiographic unit	W2 (W1)
CMU (coffee map) unit	C1h
Climatic unit	SM5
Farming system	Maize-Bean (3)
Farming system group	1d1
Agro-ecological zone	Ka-3a
Soil group	7b
Soil types - dominant	-
- associated	276, 367
- inclusion	113, 687

Agro-ecological zone Ka-3b, mapping unit Blf

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Acidity, fertility	44,69	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6; Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Specific by category (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility (special inputs)	61-66	Bukoba: Fe 2, 3, 4, Rw 3, A6, A7, A8 Sukuma: A8	Specific by category

Blf: Intermediate, semi-humid to humid Nkansi-Kasanga plain on sandstone

Altitude (m)	1000 and more
Annual rainfall (mm)	900-1200
Geology	Bukoba (2) sandstone
Physiographic unit	U (U2, U4)
CMU (coffee map) unit	C2
Climatic unit	nd
Farming system	Cassava-Rice
Farming system group	2b1
Agro-ecological zone	Ka-3b
Soil group	29a
Soil types - dominant	477
- associated	106, 341, 424, 506, 686
- inclusion	

Agro-ecological zone Ka-4a, mapping units B2g1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard)			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1; NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, 4, Ma 6 Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7, Rw 2, Fe 2; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category

B2g1: Intermediate to high, semi-humid Karagwe plains on hills, hilly to steeply dissected, on phyllite, schist and granite (CMU-D3d part)

Altitude (m)	1300-1800
Annual rainfall (mm)	800-1000
Geology	Karagwe/Ankolean (2) phyllite, quartzite, conglomerate
Physiographic unit	W1 (W3)
CMU (coffee map) unit	D3d
Climatic unit	SC7
Farming system	Coffee-Banana (3)
Farming system group	2b2
Agro-ecological zone	Ka-4a
Soil group	7c
Soil types - dominant	365
- associated	108, 116?
- inclusion	684, 786

B2g2: Intermediate to high, semi-humid Karagwe plains on hills on phyllite, schist and granite (CMU-D3 part)

Altitude (m)	1300-1800
Annual rainfall (mm)	800-1000
Geology	Karagwe/Ankolean (2) phyllite, quartzite, conglomerate
Physiographic unit	W1 (W3)
CMU (coffee map) unit	D3
Climatic unit	SC7
Farming system	Banana
Farming system group	2b2
Agro-ecological zone	Ka-4a

Soil group	7c
Soil types - dominant	365
- associated	106, 108
- inclusion	684, 786

Agro-ecological zone Ka-4b, mapping units B2e1, D2p3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint radiation?			
Flooding	37,87	A9	Any farmer, but especially good managers
Acidity, fertility	44,69	Bukoba: Fe 4, Co 1, A/l 1; Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 2, 4 Sukuma: K/N 4, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Specific by category (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category

B2e1: Intermediate, semi-humid to humid, northern Kagera floodplain on alluvial/colluvial sediments from schist and granite

Altitude (m)	1000/1150-1400
Annual rainfall (mm)	800-1500
Geology	Sub-recent (2) sediments
Physiographic unit	W4 (W8)
CMU (coffee map) unit	H1
Climatic unit	SC7
Farming system	Maize-Livestock (Dairy) and sugarcane
Farming system group	2h1
Agro-ecological zone	Ka-4b
Soil group	10
Soil types - dominant	203, 652
- associated	704, 787
- inclusion	-

D2p3: Intermediate, semi-arid northern Kagera floodplain on alluvial/colluvial sediments derived from schist and granite along Ruanda border

Altitude (m)	1000-1500
Annual rainfall (mm)	700-800
Geology	Sub-recent (2) sediments
Physiographic unit	W4 (W9)
CMU (coffee map) unit	H1
Climatic unit	DU
Farming system	Maize-Livestock (Dairy?)
Farming system group	2h1
Agro-ecological zone	Ka-4b
Soil group	10
Soil types - dominant	787
- associated	704
- inclusion	-

Agro-ecological zone Ka-4c, mapping units B2f1-4, B2t

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation, humidity, drought (length of season))			
Acidity, fertility	44,69	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Erosion ?	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Drought	35,73	Sukuma: Al, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3, 5, 6, Mu 2; Sukuma: Lu 1a, 2, 3, 5, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3; NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Bukoba: Fe 1, 2, 3, 4, Ma 6; Sukuma: Lu 3, 8, K/N 4, 11, Ve 2, Rc 2, 3, 7; NZ: Fe 1, 2	Specific by category (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Bukoba: Fe 2, 4 Sukuma: Lu 1d, 8, K/N 2, Rc 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7, Fe 2 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6	Specific by category

		NZ: Ma 1, 5, 6, M/C 2, Fe 2	
Fertility (special inputs)	61-66	Bukoba: Fe 2, 3, 4, Rw 3, A6, A7, A8 Sukuma: A8	Specific by category

B2f1: Intermediate, semi-humid to humid Katumba plateau on sandstone, shale and quartzite

Altitude (m)	1000-1500
Annual rainfall (mm)	900-1200
Geology	Bukoba (2) sandstone, shale, quartzite
Physiographic unit	PPw5 (P5)
CMU (coffee map) unit	C2
Climatic unit	SM5
Farming system	Tobacco-Pastoralism (1a)
Farming system group	2b1
Agro-ecological zone	Ka-4c
Soil group	29a
Soil types - dominant	-
- associated	341, 477
- inclusion	106, 506, 686

B2f2: Intermediate to high, semi-humid central Biharamulo area on sandstone

Altitude (m)	1200-1600
Annual rainfall (mm)	800-1000
Geology	Bukoba (2) sandstone
Physiographic unit	W3 (W7)
CMU (coffee map) unit	D2
Climatic unit	SM3
Farming system	Banana
Farming system group	2b1
Agro-ecological zone	Ka-4c
Soil group	29a
Soil types - dominant	341, 391
- associated	704, 784
- inclusion	-

B2f3: Intermediate to high, semi-humid Busando hills on sandstone and shale

Altitude (m)	1000-1700
Annual rainfall (mm)	950
Geology	Bukoba (2) sandstone
Physiographic unit	PC4 (P5)
CMU (coffee map) unit	G4h
Climatic unit	SM4
Farming system	Tobacco-Pastoralism (1a)
Farming system group	2b1
Agro-ecological zone	Ka-4c
Soil group	29a
Soil types - dominant	506
- associated	106, 477
- inclusion	-

B2f4: Intermediate, semi-humid south-western Kagera plains on sandstone and shale

Altitude (m)	1150-1400
Annual rainfall (mm)	800-1000/1200
Geology	Bukoba (2) sandstone, shale

Physiographic unit	W4 (W4)
CMU (coffee map) unit	C2h
Climatic unit	SM5
Farming system	Coffee-Banana (3)
Farming system group	2b1
Agro-ecological zone	Ka-4c
Soil group	29a
Soil types - dominant	368
- associated	106
- inclusion	686, 784

B2t: Low to high, semi-arid to humid Kigoma lowlands on sedimentary and metamorphic rocks

Altitude (m)	800-1800
Annual rainfall (mm)	600-1300
Geology	Bukoba (2) sandstone and shale and Ubendian gneiss and granite
Physiographic unit	PC1, PC3? (P6)
CMU (coffee map) unit	G4h
Climatic unit	SM5
Farming system	Cassava-Rice-Oilpalm
Farming system group	1f3
Agro-ecological zone	Ka-4c
Soil group	29b
Soil types - dominant	341, 473
- associated	106, 364, 421, 477
- inclusion	210, 651, 686

5.4. LACUSTRINE (La)

Agro-ecological zone La-1, mapping unit B212

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (length of season, drought hazard)			
Drainage	38	A9	Any farmer
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Low organic matter	3,46	Sukuma: Re 1, In 1	Any farmer, spec. cat. option In 1
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)

B212: Intermediate, semi-humid Sukumaland plains on granite and sediments, Itogolo soil type dominated parts

Altitude (m)	1000-1200
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (3) marl, sand, clay
Physiographic unit	PPs1 (P8)
CMU (coffee map) unit	H4
Climatic unit	SU3(u)
Farming system	Rice-Livestock
Farming system group	212
Agro-ecological zone	La-1
Soil group	8
Soil types - dominant	602
- associated	728
- inclusion	240

Agro-ecological zone La-2, mapping units C2c1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2, Rc 2, 3, 7; NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Flooding	37,87	A9	Any farmer, but especially good managers
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Salinity	75	NZ: A10	Good manager

C2c1: Low to intermediate, semi-arid to humid Rukwa valley/floodplain on alluvial and lacustrine sediments

Altitude (m)	800-1200
Annual rainfall (mm)	800-1200
Geology	Recent (2) sediments
Physiographic unit	RA2 (+RA 3, RA6) (R1)
CMU (coffee map) unit	G2
Climatic unit	SH3,4,5
Farming system	Tobacco-Pastoralism (1b)
Farming system group	2o1
Agro-ecological zone	La-2
Soil group	11
Soil types - dominant	767
- associated	343, 414, 425, 509, 634, 730
- inclusion	207, 672

C2c2: Low to intermediate, semi-arid to humid Rukwe/Songwe valley on alluvial sediments

Altitude (m)	800-1200
Annual rainfall (mm)	750-900/1200
Geology	Recent (2) sediments
Physiographic unit	RA2 (+RA3, RA6) (R1)
CMU (coffee map) unit	G2
Climatic unit	SH3,4,5
Farming system	Tobacco-Pastoralism (1b)
Farming system group	2o1
Agro-ecological zone	La-2
Soil group	11
Soil types - dominant	767
- associated	343, 414, 425, 509
- inclusion	207, 672

C2c3: Intermediate, semi-humid, shallow (?) soils areas ion recent deposits in Southern Highlands, Songwe-Msangano-Itumba through

Altitude (m)	1000-1500
Annual rainfall (mm)	900-1200
Geology	Recent (2) sediments
Physiographic unit	RA2, RA1, RA5 (R1)
CMU (coffee map) unit	G2
Climatic unit	SM4, SH3
Farming system	Maize-Sorghum-Pastoralism (5) or Maize-Bean (2)
Farming system group	2o1
Agro-ecological zone	La-2
Soil group	11
Soil types - dominant	109, 634, 767
- associated	343, 509, 605
- inclusion	207, 647, 673, 729

Agro-ecological zone La-3, mapping units D2o1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (length of season)			
Drainage	38	A9	Any farmer
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers

D2o1: Intermediate, semi-arid Ibushi plain on marl, sandy and clayey sediments

Altitude (m)	1000-1100
Annual rainfall (mm)	500-800
Geology	Plio-Pleistocene (3) marl, sand, clay (lake alluvium)
Physiographic unit	PPw4 (P7)
CMU (coffee map) unit	H3
Climatic unit	SU3(u)
Farming system	Cotton-Sorghum
Farming system group	212
Agro-ecological zone	La-3
Soil group	8
Soil types - dominant	238
- associated	-
- inclusion	728, 765

D2o2: East Lake Manjara shore on old lacustrine sediments

Altitude (m)	nd
Annual rainfall (mm)	600-800
Geology	Plio-Pleistocene (3) marl, sand, clay
Physiographic unit	NR2 (N3)
CMU (coffee map) unit	H3
Climatic unit	SU2,3
Farming system	Pastoralism (2b)
Farming system group	212
Agro-ecological zone	La-3
Soil group	8
Soil types - dominant	-
- associated	234, 462, 731, 771

- inclusion	-
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D2o3: Intermediate, semi-arid Shinyanga-Igunja area on metamorphic rocks and sediments (CMU-H3 area)

Altitude (m)	nd
Annual rainfall (mm)	600-800
Geology	Plio-Pleistocene (3) marl, sand, clay
Physiographic unit	PPs1 (P7,P8)
CMU (coffee map) unit	H3
Climatic unit	SU3,4,5
Farming system	Cotton-Sorghum-Pastoralism
Farming system group	212
Agro-ecological zone	La-3
Soil group	8
Soil types - dominant	602
- associated	728
- inclusion	238

Agro-ecological zone La-4a, mapping units Eel-4

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (length of season, total rainfall)			
Drainage	38	A9	Any farmer
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Flooding	37,87	A9	Any farmer, but esp good managers
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Salinity	75	NZ: A10	Good manager
Workability	72	A14	Good and medium managers

Eel: Intermediate, arid to semi-arid Nduli-Isamni flats on recent sediments over granite and gneiss

Altitude (m)	1250-1500
Annual rainfall (mm)	400-600
Geology	Recent (2) sediments
Physiographic unit	RP3 (P2)
CMU (coffee map) unit	G2
Climatic unit	SU4(r)
Farming system	Maize-Sorghum-Sunflower-Pastoralism (5)
Farming system group	2o1 (1k2)
Agro-ecological zone	La-4a
Soil group	11
Soil types - dominant	335, 343?
- associated	425, 509, 605
- inclusion	-

Ee2: Low to intermediate, arid to semi-arid Usangu plain on recent alluvial and lacustrine sediments

Altitude (m)	750-1500
Annual rainfall (mm)	400-600
Geology	Recent (2) sediments
Physiographic unit	RA1, RA5 (R2)
CMU (coffee map) unit	G2
Climatic unit	SU4(r)

Farming system	Rice-Pastoralism (1), rice schemes
Farming system group	2o1
Agro-ecological zone	La-4a
Soil group	11
Soil types - dominant	634
- associated	605, 767
- inclusion	109, 207, 647, 673, 729

Ee3: Low, semi-arid Ruaha eastern lowland/valley on lacustrine and old alluvial sediments (RA4 physiographic unit)

Altitude (m)	700-900
Annual rainfall (mm)	550
Geology	Recent (2) sediments
Physiographic unit	RA4 (R3, R4?)
CMU (coffee map) unit	G2
Climatic unit	SU3(r)
Farming system	Maize-Sorghum-Sunflower-Pastoralism (5)
Farming system group	2o1
Agro-ecological zone	La-4a
Soil group	11
Soil types - dominant	204, 647
- associated	-
- inclusion	-

Ee4: Low, semi-arid Ruaha eastern lowland/valley on lacustrine and old alluvial sediments (RA2 physiographic unit)

Altitude (m)	700-900
Annual rainfall (mm)	550
Geology	Recent (2) sediments
Physiographic unit	RA2 (R3, R4)
CMU (coffee map) unit	G2
Climatic unit	SU3(r)
Farming system	Maize-Sorghum-Sunflower-Pastoralism (5)
Farming system group	2o1
Agro-ecological zone	La-4a
Soil group	11
Soil types - dominant	767
- associated	344, 509
- inclusion	-

Agro-ecological zone La-4b, mapping unit Eg2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (total rainfall, length of season)			
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	not applicable	no cultivation
Drought	49	not applicable	no cultivation
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Sodicity	39,41,52	not applicable	no cultivation
Salinity	75	no applicable	no cultivation
Workability	72	not applicable	no cultivation

Eg2: Intermediate, arid, lake Natron shore on lacustrine sediments

Altitude (m)	nd
Annual rainfall (mm)	400-500
Geology	Plio-Pleistocene (3) marl, sand, clay
Physiographic unit	NR1 (N3)
CMU (coffee map) unit	H3
Climatic unit	SU1
Farming system	Pastoralism (2b)
Farming system group	212
Agro-ecological zone	La-4b
Soil group	8
Soil types - dominant	771
- associated	-
- inclusion	731

5.5. LAKE-WESTERN (Lw)

Agro-ecological zone Lw-1a, mapping unit B2s

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation, humidity			
Acidity, fertility	44, 69	Bukoba: Co 1, A/1 1 Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2; Sukuma: Rd 1, 3; NZ: Ma 1, Cs 1, 4, 7, Fo 1	Any farmer (option Ma 1 specific by category)
Fertility (nitrogen)	40,42,43	Bukoba: Fe 1, 3, 4, Ma 6; Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2; Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: K/N 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3, 6; Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, Ca 1, A4, A5	Usually specific by category
Fertility (spec. inputs)	63	Sukuma: A8	Specific by category

B2s: Low to high, semi-arid to humid Kigoma lowlands on sedimentary and metamorphic rocks (part on limestone and basalt)

Altitude (m)	800-1800
Annual rainfall (mm)	600-1300
Geology	Bukoba (1) limestone, basalt
Physiographic unit	PPw5 (P6)
CMU (coffee map) unit	G3
Climatic unit	SM5
Farming system	Cassava-Rice-Oilpalm
Farming system group	1f2
Agro-ecological zone	Lw-1a
Soil group	20
Soil types - dominant	-
- associated	337, 474
- inclusion	113, 505, 687

Agro-ecological zone Lw-1b, mapping unit B2o

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Acidity, fertility	44, 69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Flooding	37,87	A9	Any farmer, but especially good managers
Drainage	38	A9	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: Lu 1d, 8, K/N 2, Rc 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 7 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific by category

B2o: Low to intermediate, semi-humid Western (Tabora, Kibondo, Urambo) swamps on alluvial sediments

Altitude (m)	900-1200
Annual rainfall (mm)	800-1000
Geology	Recent (2) sediments
Physiographic unit	PPp1, PPp3 (P13)
CMU (coffee map) unit	G1
Climatic unit	SU5
Farming system	Rice-Sweet potato
Farming system group	1f1
Agro-ecological zone	Lw-1b
Soil group	13
Soil types - dominant	671, 737
- associated	701, 783
- inclusion	-

Agro-ecological zone Lw-2a, mapping unit B2h

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Acidity, fertility	44, 69	Bukoba: Co 1, Fe 1, A/l 1; Sukuma: K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6 NZ: Cs 1, Io 1, R11	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: K/N 5, 6, 9, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Low organic matter	3,46	Sukuma: In 1	Good manager
Fertility (nitrogen)	40,42,43	Bukoba: Ma6, Fe 1, 3 Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2, 3	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, R1 1	Specific by category
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: K/N 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7 Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3, 6, Mu 2 Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, Ca 1, A4, A5	Usually specific by category

B2h: Intermediate to high, semi-humid Ngara area and Kigoma town on schist and granite

Altitude (m)	1000-1500
Annual rainfall (mm)	800-1000
Geology	Karagwe/Ankolean (1) schist, granite
Physiographic unit	W4 (W4)
CMU (coffee map) unit	C3h
Climatic unit	SC7
Farming system	Coffee-Maize-Bean (2) and Maize-Livestock (Dairy?) (1d)
Farming system group	2d1
Agro-ecological zone	Lw-2a
Soil group	17
Soil types - dominant	366
- associated	115
- inclusion	685, 785

Agro-ecological zone Lw-2b, mapping unit B2e2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Acidity, fertility	44, 69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Flooding	37,87	A9	Any farmer, but especially good managers
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: Lu 1d, 8, K/N 2, Rc 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 7 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific by category

B2e2: Intermediate, semi-humid to humid Mara floodplain on granite and sediments

Altitude (m)	1150-1400
Annual rainfall (mm)	800-1200
Geology	Sub-recent (2) sediments
Physiographic unit	PR (P8)
CMU (coffee map) unit	H2
Climatic unit	SU4(u)
Farming system	Maize-Livestock (Dairy) (1b)
Farming system group	2h1
Agro-ecological zone	Lw-2b
Soil group	10
Soil types - dominant	-
- associated	202, 642
- inclusion	-

Agro-ecological zone Lw-2c, mapping units B211, B213

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard, length of season)			
Acidity, fertility	44, 69	Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5	Specific by category
Capping, surface sealing	4,19,27	Sukuma: Lu 4, Rd 1, 3, Re 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4	Any farmer
Fertility, low organic matter	2,19,20,21	Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1	Any farmer (good and medium managers for option Rc 8; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1	Specific by category
Fertility, low organic matter, drought	25,26	Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2	Any farmer (good and medium managers for option In 1)
Drainage	38	A9	Any farmer
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Low organic matter, workability	4	Sukuma: Mb 1	Specific by category
Workability	72	A14	Good and medium managers
Fertility (better manure quality)	8,9	Sukuma: M/C 1, re 2	Any farmer
Fertility, leaching	30	Sukuma: M/C 2, 3	Spec. category
Fertility (general)	79-82	Sukuma: Lu 3, 4, 5, K/N 4, 5, 6, Rc 3, 5, Re 3, M/C 4, In 1, 2	Specific by category
Fertility (water control)	74	Sukuma: Rc 3	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5	Any farmer
Fertility (special inputs)	63	Sukuma: Boron on cotton	Good managers
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1	Specific by category
Fertility (phosphate)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11	Specific by category
Fertility	54,55,56	Sukuma: Lu 1d, 8, K/N	Specific by

(potassium)		2, Rc 2	category
Fertility (NPK)	58,60	Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6	Specific by category
Fertility (general)	10-18	Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3	Usually specific by category

B211: Intermediate, semi-humid Sukumaland plains on granite and sediments

Altitude (m)	1000-1200
Annual rainfall (mm)	800-1000
Geology	Pleistocene (3) cover over Dodoma gneiss and granite
Physiographic unit	PPs3 (P8)
CMU (coffee map) unit	H4
Climatic unit	SU3(u)
Farming system	Cotton-Maize (1a)
Farming system group	2h2
Agro-ecological zone	Lw-2c
Soil group	18
Soil types - dominant	602
- associated	336, 502
- inclusion	111, 423, 740

B213: Intermediate, semi-arid to semi-humid, south-eastern Bukombe and Sikonge-Msisi plain on granite and gneiss

Altitude (m)	1100
Annual rainfall (mm)	800
Geology	Pleistocene (3) cover over Dodoma gneiss and granite
Physiographic unit	PPw1 (P5)
CMU (coffee map) unit	G7
Climatic unit	SU5
Farming system	Maize-Sorghum-Pastoralism (2)
Farming system group	2h2
Agro-ecological zone	Lw-2c
Soil group	18
Soil types - dominant	336
- associated	423
- inclusion	111, 502, 690, 740

Agro-ecological zone Lw-3a, mapping units D1c, D2d

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard)			
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, R1 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: K/N 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 7; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific by category

D1c: Intermediate, semi-arid commercial ranching area in central-northern Kagera on schist and granite

Altitude (m)	1000-1500
Annual rainfall (mm)	800
Geology	Karagwe/Ankolean schist and granite
Physiographic unit	W4 (W4)
CMU (coffee map) unit	C3h
Climatic unit	SC7??
Farming system	Maize-Livestock (1d)
Farming system group	2d1
Agro-ecological zone	Lw-3a
Soil group	17
Soil types - dominant	366
- associated	115
- inclusion	685, 785

D2d: Intermediate, semi-arid Karagwe (central and north-western Kagera) plains and hills on schist and granite

Altitude (m)	800
Annual rainfall (mm)	800?
Geology	Karagwe/Ankolean (1) schist and granite
Physiographic unit	W4, W5 (W4)
CMU (coffee map) unit	C3h
Climatic unit	SC7?
Farming system	Maize-Livestock (Dairy?) (1d)
Farming system group	2d1
Agro-ecological zone	Lw-3a
Soil group	17
Soil types - dominant	366
- associated	115, 116
- inclusion	685, 785

Agro-ecological zone Lw-3b, mapping units D2r1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (total rainfall, drought hazard, length of season)			
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Drainage	38	A9	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility (potassium)	54,55,56	Sukuma: Lu 1d, 8, K/N 2, Rc 2	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 7 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, Ve 1, RC 1, 2, 7, M/C 5, 6 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility (general)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific by category

D2r1: Intermediate, semi-arid Central and Northern plains on granite and gneiss, Igunga-Tabora plains

Altitude (m)	1100-1300
Annual rainfall (mm)	700-800
Geology	Dodoma granite, gneiss
Physiographic unit	PPw1, PPw8, PH4 (P3)
CMU (coffee map) unit	H4
Climatic unit	SU4(u)
Farming system	Sorghum
Farming system group	2h2 (212)
Agro-ecological zone	Lw-3b
Soil group	18
Soil types - dominant	336, 454
- associated	382, 423
- inclusion	111, 502, 602, 678, 740

D2r2: Intermediate, semi-arid Central-Western plains on continental deposits over granite, Dodoma area

Altitude (m)	1100-1400
Annual rainfall (mm)	500-600
Geology	Pleistocene (3) cover over Dodoma granite
Physiographic unit	PPw8, PPp2 (P9)
CMU (coffee map) unit	H6
Climatic unit	SU3(r)
Farming system	Maize-Groundnut-Livestock
Farming system group	2h2
Agro-ecological zone	Lw-3b
Soil group	18
Soil types - dominant	454, 740
- associated	336
- inclusion	602, 678

D2r3: Intermediate, semi-arid Central-Western plains on continental deposits over granite, Manyani area (CMU-H6 into Western zone)

Altitude (m)	1100-1400
Annual rainfall (mm)	500-600/800
Geology	Pleistocene (3) cover over Dodoma granite
Physiographic unit	PPw7, PPw8, PPp1, PPp2 (P10)
CMU (coffee map) unit	H6
Climatic unit	SU3(r)
Farming system	Maize-Groundnut-Livestock
Farming system group	2h2
Agro-ecological zone	Lw-3b
Soil group	18
Soil types - dominant	454
- associated	336, 423, 691, 702, 740
- inclusion	602, 678

5.6. METAMORPHIC/IGENOUS (Me)

Agro-ecological zone Me-1, mapping unit Ali

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1; NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, 4, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3, 4, 5	Spec. category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category

Ali: Intermediate to very high, humid, Mwese-Mpande range on acid gneiss

Altitude (m)	1100-2500
Annual rainfall (mm)	1200-1300
Geology	Ubendian gneiss
Physiographic unit	PC2 (P2)
CMU (coffee map) unit	G6h
Climatic unit	SH5
Farming system	Maize-Bean (2)
Farming system group	2b3
Agro-ecological zone	Me-1
Soil group	25c
Soil types - dominant	335, 473, 506?
- associated	364, 421
- inclusion	111, 210, 651

Agro-ecological zone Me-2a, mapping units A2c, A2d4, A2e

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Flooding	37,87	A9	Any farmer, but especially good managers
Salinity	75	NZ: A10	Good manager
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers

A2c: Intermediate, humid Karema depression on alluvial and lacustrine sediments and gneiss

Altitude (m)	1000-1300
Annual rainfall (mm)	1200
Geology	Ubendian gneiss
Physiographic unit	RP1 (R1)
CMU (coffee map) unit	G6
Climatic unit	SH3
Farming system	Maize-Bean (2)
Farming system group	2b3
Agro-ecological zone	Me-2a
Soil group	25c
Soil types - dominant	364?, 473
- associated	-
- inclusion	111, 335, 651, 735

A2d4: Low, humid Lake Nyasa shore on gneiss and sediments or schist and granite

Altitude (m)	500-900
Annual rainfall (mm)	1000-1500
Geology	Mocambique gneiss or Karagwe/Ankolean (1) schist and granite
Physiographic unit	HM3 (H3)
CMU (coffee map) unit	D4 (G5?)
Climatic unit	SC8
Farming system	Cassava-Rice
Farming system group	1b1
Agro-ecological zone	Me-2a
Soil group	25b?
Soil types - dominant	272
- associated	(106, 475?)
- inclusion	111

A2e: Low, humid, Lake Tanganyika shore areas on schist and granite

Altitude (m)	700-1000/1600
Annual rainfall (mm)	1000-1500
Geology	Karagwe/Ankolean (1) schist and granite
Physiographic unit	U2, (H3?)(U)
CMU (coffee map) unit	G5
Climatic unit	SH3
Farming system	Cassava-Rice
Farming system group	1b1
Agro-ecological zone	Me-2a
Soil group	25b
Soil types - dominant	106, 475 (339?), (504?)
- associated	-
- inclusion	-

Agro-ecological zone Me-2b, mapping unit A2b

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and drought (length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Workability	72	A14	Good and medium managers

A2b: Intermediate, humid northern Sengerema, Ukerewe, western Mara on granite

Altitude (m)	1200-1300
Annual rainfall (mm)	1000-1200
Geology	Basement Complex granite
Physiographic unit	PPw1, PH1, PH4 (P4)
CMU (coffee map) unit	H5h
Climatic unit	SU4(u), (SM3)
Farming system	Maize-Cassava-Cotton-Rice
Farming system group	2g1
Agro-ecological zone	Me-2b
Soil group	25e
Soil types - dominant	335a
- associated	111, 381, 421a
- inclusion	131, 501, 683, 691, 735, 741

Agro-ecological zone Me-2c, mapping unit A3a

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint humidity			
Drainage	38	A9	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Flooding	37,87	A9	Any farmer, but especially good managers

A3a: Low to very low, humid, Kyela plain on lacustrine and alluvial deposits

Altitude (m)	500
Annual rainfall (mm)	1000-2600
Geology	Recent (2) lake and stream deposits
Physiographic unit	HL (H4)
CMU (coffee map) unit	F1
Climatic unit	SC8
Farming system	Rice-Cocoa
Farming system group	1c1
Agro-ecological zone	Me-2c
Soil group	9
Soil types - dominant	647
- associated	206
- inclusion	-

Agro-ecological zone Me-3, mapping unit Blc

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Gm 1, 2 Sukuma: Rc 8, Re 1, 2, 4, Rd 4 NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2 Sukuma: Lu 4, 5, K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2, 3	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1	Any farmer (good and medium managers for options Io 1 and

		NZ: Cs 1, Io 1, R11	Rc 8; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

B1c: High to very high, semi-humid to humid Kate-Mwazye hills and Nkungwe mountain on schist and granite

Altitude (m)	1500-2300
Annual rainfall (mm)	850-1200
Geology	Karagwe/Ankolean (1) schist and granite
Physiographic unit	U3, U5 (U)
CMU (coffee map) unit	D3a (D6?)
Climatic unit	SH3, (SH5)
Farming system	Maize-Fingermillet (1a)
Farming system group	1e1
Agro-ecological zone	Me-3
Soil group	25a
Soil types - dominant	339, 475, 504
- associated	115, 422
- inclusion	685

Agro-ecological zone Me-4a, mapping units B2a1-2, B2d1-4, B2j1-4, B2k

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Gm 1, 2; Sukuma: Rc 8, Re 1, 2, 4, Rd 4 NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2 Sukuma: Lu 4, 5, K/N 5, 6, Rc 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1;	Any farmer (good and medium managers for options Io 1 and

		NZ: Cs 1, Io 1, R11	Rc 8; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, R1 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Workability	72	A14	Good and medium managers

B2a1: Intermediate to high, semi-humid Yambamrizi range and Ipumba hills on gneiss, schist and granite (physiographic unit U3 part)

Altitude (m)	1000-2000
Annual rainfall (mm)	900-1000
Geology	Ubendian gneiss, Karagwe/Ankolean (1) schist and granite
Physiographic unit	U3 (U)
CMU (coffee map) unit	D6 (D3a?)
Climatic unit	SH3
Farming system	Maize-Fingermillet (1a)
Farming system group	1e1
Agro-ecological zone	Me-4a
Soil group	25a
Soil types - dominant	473
- associated	111, 421
- inclusion	339, 501, 685

B2a2: Intermediate to high, semi-humid Yambamrizi range and Ipumba hills on gneiss, schist and granite (physiographic unit U6 part)

Altitude (m)	1000-2000
Annual rainfall (mm)	900-1000
Geology	Ubendian gneiss, Karagwe/Ankolean (1) schist and granite
Physiographic unit	U6 (U)
CMU (coffee map) unit	D6
Climatic unit	SH3
Farming system	Maize-Fingermillet (1a)
Farming system group	1e1
Agro-ecological zone	Me-4a
Soil group	25a
Soil types - dominant	-
- associated	210, 339, 651
- inclusion	-

B2d1: Low to high, semi-humid to humid Uruwira plain on gneiss

Altitude (m)	850-1600
Annual rainfall (mm)	900-1200
Geology	Ubendian gneiss
Physiographic unit	PPw6, PH2 (P6)
CMU (coffee map) unit	G6
Climatic unit	SU5
Farming system	Tobacco-Pastoralism (1a)
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	-
- associated	335, 501
- inclusion	111, 473, 691

B2d2: Intermediate to high, semi-humid to humid, shallow soils areas in Southern Highlands on gneiss and schist, Mwambwa-Mweza plain, Mpemba-Msangano-Utambella through

Altitude (m)	1500-1800
Annual rainfall (mm)	1000
Geology	Ubendian gneiss, Basement Complex
Physiographic unit	U1 (U)
CMU (coffee map) unit	D6
Climatic unit	SM4, (SH3)
Farming system	Maize-Fingermillet (1b)
Farming system group	2d2
Agro-ecological zone	Me-4a
Soil group	25d
Soil types - dominant	335, 501
- associated	421, 477
- inclusion	685

B2d3: Intermediate, semi-humid to humid, Western plateau on gneiss

Altitude (m)	1100
Annual rainfall (mm)	900-1200
Geology	Ubendian gneiss
Physiographic unit	PPw3 (P5)
CMU (coffee map) unit	G6
Climatic unit	SU5
Farming system	Maize-Bean (2)
Farming system group	2b3
Agro-ecological zone	Me-4a
Soil group	25c
Soil types - dominant	335, 473
- associated	-
- inclusion	691, 735

B2d4: Intermediate, semi-humid Inyonga and Kipembawe plains on gneiss

Altitude (m)	1000-1200
Annual rainfall (mm)	900-1000
Geology	Ubendian gneiss
Physiographic unit	PPw3, PM1 (P5)
CMU (coffee map) unit	G6
Climatic unit	SU5
Farming system	Maize-Sorghum (2)
Farming system group	2b3
Agro-ecological zone	Me-4a

Soil group	25c
Soil types - dominant	335, 473
- associated	-
- inclusion	111, 501, 691, 735

B2j1: Intermediate, semi-humid Bukombe-Kahama plateau on granite and intermediate and basic metamorphic rocks (granite, gneiss) (part on granite and gneiss)

Altitude (m)	1100-1300
Annual rainfall (mm)	800-1000
Geology	Dodoma granite and gneiss
Physiographic unit	PPw1, PH1 (P4)
CMU (coffee map) unit	C6
Climatic unit	SU5, SM3
Farming system	Maize-Groundnut-Tobacco-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	335
- associated	421
- inclusion	111, 131, 501, 691, 735

B2j2: Intermediate, semi-humid Bukombe-Kahama plateau on granite and intermediate and basic metamorphic rocks (granite, gneiss) (part on basic metamorphic rocks with ironstone)

Altitude (m)	1100-1300
Annual rainfall (mm)	800-1000
Geology	Basement Complex (or Dodoma) gneiss, granite
Physiographic unit	PPw2 (P4)
CMU (coffee map) unit	C6
Climatic unit	SU5, SM3
Farming system	Maize-Groundnut-Tobacco-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	-
- associated	381
- inclusion	111, 683, 741

B2j3: Intermediate, semi-humid Tabora plain on granite and gneiss

Altitude (m)	1000-1200
Annual rainfall (mm)	800-900
Geology	Dodoma granite, gneiss
Physiographic unit	PPw1 (P3, P5)
CMU (coffee map) unit	C6
Climatic unit	SU4
Farming system	Maize-Groundnut-Tobacco-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	335
- associated	421
- inclusion	111, 501, 691, 735

B2j4: Intermediate, semi-humid hills ranges on Tabora plain on granite and gneiss

Altitude (m)	nd
Annual rainfall (mm)	800-900
Geology	Dodoma granite, gneiss
Physiographic unit	RT (P3, P5)
CMU (coffee map) unit	C6h
Climatic unit	SU4
Farming system	Maize-Groundnut-Tobacco-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	111
- associated	-
- inclusion	335, 421, 501, 691, 735

B2k: Intermediate, semi-humid Sukumaland plains on granite and sediments, Basement Complex part (including western P4 part and physiographic units PPw1, PH1, PH4 in eastern P8 part)

Altitude (m)	1200-1300
Annual rainfall (mm)	800-1000
Geology	Basement Complex granite, gneiss
Physiographic unit	PPw1, PH1, PH4 (P4, P8)
CMU (coffee map) unit	H5h
Climatic unit	SM3
Farming system	Maize-Groundnut-Tobacco-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-4a
Soil group	25e
Soil types - dominant	335, 421, 691, 735
- associated	131, 381, 701
- inclusion	111, 501, 604, 683

Agro-ecological zone Me-4b, mapping units B2p1, B2r, B3c1-3, B3d1-2, B3h1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category

Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Workability	72	A14	Good and medium managers

B2p1: Low, semi-humid Mahenge basin, Mkulula valley and Kilosa (west Mikumi) on gneiss

Altitude (m)	900-1000
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	EF (E7)
CMU (coffee map) unit	B5h
Climatic unit	SH5
Farming system	Maize-Sorghum-Pastoralism (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	-
- associated	363, 412
- inclusion	111

B2r: Low to intermediate, semi-humid Kilombero-Mahenge plain on gneiss

Altitude (m)	1000
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (5) cover over gneiss
Physiographic unit	EPh5 (E3)
CMU (coffee map) unit	B4
Climatic unit	SH5
Farming system	Cotton-Maize (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	476
- associated	453, 503
- inclusion	111, 688

B3c1: Low, semi-humid, wet Eastern lowland footslopes on gneiss (CMU-H5 part)

Altitude (m)	500-1000
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	EPh1 (E4)
CMU (coffee map) unit	B5
Climatic unit	SH2
Farming system	Cotton-Maize (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26

Soil types - dominant	362
- associated	412
- inclusion	-

B3c2: Low, semi-humid, wet Eastern lowland footslopes on gneiss (CMU-B5H part)

Altitude (m)	500-1000
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	EF, (EPh1?), EI1 (E4)
CMU (coffee map) unit	B5h
Climatic unit	SH2
Farming system	Cotton-Maize (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	335, 362?
- associated	412, 473
- inclusion	111

B3c3: Low, semi-humid, south Masisi plain on acid metamorphic rocks (gneiss)

Altitude (m)	400-500
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	EPh8 (E5)
CMU (coffee map) unit	B5d
Climatic unit	SM4, SH3
Farming system	Sorghum-Millet-Bambara groundnuts (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	335
- associated	412, 473
- inclusion	111

B3d1: Low, semi-humid Nachingwea plain on intermediate metamorphic rocks (gneiss)

Altitude (m)	500 or more
Annual rainfall (mm)	800-1000
Geology	Plio-Pleistocene (5) cover over gneiss
Physiographic unit	EPh4 (E5)
CMU (coffee map) unit	B4
Climatic unit	SM4
Farming system	Maize-Sesame (1a)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	363
- associated	453, 503
- inclusion	-

B3d2: Low to very low, semi-humid, south-eastern Tunduru and Western Nachingwea plains on gneiss

Altitude (m)	500-600/1200?
Annual rainfall (mm)	500-800/1000
Geology	Plio-Pleistocene (5) cover over gneiss
Physiographic unit	EPh5 (E5)

CMU (coffee map) unit	B4
Climatic unit	SH3, SM4
Farming system	maize-Sesame (1a)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	476
- associated	453, 503
- inclusion	111, 688

B3h1: Low to very low, semi-humid, Eastern plains on metamorphic rocks and alluvial sediments

Altitude (m)	250-1000
Annual rainfall (mm)	800-1000
Geology	Mocambique gneiss
Physiographic unit	EPh8 (E4)
CMU (coffee map) unit	B5d
Climatic unit	SH2
Farming system	Cotton-Maize (1b)
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	335
- associated	412, 473
- inclusion	111

B3h2: Very low to low, semi-humid Muheza plain on gneiss

Altitude (m)	150-500
Annual rainfall (mm)	1000
Geology	Mocambique gneiss
Physiographic unit	EPh1 (E6)
CMU (coffee map) unit	B5
Climatic unit	DM1-3
Farming system	Maize-Sorghum (2a), sisal
Farming system group	2m1
Agro-ecological zone	Me-4b
Soil group	26
Soil types - dominant	362
- associated	412
- inclusion	-

Agro-ecological zone Me-4c, mapping unit B3a

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2,3,5, 6,8, K/N 1a,1c,3,4,6, 8,11, Ve 1,2, Rc 3,4, 7,8, Rd 1,4, Mb 1, M/C4,6, Re4, In 1, A3 NZ: Cm 1, Ma 1,3,5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7; NZ: Fe1,2	Spec. by category (esp. with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

B3a: Very low to low, semi-humid to humid Kilombero valley on alluvial sediments

Altitude (m)	< 500
Annual rainfall (mm)	1000-1200/1500
Geology	Pleistocene (1)
Physiographic unit	EA2a, EA2b (E10)
CMU (coffee map) unit	B2
Climatic unit	SH4
Farming system	Rice-Maize-Cassava-Cotton and s/cane
Farming system group	1g2
Agro-ecological zone	Me-4c
Soil group	12
Soil types - dominant	205, 611
- associated	633, 648
- inclusion	-

Agro-ecological zone Me-5a, mapping units C2a1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low	25,26	Bukoba: Ma 7, Co 1,	Any farmer (good

organic matter, drought		Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	and medium managers for options Ma 7 and In 1)
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

**C2a1: Intermediate to high, semi-arid to humid Chunya dissected plain
on gneiss**

Altitude (m)	1200-1800
Annual rainfall (mm)	700-1300
Geology	Ubendian gneiss (maybe Basement complex/Dodoma hills)
Physiographic unit	PH5 (P5)
CMU (coffee map) unit	C5d
Climatic unit	SH3, SM4
Farming system	Tobacco-Pastoralism (1a)
Farming system group	2g1
Agro-ecological zone	Me-5a
Soil group	25e
Soil types - dominant	111
- associated	421
- inclusion	274

**C2a2: Intermediate to high, semi-arid to semi-humid, shallow soil
areas in Southern Highlands, Tunduma-Ndalambo stretch, Lyambalyomfipa
escarpment**

Altitude (m)	1000/1400-1700
Annual rainfall (mm)	750-900
Geology	Ubendian gneiss
Physiographic unit	RT, HP6 (R1?)
CMU (coffee map) unit	D6
Climatic unit	SH3
Farming system	Maize-Fingermillet (1b)
Farming system group	2d2
Agro-ecological zone	Me-5a
Soil group	25d
Soil types - dominant	111
- associated	-
- inclusion	-

Agro-ecological zone Me-5b, mapping units B3b, B3i, C3i

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Salinity	75	NZ: A10	Good manager

B3b: Very low, semi-humid to humid Rufiji valley on alluvial sediments

Altitude (m)	<200
Annual rainfall (mm)	1000-1200
Geology	Recent (1) sediments
Physiographic unit	CG1, CF2 (C4)
CMU (coffee map) unit	A1
Climatic unit	SM1(u)
Farming system	Rice-Maize-Cassava
Farming system group	1h3
Agro-ecological zone	Me-5b
Soil group	28
Soil types - dominant	-
- associated	201, 641, 751, 761
- inclusion	621

B3i: Very low, semi-humid to humid coastal floodplains and deltas

Altitude (m)	<100
Annual rainfall (mm)	1000
Geology	Recent (1) sediments
Physiographic unit	CF1 (C4)
CMU (coffee map) unit	A1
Climatic unit	DM3, SM1(u)
Farming system	Rice-Maize-Cassava
Farming system group	1h3
Agro-ecological zone	Me-5b
Soil group	28
Soil types - dominant	-
- associated	201, 641
- inclusion	621

C3i: Very low, semi-arid to semi-humid Rufiji valley on alluvial sediments

Altitude (m)	<200
Annual rainfall (mm)	800
Geology	Recent (1) sediments
Physiographic unit	CF1, CF2 (C4)
CMU (coffee map) unit	A1
Climatic unit	SM1(u)
Farming system	Rice-Maize-Cassava
Farming system group	1h3
Agro-ecological zone	Me-5b
Soil group	28
Soil types - dominant	-
- associated	201, 641, 751?, 761
- inclusion	621

Agro-ecological zone Me-5c, mapping units C3a1-2, C3b, C3c

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1; NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter,	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2	Any farmer (good and medium

drought		Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	managers for options Ma 7 and In 1)
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Workability	72	A14	Good and medium managers

C3a1: Very low to low, semi-humid Eastern plains on gneiss, Handeni-Segera-Mkata plains

Altitude (m)	200-1000
Annual rainfall (mm)	500/800-1000
Geology	Mocambique gneiss
Physiographic unit	EPh1 (E3)
CMU (coffee map) unit	B5
Climatic unit	DM3
Farming system	Maize-Sorghum-Sisal
Farming system group	2m1
Agro-ecological zone	Me-5c
Soil group	26
Soil types - dominant	362
- associated	412
- inclusion	-

C3a2: Low, semi-arid to semi-humid Eastern lowland footslopes on gneiss (C-climatic part)

Altitude (m)	500-1000
Annual rainfall (mm)	800
Geology	Mocambique gneiss
Physiographic unit	EPh1 (E4)
CMU (coffee map) unit	B5
Climatic unit	SH2
Farming system	Cotton-Maize (1b)
Farming system group	2m1
Agro-ecological zone	Me-5c
Soil group	26
Soil types - dominant	362
- associated	412
- inclusion	-

C3b: Very low, semi-arid to semi-humid Eastern and Southern plains on gneiss (CMU-B4 part)

Altitude (m)	<500
Annual rainfall (mm)	750-900
Geology	Plio-Pleistocene (5) coastal cover over Mocambique gneiss
Physiographic unit	EPh2, EPh5, EPh7 (E3)
CMU (coffee map) unit	B4
Climatic unit	SM1(u)
Farming system	Maize-Sesame (1a)
Farming system group	2m1
Agro-ecological zone	Me-5c
Soil group	26
Soil types - dominant	334, 363, 413, 476

- associated	452 (453), 503
- inclusion	111, 688, 736

C3c: Very low, semi-arid to semi-humid Eastern and Southern plains on gneiss (CMU-B5 part)

Altitude (m)	<500
Annual rainfall (mm)	500-1000
Geology	Plio-Pleistocene (5) coastal sand cover over Mocambique gneiss
Physiographic unit	EPh3 (E3)
CMU (coffee map) unit	B5
Climatic unit	SM1(u)
Farming system	Maize-Sesame (1a)
Farming system group	2m1
Agro-ecological zone	Me-5c
Soil group	26
Soil types - dominant	-
- associated	413, 473
- inclusion	736

Agro-ecological zone Me-5d, mapping units B3j1-2, C3h

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Fertility, low organic matter, drought	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Lu 4, 5, 7, K/N 5, 6, 9, Rc 5, 6, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

B3j1: Very low, semi-humid Eastern plains on alluvial sediments (CMU-B1 part)

Altitude (m)	400-500
Annual rainfall (mm)	800-1200
Geology	Sub-recent (1) sediments
Physiographic unit	EA1 (E9)
CMU (coffee map) unit	B1
Climatic unit	SH2
Farming system	Rice-Maize-Cassava-Sisal
Farming system group	1h1
Agro-ecological zone	Me-5d
Soil group	23
Soil types - dominant	632
- associated	-
- inclusion	724, 781

B3j2: Very low, semi-humid Eastern plains on alluvial sediments (CMU-A2 part)

Altitude (m)	<500
Annual rainfall (mm)	800-1000
Geology	Sub-recent (1) sediments
Physiographic unit	CT, CH3 (C5)
CMU (coffee map) unit	A2
Climatic unit	SM1(u)
Farming system	Rice-Maize-Sweet potato
Farming system group	1h1
Agro-ecological zone	Me-5d
Soil group	23
Soil types - dominant	601
- associated	332, 521, 723
- inclusion	631, 677, 761

C3h: Very low, semi-arid Eastern plain on alluvial sediments (C-climatic part)

Altitude (m)	<500
Annual rainfall (mm)	800
Geology	Sub-recent (1) sediments
Physiographic unit	CT, CH3 (C5)
CMU (coffee map) unit	A2
Climatic unit	SM1(u)
Farming system	Rice-Maize-Sweet potato
Farming system group	1h1
Agro-ecological zone	Me-5d
Soil group	23
Soil types - dominant	-
- associated	332, 521, 723
- inclusion	631, 677

Agro-ecological zone Me-6a, mapping unit D1a

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint temperature			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Flooding	37,87	A9	Any farmer, esp. good managers
Salinity	75	NZ: A10	Good manager

D1a: Intermediate to high, semi-arid to semi-humid Namanyere-Laela plain on gneiss

Altitude (m)	1200-1700
Annual rainfall (mm)	750-900
Geology	Ubendian gneiss, granite?
Physiographic unit	U1 (U)
CMU (coffee map) unit	D6
Climatic unit	SH3, (SH5)
Farming system	Maize-Fingermillet (2)
Farming system group	2d2
Agro-ecological zone	Me-6a
Soil group	25d
Soil types - dominant	335, 501
- associated	210, 421, 477, 651
- inclusion	685

Agro-ecological zone Me-6b, mapping units D2b1-2, D2c, D2f, D2n, D2q1-4

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season, total rainfall)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Salinity	75	NZ: A10	Good manager
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Workability	72	A14	Good and medium managers

D2b1: Intermediate, semi-arid to semi-humid Chunya plains on gneiss

Altitude (m)	1000-1500
Annual rainfall (mm)	700-900
Geology	Ubendian gneiss
Physiographic unit	Ppw3 (P3)
CMU (coffee map) unit	C5
Climatic unit	SM4-SU4(r)
Farming system	Maize-Sorghum-Pastoralism (3)
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	335, 473
- associated	-
- inclusion	691, 735

D2b2: Intermediate, semi-arid to semi-humid Wago hills on granite, gneiss and basic metamorphic rocks and ironstone

Altitude (m)	1000-1500
Annual rainfall (mm)	700-900
Geology	Ubendian granite and gneiss
Physiographic unit	PH1, PH4 (P3)
CMU (coffee map) unit	C5h
Climatic unit	SM4-SU4(r)
Farming system	Maize-Sorghum-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	421
- associated	111, 131, 381
- inclusion	108, 335

D2c: Intermediate, semi-arid north Iringa shallow soil hill range on granite and gneiss

Altitude (m)	1000-1500?
Annual rainfall (mm)	600-700
Geology	Dodoma granite and gneiss
Physiographic unit	RT, PH1 (P2, H1, H7)
CMU (coffee map) unit	C6h
Climatic unit	SU5?
Farming system	Maize-Sorghum-Pastoralism (3)
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	111
- associated	131, 335, 421
- inclusion	-

D2f: Intermediate, semi-arid Mpwapwa and east Kondoa plains on gneiss

Altitude (m)	1000-1300?
Annual rainfall (mm)	550-800
Geology	Mocambique gneiss
Physiographic unit	EPa1, EPa2 (E2)
CMU (coffee map) unit	C4
Climatic unit	SU2
Farming system	Maize-Sorghum-Pastoralism (3)
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e

Soil types - dominant	461
- associated	735
- inclusion	111, 501, 763

D2n: Intermediate, semi-arid Meatu-Maswa, Shinyanga areas on Basement complex granite

Altitude (m)	nd
Annual rainfall (mm)	600-800
Geology	Basement complex granite
Physiographic unit	PPw1, PH1 (P8)
CMU (coffee map) unit	H5h
Climatic unit	SU3(u)
Farming system	Cotton-Sorghum-Pastoralism
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	335, 421
- associated	-
- inclusion	111, 131, 501, 691, 735

D2q1: Intermediate, semi-arid Central and Northern zone plains on granite and gneiss, north Singida, north-west Kondoa area

Altitude (m)	1100-1300
Annual rainfall (mm)	600-800
Geology	Dodoma granite, gneiss
Physiographic unit	PPw1, Pp2, PPs3, PH4 (P1, P2)
CMU (coffee map) unit	C6
Climatic unit	SU2
Farming system	Maize-Groundnut-Livestock
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	335, 735
- associated	381, 421
- inclusion	111, 501, 603, 691

D2q2: Intermediate, semi-arid Central and Northern zones plains on granite and gneiss, south Singida plain

Altitude (m)	1100-1300
Annual rainfall (mm)	600-800
Geology	Dodoma granite, gneiss
Physiographic unit	PPw1, PH1 (P2, P3)
CMU (coffee map) unit	C6
Climatic unit	SU3(r)
Farming system	Maize-Groundnut-Livestock
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	335, 421
- associated	-
- inclusion	111, 131, 501, 691, 735

D2q3: Intermediate, semi-arid Central and Northern zones plains on granites and gneiss, western Kondoa, Dodoma and southern Mbulu hills

Altitude (m)	1100-1300
Annual rainfall (mm)	600
Geology	Dodoma granite, gneiss
Physiographic unit	PH2, PH3, (P1, P2)

CMU (coffee map) unit	C6h
Climatic unit	SU2
Farming system	Maize-Groundnut-Livestock
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	111, 421
- associated	131, 335
- inclusion	-

D2q4: Intermediate, semi-arid Central and Northern zones plains on granite and gneiss, south Singida hills

Altitude (m)	1100-1300
Annual rainfall (mm)	600-800
Geology	Dodoma granite, gneiss
Physiographic unit	PH1, PPw1 (P2, P3)
CMU (coffee map) unit	C6h
Climatic unit	SU3(r)
Farming system	Maize-Groundnut-Livestock
Farming system group	2g1
Agro-ecological zone	Me-6b
Soil group	25e
Soil types - dominant	421
- associated	111, 131
- inclusion	335

Agro-ecological zone Me-7, mapping units D2a2, D3a, D3b1-2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraint drought (drought hazard, length of season, total rainfall)			
Acidity, fertility	44,69	Bukoba: Co 1, A/1 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Lu 4, Rd 1, 3, Re 1 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drainage	38	A9	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility, manure	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 6, 8, K/N 1a, 1c, 3, 4, 6, 8, 11, Ve 1, 2, Rc 3, 4, 7, 8, Rd 1, 4, Mb 1, M/C 4, 6, Re 4, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 6, 8, K/N 4, 8, 11, Ve 2, Rc 2, 3, 7; NZ: Fel,2	Spec. by category (especially with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Overgrazing	6,7	Sukuma: Lu 5, K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers

D2a2: Low to intermediate, semi-arid to semi-humid Usambara footslopes on gneiss

Altitude (m)	500-1200
Annual rainfall (mm)	600-1000
Geology	Mocambique gneiss, possible some Plio-Pleistocene (5) cover?
Physiographic unit	EM1 (E2)
CMU (coffee map) unit	B5h
Climatic unit	DM1
Farming system	Maize-Bean (5b) and Maize-Sorghum-

	Pastoralism (4)
Farming system group	2m1
Agro-ecological zone	Me-7
Soil group	26
Soil types - dominant	461
- associated	412
- inclusion	111, 363

D3a: Very low, semi-arid to semi-humid Eastern plains on gneiss, Mkata-Msata plains

Altitude (m)	300-400
Annual rainfall (mm)	500/700-800/1000
Geology	Plio-Pleistocene (5) cover over Mocambique gneiss
Physiographic unit	EPh8 (E3)
CMU (coffee map) unit	B5d
Climatic unit	DM3
Farming system	Sorghum-Millet-Grain legumes (1b), ranching
Farming system group	2m1
Agro-ecological zone	Me-7
Soil group	26
Soil types - dominant	334
- associated	413, 476
- inclusion	111

D3b1: Very low to low, semi-arid Eastern plains on gneiss, north-western Handeni, west Korogwe, north-eastern Usambara areas (CMU-B5 part)

Altitude (m)	200-750
Annual rainfall (mm)	500-800/1000
Geology	Mocambique gneiss
Physiographic unit	EPh1, EPa1 (E3)
CMU (coffee map) unit	B5 (C4?)
Climatic unit	SU3(u), SU2
Farming system	Maize-Sorghum-Pastoralism (4)
Farming system group	2m1
Agro-ecological zone	Me-7
Soil group	26
Soil types - dominant	362, 412
- associated	461
- inclusion	111, 501, 735

D3b2: Very low to low, semi-arid Eastern plains on gneiss, north-western Handeni, west Korogwe, north-eastern Usambara (CMU-B5h part)

Altitude (m)	500-1200
Annual rainfall (mm)	500-1000
Geology	Mocambique gneiss
Physiographic unit	EM1 (E2)
CMU (coffee map) unit	B5h
Climatic unit	SU3(u), SU2
Farming system	Maize-Sorghum-Pastoralism (4)
Farming system group	2m1
Agro-ecological zone	Me-7
Soil group	26
Soil types - dominant	461
- associated	412
- inclusion	363

5.7. SANDSTONE (Sa)

Agro-ecological zone Sa-1, mapping units A2f, A2g

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Mu 1, 2, Gm 1, 2 Sukuma: Re 1, 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2; Sukuma: Lu 4, 5, K/N 5, 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3, Mu 2; Sukuma: Lu 1a, 2, 3, 5, 8, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. by category (especially when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat.for options Lu 1a and In 1

A2f: Low, semi-humid south-eastern Songea and west Tunduru plains on gneiss and locally on shale and sandstone, parts on Karroo sandstone

Altitude (m)	500-800
Annual rainfall (mm)	>1000
Geology	Karoo sandstone, shale
Physiographic unit	SU (S2)
CMU (coffee map) unit	B5h
Climatic unit	SH3
Farming system	Cashew (1)
Farming system group	2i1
Agro-ecological zone	Sa-1
Soil group	14
Soil types - dominant	342
- associated	-
- inclusion	526, 693

A2g: Humid area west of Kyela plain, higher altitude, on Karroo sandstone and shale

Altitude (m)	nd
Annual rainfall (mm)	nd
Geology	Karoo sandstone, shale
Physiographic unit	RT
CMU (coffee map) unit	F2d
Climatic unit	nd
Farming system	Maize-Forest (1a)
Farming system group	2i1
Agro-ecological zone	Sa-1
Soil group	14
Soil types - dominant	110
- associated	-
- inclusion	-

Agro-ecological zone Sa-2a, mapping unit B3f

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (total rainfall)			
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Gm 1, 2; Sukuma: Re 1, 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2 Sukuma: Lu 4, 5, K/N 5, 6, M/C 4, In 2 NZ: Rl 1	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 8, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate,TSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for options Io 1 and Rc 8; spec. by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

B3f: Very low to intermediate, semi-arid to semi-humid Eastern and Southern plains and plateaux on shale and sandstone

Altitude (m)	<600-1100
Annual rainfall (mm)	600-1000
Geology	Plio-Pleistocene (4) coastal sand cover and Karroo sandstone
Physiographic unit	SU (S2)
CMU (coffee map) unit	B3
Climatic unit	SH2, SH3
Farming system	Cashew (1,2)
Farming system group	2i1
Agro-ecological zone	Sa-2a
Soil group	14
Soil types - dominant	340 (342)
- associated	-
- inclusion	(526) 527, 692 (693)

Agro-ecological zone Sa-2b, mapping units B3g1-3

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (length of season)			
Compaction	70	NZ: Cs 5	Spec. by category
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Gm 1, 2; Sukuma: Re 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2 Sukuma: K/N 5, 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2	Spec. cat (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertilit, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: In 1	Good manager
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Salinity	75	NZ: A10	Good manager
Workability	72	A14	Good and medium managers

B3g1: Very low, semi-humid Makonde plateau on sandstone, limestone and shale

Altitude (m)	200-500
Annual rainfall (mm)	800-1000
Geology	Jurassic-Paleogene
Physiographic unit	CH2 (C2)
CMU (coffee map) unit	A5
Climatic unit	SM1(u)
Farming system	Cashew (1), Coconut-Cassava-Cashew
Farming system group	2n1
Agro-ecological zone	Sa-2b
Soil group	15b
Soil types - dominant	541
- associated	674
- inclusion	-

B3g2: Very low, semi-humid, Southern hinterland hills and plains on sandstone, limestone, shale (CMU-A5d part)

Altitude (m)	100-200?
Annual rainfall (mm)	800-1000
Geology	Jurassic-Paleogene
Physiographic unit	CD2, CD3, CH2 (C3)
CMU (coffee map) unit	A5d
Climatic unit	SM1(u)
Farming system	Coconut-Cassava-Cashew
Farming system group	1g1
Agro-ecological zone	Sa-2b
Soil group	15a
Soil types - dominant	541
- associated	107 (112), 236, 674, 722
- inclusion	-

B3g3: Very low, semi-humid, Eastern hinterland hills and plains on sandstone, limestone, shale (CMU-A5 part)

Altitude (m)	<200/500
Annual rainfall (mm)	500/800-1000
Geology	Jurassic-Paleogene
Physiographic unit	CH2 (C1)
CMU (coffee map) unit	A5
Climatic unit	SM1(u)
Farming system	Coconut-Cassava-Cashew
Farming system group	1g1
Agro-ecological zone	Sa-2b
Soil group	15a
Soil types - dominant	541
- associated	674
- inclusion	-

Agro-ecological zone Sa-3a, mapping units C2d1-2, C2f, C3g

Likely constraint	IPNM strategy	IPNM technical options	Categories of farmers
Climatic constraint radiation and drought (drought hazard, total rainfall)			
Acidity, fertility	44,69	Bukoba: Co 1, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Drought	35,73	Sukuma: Al, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, Lu 4, 5, 7, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Erosion, low organic matter	71	Bukoba: Cl 1, Re 3, Gm 1, 2 Sukuma: Re 1, 2, 4, Rd 4; NZ: Cs 3	Any farmer
Erosion, fertility, low organic matter	28	Bukoba: Gm 2; Sukuma: Lu 4, 5, K/N 5, 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 8, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat (esp when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: Lu 1b, 7, K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphateTSP,SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Re 1 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/l 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1,	Specific by category

		M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

C2d1: Low, semi-arid to (semi-)humid Ruhuhu valley lowlands on alluvial and lacustrine sediments

Altitude (m)	500-900
Annual rainfall (mm)	600-1300
Geology	Karoo sandstone, shale
Physiographic unit	EA4a (E11)
CMU (coffee map) unit	F2d
Climatic unit	SH3-5
Farming system	Maize-Bean (4b)
Farming system group	2i1
Agro-ecological zone	Sa-3a
Soil group	14
Soil types - dominant	342
- associated	527
- inclusion	693

C2d2: Low to intermediate, semi-humid, dissected sedimentary plateau in Southern zone on shale and sandstone

Altitude (m)	200-1000
Annual rainfall (mm)	800-900
Geology	Karoo sandstone, shale
Physiographic unit	SD (S2)
CMU (coffee map) unit	B3d
Climatic unit	nd
Farming system	Cashew (2)
Farming system group	2i1
Agro-ecological zone	Sa-3a
Soil group	14
Soil types - dominant	342
- associated	-
- inclusion	527, 650, 693

C2f: Low to intermediate, semi-humid sedimentary plateau in Southern zone on shale and sandstone

Altitude (m)	nd
Annual rainfall (mm)	nd
Geology	Plio-Pleistocene (4) coastal sand cover over Karroo
Physiographic unit	SU (S2)
CMU (coffee map) unit	B3
Climatic unit	nd
Farming system	Maize-Sesame (1b)
Farming system group	2i1
Agro-ecological zone	Sa-3a
Soil group	14
Soil types - dominant	340
- associated	-
- inclusion	526, 692

**C3g: Very low to intermediate, semi-arid to semi-humid dissected
sedimentary plateau in Eastern zone on shale and sandstone**

Altitude (m)	200-1000
Annual rainfall (mm)	800
Geology	Karoo sandstone, shale
Physiographic unit	SD (S2)
CMU (coffee map) unit	B3d
Climatic unit	SH2-5
Farming system	Cashew (1,2)
Farming system group	2i1
Agro-ecological zone	Sa-3a
Soil group	14
Soil types - dominant	342
- associated	-
- inclusion	527, 650, 693

Agro-ecological zone Sa-3b, mapping unit C3d

Likely constraint	IPNM strategy	IPNM technical options	Categories of farmers
Climatic constraint drought (length of season, drought hazard)			
Compaction	70	NZ: Cs 5	Spec. by category
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6 NZ: Cs 1, Io 1, R11	Any farmer (good and medium managers for option Io 1; spec. cat. option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: In 1	Good manager
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Workability	72	A14	Good and medium managers

C3d: Very low, semi-arid to semi-humid Eastern hinterland hills and plains on sandstone, limestone, shale (C-climatic parts)

Altitude (m)	<200/500
Annual rainfall (mm)	800
Geology	Jurassic-Paleogene
Physiographic unit	CH2 (C1)
CMU (coffee map) unit	A5
Climatic unit	DM3
Farming system	Maize-Sorghum (2a, Coconut-Cassava-Cashew, sisal
Farming system group	2n1
Agro-ecological zone	Sa-3b
Soil group	15b
Soil types - dominant	541
- associated	674
- inclusion	-

Agro-ecological zone Sa-4, mapping unit D2i

Likely constraint	IPNM strategy	IPNM technical options	Categories of farmers
Climatic constraint drought (total rainfall)			
Drainage	38	A9	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 8, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Re 1 NZ: Cs 1, Io 1, R11	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

D2i: Low to intermediate, semi-arid to semi-humid Gumbiro area on sandstone and shale

Altitude (m)	800-1200
Annual rainfall (mm)	600-1000
Geology	Karoo sandstone, shale
Physiographic unit	EA4a, EA4b (E11)
CMU (coffee map) unit	F2d
Climatic unit	SH3
Farming system	Maize-Bean (4b)
Farming system group	2i1
Agro-ecological zone	Sa-4
Soil group	14
Soil types - dominant	342, 725
- associated	527
- inclusion	693

Agro-ecological zone Sa-5, mapping unit D3c

Likely constraint	IPNM strategy	IPNM technical options	Categories of farmers
Climatic constraint drought (total rainfall, length of season)			
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3 Sukuma: Lu 1a, 2, 3, 5, 8, K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, Cr 1, Ca 1, A4, A5	Usually specific per category
Fertility (nitrogen)	40,42,43	Sukuma: Lu 3, 8, K/N 4, 11, Ve 2 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: Lu 1c, 8, K/N 1c, 7, 11; NZ: Ma 6	Specific by category
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: Lu 4, 5, K/N 1a, 5, 6, Re 1 NZ: Cs 1, Io 1, R11	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: Lu 1a, 1b, 1c, 1d, K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Low organic matter	3,46	Sukuma: Lu 1a, 4, Re 1, In 1	Any farmer, spec. cat. for options Lu 1a and In 1

D3c: Low, semi-arid Southern plains on sandstone and shale (CMU-B3, less than 800 mm area)

Altitude (m)	200-500
Annual rainfall (mm)	500-800
Geology	Plio-Pleistocene (4) coastal sand cover over Karroo sandstone, shale
Physiographic unit	SU (S1)
CMU (coffee map) unit	B3
Climatic unit	SM1(u)
Farming system	Park (1b)
Farming system group	2i1
Agro-ecological zone	Sa-5
Soil group	14
Soil types - dominant	340
- associated	-
- inclusion	526, 692

5.8. SEDIMENTS (Se)

Agro-ecological zone Se-1, mapping unit B2m

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (length of season)			
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility, low organic matter	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6, Rc 5, 8, Re 1 NZ: Cs 1, Io 1, R11	Any farmer (good and medium managers for options Io 1 and Rc 8; specific by category for option K/N 1a)
Fertility, low organic matter	59	Bukoba: Ma 7, A/1 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, Rc 1, 2, 8, M/C 5, 6, Mb 1; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Flooding	37,87	A9	Any farmer, esp. good managers
Low organic matter	3,46	Sukuma: In 1	Good manager
Low organic matter, workability	4	Sukuma: Mb 1 NZ: Ma 1	Specific by category
Workability	72	A14	Good and medium managers

B2m: Intermediate, semi-humid Mbuga soil dominated eastern and western Sukumaland

Altitude (m)	1000-1200
Annual rainfall (mm)	800-1000
Geology	Sub-recent (2) sediments
Physiographic unit	PPp2 (P8)
CMU (coffee map) unit	H2
Climatic unit	SU3(u)
Farming system	Maize-Cassava-Cotton-Rice
Farming system group	211
Agro-ecological zone	Se-1
Soil group	22b
Soil types - dominant	738
- associated	-
- inclusion	604

Agro-ecological zone Se-2, mapping units D2p1, D2s

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (length of season, total rainfall)			
Soil degradation (gully erosion)	27,29,49, 81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Salinity	75	NZ: A10	Good manager
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Workability	72	A14	Good and medium managers

D2p1: Intermediate, semi-arid Shinyanga-Igunga area on metamorphic rocks and sediments (CMU-H2 area on sub-recent lake and stream deposits)

Altitude (m)	nd
Annual rainfall (mm)	600-800
Geology	Sub-recent (2) sediments
Physiographic unit	PPs2 (P7)
CMU (coffee map) unit	H2
Climatic unit	SU3-5
Farming system	Cotton-Sorghum-Pastoralism
Farming system group	211
Agro-ecological zone	Se-2
Soil group	22b
Soil types - dominant	604
- associated	239
- inclusion	727

D2s: Low, semi-arid, flooded or irrigated areas in Central zone on old alluvial sediments

Altitude (m)	900
Annual rainfall (mm)	500-700
Geology	Sub-recent (2) sediments
Physiographic unit	PSa, PSb (P8, P11)
CMU (coffee map) unit	H2
Climatic unit	SU3(r)
Farming system	Rice-Sorghum-Millet
Farming system group	1j2
Agro-ecological zone	Se-2
Soil group	22a
Soil types - dominant	604, 764
- associated	-
- inclusion	508, 726

Agro-ecological zone Se-3a, mapping unit Eal

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (drought hazard, total rainfall, length of season)			
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drainage	38	A9	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Salinity	75	NZ: A10	Good manager
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Workability	72	A14	Good and medium managers

Eal: Intermediate, arid to semi-arid, southern Kwimbe-northern Shinyanga area on old sediments

Altitude (m)	1000-1200
Annual rainfall (mm)	400-800
Geology	Sub-recent (2) sediments
Physiographic unit	PPp2, PPs1 (P8)
CMU (coffee map) unit	H2
Climatic unit	SU4(u)
Farming system	Rice-Pastoralism (2)
Farming system group	211
Agro-ecological zone	Se-3a
Soil group	22b
Soil types - dominant	738
- associated	-
- inclusion	604, 739

Agro-ecological zone Se-3b, mapping units Ea2, Eb3, Eb4, Ec1, Ed2, Eg1

Likely constraint	IPNM strategy no.	IPNM technical options	Categories of farmers
Climatic constraint drought (total rainfall, length of season, drought hazard)			
Capping/surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Soil degradation (gully erosion)	27,29,49,81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 8, 11, Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Flooding	37,87	A9	Any farmer, esp. good managers
Salinity	75	NZ: A10	Good manager
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers

Ea2: Intermediate, arid to semi-arid, south-west Eyasi area on old sediments

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Sub-recent (2) lake and stream deposits
Physiographic unit	PPp2 (P12)
CMU (coffee map) unit	H2
Climatic unit	SU3
Farming system	Pastoralism (2a)
Farming system group	1k2
Agro-ecological zone	Se-3b
Soil group	21a
Soil types - dominant	738
- associated	-
- inclusion	604

Eb3: Low, semi-arid Ruaha western lowland/valley on lacustrine and old alluvial sediments

Altitude (m)	700-900
Annual rainfall (mm)	550
Geology	Plio-Pleistocene (6) cover over Dodoma granite, gneiss
Physiographic unit	RA2, RP2 (R3)
CMU (coffee map) unit	G8
Climatic unit	SU3(r)

Farming system	Maize-Sorghum-Sunflower-Pastoralism (5)
Farming system group	1k1
Agro-ecological zone	Se-3b
Soil group	21b
Soil types - dominant	766
- associated	344, 455, 507, 679
- inclusion	-

Eb4: Low, semi-arid Ruaha western lowland/valley hill ranges

Altitude (m)	700-900
Annual rainfall (mm)	550
Geology	Plio-Pleistocene (6) cover over Dodoma granite, gneiss
Physiographic unit	RT (R3)
CMU (coffee map) unit	G8
Climatic unit	SU3(r)
Farming system	(Rice?-)Pastoralism (1)
Farming system group	1k1
Agro-ecological zone	Se-3b
Soil group	21b
Soil types - dominant	111
- associated	766
- inclusion	344, 455, 507, 679

Ec1: Intermediate, arid to semi-arid, southern Dodoma, western Iringa plains on granite and gneiss

Altitude (m)	1100-1300
Annual rainfall (mm)	400-600
Geology	Dodoma granite, gneiss
Physiographic unit	PPw1, PH1 (P2)
CMU (coffee map) unit	C6(h)
Climatic unit	SU3(r)
Farming system	Maize-Sorghum-Sunflower-Pastoralism (5) or Pastoralism (2a)
Farming system group	1k2 (1k1)
Agro-ecological zone	Se-3b
Soil group	21a
Soil types - dominant	335, 421, 735
- associated	-
- inclusion	111, 131, 501, 691

Ed2: Intermediate, arid to semi-arid, western Mbulu, northern Irambu areas on granite and sediments

Altitude (m)	nd
Annual rainfall (mm)	400-800
Geology	Basement complex granite and sub-recent (2) sediments
Physiographic unit	PPw1 (P2)
CMU (coffee map) unit	H2
Climatic unit	SU2
Farming system	Pastoralism (2a)
Farming system group	1k2
Agro-ecological zone	Se-3b
Soil group	21a
Soil types - dominant	335, 343?, 724?, 735
- associated	421, 425?
- inclusion	111, 501, 689

Eg1: Intermediate, arid, lake Eyasi shore on lacustrine sediments

Altitude (m)	nd
Annual rainfall (mm)	400-500
Geology	Sub--recent (2)(3v?) sediments
Physiographic unit	NR1 (N3)
CMU (coffee map) unit	H2
Climatic unit	SU3
Farming system	Pastoralism (2a)
Farming system group	1k2
Agro-ecological zone	Se-3b
Soil group	21a
Soil types - dominant	772
- associated	-
- inclusion	734

5.9. VOLCANIC ASH (Vo)

Agro-ecological zone Vo-1a (higher altitudes)/1b (lower altitudes), mapping units Ala1, Ala2, Alb, Alc, Alg1, Alg2, Alh1, Alh2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature (increasing with altitude)			
Fertility (nitrogen)	40,42,43	Bukoba: Fe 1, 2, 3, Ma 6 Sukuma: Ve 2 NZ: Fe 1, 2, 3, 4, 5	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: M/C 4, 5, In 1; NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	NZ: Ma 6	Specific by category
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Land slides ?	86	All	?
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (specific by category for option Ma 1)

Ala1: High to very high, humid to very humid, volcanic ash areas in Southern Highlands, Kiperenge range, Kitulo plateau, Ukinga mountains

Altitude (m)	1600-2900
Annual rainfall (mm)	1000-1600
Geology	Plio-Pleistocene 7v (HP3), Pleistocene 4v (HP4, Kiperenge range), HP1; volcanic ash plus intermediate and basic metamorphic intrusion and basalt
Physiographic unit	HP4, HP3 (H5)
CMU (coffee map) unit	D5v
Climatic unit	SH5, SC8
Farming system	Maize-Potato (1)
Farming system group	1a1
Agro-ecological zone	Vo-1a
Soil group	1a
Soil types - dominant	261b (265,131); 473
- associated	-
- inclusion	105; 275; 501

Ala2: High to very high, humid, volcanic ash areas in Southern Highlands, Makete valley

Altitude (m)	1600-2300
Annual rainfall (mm)	1500
Geology	Plio-Pleistocene 7v, volcanic ash plus

	intermediate and basic metamorphic intrusions and basalt
Physiographic unit	HP3 (H5)
CMU (coffee map) unit	D5v
Climatic unit	SH5, SC8
Farming system	Maize-Potato (1a)
Farming system group	1a1
Agro-ecological zone	Vo-1a
Soil group	1a
Soil types - dominant	261b
- associated	
- inclusion	105, 275

Alb: High to very high, humid to very humid, volcanic ash areas in Southern Highlands, Gofio plateau, Matambo-Ikuwo basins, Mporoto-Umalila highlands

Altitude (m)	1500-2600
Annual rainfall (mm)	1000-2000
Geology	Pleistocene 4v, volcanic ash plus intermediate and basic metamorphic intrusions and basalt
Physiographic unit	HV1, HV2, RT (H5)
CMU (coffee map) unit	E3(h)
Climatic unit	SH5, SC8
Farming system	Maize-Potato (1a)
Farming system group	2a2
Agro-ecological zone	Vo-1a
Soil group	1b
Soil types - dominant	265, 133
- associated	275, 364
- inclusion	103, 111

Alc: High to very high, humid, volcanic ash areas in Southern Highlands, Milo plateau

Altitude (m)	1900-2100
Annual rainfall (mm)	1400
Geology	Plio-Pleistocene 7v, Ubendian gneiss, volcanic ash cover over Ubendian gneiss plus intermediate and basic metamorphic intrusions and basalt
Physiographic unit	HP3, HU2 (H5)
CMU (coffee map) unit	D5d, D5v?
Climatic unit	SH5, SC8
Farming system	Maize-Potato (1a)
Farming system group	1a2 (2a2)
Agro-ecological zone	Vo-1a
Soil group	1a, 1b
Soil types - dominant	261b, 145
- associated	-
- inclusion	105, 111, 272, 275, 364

Alg1: High, humid, west Njombe plateau on granite and gneiss with volcanic ash cover (physiographic unit HP3)

Altitude (m)	1800-2000
Annual rainfall (mm)	1000-1200
Geology	Plio-Pleistocene 7v. Granite, gneiss and volcanic ash influence
Physiographic unit	HP3 (H5)

CMU (coffee map) unit	D5v
Climatic unit	SH5
Farming system	Maize-Potato (1a)
Farming system group	1a1
Agro-ecological zone	Vo-1a
Soil group	1a
Soil types - dominant	261b
- associated	-
- inclusion	105, 111, 275

Alg2: High, humid west Njombe plateau on granite and gneiss with volcanic ash cover (physiographic unit HP4)

Altitude (m)	1800-2000
Annual rainfall (mm)	1000-1200
Geology	Plio-Pleistocene 7v or rather Pleistocene 4v. Granite, gneiss and volcanic ash influence
Physiographic unit	HP4 (H5)
CMU (coffee map) unit	D5v
Climatic unit	SH5
Farming system	Maize-Potato (1a)
Farming system group	1a1
Agro-ecological zone	Vo-1a
Soil group	1a
Soil types - dominant	265
- associated	-
- inclusion	105, 111, 275

Alh1: High, humid to very humid, volcanic Rungwe highland in Southern Highlands (CMU-E3 area)

Altitude (m)	600 (>1000?)-2000
Annual rainfall (mm)	1000-2600
Geology	Pleistocene 4v. Volcanic ash plus intermediate and basic metamorphic intrusions and basalt
Physiographic unit	HU2, HV2 (H5)
CMU (coffee map) unit	E3
Climatic unit	SC8
Farming system	Coffee-Banana (1)
Farming system group	2a2
Agro-ecological zone	Vo-1b
Soil group	1b
Soil types - dominant	265
- associated	275, 364
- inclusion	103, 111

Alh2: High, humid to very humid, volcanic Rungwe highland in Southern Highlands (CMU-E3h area)

Altitude (m)	600 (>1000?)-2000
Annual rainfall (mm)	1000-2600
Geology	Pleistocene 4v volcanic ash plus intermediate and basic metamorphic intrusions and basalt
Physiographic unit	HV1 (H5)
CMU (coffee map) unit	E3h
Climatic unit	SC8
Farming system	Coffee-Banana (1)
Farming system group	2a2

Agro-ecological zone	Vo-1b
Soil group	1b
Soil types - dominant	265
- associated	-
- inclusion	103

Agro-ecological zone Vo-1c, mapping units Alk1, Alk2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature (increasing with altitude)			
Soil depth	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: M/C 4, 5, In 1; NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	NZ: Ma 6	Specific by category
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1; Sukuma: M/C 5; NZ: Ma 1, 6	Specific by category

Alk1: High, semi-humid to humid Meru-Kilimanjaro volcanic ash footslopes, Kilimanjaro footslopes

Altitude (m)	900-3500
Annual rainfall (mm)	1200?-2000
Geology	Plio-Pleistocene 8v
Physiographic unit	NV3a,3b (N4)
CMU (coffee map) unit	E4
Climatic unit	SC4
Farming system	Coffee-Banana (1)
Farming system group	2c1
Agro-ecological zone	Vo-1c
Soil group	4a
Soil types - dominant	271, 321, 782
- associated	-
- inclusion	102

Alk2: High, semi-humid to humid Meru-Kilimanjaro volcanic ash footslopes, Meru footslopes

Altitude (m)	900-3500
Annual rainfall (mm)	1200?-2000
Geology	Sub-recent 3v
Physiographic unit	NA7 (N5)
CMU (coffee map) unit	E2
Climatic unit	SC4?
Farming system	Coffee-Banana (1)
Farming system group	2c1
Agro-ecological zone	Vo-1c
Soil group	4a
Soil types - dominant	262
- associated	-
- inclusion	231, 734

Agro-ecological zone Vo-2, mapping unit Bld

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Acidity, fertility	44, 69	Bukoba: Fe 1, 4, Co 1, Re 4, A/l 1 Sukuma: Lu 1b, 3, K/N 1b, 1c, 4, 10, M/C 5 NZ: Ma 1, 6	Specific by category
Fertility (nitrogen)	40,42,43	Bukoba: Fe 1, 2, 3, Ma 6; Sukuma: Ve 2 NZ: Fe 1, 2, 3, 4, 5	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: M/C 4, 5, In 1; NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate)	50,51,53	NZ: Ma 6	Specific by category
Capping, surface sealing	4,19,27	Bukoba: Gm 1, 2 Sukuma: Rd 1, 3 NZ: Ma 1, Cs 1, 4, 6, 7, 9, Fo 1	Any farmer (option Ma 1 specific by category)

Bld: Intermediate to high, semi-humid to humid Mbozi plateau on gneiss with volcanic ash cover

Altitude (m)	1200-1800
Annual rainfall (mm)	800-1200
Geology	Plio-Pleistocene 8v over Ubendian gneiss
Physiographic unit	HP5 (H5)
CMU (coffee map) unit	D6v
Climatic unit	SH5
Farming system	Coffee-Maize-Bean (1)
Farming system group	1d2
Agro-ecological zone	Vo-2
Soil group	2
Soil types - dominant	264
- associated	478
- inclusion	275, 681

Agro-ecological zone Vo-3, mapping units Bl1a1, Bl1a2, B2b1, B2b2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard, length of season), radiation, temperature			
Drought	35,73	NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	NZ: Cs 2, 10	Any farmer
Erosion	27,28,88	NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach
Soil depth (drought stress)	1,33,34	NZ: Cs 4	Any farmer
Wind erosion	22,23	NZ: Cs 1, 3, 4, 6, 7, 9, Fo 1	Any farmer
Fertility, wind erosion	24	NZ: Cs 1, Fo 1	Any farmer
Soil degradation, gully erosion	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Overgrazing	6,7	NZ: Cs 10	Any farmer
Workability	72	NZ: Cs 5	Good and medium managers
Acidity, fertility	44,69	NZ: Ma 1, 6	Specific by category
Fertility (better manure quality)	8,9	NZ; Ma 4	Any farmer
Acidity, fertility, leaching	31	NZ: CM 1	Specific by category
Fertility (manure, compost)	10-18	NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, 4, Cr 1, Ca 1, A4, A5	Usually specific by category
Fertility (general)	74, 79-81	NZ: Fe 1, 2, 3, 4, 5, Rl 1	Specific by category
Fertility, low organic matter	2, 19, 20, 21	NZ: Cs 1, Io1, Rl 1	Any farmer (good and medium managers for option Io 1)
Fertility (nitrogen)	40,42,43	NZ: Fe 1, 2, 3, 4, 5	Spec.cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	NZ: Ma 6	Specific by category

Bl1a1: High, semi-humid Karatu plateau, Oldeani volcanic ash area (Mcl part, CMU-E4, NP3)

Altitude (m)	1500-2500
Annual rainfall (mm)	800->1000
Geology	Plio-Pleistocene 8v
Physiographic unit	NP3 (N1)
CMU (coffee map) unit	E4
Climatic unit	SM2

Farming system	Maize-Potato (1b)
Farming system group	2c1
Agro-ecological zone	Vo-3
Soil group	4a
Soil types - dominant	-
- associated	271, 321
- inclusion	-

B1a2: High, semi-humid Karatu plateau, Oldeani volcanic ash area (Mc6 part, CMU-E4h, NC2)

Altitude (m)	nd
Annual rainfall (mm)	nd
Geology	Plio-Pleistocene 8v
Physiographic unit	NC2 (N1)
CMU (coffee map) unit	E4h
Climatic unit	SM2
Farming system	Maize-Bean (1b)
Farming system group	2c1
Agro-ecological zone	Vo-3
Soil group	4a
Soil types - dominant	-
- associated	102, 141, 271, 782
- inclusion	-

B2b1: Intermediate to very high, semi-humid to humid Meru-Kilimanjaro volcanic ash plains, Meru and Hai footslopes

Altitude (m)	900-2000
Annual rainfall (mm)	800-1200
Geology	Sub-recent 3v
Physiographic unit	Na6, NA7, NV2 (N5,N6)
CMU (coffee map) unit	E2, H2v
Climatic unit	SH2, SM2, SU2
Farming system	Maize-Bean (1a)
Farming system group	2c1
Agro-ecological zone	Vo-3
Soil group	4a
Soil types - dominant	231, 262
- associated	132, 734
- inclusion	-

B2b2: Intermediate to very high, semi-humid to humid Meru-Kilimanjaro volcanic ash plains. Kilimanjaro footslopes

Altitude (m)	900-2000
Annual rainfall (mm)	800-1200
Geology	Plio-Pleistocene 8v
Physiographic unit	NV3a (N4)
CMU (coffee map) unit	E4(h)
Climatic unit	SH1, SC4
Farming system	Maize-Bean (1a)
Farming system group	2c1
Agro-ecological zone	Vo-3
Soil group	4a
Soil types - dominant	271, 321, 782
- associated	-
- inclusion	102

Agro-ecological zone Vo-4a, mapping unit Clc

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints radiation and temperature			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Fertility (nitrogen)	40,42,43	Sukuma: Ve 2 NZ: Fe 1, 2, 5	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: M/C 4, 5, In 1; NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	NZ: Ma 6	Specific by category

Clc: Intermediate to high, semi-arid to humid Mbeya stepped plain on volcanic ash

Altitude (m)	1200-1900
Annual rainfall (mm)	600-1500
Geology	Pleistocene 4v
Physiographic unit	HV2, HP4 (H5, H6)
CMU (coffee map) unit	E3h
Climatic unit	SH5, SC8
Farming system	Maize-Bean (4c)
Farming system group	2a2
Agro-ecological zone	Vo-4a
Soil group	1b
Soil types - dominant	265
- associated	-
- inclusion	103, 111, 275

Agro-ecological zone Vo-4b, mapping unit C1a

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (drought hazard), radiation, temperature)			
Erosion	27,29,88	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: Rd 1, 3, K/N 5, 6, 9, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Acidity, fertility	44,69	Bukoba: Fe 1, Co 1, Re 4, A/l 1; Sukuma: K/N 1b, 1c, 4, 10, M/C 5; NZ: Ma 1, 6	Specific by category
Low organic matter content	3,46	Sukuma: In 1	Good manager
Erosion, low organic matter content	71	Bukoba: Cl 1, Re 1, 2, 3, Mu 2, Gm 1, 2 Sukuma: Re 2, 4, Rd 4 NZ: Cs 3	Any farmer
Erosion, low organic matter content, fertility	28	Bukoba: Gm 2 Sukuma: K/N 5, 6, M/C 4, In 2; NZ: Rl 1	Any farmer
Fertility, low organic matter content	2,19,20,21	Bukoba: Gm 1, 2 Sukuma: K/N 1a, 5, 6 NZ: Cs 1, Io 1, Rl1	Any farmer (good and medium managers for option Io 1; spec. cat. for option K/N 1a)
Fertility, low organic matter content	59	Bukoba: Ma 7, A/l 1 Sukuma: K/N 1a, 1b, 1c, 2, 7, 10, Ve 1, M/C 5, 6, Mb 1 NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility, low organic matter content	25,26	Bukoba: Ma 7, Co 1, Gm 1, 2 Sukuma: K/N 5, 6, 9, M/C 4, In 1, 2 NZ: Cs 1, Fo 1, Rl 1	Any farmer (good and medium managers for options Ma 7 and In 1)
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Bukoba: Rw 2, Fe 1, 2, 3, Ma 6; Sukuma: K/N 4, 11, Ve 2 NZ: Fe 1, 2, 3, 4, 5	Spec. by category (especially when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5,	Specific by category

		M/C 4, 5, In 1 NZ: Ma 6, Rl 1	
Fertility (phosphate, TSP, SSP)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (NPK)	58,60	Bukoba: Ma 6, 7, Rw 2, Fe 2; Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6; NZ: Ma 1, 5, 6, M/C 2, Fe 2, 4	Specific by category
Fertility (manure)	10-18	Bukoba: Co 1, Ma 2, 3, 5, 6, Mu 2 Sukuma: K/N 1a, 1c, 3, 4, 6, 11, Ve 1, 2, Rd 1, 4, Mb 1, M/C 4, 6, In 1, A3 NZ: Cm 1, Ma 1, 3, 5, M/C 2, Ru 1, Fe 1, 2, 3, 4, Cr 1, Ca 1, A4, A5	Usually specific per category

Cla: High, semi-humid to humid Tarime highlands on lavas (phonolites) and granite

Altitude (m)	1500-1800
Annual rainfall (mm)	800 (-1200)
Geology	Miocene, volcanics and granite
Physiographic unit	NP4 (N10)
CMU (coffee map) unit	E6
Climatic unit	SC6
Farming system	Maize-Cassava-Sorghum-Banana- Horticulture (1)
Farming system group	111
Agro-ecological zone	Vo-4b
Soil group	6
Soil types - dominant	-
- associated	273, 361, 411
- inclusion	104, 209, 648

Agro-ecological zone Vo-4c, mapping unit C2e

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (length of season, drought hazard)			
Fertility (RP?,P?)	45,47,48,50,51,53	not applicable	no cultivation
Acidity, fertility	44,69	not applicable	no cultivation
Erosion	27,28,88	Bukoba: Ma 7, Co 1, Gm 1, 2; Sukuma: Rd 1, 3, M/C 4, In 1 NZ: Cs 1, 4, 6, 7, 9, Fo 1, Rl 1	Any farmer, communal approach (Ma 7 and In 1 specific by category)
Soil degradation, gully erosion	27,29,49,81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Drought	35,49,73	not applicable	no cultivation

C2e: Low, semi-arid to semi-humid west Serengeti area on granite and gneiss with volcanic ash cover

Altitude (m)	<1000
Annual rainfall (mm)	600-1000
Geology	Plio-Pleistocene 7v
Physiographic unit	NA1, NA2 (N7, N8)
CMU (coffee map) unit	C6v
Climatic unit	SU3
Farming system	Park (1a)
Farming system group	2k1
Agro-ecological zone	Vo-4c
Soil group	4b
Soil types - dominant	232, 252
- associated	732
- inclusion	105

Agro-ecological zone Vo-5a, mapping units D1e, D2h1, D2h3

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (length of season, drought hazard), temperature			
Sodicity	39,41,52	not applicable	no cultivation
Soil depth (drought stress)	1,33,34	not applicable	no cultivation
Drought	35,49,73	not applicable	no cultivation
Soil degradation, gully erosion	27,29,49,81	not applicable	no cultivation
Overgrazing	6,7	not applicable	no cultivation

D1e: High, semi-arid Serengeti plain

Altitude (m)	> 1000
Annual rainfall (mm)	600-800
Geology	PP (7v) volcanic ash and tuffs
Physiographic unit	NA3, NA4 (N7, N8)
CMU (coffee map) unit	E1(h)
Climatic unit	SU3
Farming system	Park (1a), Pastoralism (1a)
Farming system group	2k1
Agro-ecological zone	Vo-5a
Soil group	4b
Soil types - dominant	232
- associated	261a
- inclusion	101, 252, 544, 732

D2h1: Low to intermediate, semi-arid to semi-humid Northern lowlands on gneiss with some volcanic sediments

Altitude (m)	500-1200
Annual rainfall (mm)	550-800/1000
Geology	Sub-recent (3v) sediments and gneiss
Physiographic unit	NA1, NA2 (N9)
CMU (coffee map) unit	H4v
Climatic unit	SU2
Farming system	Park (1a), Pastoralism (1a)
Farming system group	2k1
Agro-ecological zone	Vo-5a
Soil group	4b
Soil types - dominant	251
- associated	231, 734
- inclusion	101

D2h3: Low, semi-arid, west Serengeti area on granite and gneiss with volcanic cover

Altitude (m)	nd
Annual rainfall (mm)	700-800
Geology	Plio-Pleistocene (7v) volcanic ash cover over Dodoma granite and gneiss
Physiographic unit	NA1 (N9, P8?)
CMU (coffee map) unit	C6v
Climatic unit	nd
Farming system	Park (1a)

Farming system group	2k1
Agro-ecological zone	Vo-5a
Soil group	4b
Soil types - dominant	252
- associated	732
- inclusion	232

Agro-ecological zone Vo-5b, mapping units D2h2, D2k1, D2k2, D2k3, D2l

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic drought (length of season, drought hazard), temperature			
Sodicity	39,41,52	Sukuma: A12, A13 NZ: Fe 5	Good and medium managers
Soil depth (drought stress)	1,33,34	Sukuma: Rd 1, 3 NZ: Cs 4	Any farmer
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, M/C 4 NZ: Cs 2, 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: K/N 4, 11, Ve 2; NZ: Fe 1, 2	Spec. cat.(esp. when dealing with cash crops)
Fertility (rock-phosphate?)(unsure for this zone)	45,47,48	Bukoba: Gm 1, 2 Sukuma: K/N 1b, 5, M/C 4, 5, In 1 NZ: Ma 6, Rl 1	Specific by category
Fertility (phosphate)	50,51,53	Sukuma: K/N 1c, 7, 11 NZ: Ma 6	Specific by category
Fertility (NPK)(in case of irrigation)	58,60	Bukoba: Ma 7 Sukuma: K/N 1a, 1b, 1c, 2, 7, Ve 1, M/C 5, 6; NZ: Ma 1, 5, 6, M/C 2, Fe 2	Specific by category
Wind erosion	22,23	Sukuma: Rd 1, 3 NZ: Cs 1, 3, 4, 6, 7, 9, Fo 1	Any farmer
Soil degradation, gully erosion	27,29,49, 81	NZ: Cs 2, 9, 10, Rl 1	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5 NZ: Cs 10	Any farmer
Fertility, wind erosion	24	Sukuma: K/N 9, M/C 4 NZ: Cs 1, Fo 1	Any farmer

D2h2: Low to intermediate, semi-arid to semi-humid Northern lowlands on metamorphic rocks (gneiss) with some volcanic sediments

Altitude (m)	500-1200
Annual rainfall (mm)	550-1000
Geology	Sub-recent 3v
Physiographic unit	NA6 (E2)
CMU (coffee map) unit	H2v
Climatic unit	SU2
Farming system	Maize-Bean-Pastoralism
Farming system group	2c1
Agro-ecological zone	Vo-5b
Soil group	4a
Soil types - dominant	231
- associated	734
- inclusion	262

D2k1: High, semi-arid Hanang area on volcanic ash

Altitude (m)	1500
Annual rainfall (mm)	800
Geology	Sub-recent 3v
Physiographic unit	NA9 (N1)
CMU (coffee map) unit	E2
Climatic unit	SH1
Farming system	Wheat-Barley-Maize-Bean-Pigeon pea; wheat scheme
Farming system group	2c1
Agro-ecological zone	Vo-5b
Soil group	4a
Soil types - dominant	231
- associated	-
- inclusion	543, 734

D2k2: High, semi-arid Hanang area on volcanic ash (Hanang mountain)

Altitude (m)	1500
Annual rainfall (mm)	800
Geology	Sub-recent 3v
Physiographic unit	NA9, RT (N1)
CMU (coffee map) unit	E2h
Climatic unit	SH1
Farming system	Bare
Farming system group	-
Agro-ecological zone	Vo-5b
Soil group	4a
Soil types - dominant	101, 231
- associated	142
- inclusion	543, 734

D2k3: Intermediate to high, semi-arid Northern plains on volcanic ash (CMU-E2 and H2v Meru area)

Altitude (m)	1300-1700
Annual rainfall (mm)	< 800
Geology	Sub-recent 3v
Physiographic unit	NA7 (N5)
CMU (coffee map) unit	E2, H2v
Climatic unit	SU2
Farming system	
Farming system group	Maize-Bean-Pastoralism
Agro-ecological zone	Vo-5b
Soil group	4a
Soil types - dominant	262
- associated	-
- inclusion	231, 734

D2l: Intermediate to high, semi-arid Northern plains on volcanic ash (CMU-E4, Kilimanjaro area)

Altitude (m)	1300-1700
Annual rainfall (mm)	< 800
Geology	Plio-Pleistocene 8v
Physiographic unit	NV3a (E4)
CMU (coffee map) unit	E4
Climatic unit	SU2
Farming system	Maize-Bean-Pastoralism and sugarcane estate, wheat scheme, ranches
Farming system group	2c1

Agro-ecological zone	Vo-5b
Soil group	4a
Soil types - dominant	321
- associated	-
- inclusion	102

Agro-ecological zone Vo-5c, mapping unit D2p2

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (length of season, drought hazard, low total annual rainfall)			
Drought	35,73	Sukuma: A1, Rd 2 NZ: Cs 4, 8, A 2	Good and medium managers
Drought	49	Sukuma: K/N 5, Rc 6, M/C 4; NZ: Cs 2, 10	Any farmer
Sodicity	39,41,52	Sukuma: A12, A13	Good and medium managers
Salinity	75	NZ: A10	Good manager
Workability	72	A14	Good and medium managers
Flooding	37,87	A9	Any farmer, esp. good managers
Drainage	38	not specified	?
Soil degradation, gully erosion	27,29,49, 81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Overgrazing	6,7	Sukuma: M/C 4, Re 5 NZ: Cs 10	Any farmer
Fertility (nitrogen)	40,42,43	Sukuma: Ve 2, Rc 2, 3, 7 NZ: Fe 1, 2	Spec. cat. (esp. when dealing with cash crops)
Fertility (rock-phosphate)	45,47,48	Bukoba: Gm 1, 2 Sukuma: M/C 4, 5, In 1; NZ: Ma 6, R1 1	Specific by category
Fertility (phosphate, TSP, SSP)	50,51,53	NZ: Ma 6	Specific by category

D2p2: Intermediate, semi-arid Pangani river lowlands on alluvial sediments

Altitude (m)	nd
Annual rainfall (mm)	500-800
Geology	Sub-recent 1 (+ some volcanic influence, sub-recent 3v?)
Physiographic unit	EA3a (E8)
CMU (coffee map) unit	H2
Climatic unit	SU1
Farming system	Rice-Maize-Sweet potato
Farming system group	1j1
Agro-ecological zone	Vo-5c
Soil group	16
Soil types - dominant	762
- associated	724
- inclusion	461

Agro-ecological zone Vo-6, mapping units Ef1, Ef2, Ef3, Ef4a, Ef4b, Ef4c, Ef5

Likely constraint	IPNM strategy no.	IPNM technical options	Category of farmer applicable
Climatic constraints drought (low total annual rainfall, length of season, drought hazard)			
Drought	35,73	not applicable	no cultivation
Drought	49	not applicable	no cultivation
Workability	72	not applicable	no cultivation
Salinity	75	not applicable	no cultivation
Sodicity	39,41,52	not applicable	no cultivation
Soil degradation, gully erosion	27,29,49, 81	NZ: Cs 2, 9, 10, R1 1	Any farmer
Overgrazing	6,7	Sukuma: K/N 5, M/C 4, Re 5; NZ: Cs 10	Any farmer

Ef1: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (east Serengeti area on Plio-Pleistocene (7) ashes and tuffs)

Altitude (m)	nd
Annual rainfall (mm)	nd
Geology	Plio-Pleistocene 7v
Physiographic unit	NA3, NA4, NA5 (N7, N8)
CMU (coffee map) unit	E1(h)
Climatic unit	SU2, SU3
Farming system	Park 1a), Pastoralism (1b)
Farming system group	2k1
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	232
- associated	261a
- inclusion	105, 252, 311, 544, 732

Ef2: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (north lake Manjara, Monduli steppe)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Pliocene
Physiographic unit	NA6, NA8 (N6)
CMU (coffee map) unit	E5
Climatic unit	SU2, SU3
Farming system	Pastoralism (1b)
Farming system group	2k1
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	233
- associated	143, 263, 733
- inclusion	101

Ef3: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (Kilimanjaro mountain, Ngorongoro steppe)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Plio-Pleistocene 8v
Physiographic unit	NV3b, NV3c, NC1, NC2 (N1, N4, N7)
CMU (coffee map) unit	E4(h)
Climatic unit	SU2, SU3
Farming system	Park (1a)
Farming system group	2k1
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	235, 271
- associated	102, 141, 321, 782
- inclusion	-

Ef4a: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (east Monduli volcanoes and plains CMU-H5v)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Sub-recent 3v
Physiographic unit	NV1, NR3 (N6)
CMU (coffee map) unit	H5v
Climatic unit	SU2
Farming system	Pastoralism (1b)
Farming system group	2k1
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	102, 142
- associated	734, 772
- inclusion	-

Ef4b: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (east Monduli volcanoes and plains, CMU-E2h)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Sub-recent 3v
Physiographic unit	RT, NR3 (N6)
CMU (coffee map) unit	E2h
Climatic unit	SU2
Farming system	Bare
Farming system group	none
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	102, 142
- associated	-
- inclusion	734, 772

Ef4c: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (CMU-E2 part)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Sub-recent 3v
Physiographic unit	NA7 (N5)
CMU (coffee map) unit	E2
Climatic unit	SU2
Farming system	Pastoralism (1b)
Farming system group	2k1

Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	262
- associated	-
- inclusion	231, 734

Ef5: Intermediate to high, arid to semi-arid, Northern steppes on volcanic ash (west Monduli volcanic ash plain, north of Mt. Kilimanjaro)

Altitude (m)	nd
Annual rainfall (mm)	400-600
Geology	Sub-recent 3v, volcanic ash cover over lake and stream deposits
Physiographic unit	NA6 (N6)
CMU (coffee map) unit	H2v
Climatic unit	SU1
Farming system	Pastoralism (1b)
Farming system group	2k1
Agro-ecological zone	Vo-6
Soil group	4b
Soil types - dominant	231
- associated	734
- inclusion	262

Annex 1. List of agro-ecological zones and mapping units

<u>AEZ</u>	<u>Unit</u>	<u>AEZ</u>	<u>Unit</u>	<u>Unit</u>	<u>AEZ</u>	<u>Unit</u>	<u>AEZ</u>
Co-1a	A3c	Me-4a	B2d1	Ala1	Vo-1a	B3j1	Me-5d
Co-1b	A3b	Me-4a	B2d2	Ala2	Vo-1a	B3j2	Me-5d
Co-2a	B3m1	Me-4a	B2d3	Alb	Vo-1a	B3k	Co-3a
Co-2a	B3m2	Me-4a	B2d4	Alc	Vo-1a	B3l1	Co-2b
Co-2b	B3l1	Me-4a	B2j1	Al d1	Gn-1b	B3l2	Co-2b
Co-2b	B3l2	Me-4a	B2j2	Al d2	Gn-1b	B3m1	Co-2a
Co-3a	B3k	Me-4a	B2j3	Al d3	Gn-1b	B3m2	Co-2a
Co-3a	C3e	Me-4a	B2j4	Al d4	Gn-1b	C1a	Vo-4b
Co-3b	C3f	Me-4a	B2k	Al d5	Gn-1b	C1b	Gn-5a
Gn-1a	Alh3	Me-4b	B2p1	Al d6	Gn-1b	C1c	Vo-4a
Gn-1b	Al d1	Me-4b	B2r	Al d7	Gn-1b	C1 d1	Gn-5b
Gn-1b	Al d2	Me-4b	B3c1	Al e	Ka-1	C1 d2	Gn-5b
Gn-1b	Al d3	Me-4b	B3c2	Al f	Ka-1	C1 d3	Gn-5b
Gn-1b	Al d4	Me-4b	B3c3	Al g1	Vo-1a	C2a1	Me-5a
Gn-1b	Al d5	Me-4b	B3d1	Al g2	Vo-1a	C2a2	Me-5a
Gn-1b	Al d6	Me-4b	B3d2	Al h1	Vo-1b	C2b	Gn-5c
Gn-1b	Al d7	Me-4b	B3h1	Al h2	Vo-1b	C2c1	La-2
Gn-1b	Al j1	Me-4b	B3h2	Al h3	Gn-1a	C2c2	La-2
Gn-1b	Al j2	Me-4c	B3a	Al i	Me-1	C2c3	La-2
Gn-1b	Al j3	Me-5a	C2a1	Al j1	Gn-1b	C2d1	Sa-3a
Gn-2	A2d1	Me-5a	C2a2	Al j2	Gn-1b	C2d2	Sa-3a
Gn-2	A2d2	Me-5b	B3b	Al j3	Gn-1b	C2e	Vo-4c
Gn-2	A2d3	Me-5b	B3i	Al k1	Vo-1c	C2f	Sa-3a
Gn-2	A2d5	Me-5c	C3a1	Al k2	Vo-1c	C3a1	Me-5c
Gn-2	A2d6	Me-5c	C3a2	A2a1	Ka-2	C3a2	Me-5c
Gn-2	A2d7	Me-5c	C3b	A2a2	Ka-2	C3b	Me-5c
Gn-3	B1b1	Me-5c	C3c	A2b	Me-2b	C3c	Me-5c
Gn-3	B1b2	Me-5d	B3j1	A2c	Me-2a	C3d	Sa-3b
Gn-3	B1b3	Me-5d	B3j2	A2d1	Gn-2	C3e	Co-3a
Gn-3	B1b4	Me-5d	C3h	A2d2	Gn-2	C3f	Co-3b
Gn-3	B1b5	Me-5d	C3i	A2d3	Gn-2	C3g	Sa-3a
Gn-3	B1b6	Me-6a	D1a	A2d4	Me-2a	C3h	Me-5d
Gn-3	B2c	Me-6b	D2b1	A2d5	Gn-2	C3i	Me-5d
Gn-3	B2i	Me-6b	D2b2	A2d6	Gn-2	D1a	Me-6a
Gn-4	B2p2	Me-6b	D2c	A2d7	Gn-2	D1b1	Gn-6a
Gn-5a	C1b	Me-6b	D2f	A2e	Me-2a	D1b2	Gn-6a
Gn-5b	C1 d1	Me-6b	D2n	A2f	Sa-1	D1c	Lw-3a
Gn-5b	C1 d2	Me-6b	D2q1	A2g	Sa-1	D1 d1	Gn-6b
Gn-5b	C1 d3	Me-6b	D2q2	A3a	Me-2c	D1 d2	Gn-6b
Gn-5c	C2b	Me-6b	D2q3	A3b	Co-1b	D1e	Vo-5a
Gn-6a	D1b1	Me-6b	D2q4	A3c	Co-1a	D2a1	Gn-6b
Gn-6a	D1b2	Me-7	D2a2	B1a1	Vo-3	D2a2	Me-7
Gn-6b	D1 d1	Me-7	D3a	B1a2	Vo-3	D2b1	Me-6b
Gn-6b	D1 d2	Me-7	D3b1	B1b1	Gn-3	D2b2	Me-6b
Gn-6b	D2a1	Me-7	D3b2	B1b2	Gn-3	D2c	Me-6b
Gn-6b	D2e	Sa-1	A2f	B1b3	Gn-3	D2d	Lw-3a
Gn-6b	D2g	Sa-1	A2g	B1b4	Gn-3	D2e	Gn-6b
Gn-6b	D2k4	Sa-2a	B3f	B1b5	Gn-3	D2f	Me-6b
Gn-6b	D2m1	Sa-2b	B3g1	B1b6	Gn-3	D2g	Gn-6b
Gn-6b	D2m2	Sa-2b	B3g2	B1c	Me-3	D2h1	Vo-5a
Gn-7	Eb1	Sa-2b	B3g3	B1d	Vo-2	D2h2	Vo-5b

Gn-7	Eb2	Sa-3a	C2d1	B1e	Ka-3a	D2h3	Vo-5a
Gn-7	Ec2	Sa-3a	C2d2	B1f	Ka-3b	D2i	Sa-4
Gn-7	Ed1	Sa-3a	C2f	B2a1	Me-4a	D2k1	Vo-5b
Ka-1	A1e	Sa-3a	C3g	B2a2	Me-4a	D2k2	Vo-5b
Ka-1	A1f	Sa-3b	C3d	B2b1	Vo-3	D2k3	Vo-5b
Ka-2	A2a1	Sa-4	D2i	B2b2	Vo-3	D2k4	Gn-6b
Ka-2	A2a2	Sa-5	D3c	B2c	Gn-3	D2l	Vo-5b
Ka-3a	B1e	Se-1	B2m	B2d1	Me-4a	D2m1	Gn-6b
Ka-3b	B1f	Se-2	D2p1	B2d2	Me-4a	D2m2	Gn-6b
Ka-4a	B2g1	Se-2	D2s	B2d3	Me-4a	D2n	Me-6b
Ka-4a	B2g2	Se-3a	Ea1	B2d4	Me-4a	D2o1	La-3
Ka-4b	B2e1	Se-3b	Ea2	B2e1	Ka-4b	D2o2	La-3
Ka-4b	D2p3	Se-3b	Eb3	B2e2	Lw-2b	D2o3	La-3
Ka-4c	B2f1	Se-3b	Eb4	B2f1	Ka-4c	D2p1	Se-2
Ka-4c	B2f2	Se-3b	Ec1	B2f2	Ka-4c	D2p2	Vo-5c
Ka-4c	B2f3	Se-3b	Ed2	B2f3	Ka-4c	D2p3	Ka-4b
Ka-4c	B2f4	Se-3b	Eg1	B2f4	Ka-4c	D2q1	Me-6b
Ka-4c	B2t	Vo-1a	A1a1	B2g1	Ka-4a	D2q2	Me-6b
La-1	B2l2	Vo-1a	A1a2	B2g2	Ka-4a	D2q3	Me-6b
La-2	C2c1	Vo-1a	A1b	B2h	Lw-2a	D2q4	Me-6b
La-2	C2c2	Vo-1a	A1c	B2i	Gn-3	D2r1	Lw-3b
La-2	C2c3	Vo-1a	A1g1	B2j1	Me-4a	D2r2	Lw-3b
La-3	D2o1	Vo-1a	A1g2	B2j2	Me-4a	D2r3	Lw-3b
La-3	D2o2	Vo-1b	A1h1	B2j3	Me-4a	D2s	Se-2
La-3	D2o3	Vo-1b	A1h2	B2j4	Me-4a	D3a	Me-7
La-4a	Eg2	Vo-1c	A1k1	B2k	Me-4a	D3b1	Me-7
La-4b	Ee1	Vo-1c	A1k2	B2l1	Lw-2c	D3b2	Me-7
La-4b	Ee2	Vo-2	B1d	B2l2	La-1	D3c	Sa-5
La-4b	Ee3	Vo-3	B1a1	B2l3	Lw-2c	Ea1	Se-3a
La-4b	Ee4	Vo-3	B1a2	B2m	Se-1	Ea2	Se-3b
Lw-1a	B2s	Vo-3	B2b1	B2o	Lw-1b	Eb1	Gn-7
Lw-1b	B2o	Vo-3	B2b2	B2p1	Me-4b	Eb2	Gn-7
Lw-2a	B2h	Vo-4a	C1c	B2p2	Gn-4	Eb3	Se-3b
Lw-2b	B2e2	Vo-4b	C1a	B2r	Me-4b	Eb4	Se-3b
Lw-2c	B2l1	Vo-4c	C2e	B2s	Lw-1a	Ec1	Se-3b
Lw-2c	B2l3	Vo-5a	D1e	B2t	Ka-4c	Ec2	Gn-7
Lw-3a	D1c	Vo-5a	D2h1	B3a	Me-4c	Ed1	Gn-7
Lw-3a	D2d	Vo-5a	D2h3	B3b	Me-5b	Ed2	Se-3b
Lw-3b	D2r1	Vo-5b	D2h2	B3c1	Me-4b	Ee1	La-4b
Lw-3b	D2r2	Vo-5b	D2k1	B3c2	Me-4b	Ee2	La-4b
Lw-3b	D2r3	Vo-5b	D2k2	B3c3	Me-4b	Ee3	La-4b
Me-1	A1i	Vo-5b	D2k3	B3d1	Me-4b	Ee4	La-4b
Me-2a	A2c	Vo-5b	D2l	B3d2	Me-4b	Ef1	Vo-6
Me-2a	A2d4	Vo-5c	D2p2	B3f	Sa-2a	Ef2	Vo-6
Me-2a	A2e	Vo-6	Ef1	B3g1	Sa-2b	Ef3	Vo-6
Me-2b	A2b	Vo-6	Ef2	B3g2	Sa-2b	Ef4a	Vo-6
Me-2c	A3a	Vo-6	Ef3	B3g3	Sa-2b	Ef4b	Vo-6
Me-3	B1c	Vo-6	Ef4a	B3h1	Me-4b	Ef4c	Vo-6
Me-4a	B2a1	Vo-6	Ef4b	B3h2	Me-4b	Ef5	Vo-6
Me-4a	B2a2	Vo-6	Ef4c	B3i	Me-5b	Eg1	Se-3b
		Vo-6	Ef5			Eg2	La-4a

List of mapping units and correlation with farming system zones and groups, soil groups and agro-ecological zones														
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length growing season	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
AREAS WITH AN AVERAGE ANNUAL RAINFALL OF MORE THAN 1000 MM														
Cool, high, humid areas (A1)														
High to very high, humid to very humid, volcanic areas in Southern Highlands														
A1a1	MP1a	1a1	1a	Vo-1a	1600-2900	1000-1600	m	6-12	no data	Volcanic ash	PP7v	261b,473		Le,Fe,Er,SI
A1a2	MP1a	1a1	1a	Vo-1a	1600-2300	1500	m	6-12	I	Volcanic ash	PP7v	261b		nd
A1b	MP1a	2a2	1b	Vo-1a	1500-2600	1000-2000	m	8-12	I	Basalt, volcanic ash	P4v	133,265,275,364		nd
A1c	MP1a	1a1 (2a2)	1a,1b	Vo-1a	1900-2100	1400	m	6-12	I	Volcanic ash	Uben/Moc,PP7v,PI4	145,261b		nd
High to very high, humid to very humid areas in Southern Highland on gneiss														
A1d1	MFo1a	2c2	5a	Gn-1b		1000-1600?	m		I	Gneiss	Uben	111,146,272		nd
A1d2	MFo1a	2c2	5a	Gn-1b	1500-2800	1400	m	no data	I	Gneiss	Moc	111		nd
High to very high, humid, dissected Eastern Iringa highlands on gneiss														
A1d3	MP2	2c2	5a	Gn-1b	1700-2200	1000-1400	m	5-7	I	Gneiss	Moc	272,362?		Fe,Wo,Er
Intermediate to high, humid to very humid Mahenge highlands on gneiss														
A1d4	MB2	2c2	5a	Gn-1b	800-1700	1000->1500	t	6.5-9.5	m	Gneiss	Moc	111,272,363,461		Er,Ac,De,Dg,Wo,SI
Intermediate to high, humid to very humid Western Usambara (Lushoto) highlands on gneiss														
A1d5	MB2	2c2	5a	Gn-1b	800-2000	1000->1500	b	5-6.5-12	m	Gneiss	Moc	111,272,363		Wo,Er,De,Ac,Dg,Om,SI
Intermediate to high, humid Eastern Usambara highlands on gneiss														
A1d6	MB2,tea	2c2	5a	Gn-1b	800-2000	1000-1300	b	9-12	m	Gneiss	Moc	111,272,363,412		Er,Fe
Intermediate to high, humid to very humid Morogoro highlands on gneiss														
A1d7	MB2	2c2	5a	Gn-1b	500-2000	1000->1500	t	5.5-7	m	Gneiss	Moc	111,272,363,412		Er,SI,Dg,Wo
High, humid Kigoma highlands on basalts, argillaceous sandstone, limestone, phyllite, quartzite														
A1e	CMB2	1a2	7a	Ka-1	1500-1700	1000-1500	m-t	6-8	I	Sandstone, limestone	Buk2	367,479		Fe,Ac,Er
A1f	CMB2	2b2	7c	Ka-1						Phyllite, quartzite	KA2	108,116,276,365,367,479		
High, humid west Njombe plateau on granite and gneiss with volcanic ash cover														
A1g1	MP1a	1a1	1a	Vo-1a	1800-2000	1000-1200	m	6-9	I	Volcanic ash	PPv7/Moc	261b		nd
A1g2	MP1a	1a1	1a	Vo-1a						Volcanic ash		265		
High, humid to very humid, volcanic Rungwe highland in Southern highlands														
A1h1	CB1	2a2	1b	Vo-1b	600-2000	>1000	m	6-12	I	Basalt, volcanic ash	P4v/Moc?	265,275,364		Le,Fe,Er,SI
A1h2	CB1	2a2	1b	Vo-1b	600-2000	1000-2600				Basalt, volcanic ash	P4v	265		
High, humid to very humid Rungwe highland in Southern highlands on gneiss														
A1h3	CB2	2a1	3	Gn-1a						Gneiss	Uben	275,364		
Intermediate to very high, humid Mwese-Mpande range on acid metamorphic rocks (gneiss)														
A1i	MB2	2b3	25c	Me-1	1100-2500	1200-1300	m	6-8.5	I	Gneiss	Uben	335,364,421,473,506?		Fe,Er
Intermediate to high, humid Matengo highlands, Wino ward on gneiss														
A1j1	CMB3a	2c2	5a	Gn-1b	1300-1600	1200-1500	m	6-9	I	Gneiss	Moc	272		Wo,Er,SI
Intermediate to very high, humid areas in Southern Highlands on gneiss														
A1j2	MB2	2c2	5a	Gn-1b	1000-2200	1000-1300	m	no data	I	Gneiss	Moc	272,362?		nd
Intermediate to high, humid Ludewa plateau on gneiss														
A1j3	MP2	2c2	5a	Gn-1b	1000-2000	1000-1200	m		I	Gneiss	Moc	272		
High, semi-humid to humid Meru-Kilimanjaro volcanic ash footslopes														
A1k1	CB1	2c1	4a	Vo-1c	900-3500	1000-2000	b(-t?)	5-11	I(-m)	Volcanic ash	PP8v	271,321	782	Er, Ac,Om,De
A1k2	CB1	2c1	4a	Vo-1c			b(-t?)			Volcanic ash	Subr3v	262		
Intermediate, humid areas (A2)														
Intermediate to high, humid to very humid Bukoba and Muleba high rainfall area on sedimentary and metamorphic rocks (sandstone, shale)														
A2a1	CB3,tea	2b1	29a	Ka-2	1200-1600	1000/1200-2	b	7-12	I	Sandstone, shale	Buk2	341,368,391?		Fe,Ac,Dn,Le
A2a2	CB3	2b1	29a	Ka-2	1150-1400	1000/1200+	t-b	9-12	I	Sandstone, shale	Buk2	108,341,391	704,784	Fe,Ac
Intermediate, humid Northern Sengerema, Ukerewe and Western Mara on granite														
A2b	MCCR	2g1	25e	Me-2b	1200-1300	1000-1200	b	4-5	m?	Granite	BC	111,335a,381,421a		Fe,Dr,Wo,Ac
Intermediate, humid Karema depression on alluvial and lacustrine sediments and gneiss														
A2c	MB2	2b3	25c	Me-2a	1000-1300	1200	m-t	6-9(5-7?)	I	Gneiss	Uben	473, 364?		Fe,Sa,So,FI
Low to intermediate, humid Mbinga area on gneiss														
A2d1	MB2	2c2	5a	Gn-2	500-1500	1000-1500	m	6-9	I	Gneiss	Moc	272		Wo,Er,SI
Intermediate to high, humid Lupemba-Niave hills on gneiss with volcanic ash influence (?)														

A2d2	MP2	2c2	5a	Gn-2	900-1600	1600	t	5-9	m	Gneiss	Moc	363,412		Er,Le(E7:Fe,Ac)
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length growing season	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Humid Songea plateau and Madaba-Mahanje area on gneiss														
A2d3	MB2	2c2	5a	Gn-2	750-1000	1000-1400	m	5-7	l	Gneiss	Moc	362,412,421		Fe,Ac,(Er),Wo?
Low, humid lake Nyasa shore on gneiss and sediments														
A2d4	CR	1b1	25b?	Me-2a		1200	m	8-12	l	Schist, gneiss	Moc	272?		
Low, humid Ruhuhu escarpment shallow soil area on gneiss														
A2d5	MFo1a	2c2	5a	Gn-2	700-1000	1200	m?	5-7	no data	Gneiss	Moc	111		nd
Low, semi-humid south-eastern Songea plain on gneiss														
A2d6	MB2,C1	2c2 (2i1)	5a	Gn-2	500-800	1000		5-7		Gneiss	Moc	362,412		
Humid granite hills on Songea plateau														
A2d7	MB2	2c2	5a	Gn-2	750-1000	1000-1400	m	5-7	l	Gneiss	Moc	111,421		Fe,Ac,(Er),Wo?
Low, humid lake Tanganyika shore areas on schist and granite														
A2e	CR	1b1	25b	Me-2a	500-1000	1000-1500	m	5-7	l	Schist, granite	KA1	106?,475?		Fe
Low, semi-humid south-eastern Songea plain on sandstone														
A2f	C1	2i1	14	Sa-1	500-800	1000		5-7		Sandstone, shale	Kar	342		
Low, humid west Kyela rocky terrain on sandstone and shale														
A2g	MFo1a	2i1	14	Sa-1						Sandstone, shale	Kar	110		
Warm, low, humid areas (A3)														
Low to very low, humid Kyela plain on lacustrine and alluvial sediments														
A3a	RC	1c1	9	Me-2c	500	1000-2600	m	8-12	l	Lake deposits	Rec2	206	647	Fl
Very low, humid Zanzibar-Pemba-Mafia islands														
A3b	CT	2j1	27	Co-1b	<200	1000-1300	b	4-5,1.5-2.5	b	Coastal sand and clay	PP1	331		nd
A3c	CT	2e1	19	Co-1a	100	1000-1200		5-10	m	Limestone, marl, clay	Pleist2	144,401,522		
AREAS WITH A+A211N AVERAGE AT LEAST 700 MM ANNUAL RAINFALL														
Cool, high, semi-humid areas (B1)														
High, semi-humid Karatu plateau, Oldeani volcanic ash area														
B1a1	MP1b	2c1	4a	Vo-3	1500?-2500	800->1000	t-b	3-5	l-h	Volcanic ash	PP8v	271,321		Er,Dr
B1a2	MB1b	2c1	4a	Vo-3						Volcanic ash	PP8v	102,141,271	782	
High, semi-humid to humid Mufindi and Kidugala plateau on gneiss														
B1b1	MB2,MP2	2c2	5a	Gn-3	1700-2000	900-1200	m	5-7	no data	Gneiss	Moc	272,473		Fe,Om
High, semi-humid to humid East Njombe plateau on gneiss														
B1b2	MP2,tea,wattle	2c2	5a	Gn-3	1500-1800	900-1200	m	6-9	l	Gneiss	Moc	272,473		Fe,Dr,Om
High, semi-humid to humid Pare mountains on gneiss														
B1b3	CB2,MB2	2c2	5a	Gn-3	1500-2000	800->1000	m	5-12	?	Gneiss	Moc	111,272,363		Er,Fe
High to very high, humid Mpwapa plateau on gneiss														
B1b4	MP2	2c2	5a	Gn-3	1500-2300	>1000	t	5-7	m	Gneiss	Moc	272,338,461,473		Fe,Wo,Er
High to very high, humid Eastern Ubena plateau on gneiss														
B1b5	MB2	2c2	5a	Gn-3	1100-1700	1000-1300	m			Gneiss	Moc	272,473		
Very high, semi-humid Northern Ubena plateau on gneiss														
B1b6	MB2	2c2	5a	Gn-3	1600-1800	900-1000				Gneiss	Moc	272,473		
High to very high, semi-humid to humid Kate-Mwazye hills and Nkungwe mountain on schist and granite														
B1c	MFm1a	1e1	25a	Me-3	1500-2300	850-1200	m	5-9	l	Schist, granite	KA1	115,339,422,475,504		nd
Intermediate to high, semi-humid to humid Mbozi plateau on gneiss with volcanic ash cover														
B1d	CMB1,coffee	1d2	2	Vo-2	1200-1800	800-1200	no data	6-9	no data	Gneiss, volcanic ash	(PP8v)/Uben	264,478		nd
Intermediate, semi-humid to humid Kasuli-Kibombo medium altitude western plains on basalt, limestone and sandstone														
B1e	MB3	1d1	7b	Ka-3a	1000-1500	800-1400	m-t	6.5-8	l	Basalt, limestone, sandstone	Buk1	276,367		Er,Fe,Dr
Intermediate, semi-humid to humid Nkansi-Kasanga plain on sandstone														
B1f	CR	2b1	29a	Ka-3b	1000+?	900-1200				Sandstone, shale	Buk2	477		
Intermediate, semi-humid areas (B2)														
Intermediate to high, semi humid Yambamrizi range and Ipumba hills on gneiss														
B2a1	MFm1a	1e1	25a	Me-4a	1000-2000	900-1000	m	5-7	l	Gneiss	Uben	111,421,473		nd

B2a2	MFm1a	1e1	25a	Me-4a					Gneiss	Uben	210,339	651		
Intermediate to high, semi-humid to humid Meru-Kilimanjaro volcanic ash plains														
B2b1	MB1a	2c1	4a	Vo-3	900-2000	800-1200	b	3-6	h	Volcanic ash	Subr3v	231,262	734	Dr,Er,Dg
B2b2	MB1a	2c1	4a	Vo-3			b		h	Volcanic ash	PP8v	271,321	782	
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Intermediate to high, semi-humid to humid, shallow soil areas in Southern Highlands on gneiss														
B2c	MB2	2c2	5a	Gn-3	500-1600	900-1300	no data	no data	no data	Gneiss	Moc	111		nd
Low to high, semi-humid to humid Uruwira plain on gneiss														
B2d1	TP1a	2g1	25e	Me-4a	850-1600	900-1200	m	5-6	l	Gneiss	Uben	335,501		Er,Fe
Intermediate to high, semi-humid to humid, shallow soil areas in Southern Highlands														
B2d2	MFm1b	2d2	25d	Me-4a	1500-1800	1000	m	4-6.5	l-m	Gneiss	Uben	335,421,477,501		Fe
Intermediate, semi-humid to humid Western plateau on intermediate and basic gneiss														
B2d3	MB2	2b3	25c	Me-4a	1100	900-1200	m	5-6	l-m	Gneiss	Uben	335,473		Fe,Fl
Intermediate, semi-humid Inyonga plain, Kipembawe plain on gneiss														
B2d4	MS2b	2b3	25c	Me-4a	1000-1200	900-1000	m	5-6	l-m	Gneiss	Uben	335,473		Fe,Fl
Intermediate, semi-humid to humid Northern Kagera floodplain on alluvial/colluvial sediments from schist and granite														
B2e1	ML1a,s/cane	2h1	10	Ka-4b	1000-1500	800-1500	b	9-12	l	Stream deposits	Subr2	203,652	704,787	Fl,Fe,Ac
Intermediate, semi-humid to humid Mara floodplain on granite and sediments														
B2e2	ML1b	2h1	10	Lw-2b	1150-1400	800-1200	b	4-5	m?	Stream deposits	Subr2	202	642	nd
Intermediate, semi-humid to humid Katumba plateau on sandstone, shale and quartzite														
B2f1	TP1a	2b1	29a	Ka-4c	1000-1500	900-1200	m	6-7.5	no data	Sandstone, shale, quartzite	Buk2	341,477		Fe
Intermediate to high, semi-humid Central Biharamulo area on sandstone														
B2f2	B	2b1	29a	Ka-4c	1200-1600	800-1000	t?	4-5	no data	Sandstone	Buk2	341,391	704,784	Fe,Ac,Dr
Intermediate to high, semi-humid Busando hills on sandstone and shale														
B2f3	TP1a	2b1	29a	Ka-4c	1000-1700	950	m	5-6?		Sandstone, shale	Buk2	106,477,506		
Intermediate, semi-humid south-western Kagera plains on sandstone and shale														
B2f4	CB3	2b1	29a	Ka-4c	1150-1400	800-1000/12	t-b	6-7.5	l	Sandstone, shale	Buk2	106,368		Fe,Ac
Intermediate to high, semi-humid Karagwe plains and hills on phyllite, quartzite, schist and granite														
B2g1	CB3	2b2	7c	Ka-4a	1300-1800	800-1000	b-t	7-9	l	Phyllite, quartzite	KA2	108,116?,365		Fe,De,Er
B2g2	B	2b2	7c	Ka-4a						Phyllite, quartzite	KA2	106,108,365		
B2h	CMB2,ML1d	2d1	17	Lw-2a	1000-1500	800-1000				Schist, granite	KA1	115,366		
Intermediate to high, semi-humid, shallow soil areas in Southern Highlands on gneiss														
B2i	MF01a	2c2?	5a?	Gn-3	1000-1800,	900	m	8-10	no data	Gneiss, volcanic ash?	PI4v	261b,265		nd
Intermediate, semi-humid Bukombe-Kahama plateau on granites and intermediate and basic gneiss														
B2j1	MGTP	2g1	25e	Me-4a	1100-1300	800-1000	t-m	4-6	l-m	Gneiss, granite	Dod	335,421		Fe,Fl
B2j2	MGTP	2g1	25e	Me-4a	1100-1300	800-1000				Basic granite	BC ?	381		
Intermediate, semi-humid Tabora plains on granite and gneiss														
B2j3	MGTP	2g1	25e	Me-4a	1000-1200	700-900	m	4-5	l-m	Gneiss, granite	Dod	335,421		Fe,Ac,De
B2j4	MGTP	2g1	25e	Me-4a		800-900				Gneiss, granite	Dod	111		
Intermediate, semi-humid Sukumaland plains on granites and sediments														
B2k	MGTP	2g1	25e	Me-4a	1200-1300	800-1000	t	4-5	l-h	Granite	BC	335,421	691,735	Fe,Dr,Wo,Fl,Ac
B2l1	CM1a	2h2	18	Lw-2c	1000-1200	800-1000	t	3-3.5	l-h	Granite, gneiss, wash deposits	Pleist3	336,502	602	Fe,Dr,Wo
B2l2	RL	2l2	8	La-1	1000-1200	800-1000				Wash, lake, stream deposits	PP3		602,728	
Intermediate, semi-arid to semi-humid, south-eastern Bukombe and Sikonge-Msisi plains on granite and gneiss														
B2l3	MSP2	2h2	18	Lw-2c	1100	800	m	5-6	l-m	Granite, gneiss, wash deposits	Pleist3	336,423		Dr,Fe
Intermediate, semi-humid Mbuga soil dominated eastern and western Sukumaland														
B2m	MCCR	2l1	22b	Se-1	1000-1200	800-1000	m-t	3-3.5	l-m	Stream deposits	Subr2		738	Wo
Low to intermediate, semi-humid western (Tabora, Kibondo, Urambo) swamps on alluvial sediments														
B2o	RSp	1f1	13	Lw-1b	900-1200	800-1000	m	5-6(flood)	l-m	Lake, stream deposits	Rec2		671,701,737,783	Fl,Dn
Low, semi-humid Mahenge basin, Mkulula valley and Kilosa (west Mikumi) on gneiss														
B2p1	MSP1b	2m1	26	Me-4b	900-1000	800-1000	m	6-9	no data	Gneiss	Moc	363,412		nd
Low to intermediate, semi-humid Kilosa-west and Mpwapwa medium altitude plains on gneiss														
B2p2	CMB3b	2f1	5b	Gn-4	750-1500	800-1000	t?	3-5		Gneiss	Moc	272,338,461		
Low to intermediate, semi-humid Kilombero-Mahenge plain on gneiss														
B2r	CM1b	2m1	26	Me-4b	1000	800-1000	t-m	6-9	l-m	Gneiss	PP5	453,476,503		Fe
Low to high, semi-arid to humid Kigoma lowlands on sedimentary and metamorphic rocks														

B2s	CRO	1f2	20	Lw-1a	800-1800	600-1300	m	6-7.5	l	Limestone, basalt	Buk1	337,474		Fe
B2t	CRO	1f3	29b	Ka-4c	800-1800	800-1300	m	6-7.5	l	Sandstone, shale	Buk2/Uben	106,341,364,421,473,477		Fe,Er
Warm, low, semi-humid areas (B3)														
Very low to low, semi-humid to humid Kilombero valley on alluvial sediments														
B3a	RMC,s/cane	1g2	12	Sa-2c	400-600	900-1200	t	5.5-8(flood)	m	Stream deposits	Pleist1	205	611,633,648	Fl,Fe
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Very low, semi-humid to humid Rufiji valley on alluvial sediments														
B3b	RMC	1h3	28	Me-5b	<200	800-1200	t	3-4.5(flood)	l-m	Stream deposits	Rec1	201	641,751,761	Fl
Low, semi-humid, wet Eastern lowland footslopes on gneiss														
B3c1	CM1b	2m1	26	Me-4b	500-1000	800-1000	t-m	4-6.5	l-m	Gneiss	Moc	362,412		Fe,Wo,Er,De,Ac,Dg
B3c2	CM1b	2m1	26	Me-4b	500-1000	800-1000				Gneiss	Moc	335,412,473,362		
Low, semi-humid south Masisi semi-humid plain on acid gneiss														
B3c3	SML1a	2m1	26	Me-4b	400-500	800-1000	m	5-6	l	Acid gneiss	Moc	335,412,473		Fe
Low, semi-humid Nachinwea plain on intermediate gneiss														
B3d1	MSe1a	2m1	26	Me-4b	500-600?	800-1000	m	5-6	l	Gneiss	PP5	363,453,503		Fe
Low to very low, semi-humid, south-eastern Tunduru and western Nachinwea plain on gneiss														
B3d2	MSe1a	2m1	26	Me-4b	<600	800-1000	m	5-7	l	Gneiss	PP5	453,476,503		Fe
Very low to low, semi-humid sedimentary plateau in Southern and Eastern zone on shale and sandstone														
B3f	C1,C2	2i1	14	Sa-2a	600-1100	600-1000	m-t	4-6.5,5-7	l(-m)	Sandstone, shale	PP4	340,342		Fe,Dr,Om
Very low, semi-humid Makonde plateau on sandstone, limestone and shale														
B3g1	C1,CCC	2n1	15b	Sa-2b	200-500	800-1000	m-t	3-4.5	l-m	Sandstone, limestone, shale	JP	541	674	Fe,Ac
Very low, semi-humid, Southern hinterland hills and plains on sandstone, limestone, shale														
B3g2	CCC	1g1	15a	Sa-2b	100-200?	800-1000	m-t	3-4.5	l-m	Sandstone, limestone, shale	JP	107,112,236,541	674,722	Sa,Fe,Wo
Very low, semi-humid, Eastern hinterland hills and plains on sandstone, limestone, shale														
B3g3	CCC	1g1	15a	Sa-2b	<200	800-1000	b	3-4.5, 1-2	l-h	Sandstone, limestone, shale	JP	541	674	Fe,Dr,Wo
Low to very low, semi-humid Eastern plains on metamorphic rocks and alluvial sediments														
B3h1	CM1b	2m1	26	Me-4b	250-1000	800-1000	t	4.5-6	m	Gneiss	Moc	335,412,473		Ac,Fe
Very low to low, semi-humid Muheza plains on intermediate gneiss														
B3h2	MS2a,sisal	2m1	26	Me-4b	150-500	1000	b	3-4.5,2.5-3	l-m	Gneiss	Moc	362,412		Fe,Ac
Very low, semi-humid to humid coastal floodplains and deltas														
B3i	RMC	1h3	28	Me-5b	<100	1000	b	3-4.5(flood)	?	Stream deposits	Rec1	201	621,641	nd
Very low, semi-humid Eastern plains on alluvial sediments														
B3j1	RMC,sisal	1h1	23	Me-5d	400-500	800-1000	t	(4-6.5)	m	Stream deposits	Subr1		632,724,781	(Fe,Ac),Dr,Fl
B3j2	RMSp	1h1	23	Me-5d	<500	800-1000	t	3-4.5	m	Stream deposits	Subr1	332,521	601,723	Fe,Fl
Very low, semi-humid, Eastern and Southern hinterland hills and dissected uplands on old sedimentary rocks														
B3k	MSP2,citrus	1h2	24	Co-3a	200	800-1000	?	3-4.5	?	Coastal sand and clay	PP2	471,472		?
Very low, semi-humid, Eastern and Southern hinterland plains on old sedimentary rocks														
B3l1	C1	2j1	27	Co-2b	<100-200	800-1000	m-t	3-4.5	l-m	Coastal sand and clay	PP1	331,451		Fe
Very low, semi-humid, Eastern hinterland plains on Quarternary and Tertiary sediments														
B3l2	MS2a	2j1	27	Co-2b	<200	800-1000	b	3-4.5, 1-2	l-h	Coastal sand and clay	PP1	331		Fe,Dr,Wo
Very low, semi-humid, Southern and Eastern coastal plains on Quarternary sediments														
B3m1	MS2a,sisal	2e1	19	Co-2a	<200	800-1000	b	3-4.5, 1-2	l-h	Limestone, marl, clay	Pleist2	522	675,721	Fe,Dr,Wo,Sa
B3m2	RCC,sisal	2e1	19	Co-2a	<100	800-1000	m-t	3-4.5	l-m	Limestone, marl, clay	Pleist2	522	675,721	Fe,Sa,Wo
AREAS WITH AN AVERAGE AT LEAST 500 MM ANNUAL RAINFALL														
Cool, high, semi-arid to humid areas (C1)														
High, semi-humid to humid Tarime highlands on lavas (phonolites) and granite														
C1a	MS1	1i1	6	Vo-4b	1500-1800	800-1200+	b	6-10	l-h	Volcanic phonolites	Miocene	273,361,411		Fe,Dr
High, semi-arid hills and mountains north of Mbeya and around Mbozi plateau on gneiss														
C1b	MFo1b	2a1	3	Gn-5a		800				Gneiss	Uben	111,473	682	
Intermediate to high, semi-arid to humid Mbeya stepped plain on volcanic ash														
C1c	MB4c	2a2	1b	Vo-4a	1200-1900	600-1500	m	6-9	l	Basalt, volcanic ash	Pleist4v	265		nd
Intermediate, semi-humid, upper Lukosi valley on gneiss														
C1d1	MB4a	2c2	5a	Gn-5b	1300-1400	900	m	5-6	l	Gneiss	Moc	111,272,473		Fe,Dr,Om?
Intermediate, semi-humid, lower Mufindi plateau on gneiss														

C1d2	MB4a,SF1	2c2	5a	Gn-5b	1200-1500	900		5-6		Gneiss	Moc	111,272		
Intermediate to high, semi-humid, shallow soil Usanga flat border area on gneiss														
C1d3	SF1	2c2	5a	Gn-5b	1000-1800	900	m	5-7	l??	Gneiss	Moc	111		Fe,Dr,Om,Er,Le
Intermediate, semi-arid to semi-humid areas (C2)														
Intermediate to high, semi-arid to humid Chunya dissected plain on gneiss														
C2a1	TP1a	2g1	25e	Me-5a	1200-1800	700-1300	m	4-6	l	Gneiss	Uben	111,421		Fl,Fe(?)
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length growing season	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Intermediate to high, semi-arid to semi-humid, shallow soil areas in Southern Highlands														
C2a2	MFm1b	2d2	25d	Me-5a	1000-1700	750-900	m	5-7	no data	Gneiss	Uben	111		nd
Low to intermediate, semi-arid to semi-humid East Handeni, north Morogoro hilly plains and footslopes on gneiss														
C2b	MSP1a	2f1	5b	Gn-5c	750-1500	600?-1000				Gneiss	Moc	237,363,412,461		
Low to intermediate, semi-arid to humid Rukwa valley/floodplain on alluvial and lacustrine sediments														
C2c1	TP1b	2o1	11	La-2	800-1200	600-1200	m	5-9	l-m	Lake, stream deposits	Rec2	343,414,425,509	634,730,767	So,Fl,Sa,Fe
Low to intermediate, semi-arid to humid Rukwe/Songwe valley on alluvial sediments														
C2c2	TP1b	2o1	11	La-2	800-1200	750-1200	m	5-6	l?	Stream deposits	Rec2	343,414,425,509	767	So
Intermediate, semi-humid, Songwe-Msangano-Itumba through area on recent deposits														
C2c3	MSP5	2o1	11	La-2	1000-1500	900-1200	no data	no data	no data	Stream deposits	Rec2	109,343,509	605,634,767	nd
Low, semi-arid to (semi)-humid Ruhuhu valley lowlands on alluvial and lacustrine sediments (sandstone, shale)														
C2d1	MB4b	2i1	14	Sa-3a	500-900	600-1200(90)	m	5-9	l	Sandstone, shale	Kar	342,527		nd
Low to intermediate, semi-humid dissected sedimentary plateau in Southern zone on shale and sandstone														
C2d2	C2	2i1	14	Sa-3a	200-1000	800-900	t-m	5-7	l-m	Sandstone, shale	Kar	342		Fe
Low, semi-arid to semi-humid west Serengeti area on granite and gneiss with volcanic ash cover														
C2e	P1a	2k1	4b	Vo-4c	<1000	600-1000				Volcanic ash	PP7v	232,252	732	
Low to intermediate, semi-humid sedimentary plateau in Southern zone on shale and sandstone														
C2f	MSe1b	2i1	14	Sa-3a				5-7		Sandstone, shale	PP4	340		
Warm, semi-humid areas (C3)														
Very low to low, semi-humid Eastern plains on intermediate gneiss														
C3a1	MS2a,sisal	2m1	26	Me-5c	200-1000	800-1000	t-b	3-4,1-2	m	Gneiss	Moc	362,412		Fe,Ac,Dr
C3a2	CM1b	2m1	26	Me-5c	500-1000	800	t-m	<4-6.5	m	Gneiss	Moc	362,412		Fe,Wo,Er,De,Ac,Dg
Very low, semi-arid to semi-humid Southern plains on intermediate gneiss														
C3b	MSe1a	2m1	26	Me-5c	<500	750-900	t-m	3-5	l-m	Gneiss	PP5	334,363,413,452,453,476,503		Fe
C3c	MSe1a	2m1	26	Me-5c	<500	500-1000				Gneiss	PP5	413,473		
Very low, semi-arid, Eastern hinterland hills and plains on sandstone, limestone, shale														
C3d	MS2a,CCC,sisal	2n1	15b	Sa-3b	<200	800	b	<3-4.5, 1-2	m-h	Sandstone, limestone, shale	JP	541	674	Fe,Dr,Wo
Very low, semi-arid, Eastern hinterland hills and dissected uplands on old sedimentary rocks														
C3e	MSP2	1h2	24	Co-3a	200	800	?	<3-4.5	?	Coastal sand and clay	PP2	471		?
Very low, semi-arid, Eastern and Southern hinterland plains on old sedimentary rocks														
C3f	RCC	2j1	27	Co-3b	<100-200	800	m-t	<3-4.5	m	Coastal sand and clay	PP1	331		Fe
Very low to intermediate, semi-arid dissected sedimentary plateau in Eastern zone on shale and sandstone														
C3g	C2, C1	2i1	14	Sa-3a	200-1000	800	t-m	<5-7	m	Sandstone, shale	Kar	342		Fe
Very low, semi-arid Eastern plain on alluvial sediments														
C3h	RMSp	1h1	23	Me-5d	<500	800	t	<3-4.5	m	Stream deposits	Subr1	332,521	723	Fe,Fl
Very low, semi-arid Rufiji valley on alluvial sediments														
C3i	RMC	1h3	28	Me-5d	<200	800	t	<3-4.5(flood)	m	Stream deposits	Rec1	201	641,751,761	Fl
Cool, high, semi-arid to semi-humid areas (D1)														
Intermediate to high, semi-arid to semi-humid Namanyere-Laela plain on gneiss														
D1a	MFm2	2d2	25d	Me-6a	1200-1700	750-950	m	5-6.5	l-m	Gneiss	Uben	210,335,421,477,501	651	nd
High, semi-arid to semi-humid Iringa plain on gneiss														
D1b1	MB4a,SF1	2c2	5a	Gn-6a	1500-1700	600-900(720)	m	5-6	l?	Gneiss	Moc	272,473		Fe,Dr,Om
High, semi-arid dissected west Iringa plain on gneiss														
D1b2	MB4a,SF1	2c2	5a	Gn-6a	1500-2000	600-800				Gneiss	Moc	111,473		
Intermediate, semi-arid commercial ranching area in central-northern Kagera on schist and granite														

D1c	ML1d	2d1	17	Lw-3a	1000-1500	800	b	no data	l-m	Schist, granite	KA1	115,366		nd
High, semi-arid, eastern Mbulu area on gneiss														
D1d1	WBMBP,MB5a	2c2	5a	Gn-6b	1500-2500	500-800	t-b	3-5	l-h	Gneiss	Moc	273?		Fe,Wo,Er
D1d2	WBMBP	2f1	5b	Gn-6b	1500-2500	500-800				Gneiss	Moc	131,273?,421		
High, semi-arid Serengeti plain														
D1e	Park1a,P1a	2k1	4b	Vo-5a	1000+	600-800				Volcanic ash	PP7v	232,261a		
Intermediate, semi-arid areas (D2)														
Intermediate, semi-arid to semi-humid south-eastern Babati, northern Kondoa area on gneiss														
D2a1	MB5b	2f1	5b	Gn-6b	1200?	600-900	b?	2-2.5	h	Gneiss	Moc	461		Er,Fe,Dr
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length growing season	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Low to intermediate, semi-arid to semi-humid Usambara footslopes on gneiss														
D2a2	MB5b,MSP4	2m1	26	Me-7	500-1200	600-1000	b	2-2.5?	l-h	Gneiss	Moc	412,461		nd
Intermediate, semi-arid to semi-humid Chunya plain, Wago hills on gneiss														
D2b1	MSP3	2g1	25e	Me-6b	1000-1500	700-900	m	4-5	l-m	Gneiss	Uben	335,473		Fe,Dr
D2b2	MSP3	2g1	25e	Me-6b	1000-1500	700-900				Gneiss	Uben	111,131,381,421		
Intermediate, semi-arid North Iringa shallow soil hill range on granite and gneiss														
D2c	MSP3	2g1	25e	Me-6b	1000-1500	600-700				Granite, gneiss	Dod	111,131,335,421		
Intermediate, semi-arid Karagwe (central and north-western Kagera) plains and hills on schist and granite														
D2d	ML1d	2d1	17	Lw-3a		800	?	7-12??		Schist, granite	KA1	115,116,366		
Intermediate, semi-arid Kondoa, Kibaya, west Handeni hills on gneiss														
D2e	MB5b,MSP3	2f1 (2g1)	5b	Gn-6b	1400-1500	600-800				Gneiss	Moc	461		
Intermediate, semi-arid Mpwapwa and east Kondoa plains on gneiss														
D2f	MSP3	2g1	25e	Me-6b	1000-1300	550-800				Gneiss	Moc	461	735	
Low to intermediate, semi-arid to semi-humid Northern lowlands on gneiss without volcanic sediments														
D2g	MBP,bean	2f1,(2c1)	5b,(4a?)	Gn-6b	500-1200	500-1000	b	2-?	m-h	Gneiss	Moc	461	735	Er,Sa,Dg
Low to intermediate, semi-arid to semi-humid Northern lowlands on gneiss with some volcanic sediments														
D2h1	Park1a,P1a	2k1	4b	Vo-5a	500-1200	800				Volcanic ash	Subr3v	231,251	734	
D2h2	MBP	2c1	4a	Vo-5b	500-1200	550-1000				Volcanic ash	Subr3v	231	734	
D2h3	Park1a	2k1	4b	Vo-5a	<1000	700-800				Volcanic ash	PP7v	252	732	
Low to intermediate, semi-arid to semi-humid Gumbiro area on sandstone and shale														
D2i	MB4b	2i1	14	Sa-4	800-1200	600-1000	m	5-6	l	Sandstone, shale	Kar	342,527	725	Fe,Dn
High, semi-arid Hanang area on volcanic ash														
D2k1	WBMBP,	2c1	4a	Vo-5b	1500	800	t	2-4(3-5?)	m-h	Volcanic ash	Subr3v	231		Er,Dr
D2k2	Bare	none,(2c1)	4a	Vo-5b	1500	800				Volcanic ash	Subr3v	101,142,231		
Intermediate to high, semi-arid Northern plains on volcanic ash														
D2k3	MBP	2c1	4a	Vo-5b	1300-1700	<800	t	2-3.5	m-h	Volcanic ash	Subr3v	262		Fe,De,Ac?,Er,Dr
High, semi-arid Babati area over gneiss and possibly with some volcanic ash														
D2k4	WBMBP	2f1 (2c1)	5b,(4a?)	Gn-6b						Gneiss, volcanic ash?	Moc or SR3v?	231,461		
D2l	MBP,s/cane,	2c1	4a	Vo-5b	1300-1700	<800	b?	2-3.5	l-h	Volcanic ash	PP8v	321		Er,De,So
Intermediate, semi-arid Pare mountain footslopes on intermediate gneiss														
D2m1	MB5b	2f1	5b	Gn-6b	1200-1500	500-800	b	2-4.5	h	Gneiss	Moc,Subr2	362,412,461		Er,Fe,Dr
D2m2	MB5b,sisal	2f1	5b	Gn-6b	1300-1700	500-800				Gneiss	Moc	412,461		
Intermediate, semi-arid Meatu-Maswa, Shinyanga areas on granite (basement complex)														
D2n	CSP	2g1	25e	Me-6b		600-800		3-3.5		Granite	BC	335,421		
Intermediate, semi-arid Ibushi plain on marl, sandy and clayey sediments														
D2o1	CS	2l2	8	La-3	1000-1100	500-800	m-t	3-3.5	l	Wash, lake, stream deposits	PP3	238		Er,Dg
East Lake Manjara shore on old lacustrine sediments														
D2o2	P2b	2l2	8	La-3		600-800				Wash, lake, stream deposits	PP3	234,462	731,771	
Intermediate, semi-arid Shinyanga-Igunga area on metamorphic rocks and sediments														
D2o3	CSP	2l2	8	La-3		600-800		3-3.5		Wash, lake, stream deposits	PP3		602,738	Dg,Er
D2p1	CSP	2l1	22b	Se-2		600-800		3-3.5		Lake, stream deposits	Subr2	239	604	Dg,Er
Intermediate, semi-arid Pangani river lowlands on alluvial sediments														
D2p2	RMSp	1j1	16	Vo-5c		500-600		<2,flood	m	Stream deposits	Subr1 (3v?)		724,762	Sa,So,Wo
Intermediate, semi-arid Northern Kagera floodplain on alluvial/colluvial sediments from schist and granite along Ruanda border														
D2p3	ML1c	2h1	10	Ka-4b	1000-1500	700-800	b	9-12	l	Stream deposits	Subr2		704,787	Fl,Fe,Ac

Intermediate, semi-arid Central and Northern plains on granites and gneisses														
D2q1	MGL	2g1	25e	Me-6b	1100-1300	600-800	m	2-2.5	l-m?	Granite, gneiss	Dod	335,381,421	735	Fe,De,Ac,Dg
D2q2	MGL	2g1	25e	Me-6b	1100-1300	600-800	m	3-3.5	l-m?	Granite, gneiss	Dod	335,421		Fe,De,Ac,Dg
D2q3	MGL	2g1	25e	Me-6b	1100-1300	600	m	2-2.5	l-m?	Granite, gneiss	Dod	111,131,335,421		Fe,De,Ac,Dg
D2q4	MGL	2g1	25e	Me-6b	1100-1300	600-800	m	3-3.5	l-m?	Granite, gneiss	Dod	111,131,421		Fe,De,Ac,Dg
D2r1	S	2h2, (2l2)	18	Lw-3b	1100-1300	700-800	m	4-5	l-m?	Granite, wash deposits	Pleist3	336,382,423,454		Fe,De,Ac,Dg
Intermediate, semi-arid Central-Western plains on continental deposits over granite														
D2r2	MGL	2h2	18	Lw-3b	1100-1400	500-600	m	3-3.5	l-m	Granite, wash deposits	Pleist3	336,454	740	Fe,Er,Dg,Dr
D2r3	MGL	2h2	18	Lw-3b	1100-1400	600-800	m	3-3.5	l-m	Granite, wash deposits	Pleist3	336,423,454	691,702,740	Fe,Er,Dg,Dr
Low, semi-arid, flooded or irrigated areas in Central on old alluvial sediments														
D2s	RSM	1j2	22a	Se-2	900	500-700	m-t	3-3.5 (var.)	l-h	Stream deposits	Subr2		604,764	Fe,Wo,Fl,Sa,So
Unit	FSZ	FSgroup	Soil group	AEZ	Altitude	Rainfall	Rainfall pattern	Length growing season	Drought risk	Geology (1)	Geology (2)	Upland soils	Hydromorphic soils	Main constraints
Warm, low, semi-arid to semi-humid areas (D3)														
Very low, semi-arid to semi-humid Eastern plains on intermediate gneiss														
D3a	SML1b,ranching	2m1	26	Me-7	300-400	700-1000	b-t	3-4,1-2	m-h	Gneiss	PP5	334,413,476		Fl,Dn,Dr
Very low to low, semi-arid Eastern plains on intermediate gneiss														
D3b1	MSP4	2m1	26	Me-7	200-750	500-800	t-b	3-4.5,1-2	m-vh	Gneiss	Moc	362,412,461		Fe,Ac
D3b2	MSP4	2m1	26	Me-7	500-1200	500-1000				Gneiss	Moc	412,461		
Low, semi-arid Southern plains on sandstone and shale														
D3c	Park1b	2i1	14	Sa-5	200-500	500-800	t	3-4.5	l-m	Sandstone, shale	PP4	340		Fe,Dr
AREAS WITH LOW RAINFALL														
Intermediate, arid to semi-arid areas (E)														
Intermediate, arid to semi-arid, southern Kwimbe- Northern Shinyanga area on old sediments														
Ea1	RP2	2i1	22b	Se-3a	1000-1200	400-800				Lake, stream deposits	Subr2		738	
Intermediate, arid to semi-arid south-west Eyasi area on old sediments														
Ea2	P2a	1k2	21a	Se-3b		400-600		3-3.5?		Lake, stream deposits	Subr2		738	
Intermediate, arid to semi-arid Kiteto, North Lushoto, North Monduli steppe on gneiss														
Eb1	P2b	2f1	5b	Gn-7	1000-1500	<500-600	b	<2	l-h	Gneiss	Moc	461	735	Er,De,So
Eb2	P2b	2f1	5b	Gn-7	1200?	550?				Gneiss	Moc	111		
Low, semi-arid Ruaha western lowland/valley on lacustrine and old alluvial sediments														
Eb3	MSP5	1k1	21b	Se-3b	700-900	550				Lake, stream, wash deposits	PP6	344,455,507	679,766	
Eb4	RP1	1k1	21b	Se-3b	700-900	550				Lake, stream, wash deposits	Dod+PP6?	111	766	
Intermediate, arid to semi-arid, southern Dodoma, western Iringa, north-western Lake Eyasi areas on granite and gneiss														
Ec1	MGL,MSP5,P2a	1k2, (1k1,2g1)	21a	Se-3b	1100-1300	400-600	m	3-3.5???	l-m?	Granite, gneiss, stream deposits	Dod	335,421	735	Fe,De,Ac,Dg
Ec2	Park1c	2f1	5b	Gn-7		500-600				Granite, gneiss	Dod	111		
Intermediate, arid to semi-arid, western Mbulu, northern Irambu area on granite and sediments (Basement complex)														
Ed1	P2b	2f1	5b	Gn-7	1100-1300	400-600	m	?	l-m?	Granite	BC	111,335,421	735	Fe,De,Ac,Dg
Ed2	P2a	1k2	21a	Se-3b		400-800				Granite, stream deposits	Subr2	335,343?,421,425?	724?,735	
Intermediate, arid to semi-arid Nduli-Ismani flats on recent sediments (over granite, gneiss)														
Ee1	MSP5,P2a	2o1 (1k2)	11	La-4b	1250-1500?	400-600	m	?		Stream deposits	Rec2	335,343?,425,509	605	
Low to intermediate, arid to semi-arid Usangu plain on recent alluvial or lacustrine sediments														
Ee2	RP1,rice	2o1	11	La-4b	750-1500	400-600	m	4-5,variable	l?	Lake, stream deposits	Rec2		605,634,767	Wo,Fl,Sa,Dn
Low, semi-arid eastern Ruaha lowland/valley on lacustrine and old alluvial sediments														
Ee3	MSP5	2o1	11	La-4b	700-900	550(-900)	m	3-3.5	l?	Lake, stream deposits	Rec2	204	647	Fe,Wo,So,Sa
Ee4	MSP5	2o1	11	La-4b	700-900	550				Lake, stream deposits	Rec 2	344,509	767	
Intermediate to high, arid to semi-arid, northern steppes on volcanic ash														
Ef1	Park1a,P1b	2k1	4b	Vo-6	?	400-600				Volcanic ash	PP7v	232,261a		
Ef2	P1b	2k1	4b	Vo-6		400-600				Volcanic ash	Pliocene	143,233,263	733	
Ef3	Park1a	2k1	4b	Vo-6		400-600				Volcanic ash	PPv8	102,141,235,271,321	782	
Ef4a	P1b	2k1	4b	Vo-6		400-600				Volcanic ash	Subrec 3v	102,142	734,772	
Ef4b	Bare	none	4b	Vo-6		400-600				Volcanic ash	Subrec 3v	102,142		
Ef4c	P1b	2k1	4b	Vo-6		400-600				Volcanic ash	Subrec 3v	262		
Ef5	P1b	2k1	4b	Vo-6		400-600				Volcanic ash	Subrec 3v	231	734	
Intermediate, arid, Lake Eyasi and Natron shore on lacustrine sediments														

Eg1	P2a	1k2	21a	Se-3b	400-500				Lake deposits	Subr2, 3v		772	
Eg2	P2b	2l2	8	La-4a	400-500				Lake deposits	PP3		771	